# Turkish Journal of Physiotherapy and Rehabilitation

Türk Fizyoterapi ve Rehabilitasyon Dergisi

**www.dergipark.gov.tr/tjpr**
**Volume/Cilt 34, Number/Sayı 1, 2023**

ISSN: 2651-4451 • e-ISSN: 2651-446X

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**Dergi Basım Tarihi: 20.04.2023**

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Türkiye Fizyoterapistler Derneği'nin resmi yayın organı olan Türk Fizyoterapi ve Rehabilitasyon Dergisi, bağımsız, tarafsız ve çift kör hakemlik ilkelerine uygun bir şekilde elektronik ve basılı olarak yayımlanan açık erişimli, ücretsiz, bilimsel bir yayın organıdır. Dergi, Nisan, Ağustos ve Aralık olmak üzere yılda 3 kez yayımlanır. Yazım dili Türkçe ve İngilizcedir. Bununla birlikte İngilizce gönderilen makalelere yayımlanma aşamasında öncelik verilecektir. Dergi, özgün araştırmalar, çağrılı derlemeler, sistematik derleme ve meta-analiz çalışmaları, ilginç olgu sunumları ve editöre mektupları yayımlamaktadır.

Derginin amacı fizyoterapi ve rehabilitasyon ile ilgili en yüksek bilimsel, etik ve klinik değere sahip orijinal çalışmaları yayımlamaktır. Türk Fizyoterapi ve Rehabilitasyon Dergisi, yayımladığı makalelerin daha önce başka bir yerde yayımlanmamış veya yayımlanmak üzere gönderilmemiş olması, ticari kaygılarda olmaması şartını gözetmektedir. Yayımlanacak makalenin tüm yazarlar tarafından ve çalışmanın yapıldığı yerdeki sorumlu kişi tarafından dolaylı olarak veya açık bir şekilde onaylandığını ve kabul edilmesi halinde aynı biçimde Türkçe, İngilizce veya başka bir dilde başka bir yerde yayımlanmayacağını taahhüt eder. Dergi, bilimsel kalitesi yüksek ve atıf potansiyeline sahip bir yazının yayına kabul edilmesi için en önemli kriter olan özgünlük ilkesini benimsemektedir.

Derginin yazım kuralları Uniform Requirements for Manuscripts Submitted to Biomedical Journals - International Committee of Medical Journal Editors (http://www.icmje.org) ve Committee on Publication Ethics (COPE) (https://publicationethics.org) tarafından yayımlanan rehberler ve politikalar dikkate alınarak hazırlanmıştır.

Türk Fizyoterapi ve Rehabilitasyon Dergisi (Türk Fizyoter Rehabil Derg / Turk J Physiother Rehabil), dünyanın her yerinden makaleler yayımlamaktadır ve aşağıdaki özelliklere sahip makalelere öncelik vermektedir:

- Fizyoterapi ve rehabilitasyon uygulamaları üzerinde etkisi olacak önemli araştırma sorularını ele alan ve hipotezleri güçlü yöntem ve araştırma tasarımı ile test eden özgün çalışmalar
- Klinik veya saha uygulamaları için temel teşkil edebilecek laboratuvar tabanlı çalışmalar
- Rehabilitasyon uygulamaları, politikaları, eğitimleri veya araştırmalarda karar vermeyi kolaylaştırmaya ve geliştirmeye yardımcı olabilecek çalışmalar.

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Türk Fizyoterapi ve Rehabilitasyon Dergisi'ne gönderilen yazılar çift kör hakem değerlendirme sürecinden geçer. Tarafsız bir değerlendirme sürecini sağlamak için her gönderi, alanlarında uzman olan en az iki bağımsız hakem tarafından incelenir. Hakemler yazıya ilişkin bilgileri gizli tutmakla yükümlüdür. Hakemler, çıkar çatışması olması halinde bu konu hakkında Türk Fizyoterapi ve Rehabilitasyon Dergisi'ne bildirimde bulunur.

Hakemler kendilerine gönderilen çalışmayı değerlendirme süreci tamamlanıncaya ve yayına verilinceye kadar herhangi bir amaç için kullanamaz. Hakemler makaleyi değerlendirirken nazik ve yapıcı bir dil kullanmalı, kötü yorum ve ifadelerden kaçınmalıdırlar. Hakemler makaleyi zamanında ve etik kurallara dikkat ederek değerlendirmekle sorumludurlar.

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Yazıların bilimsel içeriği ve etik kurallara uygunluğu yazar/yazarların sorumluluğundadır. Deneysel ve klinik çalışmalar ile olgu sunumlarının araştırma protokollerinin uluslararası anlaşmalara (World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects" www.wma.net) uygun olarak, etik kurul tarafından onaylanması gerekmektedir. Dergiye, etik kurul onayı almış ve Helsinki Bildirgesi'nin en güncel versiyonuna uygun yürütülmüş araştırmalar kabul edilir. Yazarlar, insan öğesi ile yapılmış çalışmalarda makalenin "YÖNTEM" bölümünde bu prensiplere uygun olarak çalışmayı yaptıklarını, kurumlarının etik kurullarından ve çalışmaya katılmış insanlardan "bilgilendirilmiş olur veya onam formlarını" (informed consent) aldıklarını belirtmek zorundadırlar. Yazarlar gerektiğinde hastalara veya katılımcılara ait bilgilendirilmiş olur veya onam formlarını belgeleyebilmelidir. Katılımcının onayı ile ilgili bilgiler, etik kurulun adı ve etik komite onay numarası da yazının "YÖNTEM" bölümünde belirtilmelidir. Etik kurul onayı gerekmeyen çalışmalar için çalışmanın tasarımı ve içeriğine uygun etik kurullardan alınan muafiyet belgesi veya sorumlu yazar tarafından yazılan bilgi amaçlı bir beyanın (meta-analiz, sistematik derleme, çağrılı derleme için) sisteme yüklenmesi gerekir. Çalışmada hayvan öğesi kullanılmış ise yazarlar, makalenin "YÖNTEM" bölümünde Guide for the Care and Use of Laboratory Animals (http://www.nap.edu/catalog/5140.html) prensipleri doğrultusunda çalışmalarında hayvan haklarını koruduklarını ve kurumlarının etik kurullarından onay aldıklarını belirtmek zorundadır.

Yazar olarak listelenen her kişi, International Committee of Medical Journal Editors (ICMJE-www.icmje.org) tarafından önerilen ve aşağıda gösterilen yazarlık kriterlerinin dördünü de karşılamalıdır:

- Çalışmanın planlanmasına, verilerin toplanmasına veya verilerin analizine ve yorumlanmasına katkısı olmalıdır,
- Makale taslağının hazırlanması veya revize edilmesine katkıda bulunmalıdır,
- Makalenin dergiye gönderilecek ve yayınlanacak son halini okuyup kabul etmelidir,
- Çalışmanın herhangi bir bölümünün doğruluğu veya bütünlüğü ile ilgili soruların uygun bir şekilde araştırıldığı ve çözümlendiği konusunda diğer yazarlarla hemfikir olmalı ve çalışmadan tüm yönleriyle sorumlu olmalıdır.

Makalelerin bilimsel içeriği ve etik kurallara uygunluğu yazarların sorumluluğundadır. Tüm çalışmalar lisanslı bir benzerlik tespit yazılımı (CrossCheck tarafından iThenticate/Turnitin vb.) tarafından taranıp ilgili rapor belge olarak başvuru sırasında sisteme yüklenmelidir. Kaynaklar, tablo ve şekil içerikleri haricindeki yazının içeriğinde benzerlik oranı %20 'nin üzerinde olmamalı ve yazarların önceki çalışmalarıyla bir benzerliği bulunmamalıdır. Benzerlik oranı %20'nin üzerindeki makaleler hakeme gönderilmeden reddedilir. İntihal, alıntı manipülasyonu ve veri sahteciliği/uydurma gibi durumlardan şüphelenilmesi veya tespit edilmesi halinde yayın kurulu COPE yönergelerini izleyecek ve bunlara göre hareket edecektir.

İletişimden sorumlu yazar makalenin sunum aşamasından basımına kadar olan süreçlerde her türlü yazışmaları gerçekleştiren yazardır. İletişimden sorumlu yazar:

- Etik kurul onay belgesi,
- Telif hakkı devir formu (e-imza veya ıslak imzalı olmalıdır. Bu formda imzası bulunanlar dışında sonradan yazar ismi eklenemez ve yazar sırası değiştirilemez.)
- Yazar katkı formu
- Çıkar çatışması formu belgelerini sisteme taratıp yüklemelidir.

Makalede, kitaplarda veya dergilerde daha önce yayımlanmış alıntı yazı, tablo, şekil vb. mevcutsa, yazarlar ilgili yazı, tablo, şekil, anket ve ölçeğin (geçerlilik, güvenirlik çalışmaları ile kullanımı için özel izin, sertifika istenen anket/ölçekler) telif hakkı sahibinden ve yazarlarından yazılı izin almak; izin yazısını makale ile birlikte göndermek ve bunu makalede belirtmek zorundadır. Hastaların kimliğini açığa çıkarabilecek fotoğraflar için hasta veya yasal temsilcisinin imzalı izinleri eklenmeli ve "YÖNTEM" bölümünde bu izinlerin alındığı ifade edilmelidir. Bilimsel toplantılarda sunulan bildiler özet şeklinde daha önce sunulmuş ve/veya basılmış ise başlık sayfasında mutlaka belirtilmelidir.

**Yazım Kuralları**

Makaleler, ICMJE -Recommendations for the Conduct, Reporting, Editing and Publication for Scholarly Work in Medical Journals (updated in December 2019 - http://www.icmje.org/icmje-recommendations.pdf ) uyarınca hazırlanmalıdır. Yazarların CONSORT'a uygun olarak makale hazırlaması gerekmektedir. Orijinal araştırma çalışmaları için STROBE kılavuzları, sistematik incelemeler ve meta-analiz için PRISMA yönergeleri, deneysel hayvan çalışmaları için ARRIVE yönergeleri kullanılmalıdır.

Türkçe makalelerde Türk Dil Kurumu'nun Türkçe Sözlüğu esas alınmalıdır. İngilizce makaleler ve İngilizce özetlerin, dergiye gönderilmeden önce dil uzmanı tarafından değerlendirilmesi gerekmektedir. Editör veya alan editörleri gerekli gördükleri hallerde İngilizce makale veya İngilizce özet için redaksiyonun sertifikasını talep edebilirler.

**Özgün Makale:** Güncel ve önemli bir konuda temel veya klinik bilgi sunan, önceki çalışmaları genişletip ilerleten veya klasik bir konuda yeni bir yaklaşım getiren türde araştırmalardan oluşur. Özgün makaleler 4000 kelimeyi ve kaynak sayısı 40'ı aşmamalıdır.

**Olgu Sunumu:** İlginç olguları, yeni fikirleri ve teknikleri tanımlamaktadır. Şekiller, tablolar ve kaynaklar yazıyı açıklamaya ve desteklemeye yetecek en az sayıda olmalıdır. Kelime sayısı 2000'i, kaynak sayısı 20'yi geçmemelidir.

**Editöryal Yorum:** Editörler Kurulu, eğitim ve klinik uygulamalar konusunda uzman bir yazarı belli bir konuda bilgilendirici bir yazı yazmak veya yorum yapmak üzere davet edebilir. Kelime sayısı 1000'i, kaynak sayısı 10'u geçmemelidir.

**Çağrılı Derleme/Sistematik Derleme/Meta-Analiz:** Sistematik derleme ve meta-analizler doğrudan, çağrılı derlemeler ise davet edilen yazarlar tarafından hazırlanmaktadır. Fizyoterapi ve rehabilitasyon bilimi ve klinik uygulamaları hakkında olabilecek her türlü konu için güncel literatürü de içine alacak şekilde hazırlanmalıdır. Yazarların o konu ile ilgili basılmış yayınlarının olması özellikle tercih nedenidir. Kelime sayısı 6000'i, kaynak sayısı 100'ü geçmemelidir.

**Editöre Mektup:** Editörler Kurulunun onayı ile yayımlanmaktadır. Mektup, dergide yayımlanmış bir makaleye yorum niteliğinde ise hangi makaleye (sayı, tarih verilerek) ithaf edildiği kaynak olarak belirtilmelidir. Mektuba cevap, editör veya makalenin yazar (ları) tarafından, yine dergide yayımlanarak verilir. Mektuplarda kelime sayısı 500, kaynak sayısı beş ile sınırlıdır.

**Dergide yayımlanmak üzere gönderilen makaleler;**

- Yazım sayfası A4 boyutunda olacak şekilde, PC uyumlu Microsoft Word programı ile yazılmalıdır.
- "Times New Roman" yazı tipi kullanılarak 12 punto ve makalenin tüm bölümleri 1,5 satır aralıklı yapılmalıdır.
- Sayfanın her kenarında en az 2,5 cm boşluk bırakılmalıdır.
- Sayfalar (sağ alt köşede) ve satırlar numaralandırılmalıdır.
- Makalenin ana başlıkları (Giriş, Yöntem, Sonuçlar, Tartışma, Kaynaklar) büyük harf kullanılarak ve koyu olarak belirtilmelidir.
- Alt başlıklar ise baş harf büyük ve koyu renk olacak şekilde yazılmalıdır.
- Metin içinde verilen sayısal değerlerde Türkçe makalelerde virgül (,); İngilizce makalelerde nokta (.) kullanılmalıdır. Verilen bu sayısal değerlerde virgül veya noktadan sonra p ve r değerleri hariç sayının iki basamağı daha verilmeli (Örnek: 13.31 veya 15,21); p ve r değerleri ise virgülden/noktadan sonra üç basamak olacak şekilde yazılmalıdır.
- Kısaltmalar, kelimenin ilk geçtiği yerde parantez içinde verilir ve tüm metin boyunca o kısaltma kullanılır. Uluslararası kullanılan kısaltmalar için 'Bilimsel Yazım Kuralları" kaynağına başvurulabilir.

**Başlık Sayfası**

Makalenin başlığı kısa fakat içeriği tanımlayıcı ve amaçla uyumlu olmalıdır. Başlıkta kısaltma kullanılmamalıdır. Makale başlığı Türkçe ve İngilizce yazılmalıdır. Türkçe ve İngilizce başlıkların tamamı büyük harfler ile koyu olarak yazılmalıdır. Ayrıca yazının 40 karakterlik kısa bir başlığı da Türkçe ve İngilizce olarak başlık sayfasında belirtilmelidir. Makalenin kelime sayısı (başlık sayfası, kaynaklar, tablolar, şekiller hariç) yazılmalıdır. Tüm yazarların açık adları, soyadları (büyük harf ile yazılacak) ve akademik unvanları, çalıştıkları kurum,

iletişim bilgileri, Open Researcher and Contributor ID (ORCID) numaraları, çalışmanın yürütüldüğü kurumun veya kurumların açık adı ve adresi belirtilmelidir. Her yazar için üst numaralandırma kullanılmalıdır. İletişimden sorumlu yazarın iletişim bilgileri ayrıca sunulmalıdır. Başlık sayfası her yazarın iletişim bilgilerini, adres, güncel e-posta adresi ve iş telefon numarasını içermelidir.

**Özetler**

Her makale Türkçe ve İngilizce özet içermelidir.

**Türkçe Özet ve Anahtar Kelimeler**

Türkçe özet ayrı bir sayfadan başlamalı ve 250 kelimeden fazla olmamalıdır. Türkçe özet bölümü çalışmanın amacını, uygulanan yöntemi, en önemli bulguları ve sonucu içermelidir. Özet, "Öz" başlığını taşımalı ve "Amaç", "Yöntem", "Sonuçlar" ve "Tartışma" alt başlıklarına ayrılmalıdır. "Sonuçlar" kısmında p değeri belirtilmelidir. Türkçe makale özetlerinde ondalık sayılarda virgül (,) kullanılmalıdır.

Anahtar kelimeler 3'ten az, 5'ten çok olmamalıdır. Anahtar kelimeler "Türkiye Bilim Terimleri" listesinden (http://www.bilimterimleri.com) seçilmelidir. Bu listede henüz yer almayan yeni bir kavram için liste dışı kelimeler kullanılabilir. Anahtar kelimelerin her biri büyük harf ile başlamalı; virgül ile birbirinden ayrılmalı ve alfabetik sıraya göre yazılmalıdır. Makale Türkçe ise İngilizce özet kısmındaki anahtar kelimeler (keywords) Türkçe anahtar kelimelerin alfabetik sıralamasına uygun sıralanmalıdır.

**İngilizce Özet (Abstract) ve Anahtar Kelimeler (Keywords)**

İngilizce özet ayrı bir sayfadan başlamalı ve 250 kelimeden fazla olmamalıdır. İngilizce özette ondalık sayılarda nokta (.) kullanılmalıdır. İngilizce özet "Purpose", "Methods", "Results" ve "Conclusion" alt başlıklarına ayrılmalıdır. İngilizce özet ve anahtar kelimeler, Türkçe özet ve anahtar kelimelerin birebir aynısı olmalıdır. Anahtar kelimeler "MeSH (Medical Subject Headings)" terimlerinden seçilmiş olmalıdır. MeSH listesinde henüz yer almamış yeni bir kavram için liste dışı kelimeler kullanılabilir. Anahtar kelimelerin her biri büyük harf ile başlamalı; virgül ile birbirinden ayrılmalı ve alfabetik sıraya göre yazılmalıdır. Makale İngilizce ise İngilizce anahtar kelimelerin (keywords) alfabetik sıralamasına göre, Türkçe anahtar kelimeler sıralanacaktır.

**Araştırma Makalesinin Bölümleri**

Makale metni Türkçe makalelerde "Giriş", "Yöntem", "Sonuçlar" ve "Tartışma" bölümlerinden oluşur. İngilizce makalelerde ise "Introduction", "Methods", "Results" ve "Discussion" bölümleri yer alır. Metin içinde beş defadan fazla tekrar eden ifadeler için standart kısaltmalar kullanılabilir. Kısaltmanın açıklaması metinde ilk geçtiği yerde belirtilmelidir.

**Giriş**

Çalışma konusuyla ilgili önceki yayınlardan elde edilen temel bilgilerin özetini içermelidir. Çalışmanın yapılmasındaki gereklilik ve amaç kısaca belirtilmelidir.

**Yöntem**

Çalışmadaki klinik, teknik veya deneysel yöntemler açıkça belirtilmelidir. Yöntem için uygun kaynaklar verilmelidir. Bu bölümde yazarlar, insanlar üzerinde yapmış oldukları çalışmaları Helsinki Bildirgesi prensiplerine uygun olarak yürüttüklerini, ilgili etik kuruldan onay aldıklarını (etik kurulun adı, tarih ve protokol numarası yazılmalıdır) ve katılımcılardan bilgilendirilmiş onam alındığını belirtmek zorundadır. Yöntem bölümü "İstatistiksel analiz" alt başlığını içermelidir. Çalışmada hayvan ögesi kullanılmış ise yazarlar, Guide for the Care and Use of Laboratory Animals (http://www.nap.edu/catalog/5140.html) prensipleri doğrultusunda hayvan haklarını koruduklarını ve ilgili etik kuruldan onay aldıklarını belirtmek zorundadırlar. Katılımcıların kimliğini açığa çıkarabilecek fotoğraflar için yayın onayı alındığına yönelik bir ifade bu bölümde yer almalıdır.

İstatistiksel analiz için herhangi bir istatistik programı kullanılmış ise kullanılan yazılım programının adı, sürüm numarası, yer, tarih ve firma bilgileri yazılmalıdır. İstatistiksel analiz yöntemleri ve örneklem büyüklüğünün hesaplanması ile ilgili bilgiler gerekçeleri ile birlikte sunulmalı, gerektiğinde kaynaklarla desteklenmelidir.

**Sonuçlar**

Sonuçlar sayısal verilere dayanmayan herhangi bir yorum içermemelidir. Tablolarda sunulan verilerin, metin içinde tekrar edilmesinden kaçınılmalı, en önemli sonuçlar vurgulanmalıdır.

**Tartışma**

Tartışma, çalışmada elde edilen en önemli sonuçlara ait bilgiler ile başlamalıdır. Çalışmadan elde edilen sonuçlar yorumlanmalı ve önceki çalışmaların sonuçları ile ilişkilendirilmelidir. Tartışmada çalışmanın kısıtlılıkları, literatüre ve klinik uygulamalara olan katkısı belirtilmelidir. "Sonuçlar" bölümünde ve tablolarda yer alan bulguların, detayları ile tartışma bölümünde tekrar edilmesinden kaçınılmalıdır. Araştırmada elde edilmeyen veriler tartışılmamalıdır.

**Aşağıdaki başlıklar tartışma kısmından sonra açıklamalarıyla beraber eklenmelidir:**

- *Destekleyen Kuruluş:* Destekleyen kuruluşlar varsa belirtilmelidir.
- *Çıkar Çatışması:* Çıkar çatışması varsa belirtilmelidir.
- *Yazar Katkıları:* Yazarların makaleye yönelik katkıları belirtilmelidir. Katkılar fikir/kavram, tasarım, denetleme/ danışmanlık, kaynaklar ve fon sağlama, materyaller, veri toplama ve/veya işleme, analiz ve/ veya yorumlama, literatür taraması, makale yazımı, eleştirel inceleme başlıkları altında toplanmalıdır.
- *Açıklamalar:* Yazı özet ve/veya bildiri şeklinde daha önce sunulmuş ise, sunulduğu bilimsel toplantı, sunum yeri, tarihi ve basılmışsa basımı yapılan yayın organına ilişkin bilgiler "Açıklamalar" kısmında belirtilmelidir.
- *Teşekkür:* Yazar olma kriterlerini karşılamayan ancak araştırma sırasında destek sağlayan (makaleyi okuma, yazma, teknik destek, dil ve istatistik desteği vb.) bireylere ve/veya kuruluşlara ilişkin bilgiler olabildiğince kısa ve öz bir şekilde "Teşekkür" kısmında belirtilmelidir.

**Kaynaklar**

Kaynaklar makale ana metinden hemen sonra yer almalıdır. Kaynaklar metinde geçiş sırasına göre, cümle sonunda (noktadan önce), Arabik rakamlarla, parantez içine alınarak numaralandırılmalıdır [Örnek: ..... meydana geldiği bulunmuştur (21).]. Kaynak sayısının 40'ı aşmamasına ve 10 yıldan eski tarihli kaynak kullanımının toplam kaynak sayısının % 15'ini geçmemesine özen gösterilmelidir. Gerekmedikçe kitapların, web sayfalarının, yayınlanmamış gözlem ve kişisel görüşmelerin kaynak olarak kullanımından kaçınılmalıdır. Birden çok kaynağa atıf varsa kaynaklar arasına virgül konulmalı ve virgülden önce ya da sonra boşluk bırakılmamalıdır. Örnek olarak (3,7,15–19) verilebilir; burada "15–19", 15. kaynaktan 19. kaynağa kadar olan beş yayını kapsamaktadır. Ana metin içinde isim belirtilerek referans gösterilmesi gerektiğinde, makalenin yazım dili İngilizce ise "Yazar adı et al." (Örnek: Burtin et al.); makalenin yazım dili Türkçe ise "Yazar adı ve diğ." (Örnek: Burtin ve diğ.) şeklinde yazılmalıdır.

Dergi adları Index Medicus'a göre kısaltılmış olarak sunulmalıdır. Standart dergide yayınlanmış bir makalede, yazar sayısı 6 ve daha az ise tüm yazarların adı yazılmalıdır. Yazar sayısı 6'dan çok ise, ilk 6 yazar yazılmalı, diğer yazarlar Türkçe makaleler için "ve diğ.", İngilizce makaleler için "et al." olarak belirtilmelidir. Endnote, Mendeley gibi program kullanacak yazarlar programların içerisinde bulunan "VANCOUVER" stilini kullanmalıdır. Vancouver stilinde verilen bir referansta mutlaka olması gereken bilgiler aşağıda belirtilmiştir: - Yazar(lar) ad(ları), - Makale adı, - Dergi adı (Index Medicus'a göre kısaltılmış), - Basım yılı, - Dergi volümu ve sayısı, - Sayfa aralığı (Örnek:10-5).

**Kaynak yazım örnekleri aşağıdaki gibidir:**

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- *Web sayfası;* Diabetes Australia. Gestational diabetes [Internet]. Canberra (AU): Diabetes Australia; 2015 [updated 2015; cited 2017 Nov 23]. Available from: https://www.diabetesaustralia.com.au/gestational-diabetes.

**Tablolar**

Tablolar, Microsoft Word dosyası formatında hazırlanmalı, her biri ayrı sayfalarda olacak şekilde makalenin sonunda yer almalı ve ana metinde geçtikleri sıraya göre numaralandırılmalıdır. Toplam tablo ve şekil sayısı en fazla 6 olmalıdır. Tablolarda her sütun başlığına kısa bir başlık yazılmalıdır. Tabloların sütunlarında her kelimenin ilk harfi büyük olmalıdır. Tablo numara ve başlığı tablonun üst kısmında yer almalı; tablo numarası koyu renk ile yazılmalı, tablo başlığından nokta (.) ile ayrılmalıdır (Örnek: **Tablo 1.** Katılımcıların Sosyodemografik Özellikleri). Tablolarda dikey çizgi kullanılmamalı sadece ilk satır üstünde, altında ve son satırın altında yatay çizgiler olmalıdır. Tabloda yer alan p değerleri *, ** ile gösterilmelidir. Notlar ve tabloda kullanılan kısaltmaların açıklamaları tablonun alt kısmında yazılmalıdır. Kısaltmaların açıklamasının yazımında önce kısaltma yazılmalı, iki nokta üst üste (:) işaretinden sonra kısaltmanın açık hali yazılmalıdır. Kısaltmalar birbirinden virgül ile ayrılmalıdır. Tabloda kullanılan değişkenlerin birimleri parantez içinde belirtilmelidir. Belirli bir aralığı kapsayan birimler aralık dilimi ile sayısal olarak ifade edilmelidir. Tabloda verilen ondalık sayılarda, Türkçe makalelerde virgül (,); İngilizce makalelerde nokta (.) kullanılmalıdır. Tablolarda verilen ondalık sayılarda virgül veya noktadan sonra iki basamak yazılmalıdır (Örnek: 31,12 veya 20.10). Ortalama, yüzde ve ortanca değerleri dışındaki değerler (p, r, vb.) virgülden/noktadan sonra üç basamak olarak yazılmalıdır. Tablo örneği aşağıda bulunmaktadır.

**Tablo 1.** Grupların Bilgi Testi Sonuçları

| Bilgi Testi | TU Grubu (n=20) | SH Grubu (n=20) | TU-SH Grubu (n=20) | t | p§ |
|---|---|---|---|---|---|
| **Ön Test** | 60,50±13,17 | 69,05±14,11 | 67,14±14,54 | 0,002 | 0,051 |
| **Son Test** | 83,00±14,18 | 73,50±9,33 | 83,33±10,17 | 0,002 | **0,001** |

*p<0,05. §Kruskal Wallis Analizi. TU: Teorik/uygulamalı ders grubu, SH: Simüle hasta grubu, TU-SH: Teorik/uygulamalı ders ve simüle hasta grubu.

**Şekiller**

Şekil başlıkları tablolardan sonra ayrı bir sayfada yer almalıdır. Şekiller ise ayrı bir dosya olarak JPEG, TIFF, PNG formatında yüksek kalitede yüklenmelidir. Makale içinde kullanılan fotoğraflar net olmalıdır. Fotoğraf ve şekiller metin içinde geçiş sırasına göre numaralandırılmalıdır. Yazarlar, insan öğesinin bulunduğu fotoğraflarda, kişiden yazılı izin ve kimliğini gizleyecek önlemler almalıdırlar. İzin metni makale ile birlikte dergiye gönderilmelidir. "YÖNTEM" bölümünün ilk paragrafında yayın onayı alındığına dair bilgi verilmelidir.

**Makale Gönderme Formatı**

Makaleler Microsoft Office Word dosyası formatında hem yazar isimleri olan hem de yazar isimleri içermeyen iki kopya şeklide DergiPark (http://dergipark.gov.tr/tjpr) sistemine kullanıcı olarak kayıt olunduktan sonra yüklenecektir. Yazar isimlerinin bulunmadığı Word dosyasında adı geçen tüm kurumların (etik kurul onayın alındığı kurum da dahil olmak üzere) "X" ile kapatılması gerekmektedir.

*Makale Değerlendirme Süreci:* Derginin yayın süreci, Uluslararası Tıbbi Dergi Editörleri Komitesi (ICMJE), Dünya Tıbbi Dergi Editörleri Birliği (WAME), Bilim Editörleri Konseyi (CSE), Yayın Etiği Komitesi (COPE), Avrupa Bilim Editörleri Birliği (EASE) ve Ulusal Bilgi Standartları Organizasyonu (NISO) kılavuzları ile uyumludur. Yazar makalenin değerlendirme sürecini DergiPark (http://dergipark.gov.tr/tjpr) sisteminden takip edebilmektedir. Dergiye gönderilen yazılar ilk olarak, teknik editör tarafından yazının dergi yönergelerine uygunluğu açısından değerlendirilecektir. Derginin yönergelerine uymayan yazılar, teknik düzeltme talepleriyle birlikte yazara tekrar gönderilecektir. Makaleler ilgili alanda uzman en az iki dış hakem tarafından değerlendirmeye tabi tutulacak ve hakem raporları, iletişimden sorumlu yazara bildirilecektir. Revizyon gerektiren makalelerde yazarın hakem yorumlarını birebir yanıtlaması ve makalenin revize edilmiş versiyonunu yüklemesi gerekir. Bu süreç, yayın kurulu makaleye onay verene kadar tekrarlanır.

**Telif Hakkı**

Dergimizde yayınlanan yazıların tüm telif hakları Türkiye Fizyoterapistler Derneği'ne aittir.

**Sorumluluk Reddi**

Türk Fizyoterapi ve Rehabilitasyon Dergisi'nde yayımlanan yazılardaki ifadeler veya görüşler, editörlerin, yayın kurulunun veya yayıncının görüşlerini değil yazarların görüşlerini yansıtmaktadır. Editörler, yayın kurulu ve yayıncı bu tür materyaller için herhangi bir sorumluluk veya yükümlülük kabul etmemektedir. Yayınlanan içerikle ilgili nihai sorumluluk yazarlara aittir.

# Instructions for Authors

Turkish Journal of Physiotherapy and Rehabilitation is the official journal of the Turkish Physiotherapy Association. Turkish Journal of Physiotherapy and Rehabilitation is open-access, free, impartial, and employs a double-blind peer-review process published electronically and in print. It is published three times a year, in April, August, and December, in Turkish and English. The manuscripts submitted in English will be given priority in the publication process. We are pleased to receive articles reporting original scientific research, invited reviews, systematic reviews or meta-analyses, rare case studies, and letters to the editor.

The journal aims to publish original studies of the highest scientific, ethical, and clinical value on physiotherapy and rehabilitation. Submission of an article implies that the work described has not been published previously, that it is not under consideration for publication elsewhere, that it is not having commercial concerns. The publication of an article is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in Turkish, English or any other language. The journal adopts the principle of originality, which is the most important criterion for an article with high scientific quality and citation potential to be accepted for publication.

The editorial rules of the journal are based on the guidelines published by Uniform Requirements for Manuscripts Submitted to Biomedical Journals - International Committee of Medical Journal Editors (http://www.icmje.org) and Committee on Publication Ethics (COPE) (https://publicationethics.org).

Turkish Journal of Physiotherapy and Rehabilitation (Turk J Physiother Rehabil) publishes articles from all over the world and gives priority to articles with the following characteristics:

- Original studies that address important research questions that will have an impact on physiotherapy and rehabilitation practices and test hypotheses with a strong method and research design
- Laboratory-based studies that can be the basis for clinical or field applications
- Studies that can help facilitate and improve decision-making in rehabilitation practices, policies, education, or research.

**ETHICAL RESPONSIBILITY**

**Editorial Board**

Editors have ethical duties and responsibilities based on the "COPE Code of Conduct and Best Practice Guidelines for Journal Editors" and "COPE Best Practice Guidelines for Journal Editors" published by the Committee on Publication Ethics (COPE) as open access. **Editors:**

- Every article published in the journal is published by journal publication policies and international standards,
- To improve the quality, originality, and readability of the journal,
- To conduct processes transparently without compromising intellectual property rights and ethical standards,
- To complete the impartial and independent evaluation processes of the articles, they are responsible for taking precautions against conflicts of interest that may arise between the authors, reviewers, and third parties.

Editors make positive or negative decisions based on the importance, original value, and validity, clarity of the narrative, and the journal's goals and objectives. They apply the "Blind Peer-Review and Evaluation Process" policies included in the publication policies of the journal. In this context, the editors ensure that the evaluation process of each study is completed in a fair, impartial, and timely manner without conflict of interest.

An independent external editor may be invited to manage the evaluation processes of the articles in which the editorial board members are the authors.

**Reviewers**

Manuscripts submitted to the Turkish Journal of Physiotherapy and Rehabilitation go through a double-blind peer-review process. To ensure an unbiased review process, each submission is reviewed by at least two independent reviewers who are experts in their fields. The reviewers are obliged to keep the information about the article confidential. In case of a conflict of interest, the reviewers notify the Turkish Journal of Physiotherapy and Rehabilitation.

The reviewers cannot use the article sent to them for any purpose until the evaluation process is completed and it is published. Reviewers should use kind and constructive language while evaluating the article and avoid bad comments and expressions. The reviewers are responsible for evaluating the article on time and by paying attention to the ethical rules.

**Authors**

The scientific content of the manuscripts and their compliance with ethical principles are under the responsibility of the author(s). The ethics committee must approve research protocols of experimental and clinical studies and case reports following international agreements (World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects" www.wma.net). The journal accepts manuscripts which; have been approved by the relevant Ethical Committees and are by ethical principles stated in the Declaration of Helsinki. The authors must state that they conducted the study according to the abovementioned principles in the "METHOD" section for studies conducted on human subjects. They also must express ethical committee approval and obtain "informed consent forms" from volunteers who participated in the study. Authors should document informed consent or consent forms of patients or participants when necessary. Information about the approval of the volunteers, the name of the ethics committee, and the ethics committee approval number should also be stated in the "METHOD" section of the manuscript. For studies that do not require ethics committee approval, letter of an exemption from the ethics committee in accordance with the design and content of the study or an informative statement written by the responsible author (for meta-analysis, systematic review, or invited review) should be uploaded to the system. In studies involving "animals," the author(s) should state in the "Methods" section that they have protected the rights of the animals by the principles of "Guide for the Care and Use of Laboratory Animals" (http://www.nap.edu/catalog/5140.html) and obtained approval from the relevant Ethical Committees.

Each person listed as an author must meet the following 4 criteria for authorship recommended by the International Committee of Medical Journal Editors (ICMJE-www.icmje.org:

- Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND
- Drafting the work or revising it critically for important intellectual content; AND
- Final approval of the version to be published; AND
- Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

The scientific content of the articles and their compliance with ethical principles are the responsibility of the authors. All studies must be checked by a licensed plagiarism detection software (iThenticate/Turnitin etc., by CrossCheck) and uploaded to the system as a supplementary document at the time of application.

The similarity rate in the content of the article should not be over 20% and should not have any similarity with the previous works of the authors except for the references, table, and figure contents. Articles with a more than 20% similarity rate are rejected without being sent to the referee. In case of suspected or detected plagiarism, citation manipulation, and data forgery/fabrication, the editorial board will follow the COPE guidelines and act accordingly.

The corresponding author carries out all kinds of correspondence from the presentation stage to the printing of the article. The corresponding author should scan and upload the following documents to the system.

- Ethics committee approval form,
- Copyright transfer form (must be e-signed or original signed. Another author's name cannot be added later, and the order of authors cannot be changed, except for those whose signatures are on this form.)
- Author contribution form
- Conflict of interest form
- Publication rights agreement form

Suppose there are cited articles, tables, and figures previously published in articles, books, or journals. In that case, the authors must obtain written permission from the copyright holder for the table, figure, survey, and scale (validity, reliability studies and special permission for its use, certificate/scales), send the permission letter together with the article, and indicate this in the article. In addition, the signed permission of the patient or his legal representative should be attached for the photographs that may reveal the identity of the patient, and it should be stated in the "METHOD" section. Finally, if the papers are presented in scientific meetings and presented and/or published in the abstracts book, authors must be stated on the title page.

**Instructions for Authors**

Articles should be prepared following ICMJE -Recommendations for the Conduct, Reporting, Editing, and Publication for Scholarly Work in Medical Journals (updated in December 2019 - http://www.icmje.org/icmje recommendations.pdf). In addition, authors are required to prepare an article in accordance with the Consolidated Standards of Reporting Trials (CONSORT) Statement. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement should be used for original research studies, Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement should be used for systematic reviews and meta-analysis, and Animal Research: Reporting of In Vivo Experiments (ARRIVE) Statement for experimental animal studies.

Turkish dictionary of Turkish Language Institution should be considered in Turkish manuscripts. A native speaker should edit the manuscripts and abstracts in English before being submitted to the journal. Editors or field editors may request proofreading for English articles or English abstracts if they deem necessary.

**Original Article:** It consists of research that provides basic or clinical information on a current and essential topic, extends, and advances previous studies, or introduces a new approach to a classic topic. Original articles should not exceed 4000 words, and the number of references should not exceed 40.

**Case Report:** It describes interesting cases, novel ideas, and techniques. Figures, tables, and references should be as minimal as possible to explain and support the text. The number of words should not exceed 2000, and the number of references should not exceed 20.

**Editorial Comment:** The Editorial Board may invite an author who is an expert in education and clinical practice to write an informative article or comment on a particular subject. The number of words should not exceed 1000, and the number of references should not exceed 10.

**Invited Review/Systematic Review/Meta-Analysis:** Systematic reviews and meta-analyses are prepared directly, while invited authors prepare invited reviews. They should also include the current literature for any subject about physiotherapy and rehabilitation science and clinical applications. It is especially preferred that the authors have published publications on that subject. The number of words should not exceed 6000, and the number of references should not exceed 100.

**Editorial Letter:** It is published with the approval of the Editorial Board. If the letter is a commentary on an article published in the journal, it should be stated as the source to which article (number, date) it is dedicated. The answer to the letter is given by the editor or the author(s) of the article, again by publishing it in the journal. The number of words in the letters is limited to 500, and the number of references is limited to five.

**Articles submitted for publication in the journal;**

- The writing page should be A4 size, with a PC-compatible Microsoft Word program.
- "Times New Roman" font with a 12-font size should be used, and all parts of the article should be written with 1.5 line spacing.
- At least 2.5 cm of space should be left on each side of the page.
- Pages (bottom right corner) and lines should be numbered.
- The main headings of the article (Introduction, Method, Results, Discussion, and References) should be written in capital letters and in bold.
- Sub-headings should begin with a capital letter as a sentence case and bold.
- In the numerical values given in the text, a comma (,) should be used in Turkish articles and a period (.) in English articles. In these numerical values given, two more digits of the number should be given after the comma or period, excluding p and r values (Example: 13.31 or 15.21); the p and r values should be written as three digits after the comma/period.
- Abbreviations are given in parentheses at the first occurrence of the word, and that abbreviation is used throughout the text. Reference can be made to the scientific spelling rules for internationally used abbreviations.

**Title Page**

The title of the manuscript should be brief but descriptive for the content and compatible with the purpose. Article title should be written in Turkish and English. The Turkish and English titles should be written in bold with capital letters. Besides, a short running title (not exceeding 40 characters) should be specified both in Turkish and English on the title page. The number of words (excluding title page, references, tables, and figures) of the article should be written. Full names, surnames (written in a capital letter), academic titles, institutions, and digital identifiers Open Researcher and Contributor ID (ORCID) of the authors, full name and address of the clinic, department, institute, hospital, or university which the study was conducted at should be declared using superscript numbers for each author. The contact information of the corresponding author should also be specified. The title page should include each author's contact information, address, current e-mail address, and business phone number.

**Abstracts**

Each manuscript should include both Turkish and English abstracts.

**Turkish Abstract and Keywords**

The Turkish abstract should begin from a separate page and not exceed 250 words. The Turkish summary section should include the purpose of the study, the methods, the primary findings, and the result. The abstract should be titled "Öz" and divided into subheadings of "Purpose," "Methods," "Results," and "Conclusion." The p-value must be specified in the "Results" section. A comma (,) should be used in decimal numbers in Turkish article summaries.

The number of keywords should not be less than 3 or more than 5. Keywords should be selected from the "Turkey Science Terms" list (http://www.bilimterimleri.com). The out-of-list terms may be used for a new concept. Each keyword begins with an uppercase letter, separated by a comma and written in alphabetical order. If the article is in Turkish, the keywords in the English abstract should be written in the alphabetical order of the Turkish keywords.

**English Abstract and Keywords:**

The English abstract should begin on a separate page and not exceed 250 words. A period (.) should be used in decimal numbers in the English summary. English abstract must be divided into subheadings of "Purpose," "Methods," "Results," and "Conclusion." The English abstract and keywords should be the same as the Turkish abstract and keywords. Keywords should be selected from "MeSH (Medical Subject Headings)" terms. The out-of-list terms may be used for a new concept that has not taken place in MeSH yet. Each keyword begins with an uppercase letter, separated by a comma and written in alphabetical order. If the article is in English, the keywords in the Turkish abstract should be sorted according to the alphabetical order of the English keywords.

**Sections of the Original Research Articles**

The sections of Turkish Article consist of "Giriş", "Yöntem", "Sonuçlar" and "Tartışma". In English articles, there are "Introduction," "Methods," "Results," and "Discussion" sections. Abbreviations can be used for the expressions repeated more than five times in the manuscript. The explanation of the abbreviation should be stated in the first place in the text.

**Introduction**

The introduction should summarize the basic knowledge obtained from previous studies related to the study topic. The rationale and purpose of the study should be described briefly.

**Methods**

The clinical, technical, or experimental methods in the study should be clearly stated. Appropriate references should be given for the method. In this section, the authors must state that they carried out their studies on humans in accordance with the principles of the Declaration of Helsinki, that they received approval from the relevant ethics committee (name of the ethics committee, date, and protocol number should be written) and informed consent was obtained. The method section should include the subtitle as "Statistical analysis." If an animal is used in the study, the authors should state that they protect animal rights in line with the principles of the Guide for the Care and Use of Laboratory Animals (http://www.nap.edu/catalog/5140.html) and have obtained approval from the relevant ethics committee. A statement that publication approval has been obtained for photographs that may reveal the identity of the participants should be included in this section.

If any statistical program is used, the name of the software program, version number, location, date and company information should be written. Information on statistical analysis methods and the calculation of sample size should be presented and supported with references when necessary.

**Results**

The results should not contain any interpretation that is not based on numerical data. In the text, repetition of the data presented in the tables should be avoided, and the most important results should be emphasized.

**Discussion**

The discussion should begin with information on the most important results obtained in the study. Results from the study should be interpreted and correlated with the results of previous studies. In the discussion, the limitations of the study, its contribution to the literature, and clinical practice should be stated. It should be avoided to repeat the findings in the "Results" section and the tables with their details in the discussion section. Data not obtained in the study should not be discussed.

**The following titles should be added after the discussion section with their explanations:**

- *Sources of Support:* If there are supporting organizations, it should be specified.
- *Conflict of Interest:* It should be stated if there is a conflict of interest.
- *Author Contributions:* Authors' contributions to the article should be stated. Contributions should be gathered under the headings of idea/concept, design, supervision/consulting, resources and funding, materials, data collection and/or processing, analysis and/or interpretation, literature review, article writing, critical review.
- *Explanations:* If the article has been presented in the form of an abstract and/or a conference proceeding before, information about the scientific meeting, place, and date of the presentation, and if published, the publication organ should be stated in the "Explanations" section.
- *Acknowledgement:* Information about individuals and/or organizations that do not meet the criteria for being an author but provided support during the research (reading the article, writing, technical support, language, and statistical support, etc.) should be stated in the "Acknowledgements" section as briefly and concisely as possible.

**References**

References should be placed after the main text. References should be numbered in the order of occurrence in the text, at the end of the sentence (before the point), with Arabic numerals, and in parentheses [Example: ..... it was found (21).]. The number of references should not exceed 40, and the use of references older than ten years should not exceed 15% of the total number of references. Unless necessary, the use of books, web pages, unpublished observations, and personal interviews as references should be avoided. If more than one reference is cited, a comma should be placed between them, and no spaces should be left before or after the comma. An example (3,7,15–19) can be given; "15–19" covers five publications from reference 15 to reference 19. If the article is in English, the references that the name will indicate in the text should be specified as "Author's name et al." (Example: Burtin et al.); if the text is in Turkish, the references that the name will indicate in the text should be specified as "Yazar adı ve diğ." (Example: Burtin ve diğ.).

Journal names should be presented in abbreviated form as in Index Medicus. All authors should be written if the number of authors is six or less in the standard journal. If the number of authors is more than 6, the first six authors should be written, and the other authors should be specified as "ve diğ." for Turkish articles and "et al." for English articles. Authors who will use programs such as Endnote, Mendeley should use the "VANCOUVER" style. The information that must be included in a reference given in Vancouver style is as follows:

- Author(s) name(s), - Article title, - Journal name (abbreviated as in Index Medicus), - Publication year, - Journal volume and issue, - Page range (Example:10-5).

Reference writing examples are as follows:

- *Article;* Burtin C, Saey D, Saglam M, Langer D, Gosselink R, Janssens W, et al. Effectiveness of exercise training in patients with COPD: the role of muscle fatigue. Eur Respir J. 2012;40(2):338-44.
- *Studies published as a supplement of the journal;* Hielkema T, Hadders Algra M. Motor and cognitive outcome after specific early lesions of the brain–a systematic review. Dev Med Child Neurol. 2016;58(Suppl 4):46-52.
- *Book;* Murtagh J. John Murtagh's general practice. 4th ed. Sydney: McGraw-Hill Australia Pty Ltd; 2007.
- *Book Section;* Cerulli G. Treatment of athletic injuries: what we have learned in 50 years. In: Doral MN, Tandogan RN, Mann G, Verdonk R, eds. Sports injuries. Prevention, diagnosis, treatment and rehabilitation. Berlin: Springer-Verlag; 2012: p. 15-9.
- *Congress Papers;* Callaghan MJ, Guney H, Bailey D, Reeves N, Kosolovska K, Maganaris K, et al. The effect of a patellar brace on patella position using weight bearing magnetic resonance imaging. 2014 World Congress of Osteoarthritis Research Society International, April 24-27, 2014, Paris. Osteoartr Cartilage; 2014;22(Suppl):S55.
- *Web page;* Diabetes Australia. Gestational diabetes [Internet]. Canberra (AU): Diabetes Australia; 2015 [updated 2015; cited 2017 Nov 23]. Available from: https://www.diabetesaustralia.com.au/gestational-diabetes.

**Tables**

Tables should be prepared in Microsoft Word file format, placed at the end of the article on separate pages, and numbered according to the order in which they occur in the main text. The total number of tables and figures should be at most 6. A short title should be written for each column heading in the tables. The first letter of each word in table columns must be capital. Table number and title should be at the top of the table; "table" should be written in bold, separated from the table title by (.) (Example: **Table 1.** Sociodemographic Characteristics of the Participants). Vertical lines should not be used in tables, and only horizontal lines should be used above and below the first line and below the last line of the table. The p values in the table should be indicated with *, **. Notes and explanations of abbreviations used in the table should be written at the bottom of the table. While writing the explanation of the abbreviations, the abbreviation should be written first, and the open version of the abbreviation should be written after the colon (:) sign. Abbreviations should be separated by commas. The units of the variables used in the table should be specified in parentheses. Units covering a certain range should be expressed numerically by the range segment. In decimal numbers given in tables, comma (,) in Turkish articles; point (.) in English articles should be used. In the decimal numbers given in the tables, two digits should be written after the comma or the point (Example: 31,12 or 20.10). Values other than a mean, percent, and median values (p, r, etc.) should be written as three digits after the comma/point (Please see the example table below).

**Table 1.** Knowledge Test Results of the Groups

| Knowledge Test | Group TP (n=20) | Group SP (n=20) | Group TP-SP (n=20) | t | p§ |
|---|---|---|---|---|---|
| **Pre Test** | 60.50±13.17 | 69.05±14.11 | 67.14±14.54 | 0.002 | 0.051 |
| **Post Test** | 83.00±14.18 | 73.50±9.33 | 83.33±10.17 | 0.002 | **0.001** |

*p<0,05. §Kruskal Wallis Analysis. TP: Theoretical/practical course group, SP: Simulated patient group, TP-SP: Theoretical/practical course, and simulated patient group.

**Figures**

A list of figures should be placed on a page after the list of tables. The authors are expected to submit good quality figure(s) in JPEG, TIFF, or PNG versions as separate files. The photographs used in the manuscript should be clear. The photographs and figures should be numbered in the order in which they are referenced. If the manuscript involves humans, written consent of the participants should be collected, and precautions should be taken to disguise individuals' identities. The text of the consent form should be sent to the journal with the manuscript. It should be indicated in the first paragraph of the "METHOD" section that the written consent was collected from the participants.

**Manuscript Submission**

Two copies of the manuscript should be prepared for submission as Word files. One file must have all author details included, and the other must be anonymized. Both versions should include the title, abstract, body, and references. All institutions mentioned in the anonymous file (including the institution where the ethics committee approval was obtained) must be written as "X." Both copies will be uploaded (after registering as a user) in the DergiPark (http://dergipark.gov.tr/tjpr) system.

*Peer Review Process:* The editorial and publication process of the journal is shaped following the guidelines of the International Committee of Medical Journal Editors (ICMJE), World Association of Medical Journal Editors (WAME), Council of Science Editors (CSE), Committee on Publication Ethics (COPE), European Association of Science Editors (EASE), and National Information Standards Organization (NISO). The author(s) will be able to follow the evaluation process of the article from the DergiPark system (http://dergipark.gov.tr/tjpr). Manuscripts submitted to the journal will first go through a technical evaluation process where the editorial office staff will ensure that the manuscript has been prepared and submitted following the journal's guidelines. Submissions that do not conform to the journal's guidelines will be returned to the submitting author with technical correction requests. The articles will be evaluated by at least two external referees who are experts in the relevant field, and the referee reports will be sent to the corresponding author. If a revision is required, the author should respond to all referee comments and upload the revised version of the manuscript. This process will be repeated until the editorial board approves the manuscript.

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# EDİTÖRDEN

**Değerli Okuyucu ve Yazarlar,**

Türk Fizyoterapi ve Rehabilitasyon Dergisi, 49 yıldır düzenli olarak her Nisan, Ağustos ve Aralık ayında yayımlanmakta, yurt içinde ve dışında fizyoterapi ve rehabilitasyon alanında çalışan klinisyen ve araştırmacılara önemli bilimsel katkılar sunmaktadır. Ayrıca dergimiz, özellikle ülkemizdeki genç akademisyenler için hem çalışmalarını tüm dünyaya tanıtmalarına hem de akademik atama/yükselme kriterlerini karşılamalarına yardımcı, saygın bir bilimsel platform olma özelliğine sahiptir.

Yayın Kurulu olarak dergimizin atıf performansını arttırarak WOS'un Science Citation Index Expanded (SCIE) koleksiyonunda da yer alabilmesi ve bilim dünyasında daha görünür ve etkin olabilmesi için çalışmalarımızı kararlılıkla sürdüreceğiz. Bununla birlikte, dergimizin fizyoterapi ve rehabilitasyon disiplini içerisindeki etki gücünü geliştirmek ve SCIE'nin zorlu kalite standartlarını karşılayabilmek için siz değerli okuyucu ve yazarlarımızın desteklerine her zaman ihtiyaç duymaktayız. Bu nedenle, özellikle WOS'ta dizinlenen bir dergiye makale hazırlarken Türk Fizyoterapi ve Rehabilitasyon Dergisinde konuya ilişkin bir makale olup olmadığını kontrol ederek ve uygunsa dergimize atıfta bulunarak destek verebileceğinizi hatırlatmak isteriz.

Değerli okuyucu, yazar ve hakemlerimizin destekleri ile dergimizin kendi disiplininde her geçen gün daha görünür hale geleceğine, ulusal ve uluslararası atıf sıralamalarında yükseleceğine ilişkin inancımız tamdır. Yayın Kurulu olarak dergimize gösterdiğiniz ilgi ve katkılarınız için teşekkür eder, klinik ve akademik çalışmalarınızda başarılar dileriz.

Yayın Kurulu adına,

Saygılarımla,

Prof. Dr. H Serap İNAL

Baş Editör

# EDİTÖRDEN

**Dear Readers and Authors,**

The Turkish Journal of Physiotherapy and Rehabilitation has been published regularly every April, August, and December for 49 years and provides important scientific contributions to clinicians and researchers working in the field of physiotherapy and rehabilitation in the country and abroad. In addition, our journal has the feature of being a respected scientific platform, especially for young academicians in our country, which helps them both to introduce their work to the whole world and to meet the criteria for academic appointment / promotion.

As the Editorial Board, we will resolutely continue our efforts to increase citation performance of the journal, to be included in the Science Citation Index Expanded (SCIE) collection of WOS and to improve visibility and impact in the scientific world. However, we always need the support of our esteemed readers and authors, to improve the impact of our journal in the discipline of physiotherapy and rehabilitation and to meet the demanding quality standards of SCIE. For this reason, we would like to remind you that when preparing an article for a journal indexed in WOS, you can support by checking and citing if there is an article on the subject in the Turkish Journal of Physiotherapy and Rehabilitation.

With the support of our esteemed readers, authors, and referees, we firmly believe that our journal will become more visible in its own discipline and will rise in national and international citation rankings. As the Editorial Board, we thank you for your interest and contributions to our journal and wish you success in your clinical and academic studies.

On Behalf of the Editorial Board,

Kind Regards,

H. Serap İNAL, PT. Prof.

Editor-in-Chief

ISSN:2651-4451 • e-ISSN: 2651-446X

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**2023 34(1)**

**www.dergipark.gov.tr/tjpr**

# Turkish Journal of Physiotherapy and Rehabilitation

Türk Fizyoterapi ve Rehabilitasyon Dergisi

## ARAŞTIRMA MAKALELERİ (ORIGINAL ARTICLES)

ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)13-20*

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***Received:*** *20.05.2022 (Geliş Tarihi)*
***Accepted:*** *25.01.2023 (Kabul Tarihi)*

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# CORRELATION BETWEEN FOOTWEAR SUITABILITY, FEAR OF FALLING AND PHYSICAL ACTIVITY IN THE THIRD TRIMESTER

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** Pregnancy is a time in which the biomechanics of the body changes due to intense physiological and physical changes, especially in the third trimester, when an increase in falls and a decrease in physical activity may occur. The aim of this study is to investigate the relationship between the suitability of footwear used by pregnant women, fear of falling, and physical activity in third trimester of pregnancy.

**Methods:** One hundred twenty-three pregnant women aged between 18-40 years with a gestational age of 28 weeks and above were included the study. The Footwear Assessment Score was used to assess the suitability of the footwear. The fear of falling of the participants was measured using the Falls Efficacy Scale-International, and the physical activity level was measured using the short form of the International Physical Activity Questionnaire.

**Results:** A low negative correlation (r=-0.215;p<0.05) was found between physical activity and fear of falling, and a low positive correlation (r=0.256;p<0.01) was found between footwear suitability and physical activity in pregnant women. There was no statistically significant relationship (r=-0.120;p=0.185) between footwear suitability and fear of falling.

**Conclusion:** According to the findings of the current study, it can be concluded that physical activity and a more appropriate choice of shoes based on the level of physical activity may reduce the fear of falling during pregnancy. Future studies are needed to investigate footwear suitability during pregnancy in more detail.

**Keywords:** Footwear Suitability, Fear of Falling, Physical Activity, Pregnancy, Third Trimester

# ÜÇÜNCÜ TRİMESTERDE AYAKKABI UYGUNLUĞU, DÜŞME KORKUSU VE FİZİKSEL AKTİVİTE ARASINDAKİ İLİŞKİ

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Gebelik, özellikle üçüncü trimesterde yoğun fizyolojik ve fiziksel değişikliklere bağlı olarak vücut biyomekaniğinin değiştiği, düşmelerde artış ve fiziksel aktivitede azalmanın söz konusu olabildiği bir dönemdir. Bu çalışmanın amacı gebeliğin üçüncü trimesterinde gebelerin kullanmış olduğu ayakkabıların uygunluğu, düşme korkusu ve fiziksel aktivite arasındaki ilişkiyi araştırmaktır.

**Yöntem:** Çalışmaya 18 - 40 yaş arası, gestasyonel yaşı 28 hafta ve üzeri olan 123 gebe dahil edildi. Ayakkabı uygunluğunu değerlendirmek için Ayakkabı Değerlendirme Ölçeği kullanıldı. Katılımcıların düşme korkusu Uluslararası Düşme Etkinlik Ölçeği ile, fiziksel aktivite düzeyleri ise Uluslararası Fiziksel Aktivite Anketi – kısa form kullanılarak ölçüldü.

**Sonuçlar:** Gebelerde fiziksel aktivite ile düşme korkusu arasında düşük negatif korelasyon (r=-0,215;p<0,05), ayakkabı uygunluğu ile fiziksel aktivite arasında düşük pozitif korelasyon (r= 0,25;p<0,01) bulundu. Ayakkabı uygunluğu ile düşme korkusu arasında istatistiksel olarak anlamlı bir ilişki (r=-0,120;p=0,185) yoktu.

**Tartışma:** Bu araştırmanın bulgularına göre gebe kadınlarda fiziksel aktivite düzeyi arttıkça ayakkabı seçiminde daha uygun ayakkaılar olacağı ve fiziksel aktivitenin gebelikte düşme korkusunu azaltabileceği sonucuna varılabilir. Gebelikte ayakkabı uygunluğunun daha detaylı araştırılması için gelecek çalışmalara ihtiyaç vardır.

**Anahtar kelimeler:** Ayakkabı Uygunluğu, Düşme Korkusu, Fiziksel Aktivite, Gebelik, Üçüncü Trimester

## INTRODUCTION

Pregnancy is a complex period of intense physiological and bodily changes, especially in third trimester, which may have an impact on the well-being of the mother. Changes include a growing uterus, hormone fluctuations, triggering ligamentous laxity and weight gain (1,2). There are also postural changes and biomechanical adaptations that develop during pregnancy, such as moving the center of gravity forward due to the developing fetus and growing uterus, which results in increased lumbal lordosis (2,3). In order for the longitudinal arch to adapt to the increased body weight, the foot must have sufficient flexibility (4). The hormonal changes during pregnancy increase the laxity of ligaments and cause a decrease in the height of the foot arches and an increase in the foot length and forefoot width (4–6). Due to these anatomical adaptations in the foot, choosing suitable shoes during pregnancy is crucial and can be difficult. The use of appropriate shoes positively affects physical fitness and performance by supporting the arches of the foot. Kolářová et al. (7) reported that the load on the foot shifts during pregnancy in a forward medial direction and the plantar pressure values increase under the longitudinal arch and medial forefoot region. In the same study, the authors investigated the effects of biomechanical shoes, which consist of patented insoles, to promote a more balanced load on all the toes when walking and correction of the calcaneus position in pregnant women; but there was no effect of the biomechanical shoes worn at least 3 hours a day on the feet of pregnant women (7). Previous studies have also focused on special footwear designs for pregnant women as foot health is important (8,9). While most of the studies investigate the effects of special or specially designed shoes during pregnancy (8–11), there is a limited number of studies examining the shoes that women choose during pregnancy (12).

Postural and biomechanical changes occurring in the joints and soft tissues, such as ligaments, alter the postural balance and increase the risk of falling (2). According to a study conducted by Dunning et al. (13), 1070 of 3997 pregnant women reported falling at least once during pregnancy. Falling may be due to internal factors as well as external factors, such as inappropriate shoes (14). The leading extrinsic causes of falls of pregnant women are slippery surface and carrying an object (or a child) (14). In a study, it was also reported that the risk of falling is significantly increased in pregnant women who do not participate in regular physical activity (15).

A reduction of physical activity is often observed as a result of various factors during pregnancy (16). Román-Gálvez et al. (17) reported that physical activity decreases with pregnancy, increases slightly in the second trimester but drops in the third trimester. However, regular physical activity during pregnancy improves physical conditioning, helps control maternal weight gain, improves body image, and provides psychological well-being (16). Physical activity during pregnancy can also improve cardiovascular health by reducing heart rate and blood pressure, improve pulmonary function by increasing peak flow and improving oxygen uptake, and reduce the risk of developing gestational diabetes by increasing insulin affinity 16,17). Additional advantages are reduced risk of depression, improved quality of sleep, reduced anxiety, and reduced edema in the extremities (16). Increasing physical activity during pregnancy is important for the health of the pregnant woman and the fetus considering the majority of body changes occur in the third trimester. Similarly, it is also important to know the factors that cause falling during pregnancy to reduce the risk of falling and to protect the health both of pregnant woman and the fetus. So, the aim of this study is to investigate the relationship between the footwear suitability, fear of falling, and physical activity in third trimester of pregnancy.

## METHODS

This cross-sectional descriptive study was carried out in accordance with the guidelines of Declaration of Helsinki and approved by the Ethics Committee of Erciyes University under protocol number 96681246-2019/727. Written informed consent was obtained from all subjects included in the study.

### Participants

The study sample consisted of 123 pregnant women followed up for antenatal care in the Kayseri City Hospital. Between October 2019 and June 2020, women aged between 18-40 years, having a spontaneous pregnancy, and with a gestational age of 28 weeks and above were included in the study. Women with high-risk pregnancies detected by the physician, with chronic (neurologic, endocrine, orthopedic, or rheumatologic) diseases, with chronic vertigo, with acute or chronic otitis media, with multiple pregnancies, and women who wore shoes other than regular daily footwear at the time of assessments were excluded.

### Sample size

In the literature, a correlation coefficient 0.271 was reported for the relationship between fall risk and physical activity in women aged 20-73 years (18). In this study, we hypothesized to detect a significant relationship between fear of falling and physical activity with a correlation coefficient in pregnant women. The sample size was calculated as 123 subjects to detect this relationship with a 95% confidence level and 80% power (19).

### Measurements

Socio-demographic characteristics of the participants, such as age, education level, occupation, smoking-alcohol use, medication use, previous pregnancy and number of miscarriages, gestational week, and the history of falls in current and previous pregnancies were recorded. Participants were also asked if the shoes worn at the time of assessments were their regular daily footwear.

The Footwear Assessment Score (FAS) was used to assess the suitability of the footwear. The footwear-related parameters, such as the shoe style, bending point, width, height of the toe box, slipping out of the foot when walking, the distance between the longest toe and the shoe, heel height and fixation are assessed with FAS. Scored out of 15, higher scores indicate a higher suitability level of the footwear (20,21). Although the FAS is a scale developed primarily for use in children's footwear, it is also used in different age groups such as adults (22), older adults, (23) and elderly (24) in the literature. The Turkish version of FAS proved to be reliable (20).

The fear of falling of the participants was measured using The Falls Efficacy Scale-International (FES-I). The scale is a commonly used clinical tool for the assessment of perceived confidence in performing a range of activities (both physical and social) of daily life without falling. FES-I consists of 16 items, which are scored on a 4-point Likert scale ranging from 1 (not at all concerned) to 4 (very concerned). Response scores for all items are summed to yield a total FES-I score ranging between 16 (absence of concern) and 64 (extreme concern), with a higher sum score indicating lower self-efficacy (25). The Turkish version of FES-I proved to have reliability and validity (26).

The International Physical Activity Questionnaire (IPAQ) is a widely used standardized tool to measure the level of physical activity, with the long (27-item) and short form (7-item) versions available (27). The short form of IPAQ was used to evaluate the level of physical activity of the participants in this study. The questionnaire included questions about the frequency and duration of vigorous intensity, moderate intensity, and walking activity in the previous 7 days. The scores were calculated of the estimation of energy expenditure in metabolic equivalent (MET) (3.3 MET for walking, 4 MET for moderate activity and 8 MET for vigorous activity) (27,28)097 university students (721 women, 376 men; ages 18-32. The results of the items were summarized to determine the overall physical activity score of all categories and the participants were classified into high, moderate, and low activity groups based on their scores. In this study, high physical activity level was defined as >3000 MET-min/week, moderate physical activity level 600-3000 MET-min/week, and low physical activity level <600 MET-min/week. The Turkish version of FES-I proved to have reliability and validity (27,29)but no standardised systems exist for international surveillance. The International Physical Activity Questionnaire (IPAQ. The IPAQ also contained an item about time spent sitting, developed as a separate indicator and not

**Table 1.** Sociodemographic and Clinical Characteristics of the Participants

| | X ± SD | MIN - MAX |
|---|---|---|
| **Age (year)** | **27.41 ± 5.62** | **18 - 41** |
| **Gestational age (week)** | **36.48 ± 2.5** | **29 - 41** |
| | **n** | **%** |
| **Educational level** | | |
| Elementary school | 58 | 47.15 |
| High school | 52 | 42.28 |
| Undergraduate | 11 | 8.94 |
| Graduate | 2 | 1.63 |
| **Occupation** | | |
| Housewife | 103 | 83.74 |
| Government official | 9 | 7.32 |
| Self-employed | 9 | 7.32 |
| Other | 2 | 1.63 |
| **Number of previous pregnancies** | | |
| 0 | 74 | 60.16 |
| 1 | 27 | 21.95 |
| 2 | 11 | 8.94 |
| ≥ 3 | 11 | 8.94 |
| **Number of miscarriages** | | |
| 0 | 117 | 95.12 |
| 1 | 4 | 3.25 |
| ≥ 2 | 2 | 2.63 |

X ± SD = mean ± standard deviation; MIN – MAX = minimum - maximum

as part of the summed physical activity score (27,28)097 university students (721 women, 376 men; ages 18-32, and it was not included in physical activity score in this study.

## Statistical analysis

Qualitative variables are presented as percentages and quantitative variables are shown as means with standard deviations. Data analyses were performed using the SPSS V.20 (SPSS Inc., USA) program. The Shapiro-Wilk test was used to evaluate whether the data had normal distribution. Spearman correlation coefficient and statistical significance were calculated for the relationships between variables, at least one of which was not normally distributed. The significance level was accepted as $p < 0.05$.

## RESULTS

Nine women had a history of falling at least once in their previous pregnancies, and another seven had a history of falling at least once in their current pregnancy. There was no woman with a history of falling in both her previous and cur-

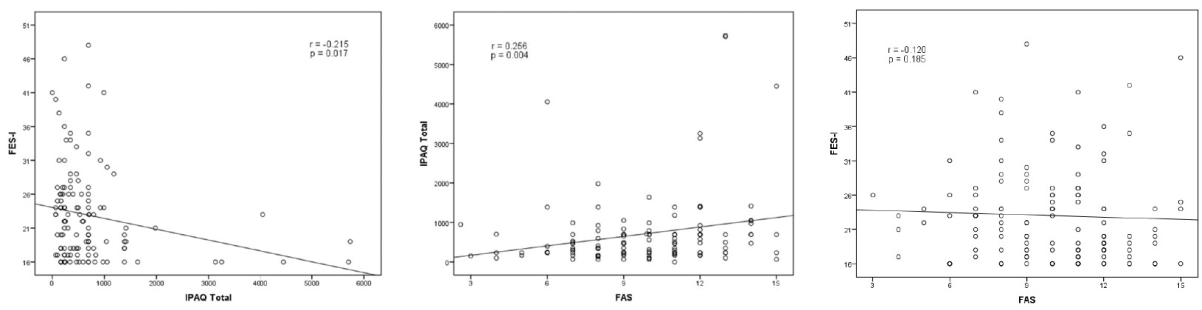


**Figure 1.** The Relationships Between Footwear Suitability, Fear of Falling and Physical Activity. IPAQ = International Physical Activity Scale; FES-I = The Falls Efficacy Scale-International; FAS = The Footwear Assessment Score

**Table 2.** The Footwear Suitability, Fear of Falling, Physical Activity Scores and Physical Activity Levels of Participants

| | X±SD | MIN-MAX |
|---|---|---|
| **FAS** | 9.92 ± 2.63 | 3 - 15 |
| **FES-I** | 22.61 ± 7,1 | 16 - 48 |
| **IPAQ (MET-min/week)** | | |
| Vigorous | 0 | 0 |
| Moderate | 144.32 ± 482.43 | 0 - 3360 |
| Walking | 563.41 ± 690.8 | 0 - 5544 |
| IPAQ Total | 707.78 ± 949.11 | 0 - 5704 |
| Sitting | 420.2 ±343 | 90 - 2400 |
| | **n** | **%** |
| **The physical activity level according to IPAQ** | | |
| Low | 75 | 61 |
| Moderate | 42 | 34.1 |
| High | 6 | 4.9 |

X ± SD = mean ± standard deviation; MIN – MAX = minimum – maximum; FAS = The Footwear Assessment Score; FES-I = The Falls Efficacy Scale – International; IPAQ = International Physical Activity Questionnaire; MET = metabolic equivalent task

rent pregnancies. None of the pregnant women included in the study were on medication other than vitamin/mineral supplements taken under physician supervision during pregnancy. None of the women consumed alcohol, and 12 women declared that they smoked during their current pregnancies. Other demographic and clinical characteristics of the participants included in the study are shown in Table 1. The footwear suitability, the fear of falling, the physical activity scores and levels are shown in Table 2. The physical activity levels of the pregnant women were categorized as low (n = 75), moderate (n = 42), and high (n = 6) according to IPAQ (Table 2).

The results of the study showed a low negative correlation (r = -0.215; p = 0.017) between physical activity and fear of falling, and a low positive correlation (r = 0.256; p = 0.004) between footwear suitability and physical activity in pregnant women. There was no statistically significant relationship (r = -0.120; p = 0.185) between footwear suitability and fear of falling (Figure 1).

## DISCUSSION

TTo our knowledge, there is no study that investigates the relationship between footwear suitability, fear of falling, and physical activity during pregnancy. In this study where we aimed to investigate the relationship between footwear suitability, fear of falling, and physical activity in the third trimester of pregnancy, a low positive correlation was found between footwear suitability and physical activity, and a low negative correlation was found between physical activity and fear of falling in pregnant women. However, there was no relationship between footwear suitability and fear of falling in pregnant women. One of the important findings in this study is that more than half of the pregnant women had low physical activity levels according to the IPAQ.

As pregnancy progresses, physical changes occur, such as the shift of the center of gravity, increased lumbar lordosis, and a decrease in the longitudinal arch of the foot due to increased body mass and an enlarged uterus (3,4). The kinematics of gait also changes during pregnancy with the changes in pelvic tilt, increased hip flexion, stance knee and swing foot angle ranges of motion (30,31). Due to the anatomical adaptations and changes in gait kinematics, choosing suitable shoes during pregnancy is important and can be difficult. Low heel height (<3 cm), but not flat shoes, is recommended during pregnancy to avoid musculoskeletal disorders (32). Kolářová et al. (7) reported that the load of the foot shifts during pregnancy in a forward medial direction and the plantar pressure values increase under the longitudinal arc and medial forefoot region, but it has also been noted that the biomechanical shoes worn at least 3 hours a day had no effects on the feet of pregnant women. While most

of the studies investigate the effects of special or specially designed shoes during pregnancy (8–11), there is a limited number of studies examining the shoes that women choose during pregnancy (12). Most of these studies investigated the causes of falls during pregnancy and mentioned the unsuitability of the shoes at the time of the fall (12,13,33,34). In a qualitative research performed by Brewin et. al. (1), pregnant women reported wearing slippers, flip-flops, or high heels. In another study, the use of high heels during pregnancy was mentioned (32). The present research is one of the few studies in the literature investigating the shoes that women choose during pregnancy. As a result of this study, an average of 9.9 points was obtained in the suitability of shoes evaluated with the FAS, with a maximum of 15 points, which may indicate that suitable shoes were used during pregnancy by most of the participants.

A number of previous studies have evaluated postural balance and found decreased postural equilibrium and increased postural instability, especially greater antero-posterior sway, during pregnancy (35,36). Postural and biomechanical changes occurring in the joints and soft tissues, such as ligaments, alter the postural balance and increase the risk of falling during pregnancy (2). Falls are a common cause of injury during pregnancy, such as bone fractures, preterm delivery, joint and muscle injuries, and head trauma, and they potentially pose a danger to both maternal and fetal health (2,37). It was reported that falls are the second most common cause of trauma in pregnancy after traffic accidents (38). There are many risk factors for falling during pregnancy such as women ≥ 160 cm in height, young women compared to older pregnant women, walking on slippery floors, carrying an object, or having one or more toddlers (13,33,34). In a current systematic review 13 intrinsic and 11 extrinsic risk factors for falling during pregnancy were identified, including inappropriate shoes (14). It was also recommended to wear shoes to increase the shoe-floor coefficient of friction to reduce falls during pregnancy (39). In our study, no significant correlation was found between footwear suitability and fear of falling perceived by women ($r = -0.120$; $p = 0.185$). So, it can be concluded that the choice of shoes does not affect the fear of falling during pregnancy. However, it is important to note that this result emphasizes footwear suitability and "fear of falling", not the actual fall events in pregnancy. More studies that investigate the relationship between the history of falling in the past or current pregnancy and the suitability of footwear are needed. McCrory et al. (15) also reported that the risk of falling is significantly increased in pregnant women who do not participate in regular physical activity.

Regular physical activity during pregnancy is crucial and previous studies have focused on this topic (17,40,41). Daşıkan et. al (42) reported that pregnant women had low physical activity levels in Turkey. In the present study, only 6 (5%) women had high, 42 (34%) women had moderate, and 75 (61%) had low levels of physical activity. According to a cohort study, physical activity decreases during pregnancy and critically drops in the third trimester (17). However, guidelines include recommendations to encourage pregnant women without any complications to perform moderate-intensity physical activity during pregnancy (40,41). Physical exercises were suggested as preventative strategies to increase postural stability and reduce the risk of falling among pregnant women (2,15). McCrory et al. (15) reported that sedentary pregnant women had a higher rate of falls than those who performed exercise. Similarly, there was a low correlation between physical activity and fear of falling in our study. The fear of falling in pregnant women decreased as they exercised. Physical activity, among other important and positive effects, can create a healthier pregnancy experience by reducing the fear of falling in pregnant women.

Gimunová et al. (9) reported that special footwear designed for pregnant women changes the kinematic of gait pattern with a preventive effect against the falling of the foot arches. Another study demonstrated that wearing special footwear among pregnant women may prevent venous blood velocity reduction and decrease the risk of venous disease development during advanced phases of pregnancy (10). Considering the effects of body kinematics and blood circulation on physical activity, there may be a link

between the shoes used during pregnancy and physical activity. However, in a study by Kolářová et al. (7) examining the effect of biomechanical shoes during and after pregnancy, no statistically significant difference was found between the control and experimental groups. In this study, we demonstrated a low correlation between physical activity and footwear suitability. FAS scores also increased with increasing physical activity levels. Pregnant women with high physical activity levels may be choosing more appropriate shoes. However, it should be kept in mind that a comparison based on the physical activity levels of pregnant women will present more convenient results. Based on this contentious information about the effects of shoes during pregnancy in the literature, future research can focus on this topic.

The present study also had some limitations. First, the pregnant women included in the study were asked if the shoes worn at the time of assessments were their regular daily footwear. Although the shoes that the women wore most frequently during pregnancy were evaluated, different shoes they occasionally wear may also influence the fear of falling and physical activity. Second, more than half of the participants had low physical activity levels, and only six out of 123 women had a high level of physical activity. Third, the type of shoes (e.g., sneakers or flats) used by the participants was not noted. The last limitation is that the amount of time women (mainly housewives) spend outside in the winter or the effects of environmental factors on their fear of falling due to the winter season have not been questioned. Studies are needed to be conducted with a similar number of participants from each of the three levels of physical activity.

## CONCLUSION

In conclusion, there was a low positive correlation between footwear suitability and physical activity, and a low negative correlation between physical activity and fear of falling in the third trimester of pregnancy. However, no relationship was found between footwear suitability and fear of falling. According to the findings of the current study, it can be concluded that pregnant women may be choosing more appropriate shoes as the level of physical activity increases, and physical activity may reduce the fear of falling during pregnancy. Future studies are needed to investigate footwear suitability during pregnancy.

***Sources of support:*** This study has been supported by TÜBİTAK 2209-A Project (Registration number: 1919B011901991).

***Conflict of Interest:*** The authors declare no conflicts of interest.

***Author Contributions:*** All authors contributed to the project's initial conception. Concept – BKV, MYG, HA; Design – BKV, MYG, HA, DO, BED, GG, AS; Supervision – BKV, MYG, HA; Data collection and/or Processing – DO, BED, GG, AS; Statistical analysis and/or interpretation – BKV; Literature Research – BKV, MYG, DO, BED, GG, AS; Writing manuscript – BKV, MYG, DO, BED, GG, AS; Reviewing/editing the manuscript – BKV, MTG and HA.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)21-28*

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***Received:*** *5.08.2021 (Geliş Tarihi)*
***Accepted:*** *2.12.2022 (Kabul Tarihi)*

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# THE ACUTE EFFECT OF STATIC VERSUS PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION STRETCHING COMBINED WITH KINESIOLOGY TAPING® OF HAMSTRING MUSCLES ON FUNCTIONAL TESTS IN ADOLESCENT TAEKWONDO ATHLETES

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** In taekwondo, muscle flexibility specifically in the lower limb is of great importance for athletic performance. In this study, we evaluated the acute effects of static versus proprioceptive neuromuscular facilitation (PNF) stretching combined with kinesiology taping (KT) of the hamstring muscle on functional tests in adolescent taekwondo athletes.

**Methods:** 20 adolescent taekwondo athletes aged 9 to 18 years with red, black belt color participated in this study. They performed static, or PNF stretching in both legs, then two I strips with 30% tension as an inhibitory fashion was applied over the hamstring muscles of one leg and the other leg was determined as control. Single leg vertical jump test, single leg hop test, and taekwondo specific agility test (TSAT) were performed before, just after, and 24 hours after interventions.

**Results:** Repeated measures ANOVA test was used for statistical analysis of the data. All functional tests results demonstrated significant improvement over time (Single leg vertical jump ($p=0.005$), single leg hop test ($p=0.01$), and TSAT ($p=0.03$)) but none of the stretching or the KT groups affected the functional performance of the participants (Single leg vertical jump ($p=0.36$) and single leg hop test ($p=0.50$)).

**Conclusion:** We think that both static and PNF stretching exercises improve the functional performance of adolescent taekwando athletes for up to 24 hours, however KT application has no significant effect.

**Keywords:** Athletes, Functional Tests, Kinesiology Taping, Stretching

# ADÖLESAN TEKVANDO SPORCULARINDA KİNEZYOLOJİK BANTLAMA® İLE BİRLİKTE UYGULANAN STATİK GERMEYE KARŞI PROPRİOSEPTİF NÖROMUSKÜLER GERMENİN FONKSİYONEL TESTLERE AKUT ETKİSİ

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Özellikle alt ekstremitedeki kas esnekliği, tekvandoda sportif performans için büyük önem taşımaktadır. Bu çalışmada, adölesan taekwondo sporcularında hamstring kasına uygulanan kinezyolojik bantlama ile birlikte statik veya proprioseptif nöromüsküler fasilitasyon (PNF) germe egzersizinin akut etkilerini fonksiyonel testler üzerinde değerlendirdik.

**Yöntem:** Bu çalışmaya 9-18 yaş arası kırmızı, siyah kuşaklı 20 adölesan tekvando oyuncusu katıldı. Her iki bacağa statik veya PNF germe uygulandı. Ardından bir bacağın hamstring kasına inhibisyon amacıyla %30 gerimli iki adet I bandı uygulanırken diğer bacak kontrol olarak belirlendi. Müdahalelerden önce, hemen sonra ve 24 saat sonra tek bacak dikey sıçrama testi, tek bacak hoplama testi ve tekvandoya özgü çeviklik testi (TÖÇT) uygulandı.

**Sonuçlar:** İstatistiksel analizler için tekrarlanan ölçümlerde ANOVA testi kullanıldı. Tüm fonksiyonel test sonuçları zaman içinde artış gösterdi (tek bacak dikey sıçrama testi $p=0,005$, tek bacak hoplama testi $p=0,01$ ve TÖÇT $p=0,03$) ancak germe veya KT gruplarının hiçbirinde katılımcıların fonksiyonel performansının etkilenmediği görüldü (tek bacak dikey sıçrama testi $p=0,36$ ve tek bacak hoplama testi için $p=0,50$).

**Tartışma:** Herhangi belirgin bir fark olmadan hem statik hem de PNF germe egzersizlerinin, adölesan tekvando oyuncularının fonksiyonel performansını 24 saate kadar iyileştirebilir. KT uygulamasının önemli bir etkisi olmamıştır.

**Anahtar Kelimeler:** Sporcular, Fonksiyonel Testler, Kinezyolojik Bantlama, Germe

## INTRODUCTION

Taekwondo has evolved into an Olympic combat sport in the modern day. Taekwondo movements require a high degree of flexibility, particularly in the lower limbs (1). Additionally, kicking techniques are preferred over upper extremity blows due to their higher ratings. According to cinematic and isokinetic analysis, adequate hip and knee joint range of motion, particularly in end range, during a kick movement is critical for optimal task performance, which can be influenced in a variety of ways by antagonist muscle stiffness (2). Sufficient muscle flexibility is believed to be one of the critical components, and it has been noted that insufficient flexibility can predispose an athlete to injury and even delay the recovery period (3-5).

Stretching exercises are extensively utilized by athletes for a variety of goals, including improving flexibility and functional performance or preventing injury, as part of their warm-up routines and before to their primary athletic activity (6). Static and PNF stretching techniques are known to be popular among athletes and to enhance range of motion in both the short and long term (7,8). There has recently been disagreement about the effect of pre-activity stretching on athletes' functional performance, with some studies reporting harmful impacts on athletic performance when stretching was applied just before the sport activity (9,10).

Kinesiology taping (KT) is a method which utilizes an elastic tape that represents the behavior of the skin (11). It was first developed by Dr. Kase in 1990 and recently a growing number of athletes use it for different purposes like muscle activity and extensibility and functional performance modifications (6,12,13). However, available evidence about KT's effectiveness and mechanism of action is sparse, and current research in the sports and musculoskeletal domains has not produced consistent results (11,12,14).

In light of the aforementioned discrepancies, we hypothesized that combining KT with stretching techniques could yield positive effects in terms of enhancing flexibility and functional performance.

## METHODS

### Participants

Our study included 20 adolescent taekwondo athletes aged between 9 to 18 years with red, black belts who had practiced taekwondo sessions at least one hour, three times a week for the previous two years. From October 2018 to April 2019, we conducted research at the Iran Taekwondo Federation. Using pain medication and having a history of lower limb injury or neuromuscular issues within the last year, as well as being unable to do the functional tests effectively or maintain KT for 24 hours, were exclusion factors (6). We obtained approval for the study from the Research Council and Ethics Committee affiliated with Iran University of Medical Science, as well as individual signed informed permission. Additionally, individuals were permitted to withdraw from the survey at any point during the study. Table 1 summarizes the participant's demographic characteristics.

### Procedure

Static and PNF stretching groups were assigned at random to the participants. A ball-kick test was used to determine which leg was the dominant one. In a supine position, leg length was measured from the anterior superior iliac spine

**Table 1.** Demographic Information of the Participants

| Group | Static | | | PNF | | | |
|---|---|---|---|---|---|---|---|
| | Min | Max | Mean (SD) | Min | Max | Mean (SD) | P |
| **Age (year)** | 10 | 15 | 12.2 (1.81) | 9 | 18 | 12 (2.62) | 0.84 |
| **Height (cm)** | 144 | 178 | 162 (10.28) | 136 | 174 | 154 (11.65) | 0.11 |
| **Weight (kg)** | 32 | 61 | 49.7 (7.76) | 28 | 64 | 44 (11.74) | 0.22 |
| **BMI (kg/m²)** | 15.43 | 20.86 | 18.81 (1.66) | 15.13 | 21.75 | 18.45 (2.48) | 0.70 |

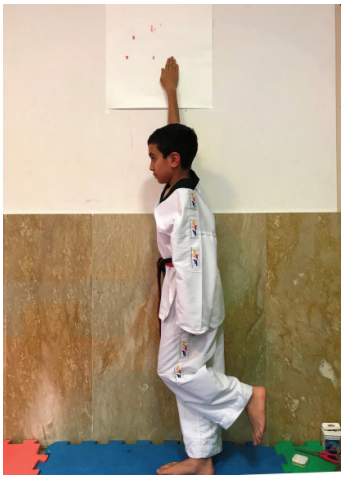

**Figure 1.** Single leg jump and reach test


**Figure 2.** Single Leg Hop Test

to the distal region of the medial malleolus (15). Ten minutes of jogging and submaximal kicking, squatting, and jumping served as the warm-up (16). Athletes repeated each functional test for familiarization (16,17). Following that, a blind examiner evaluated the participant's functional ability using three functional tests separated by one-minute rest periods. Following that, another researcher conducted static or PNF stretching to both legs and randomly tapped one of the dominant or non-dominant legs with KT. Acute and 24-hour follow-up functional assessments were performed. Both legs were completed with a single leg vertical jump (SLVJ) and a single leg hop test (SLH); one leg had KT and the other did not. As a control group, we used the other leg (without KT). We were unable to compare KT and no-KT individually because the taekwondo specialized agility test (TSAT) is done with both legs. For the Taekwondo-specific agility test, we compared static and PNF stretching groups before and after treatments (without stretch and KT) (with stretch and KT).

## Functional tests

### Single leg vertical jump

The athlete was advised to stand on one leg, approximately one foot away from the wall, and use their index finger to make a mark on the wall as a reference point. They then leapt to their feet and left a mark on the wall. The difference between these two points in centimeter was determined, and the test result was derived as the average of the two best results out of three attempts (see Figure 1) (18). Both legs were tested; one had KT and the other did not; the non-KT leg served as a control group. According to statistical analysis, the ICC of this test was 0.93.

### Single leg hop test

The athlete was told to stand behind a starting line with his testing leg's toe tangent to the line. The patient then jumped forward as far as he could and landed on the test leg, holding the landing posture for at least two seconds. After normalizing to the subject leg length, the distance between the rare foot at landing and the start point was measured in centimeter, and the test result was the average of two best performances out of three attempts (see Figure 2). Both legs were tested, and trials with extra hop landings or instability were disqualified (17). The test was carried out on both legs, one of which had KT and the other which did not. The no-KT group served as the control group. According to statistical analysis, the ICC of this test was 0.93.

### Taekwondo specific agility test

The test was conducted in a 4*4-meter area with three sparring partners who were nearly as tall as the subject and held torso-height kick targets (partner 1 and 2 held one, and partner 3 held two kick targets). The individual took a position in front of the starting/ending point. At the start of the test, the athlete stepped forward without crossing his or her feet. Then, facing partner 1, perform a round house kick (dollyo-chagi) with your left leg. Then, facing partner 2, perform a round house kick with your right leg. Then, retaining a guard position, return to the central point

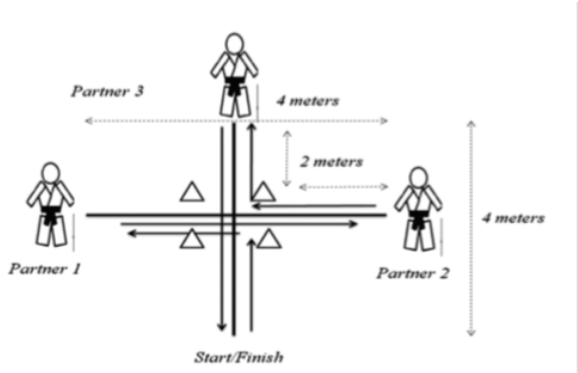


**Figure 3.** Taekwondo Specific Agility Test

**Table 2.** Functional Tests Properties in Static and PNF Stretching Groups with and without Kinesiology Taping

| Tests | Stretching Group | Mean and SD | Mean Difference | Sig. (2-tailed) Lower | 95% Confidence Interval of the Difference | |
|---|---|---|---|---|---|---|
| | | | | | | Upper |
| **SLVJ1 no-KT (cm)** | Static<br>PNF | 20.90 (5.36)<br>21.75 (5.13) | -0.85 | 0.72 | -5.78 | 4.08 |
| **SLVJ 1 KT (cm)** | Static<br>PNF | 20.75 (5.84)<br>21.32 (4.03) | -0.57 | 0.80 | -5.29 | 4.14 |
| **SLVJ 2 no-KT (cm)** | Static<br>PNF | 21.55 (5.96)<br>21.82 (5.72) | -0.27 | 0.91 | -5.63 | 5.08 |
| **SLVJ 2 KT (cm)** | Static<br>PNF | 21.67 (5.34)<br>23.20 (4.15) | -1.52 | 0.48 | -6.02 | 2.97 |
| **SLVJ 3 no-KT (cm)** | Static<br>PNF | 22.82 (6.25)<br>23.37 (6.40) | -0.55 | 0.84 | -6.49 | 5.39 |
| **SLVJ 3 KT (cm)** | Static<br>PNF | 21.90 (5.00)<br>22.50 (4.07) | -0.60 | 0.77 | -4.88 | 3.68 |
| **SLHT1 no-KT (cm)** | Static<br>PNF | 130.54 (18.70)<br>129.55 (17.65) | 0.98 | 0.90 | -16.09 | 18.07 |
| **SLHT1 KT (cm)** | Static<br>PNF | 133.54 (25.70)<br>126.06 (17.48) | 7.48 | 0.45 | -13.16 | 28.13 |
| **SLHT2 no-KT (cm)** | Static<br>PNF | 138.78 (17.23)<br>132.75 (23.77) | 6.02 | 0.52 | -13.48 | 25.53 |
| **SLHT2 KT (cm)** | Static<br>PNF | 138.46 (23.84)<br>133.84 (20.96) | 4.61 | 0.65 | -16.47 | 25.70 |
| **SLHT3 no-KT (cm)** | Static<br>PNF | 135.24 (25.63)<br>139.78 (24.21) | -4.54 | 0.68 | -27.96 | 18.88 |
| **SLHT3 KT (cm)** | Static<br>PNF | 140.48 (35.78)<br>139.15 (26.89) | 1.32 | 0.92 | -28.41 | 31.06 |
| **TSAT1 (sec)** | Static<br>PNF | 5.53 (0.56)<br>5.24 (0.47) | 0.29 | 0.22 | -0.19 | 0.78 |
| **TSAT2 (sec)** | Static<br>PNF | 5.32 (0.48)<br>5.31 (0.41) | 0.01 | 0.96 | -0.41 | 0.43 |
| **TSAT3 (sec)** | Static<br>PNF | 5.07 (0.34)<br>5.12 (0.46) | -.055 | 0.76 | -0.43 | 0.32 |

SLVJ: Single leg vertical jump; SLHD: Single leg hop test; TSAT: Taekwondo specific agility test; 1,2,3: 1 for pre intervention, 2 for immediately and 3 for 24 hours later; KT: with kinesiology taping, no-KT: without kinesiology taping; KT or no-KT conditions for TSAT did not determine.

and do a double house kick (narae-chagi) toward partner 3 before returning to the starting/ending point. The examiner kept track of time with a chronometer and gave the best performance out of three trials as the test result (see Figure 3) (16). According to statistical analysis, the ICC of this test was 0.96.

## Stretching protocol

Static stretch: The individuals were requested to lie down in a supine position. For 30 seconds, the therapist passively moved the hip joint from extension to the greatest tolerated degree of flexion while maintaining the knee joint in full extension. This procedure was performed five times with a 30-second rest period in between.

PNF Stretch: PNF stretching was performed in the same manner as static stretching. PNF stretching (Hold-relax) began with passively positioning the target muscle (Hamstrings) in a stretch position, followed by 9 seconds of isometric contraction at a submaximal (30% of maximal voluntary contraction) intensity. The

**Table 3.** Repeated Measures ANOVA Test Results

| Outcome Measures | Time | | Time*Stretch Group | | Time*KT Group | | Time*Stretch Group*KT Group | |
|---|---|---|---|---|---|---|---|---|
| | Sig. | Eta-Squared | Sig. | Eta-Squared | Sig. | Eta-Squared | Sig. | Eta-Squared |
| **SLVJ (cm)** | 0.01 | 0.10 | 0.96 | 0.001 | 0.36 | 0.04 | 0.76 | 0.008 |
| **SLHT (cm)** | 0.005 | 0.09 | 0.97 | 0.002 | 0.50 | 0.03 | 0.26 | 0.02 |
| **TSAT (sec)** | 0.03 | 0.22 | 0.28 | 0.09 | | | *** | |

SLVJ: Single leg vertical jump; SLHD: Single leg hop test; TSAT: Taekwondo specific agility test. ***: KT or no-KT conditions for TSAT did not determine.

target muscle was then passively placed into a larger position. This approach was repeated five times with a 30-second rest period in between (19).

### Kinesiology taping method

A certified physiotherapist used the KT method to apply a standard 5-cm wide, 0.5-mm thick, and water resistant elastic adhesive kinesiology tape (Green color, K-Active, Europe GmbH) to the hamstring muscles. The athlete bowed forward to maintain a stretch in the hamstring muscle. Then, two I strips with 30% tension were introduced through the ischial tuberosity, over the muscle, and into the popliteal fossa's medial and lateral borders (14). KT was used for inhibitory application in the direction from insertion to origin.

### Statistical analysis

The Statistical Package for the Social Sciences was used to analyze the data (SPSS software; version21). The alpha value has been set to 0.05. The average confidence interval for all analyses was 95%. The Shapiro-Wilk test was performed to determine the distribution's normality. The Repeated measure ANOVA test was performed to evaluate variables within groups three times (Pre-intervention, acutely post-intervention, and 24 hours later) and between groups (Static or PNF Stretching and KT or no-KT). Additionally, Independent T-Test and post hoc analyses were done on the variables within the group.

### Sample size calculation

The sample size of this investigation was calculated based on a pilot study (initial n = 5) using the G*Power Statistical Package (version 3.0.10) with an α value of 0.05 to achieve a statistical power of 0.80 and an effect size of 0.30 (the least effect size in outcome measures i.e. single leg hop test). The following options were also selected: test family, f test; ANOVA repeated measures, within-between interaction and type of power analysis, a priori. Total sample size was determined 20.

## RESULTS

The Shapiro-Wilk test revealed that all variables had a normal distribution. The characteristics of the subjects did not differ significantly between the two stretch groups (p>0.05). At baseline, there were no significant differences in the variables between the groups (p>0.05).

According to independent t-tests (Table 2) and repeated measure ANOVA test, it is implied that participants' functional performance changed significantly over time in all functional tests, but that there was no significant difference between the PNF and static groups, nor between the KT and no-KT groups, acutely and 24 hours after interventions. Mauchly's test was used to determine the sphericity of the data, and the Partial Eta Squared was computed (Table 3).

All functional tests results demonstrated significant improvement over time (Single leg vertical jump (p = 0.005), single leg hop test (p = 0.01), and TSAT (p = 0.03)) but none of the stretching or the KT groups did not affect the functional performance of the participants (Single leg vertical jump (p = 0.36) and single leg hop test (p = 0.50)).

## DISCUSSION

The present study's findings indicated that both static and PNF stretching considerably improved functional tests both acutely and 24 hours following the intervention. To enhance the beneficial effects of stretch or to mitigate the detri-

mental effects of stretch, we added KT following the stretching approach. However, we observed no effect of KT on stretching groups. Despite a decline in functional performance, such as jumping ability, in certain studies (20), our findings indicated an improvement in functional performance following the application of stretching strategies. There are conflicting findings in literature; some studies indicate that stretching improves functional performance (21), while other studies indicate that stretching decreases functional capacity (14). Different stretching techniques, participant characteristics, type of sporting activities, type of functional tests, stretching dose, and time of assessments may all have an effect on these outcomes.

Nowadays, KT is being used more frequently in athletic fields. Regardless of the effect of stretching, we expected that applying KT following stretching procedures would enhance the stretching effect or mitigate the stretching effect. Additionally, this impact may be more apparent in PNF stretching due to the fact that PNF stretching utilizes a stronger neurophysiological mechanism such as reciprocal inhibition and autogenic inhibition.

Additionally, kicking techniques are preferred over upper extremity blows due to their higher ratings. According to kinematic and isokinetic analysis, adequate hip and knee joint range of motion, particularly in end range, during a kick movement is critical for optimal task performance, which can be influenced in a variety of ways by antagonist muscle stiffness (2). As a result, we chose this activity and applied stretching techniques and KT to adolescent athletes' hamstring muscles. Adolescent taekwondo players spend more time warming up and augmenting flexibility in their lower extremities and choosing the optimum stretching strategy can benefit them.

A 2018 review article found evidence that PNF stretching can significantly improve muscular performance in six articles (21). In comparison, Bradely et al. tested healthy volunteers' jumping performance 5, 15, 30, 45, and 60 minutes after several stretching methods. They reported that after stretching, jump height was significantly reduced, particularly in static and PNF, compared to the ballistic stretching group. After 15 minutes, the decline in jump height was gone (20). Evan Peck et al. investigated the effects of static, dynamic, and PNF stretching on several functional tasks classified as power and strength-dominant, speed or agility-dominant, and endurance-dominant sports in a 2014 literature review. They reported that static stretching had a detrimental effect on functional performance across all categories. The study on PNF stretching has been sparse and contradictory. In conclusion, they advised against acute static or PNF stretching prior to primary activities (10).

Behm et al. did another systematic review on the acute effects of stretching on performance in 2015. They detected functional impairment following static stretching that was greater in strength-based exercises than in power-speed activities. Additionally, they state that, despite the paucity of evidence on the effect of PNF stretch, it appears as though functional damage is more prevalent in this mode of stretch. They believe that these adverse effects are most noticeable when functional tests are administered within 3-5 minutes of stretching, although in normal conditions, the period between stretching and sports competition is greater than 10 minutes, during which some refinements will occur (9). Additionally, they note that these impairments may vary according to clinical and athletic settings and are proportional to stretching time, implying that functional performance reductions are more feasible with stretching activities lasting longer than 60 seconds (9). Numerous factors have been proposed as possible explanations for the force and probably functional reduction observed following stretching exercises, including changes in tendon stiffness or force-length relationship, stretch-induced contractile fatigue or damage, and decreased electromechanical coupling or central drive (9).

Several possible mechanisms of action for KT have been hypothesized, including suppression of motor unit firing, increased blood circulation, cutaneous mechanoreceptor activation, and fascial unloading (12,14,22).

From a comparison standpoint, the research re-

garding the effectiveness of static versus PNF stretching workouts on hamstring flexibility and subject performance is inconsistent (3,9,10,20, 23,24). According to some authors, despite its primary effect on range of motion, PNF stretching may result in an additional loss in performance (3). On the other hand, past research, including our own, has demonstrated that both static and PNF stretching workouts are helpful at increasing hamstring flexibility, with no statistically significant difference between the two (6,25-27). Additionally, our study's findings confirmed that both stretching strategies significantly enhanced functional performance.

Similarly, our findings indicate that applying KT over the hamstring muscle had no influence on the participant's physical performance in either the static or PNF stretch groups. Indeed, due to the participants' functional recovery, we are unable to state categorically whether KT administration could prevent stretching-induced functional deterioration. We concluded that both static and PNF stretching exercises significantly enhanced the athletes' functional performance acutely and after 24 hours. Furthermore, there were no significant differences in functional improvement between the static stretch and PNF groups, or between the KT and no-KT groups.

The study's limitations include the fact that participants were restricted to healthy adolescent athletes without hamstring muscle shortening. We examined the role of stretching as a warm-up strategy, not as a meaning of resolving movement limitations. Future research can examine the effect of static or PNF stretching combined with KT on muscle shortening. Additionally, in our study design, we compared KT to a control group that did not receive KT. In future research, sham KT could be used in place of a no-KT group. Another limitation of our study was that we investigated only the immediate effect of KT and further research is warranted to evaluate the effect of prolonged or repeated applications of KT.

***Sources of Support:*** None

***Conflict of Interest:*** The authors declare no conflict of interest.

***Author contributions:*** Concept – NA, HM, AA, MD, GR; Design – NA, HM, AA, MD, GR; Supervision – HM, AA, MD; Resources and Financial Support – GR, MD; Materials – NA; Data Collection and/or Processing – NA, HM, AA, MD, GR; Analysis and/or Interpretation – NA, HM; Literature Research – NA, HM; Writing Manuscript – NA, HM, AA, MD, GR; Critical Review – NA, HM, AA, MD, GR.

***Ethical Approval:*** The study protocol was accepted by the Ethics Board for Clinical Research at Iran University of Medical Sciences (Approved Date: 2018/8/11 and Approval Number: IR.IUMS.REC.1396.9411452001).

***Informed Consent:*** A written informed consent form was obtained from all participants.

***Acknowledgment:*** None.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)29-37*

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***Received:*** *12.08.2021 (Geliş Tarihi)*
***Accepted:*** *03.02.2022 (Kabul Tarihi)*

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# EVALUATION OF THE PHYSICAL ACTIVITY LEVELS OF COVID-19 PATIENTS IN TURKEY

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** Covid-19 is a viral infection that affects either the respiratory system or the other systems. Studies about the effects of Covid-19 on physical activity are still scarce. This study aims to compare the changes in the physical activity levels of patients before and six months after Covid-19 in Turkey.

**Methods:** One hundred and six participants that have been six months after Covid-19 contraction were included in the study. Along with the Patient Assessment Questionnaire, the International Physical Activity Questionnaire Short Form was used to assess physical activity energy consumption (vigorous-intensity physical activities, moderate-intensity physical activities, walking, and total physical activities).

**Results:** Participants became either less physically active or more sedentary six months after Covid-19 (p=0.019). Vigorous-intensity physical activity levels were significantly decreased (Mean±SD: 341±854 vs. 109±331 Metabolic Equivalent Task minutes/week, p=0.015), and perceived fatigue during exercise was significantly increased between before and six month after infection (Mean±SD: 4.76±2.17 vs 6.17±2.27, p=0.001). Participants who had dyspnea (n=12) during the period of Covid-19, did more moderate-intensity physical activity (p=0.020) and walking (p =0.021) after Covid-19, compared to those who had not.

**Conclusion:** Particularly changes in vigorous-intensity physical activity levels and perceived fatigue during exercise were seen in Covid-19 infected patients. We recommend supporting gradually increased tailor-based exercise programs by health professionals in public health agencies, not only for protecting the individuals from Covid-19 outcomes, but also for returning to their pre-infection fitness levels.

**Key Words:** Covid-19, Physical Activity, Questionnaire

# COVİD-19 TANISI ALMIŞ KİŞİLERİN FİZİKSEL AKTİVİTE DÜZEYLERİNİN DEĞERLENDİRİLMESİ

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Covid-19 solunum sistemini veya diğer sistemleri etkileyen viral bir enfeksiyondur. Covid-19'un fiziksel aktivite üzerindeki etkileri ile ilgili çalışmalar halen yetersizdir. Bu çalışmanın amacı Türkiye'de hastaların Covid-19 öncesi ve altı ay sonrası fiziksel aktivite düzeylerindeki değişiklikleri karşılaştırmaktır.

**Yöntem:** Çalışmaya Covid-19'un üzerinden altı ay geçmiş 106 katılımcı dahil edildi. Hasta Değerlendirme Anketi ile birlikte, fiziksel aktivite enerji tüketimini (şiddetli fiziksel aktiviteler, orta yoğunlukta fiziksel aktiviteler, yürüme ve toplam fiziksel aktiviteler) değerlendirmek için Uluslararası Fiziksel Aktivite Anketi Kısa Formu kullanıldı.

**Sonuçlar:** Katılımcılar, Covid-19'dan 6 ay sonra ya fiziksel olarak daha az aktif ya da daha sedanter hale geldi (p=0,019). Şiddetli fiziksel aktivite seviyeleri önemli ölçüde azaldı (Ortalama±SS:341±854 vs. 109±331, Metabolik Eşdeğer dakika/ hafta, p=0,015) ve egzersiz sırasında algılanan yorgunluk enfeksiyondan önceki ve sonraki altı ay arasında önemli ölçüde arttı (Ortalama±SS: 4.76±2.17 vs 6.17±2.27, p=0,001). Covid-19 döneminde nefes darlığı (n=12) olan katılımcılar, olmayanlara göre Covid-19 sonrası daha fazla orta yoğunlukta fiziksel aktivite (p=0,020) ve yürüyüş (p=0,021) yaptı.

**Tartışma:** Covid-19 ile enfekte olan hastalarda özellikle şiddetli fiziksel aktivite seviyelerinde ve egzersiz sırasında algılanan yorgunlukta değişiklikler görüldü. Bireyleri sadece Covid-19 sonuçlarından korumak için değil, aynı zamanda bireylerin enfeksiyon öncesi fiziksel uygunluk seviyelerine geri dönmeleri için, halk sağlığı kurumlarındaki sağlık profesyonelleri tarafından kademeli olarak artırılan kişiye özel egzersiz programlarının desteklenmesini öneriyoruz.

**Anahtar Kelimeler:** Covid-19, Fiziksel Aktivite, Anket

## INTRODUCTION

A novel type of coronavirus-induced Covid-19 infection is a viral infection, which was discovered in Wuhan, China in December 2019, that affects either the respiratory system or the other systems (1,2). Due to its high risk of transmission, it was declared as a global pandemic by the World Health Organization on March 11, 2020, and the first Covid-19 case was announced by the Republic of Turkey Ministry of Health on the same date (3). After an incubation period, some patients show no Covid-19 symptoms and become asymptomatic carriers (4); some patients have signs and symptoms including fever, cough, myalgia, fatigue, dyspnea, sputum production, and pneumonia (1,4). These patients are prone to develop diffuse myopathy, decreased pulmonary function and inspiratory muscle strength, deteriorated functional capacity, and decreased muscle mass due to immobilization (5). Changes in the hemoglobin structure may result in less oxygen and carbon dioxide transportation (3).

The coronavirus affects the immune system response. It has been reported that Covid-19 affected patients have higher levels of pro-inflammatory cytokines, such as TNF-α, IFN-γ, IL-1β, and IL-6compared to healthy subjects. It has been revealed that the expression levels of these cytokines are directly related to disease severity.In all recovery phases of Covid-19 infected patients, the administration of moderate and adapted physical activity improves physical and psychological well-being by alleviating the release of pro-inflammatory cytokines through the modulation of anti-inflammatory cytokines, such as IL-1Ra, IL-6, and IL-10. Thus, it can be said that physical activity could play an important role in countering the imbalance in antiviral immunity (6). On the other hand, it is well-known that physical activity is strongly recommended for health promotion and disease prevention (7). Moderate and adapted physical activity also protects the individuals against inflammation induced by Covid-19 (6).

To reduce the spread of the disease, governments advocated for social distancing, quarantine, and business closures. It will be important to gauge adherence to these measures and their effect on physical activity (8). Further, the management of Covid-19 is the patient's isolation and supportive medical care, as recommended by the National Institutes of Health of the United States (2). Due to the effects of Covid-19 on the immune system and isolation of Covid-19 patients for a certain period of time, we thought that the physical activity levels of the infected patients might change. To the best of our knowledge, there is no information about the physical activity levels of Covid-19 patients in Turkey. Therefore, we aimed to compare the changes in the physical activity levels before and six months after Covid-19 infection.

## METHODS

### Design

The current online study was realized through Google online survey platform (Google LLC, Mountain View, CA, United States) and communicated via WhatsApp (WhatsApp Inc, California, United States) due to the Covid-19 pandemic between March 2021 and May 2021. Patient Assessment Questionnaire and International Physical Activity Questionnaire-Short Form were instructed to all participants in a single form. The introduction of this online questionnaire included a description and purpose of the study, and the anonymity and confidentiality declarations as "We invite you to a scientific research on Covid-19 to compare your physical activity level before Covid-19 with your current physical activity level. The data are anonymous, confidential, and confidentiality will be guaranteed. Participation is completely voluntary, and you can withdraw at any time after participating. You will not be charged or paid any fees for your participation. The information will be used for research purposes only, and your personal information will be kept strictly confidential. The questionnaire will be saved only after clicking the 'submit' button". The Ethics Committee of Gazi University provided ethical approval (2021-239/05.03.2021). All participants in the study gave their informed consent before participation according to the principles of the Declaration of Helsinki. The rights of the participants were fully protected during the study procedures.

### Participants

The inclusion criteria were (a) aged between 18 and 65 years, (b) positive real-time polymerase-chain-reaction (PCR) test, and (c) have

been six months after Covid-19. The sample size was determined by using G*Power software (version 3.1, Universitat Düsseldorf, Germany) based on results of the International Physical Activity Questionnaire-Short Form of Bertheussen et al (2013) (9). With a power of 95%, 95% confidence interval, and effect size of 0.33, the power analysis resulted in 106 participants.

### Questionnaires

*Patient Assessment Questionnaire:* Demographic characteristics of the patients were recorded, including gender (female/male), age (years), height (cm), weight (kg), and body mass index (kg/m$^2$). All patients were asked about smoking status; the presence of other chronic diseases; Covid-19 signs and symptoms and pneumonia; the use of medication and hospitalization (service, intensive care unit) status during the treatment of Covid-19; and exercise parameters (frequency, type, duration) and perceived fatigue during exercise before and six months after Covid-19. The question of perceived fatigue during exercise was scored from 0-10. 0 means no fatigue, and 10 means more fatigue (10).

*International Physical Activity Questionnaire-Short Form (IPAQ-SF):* The International Physical Activity Questionnaire is an instrument that assesses individuals' physical activity (vigorous-intensity physical activities, moderate-intensity physical activities, walking, and total physical activities) and energy consumption in Metabolic Equivalent Task minutes per week (7). In this current study, the participants were asked to consider physical activities they did, not only the current time they are in but also six months before Covid-19. The IPAQ-SF which consists of seven questions is designed to assess the physical activity levels of individuals between the ages of 15 and 69 (11). They reported the frequency and duration of different types of activities including vigorous-intensity physical activities (i.e.carrying/moving a heavy load [>20 kg], performing intense aerobic exercises that increase the breathing rate more frequently than normal); moderate-intensity physical activities (i.e.carrying a light load, working in the garden, performing aerobic exercises at a modest intensity, not out of breath and could hold a conversation); and walking activities in the last week (12). The intensity of activities is converted to Metabolic Equivalent of Task minutes per week (MET minute/week) despite the scoring of the IPAQ-SF. Standard MET values are established for all activities (walking=3.3 MET, moderate-intensity physical activity=4.0 MET, and vigorous-intensity physical Activity=8.0 MET). Physical activity levels are categorized as "low active (<600 MET-minute/week)", "minimal active (600-3000 MET-minute/week)", and "high active (>3000 MET-minute/week)" (13). The Turkish validity and reliability of the short and long versions of this questionnaire were performed by Saglam et al. (2010) (12).

### Statistical Analysis

Statistical analysis was performed using the IBM SPSS (Statistical Package for the Social Sciences) (BM Corp., Armonk, New York, United States) software version 26.0. The variables were investigated using visual (histograms, probability plots) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk's tests) to determine whether or not they are normally distributed. Descriptive analyses were presented using tables of frequencies for the ordinal variables and using medians and interquartile range (IQR) for the non-normally distributed and ordinal variables. Dependent groups were compared with the Wilcoxon test, and independent groups were compared with the Mann-Whitney *U* test since the measurements were the ordinal variables or not normally distributed numeric variables. A p-value of less than 0.050 was considered to show a statistically significant result.

## RESULTS

*General Descriptives and Clinical Characteristics of Participants*

Descriptives and clinical characteristics of participants are shown in Table 1. The study sample (n=106) comprised 65.1% of females and 34.9% of males. The mean±SD age was 34.95±10.53, and the mean±SD height was 167.22±8.33 cm. Body Mass Index (BMI) was 25.25±4.57 kg/m$^2$. The BMI was then divided into two categories: normal weight (BMI: 18.5–24.9 kg/m$^2$) and abnormal weight (underweight BMI<18.5 kg/m$^2$, overweight BMI: 25.0–29.9 kg/m$^2$, and obese BMI: ≥30 kg/m$^2$). As shown in Table 1, 53.8% of participants are classified as normal-weight participants. 85 participants (80.2%) were non-smokers. The mean±SD

**Table 1.** Descriptives and Clinical Characteristics of Participants (n=106)

| | | Mean±SD | Median (IQR) |
|---|---|---|---|
| **Age (year)** | | 34.95±10.53 | 34.00 (25-43) |
| **Height (cm)** | | 167.22±8.33 | 165.50 (160.00-172.00) |
| **Weight (kg)** | | 70.92±15.08 | 70.00 (58.00-80.00) |
| **BMI (kg/m²)*** | | 25.25±4.57 | 24.49 (22.06-27.28) |
| | | **n (%)** | |
| **Gender** | Female | 69 (65.10) | |
| | Male | 37 (34.90) | |
| **BMI*** | Normal Weight | 57 (53.80) | |
| | Abnormal Weight (Underweight, Overweight, Obese) | 49 (46.20) | |
| **Marital Status** | Married | 66 (62.30) | |
| | Unmarried | 40 (37.70) | |
| **Education Level** | Undergraduate | 60 (56.60) | |
| | High School | 21 (19.80) | |
| | Associate Degree | 11 (10.40) | |
| | Elementary School | 7 (6.60) | |
| | Post Graduate | 7 (6.60) | |
| **Job** | Public | 78 (73.60) | |
| | No Job | 10 (9.40) | |
| | Private | 8 (7.50) | |
| | Student | 8 (7.50) | |
| | Retired | 2 (1.90) | |
| **Chronic Diseases** | No | 73 (68.90) | |
| | Yes | 33 (31.10) | |
| **Smoking** | No | 85 (80.20) | |
| | Yes | 21 (19.80) | |

*BMI: Body Mass Index

smoking of 21 participants was 13.41±5.75 per day and 159.55±93.88 months.

*Covid-19 Signs and Symptoms of Participants*

While 103 participants (97.2%) had Covid-19 symptoms, 3 participants (2.8%) did not. The duration of symptoms lasted less than a week in 38 (35.8%), between one week and ten days in 38 (35.8%), and more than ten days in 27 (25.5%) participants. Covid-19 was accompanied by pneumonia in 5 participants (4.7%). 4 participants (3.8%) were hospitalized in the service. Mean±SD day of hospitalization was 8.50±5.80. There was no hospitalization in the intensive care unit. The distribution of signs and symptoms is shown in Table 2.

*Using of Medication during the Treatment of Covid-19*

While 86 participants (81.1%) used medications for the treatment of Covid-19, 20 participants (18.9%) did not. The Mean±SD day of using medication was 5.44±1.96. The most used medication was Favipiravir, with 42 participants (39.6%).

*Changes in Exercise Parameters (Frequency, Type, Duration) and Perceived Fatigue During Exercise before and Six Months after Covid-19*

Changes in exercise frequency, type, and duration before and six months after Covid-19 was not statistically significant (p=0.538, p=0.379, p=0.932). Perceived fatigue during exercise before Covid-19 was 4.76±2.17, and after six months,

it was 6.17±2.27. This increase in perceived fatigue during exercise was statistically significant (p=0.001), particularly in females as compared to males (p=0.026).

**Table 2.** Covid-19 Signs and Symptoms of Participants

| | | n (%) |
|---|---|---|
| **Signs/ Symptoms** | Fatigue | 82 (77.40) |
| | Arthralgia | 74 (69.80) |
| | Loss of Smell | 59 (55.70) |
| | Headache | 57 (53.80) |
| | Loss of Taste | 49 (46.20) |
| | Cough | 33 (31.10) |
| | Sore throat | 32 (30.20) |
| | Fever | 32 (30.20) |
| | Diarrhea | 22 (20.80) |
| | Dyspnea | 12 (11.30) |
| | Dizziness | 12 (11.30) |
| | Corneal Infection | 1 (0.90) |

*Changes in IPAQ-SF Category and Scores before and Six Months after Covid-19*

The IPAQ-SF category results demonstrated that before Covid-19 infection, 59.4% of participants were low active, 29.2% were minimal active, and 11.3% were highly active. Six months after Covid-19, the percentage of low active and minimal active participants expanded up to 66.0% and 30.2% respectively, while highly active participants dropped to 3.8%. These changes in physical activity levels before and Six months after Covid-19 was statistically significant (p=0.019). Vigorous-intensity physical activity in MET-minute/week also illustrated a statistically significant difference between before and after Covid-19 infection (Mean±SD: 341±854 vs. 109±331 MET–minute/week, p=0.015) (Table 3).

*Changes in IPAQ-SF Scores according to Gender before and Six Months after Covid-19*

With respect to gender classifications, before Covid-19, vigorousintensity physical activity IPAQ-SF scores were 235±760 in females, 537±987 in males, and was statistically different in MET–minute/week (p=0.039).

**Table 3**. Classification of Participants according to IPAQ-SF Category and Scores before and Six Months after Covid-19 (n=106)

| **IPAQ-SF Category** | **Before Covid-19** | | **Six Month After Covid-19 (Current Status)** | | p |
|---|---|---|---|---|---|
| | n (%) | | n (%) | | |
| Low Active (<600 MET-minute/week) | 63 (59.40) | | 70 (66.0) | | **0.019*** |
| Minimal Active (600-3000 MET-minute/week) | 31 (29.20) | | 32 (30.20) | | |
| High Active (>3000 MET-minute/week) | 12 (11.30) | | 4 (3.80) | | |
| **IPAQ-SF Scores (MET-minute/week)** | **Before Covid-19** | | **Six Month After Covid-19 (Current Status)** | | |
| | **Mean±SD** | **Median (IQR)** | **Mean±SD** | **Median (IQR)** | |
| Vigorous-intensity Physical Activity IPAQ-SF Score | 341±854 | 0 (0-160) | 109±331 | 0 (0-0) | **0.015*** |
| Moderate-intensity Physical Activity IPAQ-SF Score | 218±475 | 0 (0-240) | 176±405 | 0 (0-160) | 0.224 |
| Walking IPAQ-SF Score | 459±653 | 231 (0-578) | 398±490 | 231 (0-528) | 0.240 |
| Total Physical Activity IPAQ-SF Score | 1012±1452 | 471 (0-1035) | 714±943 | 396 (116-935) | 0.094 |

**Table 4.** IPAQ-SF Scores According to Dyspnea and Fatigue During the Period of Covid-19*p<0.05

| IPAQ-SF Scores According to Dyspnea During the Period of Covid-19 (MET-minute/week) | Had Dyspnea (n=12) | | No Dyspnea (n=94) | | p |
|---|---|---|---|---|---|
| | Mean±SD | Median (IQR) | Mean±SD | Median (IQR) | |
| Vigorousintensity Physical Activity IPAQ-SF Score | 33±115 | 0 (0-0) | 119±349 | 0 (0-0) | 0.299 |
| Moderate-intensity Physical Activity IPAQ-SF Score | 328±424 | 220 (0-510) | 157±401 | 0 (0-120) | **0.020*** |
| Walking IPAQ-SF Score | 707±554 | 644 (215-1386) | 358±470 | 231 (0-495) | **0.021*** |
| Total Physical Activity IPAQ-SF Score | 1068±920 | 1034 (215-1806) | 669±941 | 396 (83-693) | 0.107 |
| **IPAQ-SF Scores According to Fatigue During the Period of Covid-19 (MET-minute/week)** | **Had Fatigue (n=82)** | | **No Fatigue (n=24)** | | **p** |
| | **Mean±SD** | **Median (IQR)** | **Mean±SD** | **Median (IQR)** | |
| Vigorous-intensity Physical Activity IPAQ-SF Score | 42±133 | 0 (0-0) | 338±607 | 0 (0-440) | **0.001*** |
| Modarate-intensity Physical Activity IPAQ-SF Score | 144±315 | 0 (0-120) | 286±620 | 20 (0-290) | 0.159 |
| Walking IPAQ-SF Score | 371±441 | 248 (0-495) | 488±633 | 231 (42-619) | 0.711 |
| Total Physical Activity IPAQ-SF Score | 596±668 | 396 (160-792) | 1119±1504 | 342 (91-2050) | 0.674 |

*Changes in IPAQ-SF Scores according to Marital Status before and Six Months after Covid-19*

According to marital status, the median IPAQ-SF scores before Covid-19 was 815±1287 for married participants and 1338±1655 for unmarried. The difference between this value was statistically significant (p=0.039). The difference between post-Covid-19 total IPAQ-SF scores (p=0.011) and walking IPAQ-SF scores (p=0.001) between married and unmarried participants was also statistically significant.

*Changes in IPAQ-SF Scores according to the Use of Medication before and Six Months after Covid-19*

The use of medication during the Covid-19 treatment process did not affect the IPAQ-SF scores after recovery (p>0.050).

*IPAQ-SF Scores according to Covid-19 Symptoms Six Months after Covid-19*

Changes in the IPAQ-SF scores of the participants after Covid-19, who had symptoms of dyspnea and fatigue during the period of Covid-19 are shown in Table 4.

## DISCUSSION

This study involved one hundred and six participants with a diagnosis of Covid-19 to determine the changes in the physical activity levels before and six months after Covid-19 infection. Our findings indicated that vigorous-intensity physical activity levels were significantly decreased, and perceived fatigue during exercise was significantly increased between before and six months after Covid-19 infection.

The relationship between physical inactivity and Covid-19 has already been demonstrated in previous studies (14,15). Recently, it has been investigated that physical inactivity was significantly associated with the severity of Covid-19. Patients with lower levels of physical activity were affected by a more severe form of Covid-19 (14). Sallis et al. (2021) found that Covid-19 patients who were consistently inactive during the two years were more likely to be hospitalized, admitted to the intensive care unit, and physical inactivity was the strongest risk factor for severe Covid-19 outcomes (15). In addition, hospitalization of athletes with regular sports was 33% lower than the nonathletic group (16). It has also been reported that social distancing and long stays at home due to the closure of indoor and outdoor sports and recreation facilities

encourage less time spent on physical activity by the healthy, uninfected population. (8,17-22). Meiring et al (2021) reported that participants were not able to maintain their usual level of physical activity due to the closure of their gym facilities (19). The physical activity level during the period of social distancing was lower than prior to the pandemic period as stated in Puccinelli et al.'s study (21). As in the previous studies, Robinson et al (2021) indicated that a large number of participants reported negative changes in physical activity behavior (20). Tison (2020) also found that within 30 days of the Covid-19 declaration, there was a 27.3% decrease in mean steps in healthy adults due to social distancing (8). Therefore, it can be said that the Covid-19 pandemic has a negative impact on physical activity (21).

It is well-known that regular physical activity diminishes the risk of systemic inflammation by improving immune function (15), and has preventative effects on severe Covid-19 symptoms (23); however, even after a mild suspected Covid-19, individuals experience a prolonged recovery, particularly when trying to return to exercise (24). In this present study, participants became either less physically active or more sedentary six months after Covid-19. Previously, Lesser et al (2020) indicated that 40.5% of inactive healthy individuals became less active during the Covid-19 period (18). Castañeda-Babarro et al (2020) found that vigorous physical activities decreased by 16.8%, whereas sedentary time increased by 23.8% in healthy adults during Covid-19 confinement, either (17). If physical activity decreases even in healthy people, we think that this is inevitable in people who have been infected with Covid-19. Whereas physical activity levels were mostly insufficient before the Covid-19 pandemic in Turkey (25), Covid-19 infection has likely had more of the potentially unintended results of reduced physical activity levels.

Sincelong-term effects of Covid-19 are not currently known, several key concerns are highlighted to return to physical activity for Covid-19 patients. Potential risks includingviral myocarditis and thromboembolic complications (i.e pulmonary emboli); also the psychology of the person lead to caution when advising a return to physical activity after an asymptomatic period of infection at least seven days (24). Previously it has been shown that excessive amounts of prolonged, high-intensity exercise may impair immune function, while engaging in moderate activity may enhance immune function above sedentary levels (26). If the patient had common symptoms of Covid-19 like dyspnea and fatigue during the Covid-19 period (1), low-intensity activities such as breathing, stretching, and light strengthening activities, then further moderate-intensity physical activities can be suggested (24). In this current study, participants who had dyspnea during the period of Covid-19, did more moderate-intensity physical activity and walking six months after Covid-19, compared to those who did not. Possibly the main sources of physical activity (i.e physical activity guidelines and tools, social media) may have guided participants to return to physical activity after Covid-19 (24). Therewithal, it was stated that patients felt extremely fatigued when doing the smallest amount of exercise (24), or any physical activity resulted in the onset of fatigue (27). Our findings confirmed these statements that participants did lower vigorous-intensity physical activity after Covid-19, and perceived fatigue during exercise was significantly increased between before and six months after Covid-19, particularly in females. For this reason, gradual physical activity support should be provided by exercise specialists to those who experience dyspnea and/or fatigue after infection.

Gender and marital status differences in exercise habits have been already indicated with previous studies (28,29). It has been stated that females were generally more prone to do low-intensity activities (28). In a study by Castañeda-Babarro et al (2020), during Covid-19 confinement healthy men reported a higher decrease in vigorous activities (17). López-Bueno et al (2020) also showed reductions in weekly minutes of physical activity especially in healthy men (22). In this current study, it was observed that the infected male group showed significantly higher vigorous-intensity physical activity levels before Covid-19 as compared to the female group. Lower vigorous-intensity physical activity levels found in the female group is possibly due to a higher amount of housework physical activities (30). Dlugonski& Motl (2013) stated that unmarried mothers were less physically active when compared to married mothers and non-moth-

ers (29). In contrast to this study, our findings suggested that unmarried participants lead a more active lifestyle before and after Covid-19 possibly due to the lack of childcare (24).

The limitations of this article should be mentioned. Firstly, although the IPAQ short form is about the last seven days, due to the unprecedented situation, we asked participants to remember the level of their physical activity six months before the Covid-19 infection. Secondly, we used the shorter form of IPAQ instead of the longer form. Since we sent the questionnaire over the internet, we thought that it would be difficult for participants to read the longer form. Another limitation could be the cross-sectional design of the study since we did not conduct a comparative study with a randomized controlled group.

In conclusion, studies have shown that quarantine negatively affects the physical activity levels of healthy individuals. The results of this current study also showed that a particularly lower level of vigorous-intensity physical activity and fatigue during exercise were seen among Covid-19 infected patients. Using Covid-19 medications in the treatment process did not affect the level of physical activity after recovery. In the light of the literature, we recommend supporting gradually increased tailor-based exercise programs by health professionals in public health agencies, not only for protecting the individuals from Covid-19 outcomes, but also for returning to their pre-infection fitness levels. Since the long-term effects of Covid-19 are not currently known, studies with longer-term results are needed for further conclusions and recommendations.

***Sources of Support:*** This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

***Conflict of Interest:*** No potential conflict of interest was reported by the authors.

***Author Contributions:*** Author Ekin Taçalan and Author Nihan Kafa have given substantial contributions to the conception, design, and supervision of the manuscript, while author Ekin Taçalan contributed significantly to data collection, analysis, and interpretation of the data, and writing of the manuscript. All authors have participated in literature research, and author Nihan Kafa revised it critically. All authors read and approved the final version of the manuscript.

***Explanations:*** None.

***Acknowledgments:*** None.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)38-44*

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***Received:*** *15.08.2021 (Geliş Tarihi)*
***Accepted:*** *16.08.2022 (Kabul Tarihi)*

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# DOES PHYSICAL ACTIVITY LEVEL DEPEND ON EXERCISE PERCEPTION AND BODY AWARENESS?

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** In this study, it was aimed to investigate whether physical activity level depends on exercise perception and body awareness.

**Methods:** A total of 116 people between the ages of 18-25 years who did not have any disease-preventing physical activity participated in the study. Using a face-to-face questionnaire and inquiry methods, participants were evaluated with Body Awareness Questionnaire (BAQ), Exercise Benefits/Barriers Scale (EBBS), and International Physical Activity Questionnaire-Short Form (IPAQ-SF).

**Results:** The mean age and body mass index of the participants were 20.38 years and 21.86 kg / $m^2$. In IPAQ-SF scores, 28.4% of the participants were at the low activity level, 40.5% were at the medium activity level and 31% were at the high activity level. There was a weak correlation (r <0.400) between body awareness and IPAQ-SF score and a negative correlation between BAQ and EBBS benefits score (r <0.400). There was a weak correlation between IPAQ-SF scores and BAQ scores (r <0.400).

**Conclusions:** According to the results from the present study, the level of physical activity was found to be depend on body awareness and perceived exercise barriers. To increase the level of evidence in our study, there is a need for studies with more groups of participants and students living in different conditions.

**Key Words:** Body Awareness, Exercise, Physical Activity, University Students

# FİZİKSEL AKTİVİTE DÜZEYİ EGZERSİZ ALGISINA VE VÜCUT FARKINDALIĞINA BAĞLI MIDIR?

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Bu çalışmada, fiziksel aktivite düzeyinin egzersiz algısı ve beden farkındalığına bağlı olup olmadığının araştırılması amaçlandı.

**Yöntem:** Çalışmaya 18-25 yaş arasında fiziksel aktiviteye engel olacak herhangi bir hastalığı bulunmayan 116 sağlıklı birey dahil edildi. Katılımcılar Beden Farkındalığı Anketi (BAQ), Egzersiz Faydaları / Engeller Ölçeği (EBBS) ve Uluslararası Fiziksel Aktivite Anketi-Kısa Formu (IPAQ-SF) ile yüz yüze değerlendirildi.

**Sonuçlar:** Katılımcıların yaş ortalaması ve vücut kitle indeksi 20,38 yıl ve 21,86 kg/$m^2$ idi. IPAQ-SF skorlarında katılımcıların %28,4'ü düşük aktivite seviyesinde, %40,5'i orta aktivite seviyesinde ve %31'i yüksek aktivite seviyesindeydi. BAQ ile IPAQ-SF puanı arasında zayıf korelasyon (r <0,400) ve BAQ ile EBBS fayda puanı arasında negatif korelasyon (r <0,400) vardı. IPAQ-SF puanları ile BAQ puanları arasında da zayıf bir korelasyon (r<0,400) bulundu.

**Tartışma:** Çalışmanın sonucuna göre fiziksel aktivite düzeyinin, beden farkındalığına ve algılanan egzersiz engellerine bağlı olduğu bulunmuştur. Çalışmamızın kanıt düzeyini artırmak için daha fazla katılımcı grubu ve farklı koşullarda yaşayan öğrencilerle yapılacak çalışmalara ihtiyaç vardır.

**Anahtar Kelimeler:** Egzersiz, Fiziksel Aktivite, Üniversite Öğrencileri, Vücut Farkındalığı

## INTRODUCTION

Physical activity is defined as any movement that requires skeletal muscles to expend energy (1). Although lack of physical activity is shown as a risk factor for non-communicable diseases such as stroke, diabetes, and cancer, physical activity is gradually decreasing in most countries. Globally, 23% of adults and 81% of adolescents going to school are not sufficiently active (2). Many factors affect physical activity levels such as demographic variables, awareness, beliefs, positive benefits affecting the physical activity level and perceived barriers that affect negatively (3).

Perceived barriers create intra and inter personality levels known as an important determinant of physical activity (4,5,6). Internal-personal or external-environmental barriers have been described in various studies. Internal barriers are related to the motivation of individuals, while external barriers depend on the environment and the structure of societies. (7,8).

Body awareness is a complex concept in which one's bodily and emotional functions take place together. Accordingly, it consists of many parameters such as position perception, movement sense and cognitive thoughts (9). Increasing this awareness, in which physiological and psychological processes are intertwined, is possible with mind-body approaches. This increase plays an important role in increasing the control of breathing, mind, emotional processes and also in increasing postural control with the improvement in balance, coordination, and muscle-joint movements (10,11).

Although many studies on exercise perception assessed the perceived usefulness and obstacles of exercise among young people, there was no study among university students that examined body awareness, exercise perception, and physical activity level. This study aims to investigate whether the level of physical activity is linked to exercise perception and body awareness.

## METHODS

This study was conducted at the University of Health Science, Faculty of Hamidiye Health Sciences, Department of Physiotherapy and Rehabilitation in Istanbul, Turkey, between January 2020 and July 2020. Students who did not have a problem preventing physical activity between the ages of 18-25 years were included in the study. All participants were healthy students at the University of Health Science.

The study was carried out under the supervision of both the University of Health Science, Hamidiye Scientific Research Ethics Committee (Protocol Number: 19/167, Date: 27.12.2019) and registered on the ClinicalTrial.gov website (registration number: NCT04270227). The study was conducted in accordance with the Helsinki Declaration. Written informed consent was obtained from each patient.

Demographic data form, which includes demographic information such as age, gender, and height, international physical activity questionnaire short form (IPAQ-SF), consisting of 7 questions, the body awareness questionnaire (BAQ) consisting of 18 questions, the exercise benefits/barriers scale (EBBS), which has 14 questions on exercise barriers, 29 questions on exercise benefits, were used in the study. The survey was presented to participants in a single document. In the usual course routines, all volunteers were informed about the evaluations and written approvals were obtained by getting prior approval from the teacher of the course. Information was taken from the participants at a time away from the exam periods as the emotional state may have an impact on the results.

### Outcome Measurements

Body Awareness Questionnaire (BAQ): It is a questionnaire consisting of four subgroups (changes in the body process, sleep-wake cycle, prediction at the onset of the disease, prediction of body responses) and a total of 18 statements aimed at determining the normal or abnormal sensitivity level of the body composition. BAQ is widely used in research for various populations; measuring beliefs about the individual's sensitivity to normal, abnormal, sensitive, or non-sensitive body processes. It is a self-report scale based on the concept. The participant is asked to score between one and seven numbers for each statement. In the survey, the ratings are made as total points. The high score shows that body sensitivity is better (12,13,14).

Exercise Benefits/Barriers Scale (EBBS): It is a 43-item questionnaire that uses the 4-item Likert

scale. Three different scores are obtained from this scale: exercise benefits scale score, exercise barriers scale score, and total score. Questions on the benefits scale are grouped into 5 categories: (1) life development, (2) physical performance, (3) psychological appearance, (4) social interaction, and (5) preventive health. Questions on the disability scale are grouped into 4 categories: (1) work environment, (2) time-wasting, (3) physical exertion, and (4) family encouragement. The score ranges from 43 to 172. High scores on the benefits scale indicate that the perceived benefits of physical activity are high, while high scores on the barriers scale indicate that the perceived barriers to physical activity are low. The survey was developed by Sechrist et al. The Turkish validity and reliability survey of the survey was conducted in 2017 (15-17).

International Physical Activity Questionnaire-Short Form (IPAQ-SF): The short form of the international physical activity questionnaire, which consists of seven questions, was used to determine the levels of physical activity. The validity and reliability studies of this survey in Turkey were conducted by Öztürk (18) on university students. The criterion for the activity evaluation is that each activity is performed at least 10 minutes at a time. The "MET-min/week" score is obtained by multiplying the time in minutes, the number of days, and the MET value corresponding to the basal metabolic rate (multiples of oxygen consumption at rest). Accordingly, the total score is classified as; low physical activity level (if not moderate or vigorous), moderate physical activity level (600-3000 MET-min/week), and high physical activity level (>3000 MET-min/week) (18,19).

## Statistical Analysis

Statistical analysis was conducted using SPSS version 15 (SPSS Inc., Chicago, IL, USA). In addition to descriptive methods, Pearson correlation analysis was used. In addition, independent sample testing was used to compare gender data. Descriptive and clinical features of patients were defined as mean (frequency) and rate (%) for categorical variables, and standard deviation for continuous variables. The normalizations of the test data were examined using the Shapiro Wilk test. Mann Whitney U test was used for intergroup changes in the data with no normal distribution. Variables were expressed as median, minimum and maximum, $p < 0.05$ was considered statistically significant. Considering the IPAQ-SF total values, which is the primary outcome measurement parameter (20), which is one of the evaluation parameters in our study, 58 women and 58 males in the power analysis conducted with the G * power 3.1.9.4 program according to the 0.05 alpha level. It was calculated that 116 people should be recruited.

## RESULTS

The average age and body mass index of the participants was 20.38 years and 21.86 kg/m$^2$. While smoking was 23%, 18% of this rate was composed of men, 56% of the students were staying in a dormitory (Table 1).

EBBS barriers score mean value was 28.59, EBBS benefits score mean value was 53.19, EBBS total score value was 81.78, and BAQ mean score was 87.86. In IPAQ scores, 28.4% of the participants were at a low activity level, 40.5% were at the medium activity level and 31% were at high activity level (Table 2).

**Table 1.** Characteristics of Group Participants

| Parameter | Total (n=116) | Male (n=58) | Female (n=58) |
|---|---|---|---|
| Age, year mean (min-max) | 20.38 (18-25) | 21.00 (18-25) | 19.76 (18-25) |
| BMI, kg/m$^2$ mean (min-max) | 21.86(15.94-30.85) | 23.01(17.51-30.09) | 20.72(15.94-30.85) |
| Smoking, n (%) | 23 (19.8) | 18 (31.0) | 5 (8.6) |
| Environment, n (%) | | | |
| Home | 60 (51.7) | 32 (55.2) | 28 (48.3) |
| Dormitory | 56 (48.3) | 26 (44.8) | 30 (51.7) |

BMI: Body Mass Index

**Table 2.** IPAQ, BAQ, EBBS Barriers, EBBS Benefits, EBBS Total Survey Score by Genders

| Parameter | Total (n=116) | Male (n=58) | Female (n=58) | P |
|---|---|---|---|---|
| Physical Activity Levels n (%) | | | | |
| Low | 33 (28.4) | 15 (25.9) | 18 (31) | |
| Moderate | 47 (40.5) | 18 (31.0) | 29 (50) | .039 |
| High | 36 (31) | 25 (43.1) | 11(19) | |
| Total | 116 (100) | 58 (100) | 58 (100) | |
| EBBS Barriers mean(min-max) | 28.59(16-48) | 28.86 (16-48) | 29.03 (19-61) | .591 |
| EBBS Benefits mean(min-max) | 53.19(30-82) | 51.67(30-82) | 54.71(30-73) | .177 |
| EBBS Total mean(min-max) | 81.78(49-109) | 80.48(53-109) | 83.07(49-106) | .369 |
| BAQ mean (min-max) | 87.86(50-121) | 87.93 (50-121) | 87.79 (65-113) | .699 |

EBBS: Exercise Benefits/Barriers Scale, BAQ: Body Awareness Questionnaire , *p<0.05

There was a weak correlation between body awareness and IPAQ score (r <0.400). A weak negative correlation was found between body awareness and the EBBS benefits score (r <0.400). In addition, a weak negative correlation was found between EBBS total scores and IPAQ scores (r <0.400). While there was a weak correlation between IPAQ-SF scores and BAQ scores (r <0.400). There was a negative weak correlation between IPAQ-SF and EBBS benefits and barriers (r <0.400) (Table 3).

The EBBS total score was weakly correlated (r <0.400). Body awareness was found to be very weak negative correlations in smokers (r <0.200). When the authors looked at the correlation of IPAQ-SF scores with BAQ by gender in the scores, there was no significant difference in any parameters among women, and a weak correlation was found among men (r<0.400). While the benefits and total values of IPAQ-SF and EBBS by gender were moderately correlated in males (r<0.600), the EBBS barriers scores were negatively correlated in males with IPAQ-SF scores (r<0.400).

## DISCUSSION

Many studies examine physical activity with parameters such as nutrition, stress, academic success, and mental health among university students. In addition to these, it has been researched in parameters such as motivations, obstacles, benefits against physical activity in university students. The

**Table 3.** IPAQ, BAQ, EBBS Barriers, EBBS Benefits, EBBS Total Survey Score Correlation Analysis Results

| | IPAQ-SF | BAQ | EBBS Barriers | EBBS Benefits | EBBS Total |
|---|---|---|---|---|---|
| IPAQ-SF | | | | | |
| r | | ,242* | -,214* | -,349* | -,383* |
| P | | ,009 | ,021 | ,000 | ,000 |
| BAQ | | | | | |
| r | ,242* | | ,082 | -,240* | -,164 |
| P | ,009 | | ,380 | ,010 | ,079 |
| EBBS Barriers | | | | | |
| r | -,214* | ,082 | | ,186* | ,576** |
| P | ,021 | ,380 | | ,045 | ,000 |
| EBBS Benefits | | | | | |
| r | -,349* | -,240** | ,186* | | ,910*** |
| P | ,000 | ,010 | ,045 | | ,000 |
| EBBS Total | | | | | |
| r | -,383* | -,164 | ,576** | ,910*** | |
| P | ,000 | ,079 | ,000 | ,000 | |

EBBS: Exercise Benefits/Barriers Scale, BAQ:Body Awareness Questionnaire, IPAQ: International Physical Activity Questionnaire *: Weak Correlation **: Moderate Correlation ***: Very High Correlation

originality of our study is that it is the first study to examine the level of physical activity, perceived exercise benefits/barriers and its relationship with body awareness. The information obtained from our study will contribute to minimizing or eliminating the problems that may arise with inactivity at an advanced age by encouraging the active lifestyle before the students participate in the working life and by creating healthy lifestyle behaviors. At the same time, according to the determined barriers, data will be obtained for universities to remove the barriers of physical activity in front of young people. Thus, chronic diseases that can be prevented by changing the physical activity level from an early age and applying these gains throughout life can be prevented.

Although many factors are included in the concept of body awareness (changes in body process, sleep-wake cycle, prediction at the onset of disease, prediction of body responses), each parameter is important in terms of functioning in life. Body awareness is evaluated by various questionnaires created today (13). In a study linking exercise and eating habits with body awareness, they concluded that body awareness did not affect these parameters (21). The fact that body mass index was not associated with physical activity in our study supports this previous study. In another study on chronic kidney patients, individuals who knew the benefits of exercise were shown to be higher than those who did not know the benefits of disease awareness and body awareness scores (22).

The fact that no difference was observed between the genders in the studies conducted supports the lack of a significant difference between the body awareness in our study (23,24). When the level of physical activity was evaluated by gender, women are more active at medium severity (50%) while men are more active at higher severity (43%). As the physical activity level of men increased, BAQ scores increased and EBBS Barriers scores decreased, whereas women did not find such a correlation.

In our study, there was no chronic disease among the students. In the studies conducted previously, it is emphasized that being physically active in the university period and providing good mental and physical health in later life (25). According to a study conducted on Japanese university students, they concluded that students with high physical activity were more successful in solving social problems (26). In our study, 31% were highly active when the researchers evaluated the physical activity levels of those people who did not have a physical disability, and 40% were moderately active, 28.4% were inactive. Another study on university students found that students were not active and did not match our results (27).

Non-smoker students had higher body awareness. No studies on smoking and body awareness have been found in the literature. This may be another study topic. Individuals who smoke constitute 23% of our study. Although this is not a low rate, when it was compared between genders, men make up 18% of this rate. The prevalence of the smoking habit among men was found to be compatible with another study on university students (28).

There are too many parameters that affect the level of physical activity. The perceived barriers scores were low in individuals with high levels of physical activity. At the same time, the perceived benefits scores of inactive individuals are high. This shows that people are aware of exercise, but they tend to avoid exercise due to environmental factors such as distance to exercise, time, economic, family and friends, or personal factors like fatigue, personality, as well as the items in the obstacle scores. Although these parameters have been evaluated with the questions included in the exercise benefits and barriers scale, a more detailed investigation should be carried out in future studies to determine the exact causes. Since our study was carried out in the city center and the largest city of our country, while these students are expected to be individuals with less difficulty in accessing various opportunities, perceived barriers scores were found to be high. The absence of a significant difference in parameters for students living at home compared to students living in the dormitory at University suggests that cohabitation with peers does not affect the level of physical activity.

Our study has some limitations. The researchers used a questionnaire, which is a subjective method for evaluating the level of physical activity. In future studies, more objective results can be achieved by evaluating with methods such as pedometer, accel-

erometer, direct observation. In addition, sampling selection from a relatively narrow and single university may be another limitation of the study.

According to the results of our study, physical activity level depends on body awareness and perceived exercise barriers. To increase the level of evidence in our study, further studies are needed in students studying in different conditions with a greater number of groups of participants. Simple body awareness exercises should also be added to the exercises, as increased body awareness will contribute to the level of physical activity. In addition, universities must ensure that students participate collectively in physical activity by organizing activities that can be implemented in conjunction with the group. Free outdoor and indoor gyms should be added to maximize access to exercise on campuses and dorms. In these gyms, not only types of exercise such as fitness, aerobics, swimming, but also exercises that will increase body awareness and are relatively non-strenuous, such as pilates, yoga, tai-chi, should be performed. Thus the perceived barriers can be minimized.

***Sources of Support**:* None. The authors received no financial support for the research, authorship and/or publication of this article.

***Conflict of Interest:*** The authors declare no conflicts of interest.

***Ethical Approval:*** University of Health Science, Hamidiye Scientific Research Ethics Committee 27.12.2019 dated 19/167 number necessary permission was obtained.

***Informed Consent:*** The students included in the study were informed about the study's methodology, and written informed consent was obtained for participation in the study.

***Peer-Review:*** Evaluated by external independent reviewers.

***Author Contributions:*** The authors will comply with the editor's decision on this matter. Author Contributions: Concept - NB, EP; Supervision – EP, Resources and Financial Support – NB, EP; Materials – NB; Data Collection and/or Processing - NB, EP; Analysis and/or Interpretation – EP; Literature Research - NB; Writing Manuscript – NB; Critical Review - EP.

***Acknowledgments:*** This study was presented as an online oral presentation at the 4th International Health Science and Life Congress (IHSLC 2021) held on April 8-10, 2021.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)45-54*

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# INVESTIGATING THE EFFECTS OF FATIGUE PROTOCOL ON SPATIOTEMPORAL CHARACTERISTICS OF GAIT IN PATIENTS WITH CHRONIC NECK PAIN

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** Chronic neck pain (CNP) may lead to problems, such as functional limitations, disability, and fatigue. Gait maintains postural orientation; It is important to investigate the effects of fatigue on walking in patients who subjectively define a certain level of fatigue, not for a certain period. This study aimed to investigate the effects of fatigue protocol on gait spatiotemporal characteristics in patients with CNP.

**Methods:** Fifty-three patients with CNP, and twenty-six healthy controls were included. The groups were matched with Propensity Score Matching in terms of age and fatigue threshold as 26 individuals. Pain intensity and disability were evaluated with the Visual Analog Scale, and Neck Disability Index, respectively. Gait assessment was recorded with OptoGait (1.6.4.0, Microgate, Bolzano, Italy) for one minute while individuals walked at their preferred speed on the treadmill. Individuals keep walking on the treadmill and fatigue levels were asked for Modified Borg Scale. While fatigue reached 4 points, gait assessment was recorded for one minute. A two-way repeated-measures ANOVA was used for interaction time-by-group.

**Results:** The median pain intensity was 7(4-9), and the disability was moderate in patients. Left step length, stride length, and cadence, showed significant, similar changes within the groups over time($p<0.05$), while there were differences between groups in cadence ($p<0.05$). There was no difference in time-group interaction in terms of gait variables ($p>0.05$).

**Conclusion:** Fatigue may lead to changes in the gait parameters of patients with CNP, it may cause the development of compensation strategies to maintain the position, mobility, and stabilization of the spine.

**Keywords:** Neck pain, Fatigue, Gait

# KRONİK BOYUN AĞRILI HASTALARDA YORGUNLUK PROTOKOLÜNÜN YÜRÜYÜŞÜN ZAMAN MESAFE KARAKTERİSTİKLERİ ÜZERİNE ETKİLERİNİN ARAŞTIRILMASI

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Kronik boyun ağrısının (KBA) fonksiyonel limitasyonlar, özür, yorgunluk gibi sorunlara yol açabilmektedir. Yorgunluğun günlük yaşam aktivitelerini etkilemesi, belirli süre için değil, subjektif olarak belirli bir düzeyde yorgunluk tanımlayan hastalarda yorgunluğun postural oryantasyonu sağlayan yürüme üzerine etkilerinin araştırılması önemlidir. Bu çalışmanın amacı, KBA'lı hastalarda yorgunluk protokolünün yürüyüşün zaman mesafe karakteristikleri üzerindeki etkilerini araştırmaktır.

**Yöntem:** Çalışmaya 53 KBA'lı, 26 sağlıklı kontrol alındı. Gruplar yaş, yorgunluk eşiği bakımından Propensity Score Matching ile 26 birey olacak şekilde eşleştirildi. Ağrı şiddeti, özür sırasıyla Görsel Analog Skala, Boyun Özür Anketi ile değerlendirildi. OptoGait (1.6.4.0, Microgate, Bolzano, İtalya) ile bireyler koşu bandında bireyler tercih ettikleri hızda yürürken yürüyüşleri önce bir dakika süreyle kaydedildi. Yorgunluk düzeyleri Modifiye Borg Skalası ile değerlendirildi. Yorgunlukları 4 puana ulaştığında tekrar 1 dakikalık yürüyüş değerlendirmesi yapıldı, yürüyüş bandı durduruldu. Zaman-grup etkileşimi değerlendirmesinde Tekrarlı Ölçümlerde iki Yönlü ANOVA analizi uygulandı.

**Sonuçlar:** KBA'lı bireylerde ağrı şiddeti ortancası 7(4-9) idi, özür orta düzeydeydi. Sol adım uzunluğu, çift adım uzunluğu, kadans, ortalama hız gruplar içinde zamanla anlamlı, benzer değişiklikler gösterirken ($p<0,05$). Kadansta gruplar arası farklılık vardı ($p<0,05$). Zaman-grup etkileşiminde yürüyüş değişkenleri açısından fark yoktu ($p>0,05$).

**Tartışma:**Yorgunluk, KBA'lı hastaların yürüme parametrelerinde değişikliklere yol açabilir. Omurganın pozisyonunu, mobilitesini, stabilizasyonunu korumak için yürüyüşte kompansasyon stratejilerinin geliştirilmesine neden olabilir.

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***Received:*** *13.10.2021 (Geliş Tarihi)*
***Accepted:*** *12.01.2023 (Kabul Tarihi)*

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## INTRODUCTION

Neck pain (NP), which continues for longer than three months, is defined as chronic neck pain (CNP), and studies have shown that CNP may lead to problems, such as functional limitations, fear of movement, disability, and neck muscle fatigue or general fatigue (1,2).

When the location of the neck region is considered, the importance may be understood of the functions of sensorial receptors, such as muscle spindles and golgi tendon organ, proprioceptors, and nociceptors in the neck muscles. These functions include the perception of motion, determination of the location of a motion in space, perception of pain stimuli, transmission to the cortex, processing and responding processes (3). Muscle fatigue changes the discharge of receptors, such as muscle spindles and golgi tendon organ, and postural orientation deteriorated by the alteration of proprioception (4,5). The fatigue of the neck muscles of individuals with neck pain begins in a shorter time in isometric voluntary neck movements compared to healthy controls (6). On the other hand, individuals with neck pain experience general fatigue during activities in their daily lives (2). Fishbain et al. reported a relationship between self-reported fatigue and pain, so they stated that general fatigue should be addressed in patients experiencing pain (7). While carrying a bag, climbing stairs, or walking moderate and long distances, patients with pain may develop several problems, such as fatigue starting in the upper extremity and spreading to the lumbar region, cardiac loading, and strain. Thus, sprains may occur (8,9).

Gait is an important phenomenon in providing and maintaining postural orientation (6). Gait parameters may be affected in case of pain and disability (1,10). Various studies have shown that, although limited, step length, gait speed, and cadence decrease, and postural sway increase in the anteroposterior direction in patients with CNP compared to healthy control (HC) (1,11,12). These findings suggest that CNP may be associated with gait disturbance.

After insufficient rest, the pain and stiffness associated with fatigue may cause muscle fatigue, thereby generating a vicious circle (13). Although EMG studies on fatigue, strength, and endurance of neck muscles showed the relationship between muscle fatigue and NP (6), information about how the patients manage general fatigue is lacking. Fatigue affects daily living activities and it is important to investigate the effects of fatigue on walking in patients identified with a subjective certain level of fatigue rather than for a certain period.

Fatigue affects daily living activities, and it is important to investigate the effects of fatigue on walking in patients identified with a subjective certain level of fatigue rather than for a certain period. There is a lacking area in fatigue and walking studies in patients with CNP in the literature. Therefore, the effects of general fatigue on gait parameters should be investigated in patients with NP. The present study aims to investigate the effects of general fatigue protocol on gait spatiotemporal characteristics in patients with CNP.

## METHODS

### Research Approval and Participants

This cross-sectional study was conducted in the author's institution after the approval for this research was granted by the ethics committee of the authors' affiliated institutions. All participants were given informed consent. All procedures were conducted according to the Declaration of Helsinki. The research was carried out at Hacettepe University Faculty of Physical Therapy and Rehabilitation, between January 2018 and January 2019, and is a cross-sectional study.

The study included 26 individuals in HC and 53 patients with CNP who had unilateral non-specific pain in the neck and shoulder area and were diagnosed with CNP by a physiatrist and referred to physiotherapy. The inclusion criteria were the presence of pain for at least three months, a resting pain score of≥2 according to the Visual Analog Scale (VAS) (14,15), the Neck Disability Index (NDI) score of≥5(mild and above) (16), and whose dominant leg is the right side.

Exclusion criteria were defined as the presence of any neurologic or systemic disease, intervertebral disc displacement, radiating pain neck from the upper extremity, radiculopathy, myelopathy, insufficiency malignancy, tendinitis or bursitis in any up-

per/lower extremity, scoliosis, acute inflammation, non-union of a fracture, pregnancy, a history of upper/lower extremity surgery.

### Demographics and Self-Ratings

The demographic data of all patients (gender, age, and body mass index) were recorded. The pain intensity during the activity of all patients with CNP was evaluated with VAS, by the participant marking a vertical line on a 10cm horizontal line to represent the intensity of the pain where 0=no pain,10=intolerable pain (14). Functional disability was evaluated with the 10 items NDI, which consists of 10 items asked for functional tasks such as the activities of daily life, driving, reading, lifting, working, and recreation. Each item is scored between 0 and 5, providing a total score ranging from 0=no disability to 50=complete disability (16,17).

### Gait and Fatigue Assessments

In the assessment of the spatiotemporal (distance, timing) characteristics of gait, a treadmill, and a valid, reliable OptoGait photocell-based system were used (Version 1.6.4.0, Microgate, Bolzano, Italy). The spatial variables included stride length and step length; the temporal variables included gait cycle, speed, cadence, step time, pre-swing, swing, stance phases, single and total support, and load response (1). Each bar is 1 meter long, and each bar, which is placed 3 mm above the ground and 1 cm apart, has 96 LEDs. The device is designed so that when an individual passes between 2-rod bars positioned parallel on the floor, their feet block the transmission and reception. The timing, size, and distance are detected, and spatial-temporal parameters are calculated automatically. OptoGait is connected to a personal computer using the OptoGait software program via an interface unit. The data were output at a frequency of 1000 Hz and stored on a computer (18). Optogait is an acceptable system for the assessment of gait in the general population (18).

The treadmill was selected to generate controlled fatigue (19). First, the subject became accustomed to walking on the treadmill at a comfortable walking speed. Then, each subject determined their preferred walking speed. The preferred walking speed of individuals remained constant throughout the protocol. Spatiotemporal parameters were recorded at this preferred walking speed by the OptoGait photocell-based system for one minute. After this recording, the participants continued to walk until they were fatigued. Fatigue levels of participants were asked every minute and the participants scored their perception of fatigue. When the fatigue level reached the level of four points (somewhat severe) according to Modified Borg Scale (MBS)(20), the gait parameters were recorded again by the OptoGait photocell-based system for one minute, the fatigue threshold was recorded and the test was completed. The four (4) is a little intense level on the Modified Borg Scale. Therefore, to prevent cardiovascular adaptations and create general body fatigue that patients experience in their daily living, we determined the fatigue threshold to 4 as “a little intense” (20).

The MBS assesses the intensity of exercise or resting dyspnea and the intensity of fatigue on a scale of 0-10(0=none, 10=maximum intensity) (20).

### Statistical analysis

Data obtained in the study were analyzed statistically using IBM SPSS software version 20.0 (Statistical Package for the Social Sciences, IBM Corp., Armonk, NY, U.S.A.). Group characteristics were calculated as mean and standard deviation values. The conformity of the data to normal distribution was assessed using the Shapiro-Wilks tests. A value of $p<0.05$ was accepted as statistically significant. The Propensity Score Matching was performed with R 4.1.2 Studio ggplot2 ve BlandAltmanLeh program.

To study the effects of the FP, the outcome measures were compared time-by-group interaction effects, one the between-groups factor (group) and one the within-groups factor (time) by a two-way repeated-measures ANOVA. In the examination of whether there was a difference between the cadence before and after the FP, the ANOVA analysis was performed. According to cadence the observed power of the study was 0.932. The sample size was sufficient.

## RESULTS

### Participants

There were 53 individuals with CNP and 26 individuals with HC. There was no difference between groups concerning gender, BMI, preferred speed (Table 1) and spatio-temporal characteristics of

**Table 1.** Characteristics of Participants

| | Before Propensity Score Matching | | | After Propensity Score Matching | | |
|---|---|---|---|---|---|---|
| | CNP (n=53) Median (% 25-75) | HC (n=26) Median (% 25-75) | P Value | CNP (n=26) Median (% 25-75) | HC (n=26) Median (% 25-75) | P Value |
| Age (Years) | 46 (39-52.5) | 32 (28-45.25) | 0.007* | 40 (25-44) | 32 (28-45) | 0.898 |
| BMI (kg/m$^2$) | 25.70 (23.4-29.3) | 26.35 (22.7-28.2) | 0.854 | 25.3 (21.5-28.4) | 26.4 (22.7-28.2) | 0.470 |
| Gender (F/M) (n) | 38/15 | 13/13 | 0.083 | 16/10 | 13/13 | 0.402 |
| Fatigue Threshold (min) | 7.29 (4.47-9.83) | 12.67 (9.2-16.57) | 0.000** | 9.75 (8-15.24) | 12.67 (9.2-16.26) | 0.188 |
| Preferred Walking Speed (Km/h) | 4.1 (3.35-4.9) | 4.9 (3.87-5.22) | 0.051 | | | 0.743 |
| Pain Intensity (cm) | 7 (4-9) | - | | 6 (4-8) | | |
| Disability | 18 (11-23) | - | | 14 (7-19) | | |

min: Minute, cm: centimeter, Km/h: Kilometer/hour, * p<0.05, ** p<0.000, CNP: Chronic Neck Pain, HC: Healthy Controls, BMI: Body Mass Index, cm: Centimeter, ***p:*** Statistical Significance**,** F:Female, M:Male

**Table 2.** The Baseline Results of Spatiotemporal Characteristics of Gait

| Spatiotemporal Characteristics of Gait | CNP (N=26) Mean±SD | HC (N=26) Mean±SD | P Value |
|---|---|---|---|
| **Right Step Length$_{T0}$** | 66±12.2 | 65.2±10.9 | 0.136 |
| **Left Step Length$_{T0}$** | 65.8±11.5 | 64±10.3 | 0.310 |
| **Stride Length$_{T0}$** | 131.8±23.9 | 129±21 | 0.219 |
| **Right Stance Phase$_{T0}$** | 60.7±4.7 | 61.3±5.1 | 0.392 |
| **Left Stance Phase$_{T0}$** | 60.7±4.5 | 61.3±4.9 | 0.424 |
| **Right Swing Phase$_{T0}$** | 41.5±5.7 | 40.2±5.2 | 0.762 |
| **Left Swing Phase$_{T0}$** | 41.5±5.7 | 40.2±5.1 | 0.424 |
| **Right Single Support$_{T0}$** | 40.2±4.9 | 39.5±4.3 | 0.941 |
| **Left Single Support$_{T0}$** | 40.9±4.7 | 39±4.4 | 0.719 |
| **Total Double Support$_{T0}$** | 19.2±8 | 21.4±8.6 | 0.313 |
| **Right Load Response$_{T0}$** | 8.8±4.3 | 10.4±4.4 | 0.149 |
| **Left Load Response$_{T0}$** | 9.3±4.4 | 10.5±4.4 | 0.452 |
| **Right Preswing Phase$_{T0}$** | 10.5±4.1 | 10.8±4.3 | 0.508 |
| **Left Preswing Phase$_{T0}$** | 9.7±4.3 | 11.1±4.5 | 0.247 |
| **Right Step Time$_{T0}$** | 0.527±0.166 | 0.503±0.062 | 0.989 |
| **Left Step Time$_{T0}$** | 0.503±0.145 | 0.501±0.069 | 0.955 |
| **Gait Cycle$_{T0}$** | 1.06±0.29 | 1.02±0.11 | 0.806 |
| **Cadance$_{T0}$** | 132.8±23.6 | 120.1±18.4 | 0.296 |
| **Right Speed$_{T0}$** | 1.3±0.24 | 1.27±0.3 | 0.364 |
| **Left Speed$_{T0}$** | 1.41±0.34 | 1.30±0.32 | 0.426 |
| **Avarage Speed$_{T0}$** | 1.35±0.24 | 1.29±0.31 | 0.351 |

CNP: Chronic Neck Pain, HC: Healthy Controls SD:Standart Deviation, $T_0$: Before Fatigue Protocol, p: Significant level.

gait (Table 2). However, there was a difference between the groups in terms of age and fatigue threshold (p=0.007, p=0.000, respectively). Patients with CNP got tired at 5.38 minutes earlier than individuals with HC. It was thought that these two variables might affect the gait parameters, and the groups had to be matched so that there would be no difference. After the propensity score matching analysis, there was no difference between the groups in terms of age and fatigue threshold, when the results of the analysis were examined for 26 individuals in each group. The dominant extremity of all individuals was right. Therefore, there was no difference between the groups. The demographic characteristics were given in Table 1. There were no differences between the groups in terms of right and left lower extremity gait results in baseline (Table 2).

## The Results of Two-Way Repeated-Measures ANOVA for Spatiotemporal Characteristics of Gait

After the FP, the right step length, right and left stance phase, right and left swing phase, right and left single support, total double support, right and left load response, right and left pre-swing phase, right and left step time, gait cycle, right and left speed, average speed showed no significant effect for the time in CNP and HC groups (p>0.05). However, left step length, stride length and cadence showed a significant effect on time (p<0.05). In patients with CNP and HC, there were statistically significant increases in left step length, and stride length; decreases in the cadence according after FP (p<0.05) (Table 3).

The right and left step length, stride length, right and left stance phase, right and left swing phase, right and left single support, total double support, right and left load response, right and left pre-swing phase, right and left step time, gait cycle, cadence, right and left speed, average speed showed similar changes over the time in CNP and HC groups. There were no significant time-by-group interaction effects of these spatiotemporal characteristics (p>0.05) (Table 3).

The results showed significant effects for the group in the cadence (p=0.044). However, there was no significant difference between the groups in terms of spatiotemporal characteristics (p>0.05), except for cadence (Table 2). Among the groups after FP, the cadence was higher in CNP compared to HC (p=0.044).

**Table 3.** The Propensity Score Matching Results of Spatiotemporal Characteristics of Gait and Results of Two-Way Repeated Measures ANOVA According to Fatigue Protocol

| Spatiotemporal Characteristics of Gait | Before Propensity Score Matching | | After Propensity Score Matching | | The Results of ANOVA After Propensity Score Matching | | |
|---|---|---|---|---|---|---|---|
| | CNP (N=53) Mean±SD | HC (N=26) Mean±SD | CNP (N=26) Mean±SD | HC (N=26) Mean±SD | Time (F, P-Value, $n^2$) | Group (F, P-Value, $n^2$) | Time x Group (F, P-Value, $n^2$) |
| **Right Step Length$_{T0}$** | 60.86±12.24 | 65.19±10.92 | 66±12.2 | 65.2±10.9 | 2.109, 0.153, 0.041 | 0.232, 0.632, 0.005 | 1.065, 0.307, 0.021 |
| **Right Step Length$_{T1}$** | 62.57±12.23 | 65.48±11.48 | 67.8±12.3 | 65.5±11.5 | | | |
| **Left Step Length$_{T0}$** | 61.14±12.29 | 64.04±10.27 | 65.8±11.5 | 64±10.3 | 7.536, **<0.05,** 0.133 | 0.370, 0.546, 0.007 | 0.028, 0.867 0.001 |
| **Left Step Length$_{T1}$** | 63.22±12.71 | 65.88±10.79 | 67.9±13.2 | 65.9±10.8 | | | |
| **Stride Length$_{T0}$** | 121.94±24.52 | 129±21.01 | 131.8±23.9 | 129±21 | 5.878, **<0.05,** 0.107 | 0.301, 0.586, 0.006 | 0.257, 0.614, 0.005 |
| **Stride Length$_{T1}$** | 125.51±24.5 | 131.34±22.1 | 135.4±24.3 | 131.3±22.1 | | | |
| **Right Stance Phase$_{T0}$** | 60.38±4.24 | 61.33±5.11 | 60.7±4.7 | 61.3±5.1 | 0.671, 0.417, 0.014 | 0.399, 0.531, 0.008 | 0.028, 0.867, 0.001 |
| **Right Stance Phase$_{T1}$** | 59.52±3.96 | 60.96±4.34 | 60.1±4.4 | 61±4.3 | | | |

CNP: Chronic Neck Pain, HC: Healthy Controls SD:Standart Deviation, $T_0$: Before Fatigue Protocol, $T_1$: After Fatigue Protocol, **F:**F ratio , ***p*:** Statistical Significance**, $n^2$:** Partial Eta Squared

**Table 3. (Continuous)** The Propensity Score Matching Results of Spatiotemporal Characteristics of Gait and Results of Two-Way Repeated Measures ANOVA According to Fatigue Protocol

| | **Before Propensity Score Matching** | | **After Propensity Score Matching** | | **The Results of ANOVA After Propensity Score Matching** | | |
|---|---|---|---|---|---|---|---|
| **Spatiotemporal Characteristics of Gait** | **CNP (N=53)** **Mean±SD** | **HC (N=26)** **Mean±SD** | **CNP (N=26)** **Mean±SD** | **HC (N=26)** **Mean±SD** | **Time (F, P-Value, $n^2$)** | **Group (F, P-Value, $n^2$)** | **Time x Group (F, P-Value, $n^2$)** |
| **Left Stance Phase$_{T0}$** | 60.48±4.2 | 61.34±4.9 | 60.7±4.5 | 61.3±4.9 | 1.426, 0.238, 0.028 | 0.101, 0.752, 0.002 | 0.163, 0.688, 0.003 |
| **Left Stance Phase$_{T1}$** | 60.24±3.90 | 60.36±4.56 | 60.2±4.6 | 60.4±4.6 | | | |
| **Right Swing Phase$_{T0}$** | 40.66±7.55 | 40.15±5.2 | 41.5±5.7 | 40.2±5.2 | 0.022, 0.883, 0.000 | 1.549, 0.219, 0.031 | 0.583, 0.449, 0.012 |
| **Right Swing Phase$_{T1}$** | 42.22±4.75 | 39.57±4.61 | 41.6±4.9 | 39.6±4.6 | | | |
| **Left Swing Phase$_{T0}$** | 41.23±5.09 | 40.24±5.08 | 41.5±5.7 | 40.2±5.1 | 0.306, 0.582, 0.006 | 1.592, 0.213, 0.031 | 0.598, 0.443, 0.0112 |
| **Left Swing Phase$_{T1}$** | 40.86±5.5 | 40.12±4.5 | 42.2±5 | 40.1±4.5 | | | |
| **Right Single Support$_{T0}$** | 39.62±7.26 | 39.5±4.25 | 40.2±4.9 | 39.5±4.3 | 0.000, 0.993, 0.000 | 0.125, 0.725, 0.003 | 0.429, 0.516, 0.0009 |
| **Right Single Support$_{T1}$** | 39.57±5.01 | 39.58±4.56 | 40.5±4.1 | 39.6±4.6 | | | |
| **Left Single Support$_{T0}$** | 39.52±6.94 | 38.97±4.36 | 40.9±4.7 | 39±4.4 | 0.022, 0.882, 0.000 | 0.835, 0.365, 0.017 | 3.781 0.058 0.072 |
| **Left Single Support$_{T1}$** | 40.51±7.15 | 39.84±4.33 | 39.9±3.6 | 39.8±4.3 | | | |
| **Total Double Support$_{T0}$** | 19.43±7.55 | 21.38±8.64 | 19.2±8 | 21.4±8.6 | 0.416, 0.512, 0.008 | 1.073, 0.305, 0.021 | 0.006, 0.938, 0.00 |
| **Total Double Support$_{T1}$** | 18.58±6.56 | 20.88±8.44 | 18.6±7.7 | 20.9±8.4 | | | |
| **Right Load Response$_{T0}$** | 8.89±4.21 | 10.40±4.38 | 8.8±4.3 | 10.4±4.4 | 0.000, 0.994, 0.000 | 1.954, 0.168, 0.038 | 0.027, 0.870, 0.001 |
| **Right Load Response$_{T1}$** | 9.02±3.71 | 10.3±4.3 | 8.9±4.3 | 10.3±4.3 | | | |
| **Left Load Response$_{T0}$** | 9.55±5.42 | 10.49±4.38 | 9.3±4.4 | 10.5±4.4 | 0.318, 0.575, 0.006 | 1.389, 0.244, 0.028 | 0.016, 0.898, 0.000 |
| **Left Load Response$_{T1}$** | 8.77±3.35 | 10.3±4.22 | 9±3.8 | 10.3±4.2 | | | |

CNP: Chronic Neck Pain, HC: Healthy Controls SD:Standart Deviation, $T_0$: Before Fatigue Protocol, $T_1$: After Fatigue Protocol, **F:**F ratio , ***p*:** Statistical Significance**, $n^2$:** Partial Eta Squared

**Table 3. (Continuous)** The Propensity Score Matching Results of Spatiotemporal Characteristics of Gait and Results of Two-Way Repeated Measures ANOVA According to Fatigue Protocol

| Spatiotemporal Characteristics of Gait | Before Propensity Score Matching | | After Propensity Score Matching | | The Results of ANOVA After Propensity Score Matching | | |
|---|---|---|---|---|---|---|---|
| | CNP (N=53) Mean±SD | HC (N=26) Mean±SD | CNP (N=26) Mean±SD | HC (N=26) Mean±SD | Time (F, P-Value, $n^2$) | Group (F, P-Value, $n^2$) | Time x Group (F, P-Value, $n^2$) |
| **Right Preswing Phase$_{T0}$** | 10.12±4.12 | 10.79±4.35 | 10.5±4.1 | 10.8±4.3 | 1.491, 0.228, 0.030 | 0.545, 0.464, 0.011 | 1.276, 0.264, 0.025 |
| **Right Preswing Phase$_{T1}$** | 9.64±3.53 | 10.74±4.48 | 9.4±4 | 10.7±4.5 | | | |
| **Left Preswing Phase$_{T0}$** | 9.95±4.02 | 11.14±4.52 | 9.7±4.3 | 11.1±4.5 | 0.268, 0.607, 0.005 | 0.779, 0.382, 0.016 | 0.642, 0.427, 0.013 |
| **Left Preswing Phase$_{T1}$** | 9.43±3.91 | 10.4±4.31 | 9.9±4.2 | 10.4±4.3 | | | |
| **Right Step Time$_{T0}$** | 0.503±0.137 | 0.503±0.062 | 0.527±0.166 | 0.503±0.062 | 0.024, 0.876, 0.000 | 0.099, 0.754, 0.002 | 1.999, 0.164, 0.039 |
| **Right Step Time$_{T1}$** | 0.51±0.1 | 0.51±0.06 | 0.512±0.138 | 0.516±0.062 | | | |
| **Left Step Time$_{T0}$** | 0.499±0.126 | 0.501±0.069 | 0.503±0.145 | 0.501±0.069 | 3.545, 0.066, 0.067 | 0.014, 0.907, 0.000 | 0.409, 0.526, 0.008 |
| **Left Step Time$_{T1}$** | 0.50±0.11 | 0.52±0.06 | 0.515±0.133 | 0.524±0.067 | | | |
| **Gait Cycle$_{T0}$** | 1.034±0.238 | 1.022±0.119 | 1.06±0.29 | 1.02±0.11 | 0.547, 0.463, 0.011 | 0.104, 0.748, 0.002 | 1.422, 0.239, 0.028 |
| **Gait Cycle$_{T1}$** | 1.04±0.24 | 1.05±0.12 | 1.053±0.304 | 1.052±0.121 | | | |
| **Cadance$_{T0}$** | 125.58±22.73 | 120.1±18.35 | 132.8±23.6 | 120.1±18.4 | 12.374, **0.001,** 0.202 | 4.25, **0.044**, 0.08 | 1.414, 0.240, 0.028 |
| **Cadance$_{T1}$** | 121.11±20.57 | 114.26±14.19 | 121±18.7 | 114.3±14.2 | | | |
| **Right Speed$_{T0}$** | 1.20±0.31 | 1.27±0.30 | 1.3±0.24 | 1.27±0.3 | 0.379, 0.541, 0.008 | 0.239, 0.627, 0.005 | 0.094, 0.761, 0.002 |
| **Right Speed$_{T1}$** | 1.20±0.29 | 1.25±0.29 | 1.30±0.26 | 1.25±0.30 | | | |
| **Left Speed$_{T0}$** | 1.23±0.36 | 1.30±0.32 | 1.41±0.34 | 1.30±0.32 | 3.508, 0.067, 0.067 | 1.271, 0.265, 0.025 | 0.392, 0.534, 0.008 |
| **Left Speed$_{T1}$** | 1.21±0.28 | 1.25±0.31 | 1.32±0.27 | 1.25±0.31 | | | |
| **Avarage Speed$_{T0}$** | 1.21±0.30 | 1.28±0.30 | 1.35±0.24 | 1.29±0.31 | 3.878, 0.055, 0.073 | 0.662, 0.420, 0.013 | 0.142, 0.708, 0.003 |
| **Avarage Speed$_{T1}$** | 1.20±0.27 | 1.25±0.30 | 1.31±0.26 | 1.25±0.31 | | | |

CNP: Chronic Neck Pain, HC: Healthy Controls SD:Standart Deviation, $T_0$: Before Fatigue Protocol, $T_1$: After Fatigue Protocol, **F:**F ratio , ***p*:** Statistical Significance**, $n^2$:** Partial Eta Squared

## DISCUSSION

This study investigated the effects of the fatigue protocol on gait spatiotemporal characteristics in patients with CNP. Also, to our knowledge, it is the first study to investigate the fatigue protocol effects on spatiotemporal characteristics in patients with CNP. In this study, according to ANOVA results, there were statistically significant increases in left step length, and stride length; decreases in the cadence according after FP in both groups. The cadence was higher in CNP compared to HC after the FP between groups. However, there were no statistically significant differences in spatiotemporal parameters except for cadence. We showed that spatiotemporal characteristics change with fatigue in patients with CNP and HC groups. And we found that patients with CNP got tired earlier than individuals with HC. We think that the reason for patients with CNP and HC groups to do this is to compensate and to stabilize against fatigue during walking.

Patients with CNP have reported that repetitive activities that require a stable posture to be maintained, such as driving or typing, carrying bags, and climbing stairs, caused fatigue in the muscles of the cervical, and lumbar region (13, 21). However, the previous studies lack clarity regarding certain details about fatigue, which directly affect walking, such as the fatigue threshold and the period of occurrence of fatigue. Therefore, it was deemed necessary in the current study to investigate how walking is affected in patients with CNP by creating fatigue independent of activities. Pain and functional ability may be predictive factors in fatigue (22). It has been reported that chronic pain, such as low back pain, fibromyalgia, rheumatoid arthritis, and headache, is associated with fatigue (7). Although there is a lack of studies concerning the effects of fatigue during walking in CNP, we found that patients with CNP got tired 5.38 minutes earlier than the HC group. We think that the reason for this may be pain intensity and disability. Fatigue may occur with personal or environmental factors, with activity or without activity (22). However, in our study that we compared with HC, the pain intensity was above moderate, and the disability was moderate level, suggesting that pain and disability may cause earlier fatigue in patients with CNP. In an evidence-based review, Fishbain et al. reveal the reason for the development of fatigue with pain based on three pieces of evidence. First, fatigue increases with increasing pain, and fatigue decreases with decreasing pain. Secondly, the increase in the duration of pain increases the likelihood of fatigue. Thirdly, as the intensity of pain increases, fatigue also increases (7). Although studies on fatigue and disability in chronic pain are limited, fatigue has been associated with increased pain and impairment of functional abilities in neurological studies. The pain and fatigue also cause increased chronic disability and this cycle may continue in complex ways by increasing each other (23).

In recent studies in the literature, it has been stated that there are differences in spatiotemporal characteristics of walking in patients with CNP compared to the HC group (1,24,25). Although these studies have been a subject of interest in the literature recently, they have been conducted in different walking protocols in patients with CNP and have shown that patients with CNP have less speed, cadence, step length, and stride lengths compared to individuals in the HC group. Uthaikhup et al. found that the decrease in speed was associated with disability (1), while Kırmızı et al. found the step length and preferred speed parameters associated with disability (26). Kırmızı et al. stated that altered gait parameters might be to compensate for the reduced shock absorption capacity (26). However, unlike these study protocols, our study investigated the effects of fatigue on the spatiotemporal parameters of gait in the CNP and HC group. After fatigue protocol, we found differences in cadence, stride length, and left step length in CNP and HC groups. However, among the groups, the cadence was higher in CNP than in HC. It has been reported that patients in the CNP group have a shorter stride length to the support base and thus provide stability by reducing anteroposterior displacement (27). It is stated that shorter steps are more stable and safe, and the asymmetry in step lengths can be accepted as a measure of walking ability (28,29). Therefore, the underlying problem of step length asymmetry may be indicative of compensatory mechanisms. It has been observed that individuals take longer steps on the right and left with fatigue. However, left stride length is significant in individuals. The fact that dominant feet are correct in all

individuals, and the left stride length increases with fatigue in all individuals and is higher in CNP compared to HC may indicate that individuals with CNP are more prone to deterioration of stabilization ability. Since the right foot is dominant, it may be compensating for fatigue, but the left foot may not be able to compensate.

In this study, the findings show that walking parameters showed similar significant responses after fatigue in individuals with CNP and HC. However, when we look at the between groups, the difference in cadence, which is higher in CNP than in HC, is striking. In adaptation to fatigue, individuals in the CNP and the HC group decreased cadence, both within and between groups. Among the groups, cadence results in individuals CNP were higher than in HC, after the FP. However, studies in the literature indicated that cadence is less in CNP compared to HC. (12, 30). In our results, individuals with CNP were getting tired almost 5 minutes earlier. In addition to pain and disability, individuals' with CNP have higher walking cadences than HC, which may lead to earlier fatigue. Both groups decrease the number of steps per minute while getting tired, but because their cadence is higher, individuals with CNP may get tired first. Although our results indicated that both groups showed similar changes in adapting to fatigue; The cadence parameter may cause the inability of individuals with CNP to adapt to fatigue during walking.

When there is an abnormality in one of the bones, joints, muscle structures, normal walking is impaired (25). With the pain, the time spent in the standing phase decreases, and the time spent in the swing phase increases (31). In our results, after the fatigue protocol, there were no significant differences in stance, pre-swing and swing phases, load responses, and single and total support both within and between groups. Although the number of studies investigating the spatiotemporal characteristics of walking in patients with CNP is limited in the literature, patients with CLBP have been found higher swing duration compared to the HC group (32,33). Ground reaction forces act on the body in the stance phase, and shortening the stance phase provides a reduction in ground reaction forces and relieves pain (34). In individuals with LBP, wide-angle movements of the spine are avoided to minimize the forces that may cause pain. Apart from being a protective strategy, it is stated that pain may affect walking parameters negatively (32). The fact that the lumbar region is closer to the lower extremity but the neck is far from the lower extremity may be a normal consequence of these results being insignificant. Uthaikhup et al. state that the gait did not vary between the CNP and the HC group when observed (1). From the results of our study supporting the results of Uthaikhup et al. and Kırmızı et al., we think that when the observation is performed, the dynamics of walking change with fatigue, although the gait does not vary between patients with CNP and HC (1,26).

A series of limitations were observed in this study. The most important limitation of this study is that although perceived fatigue is examined, the fatigue threshold wasn't measured by the amount of lactic acid in the blood. Also, the findings obtained in this study raise the questions of how investigations and evaluations should be performed on how proprioception sensation, body sway, ground reaction forces, and compensatory body movements may be affected by fatigue and gait parameters in individuals with CNP. We evaluated only the kinematics of gait. There is a need for further studies to examine fatigue both systematically and through what is perceived by the patients.

In conclusion, fatigue may lead to changes in the gait parameters of patients with CNP, and in general, it may cause the development of compensation strategies to maintain the position of the spine, and maintain mobility and stabilization. In this case, the result of changes in gait parameters in individuals with CNP, fatigue is seen to be one of the factors causing these changes. The most important results of this study show that patients with CNP are tired earlier than HC. When all individuals, get tired while walking, they increase the left step length, and stride length parameter, however, decrease the cadence. The higher cadence in CNP compared to HC suggests that it may cause early fatigue in CNP. When patients come to clinics, it would be useful to evaluate the parameter of fatigue together with gait.

***Source of Support:*** None

***Conflict of Interest:*** The authors report no declarations of interest.

***Author Contribution;*** DO, AD, OU: Conceptualization, Methodology, Investigation, Writing-Original draft preparation, Visualization, Project administration. DO, AD, OU: Conceptualization, Methodology, Formal Analysis, Writing-Original draft preparation, Visualization. DO, AD, OU: Conceptualization, Methodology, Writing- Reviewing and Editing, Project administration, Supervision. DO, AD, OU: Resources, Writing- Reviewing and Editing, and Supervision. DO, AD, OU: Investigation, Writing- Reviewing and Editing, Resources.

***Explanations:*** This study has been never presented or published in a scientific platform.

***Acknowledgement:*** None

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)55-63*

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# ALT EKSTREMİTE KAS KUVVETİ, KALÇA EKLEM HAREKET AÇIKLIĞI VE SUBTALAR AÇININ DİNAMİK DENGE İLE İLİŞKİSİ

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Sağlıklı bireylerde alt ekstremite kas kuvveti, kalça eklemi hareket açıklığı ve subtalar açının dinamik denge ile olan ilişkisini belirlemekti.

**Yöntem:** Çalışmamıza 69 sağlıklı ve gönüllü birey (yaş=22,17±1,25 yıl; 47 kadın, 22 erkek) dahil edildi. Bireylerin dinamik dengeleri Y denge testi (YDT), alt ekstremite kas kuvvetleri el dinamometresi, kalça eklem hareket açıklıkları ve subtalar açıları ise universal gonyometre ile değerlendirildi.

**Sonuçlar:** YDT ile alt ekstremite kas kuvvetleri ve kalça eksternal rotasyon hareket açıklıkları arasında pozitif anlamlı bir ilişki vardı ($p<0,05$). Kademeli çoklu doğrusal regresyon analizi, hamstring kas kuvvetinin, dominant bacak YDT kompozit skorunun %22 varyans, non-dominant bacak YDT kompozit skorunun %32 varyans ile anlamlı ve bağımsız belirleyicisi olduğunu gösterdi.

**Tartışma:** Hamstring kas kuvveti, sağlıklı bireylerde dinamik dengenin bir belirleyicisi olarak bulundu. Hamstring kas kuvvetinin bilateral olarak geliştirilmesi sağlıklı bireylerde dinamik dengeye de katkı sağlayabilir.

**Anahtar Kelimeler:** Alt Ekstremite, Hamstring Kasları, Kas Kuvveti, Postüral Denge

# RELATIONSHIP OF LOWER EXTREMITY MUSCLE STRENGTH, RANGE OF HIP MOTION AND SUBTALAR ANGLE WITH DYNAMIC BALANCE

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** To determine the relationship between lower extremity muscle strength, hip joint range of motion, and subtalar angle with dynamic balance in healthy individuals.

**Methods:** Sixty-nine healthy and volunteer individuals (age=22.1±71.25 years; 47 females, 22 males) were included in our study. Dynamic balances of the individuals were evaluated with the Y balance test (YBT), lower extremity muscle strengths were evaluated with a hand-held dynamometer, hip joint range of motions and subtalar angles were evaluated with a universal goniometer.

**Results:** There was a positive significant correlation between lower extremity muscle strength, hip external rotation range of motions and, YBT ($p<0.05$). Stepwise multiple linear regression analysis showed that hamstring muscle strength was a significant and independent predictor of the dominant leg YBT composite score with 22% of the variance and the non-dominant leg YBT composite score with 32% of the variance.

**Conclusion:** Hamstring muscle strength was found to be a predictor of dynamic balance in healthy individuals. Improvement of hamstring muscle strength bilaterally may also contribute to dynamic balance in healthy individuals.

**Key Words:** Hamstring Muscles, Lower Extremity, Muscle Strength, Postural Balance

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***Received:*** *31.10.2021 (Geliş Tarihi)*
***Accepted:*** *2.12.2022 (Kabul Tarihi)*

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## GİRİŞ

Postüral kontrol ölçümleri, yaralanmaların önlenmesi ve rehabilitasyonda nöromusküler fonksiyon seviyelerinin belirlenmesi açısından önemli bir araçtır. Minimal hareketle bulunduğun pozisyonu koruma "statik postüral kontrol"; istenilen bir hareketi yaparken istikrarlı bir şekilde pozisyonunu koruma ise "dinamik postüral kontrol" olarak tanımlanır (1). Dinamik postürün korunması genellikle bireylerin destek yüzeyinden ödün vermeden fonksiyonel görevi tamamlamasını içerir. Dinamik postüral kontrolün sağlanması için propriosepsiyon, eklem hareket açıklığı ve kuvvetin yanı sıra sabit ve dik kalma yeteneği gereklidir (2). Dinamik postüral kontrol, sağlıklı bireylerde performansı artırmak amaçlı yapılan bir egzersiz programı sonrası yaralanma riskini azaltmak için önemli bir ölçüm olabilir (1). Zayıf bir postüral kontrol ise yaralanma riskiyle yakından ilişkilidir (3,4). Literatürde, kalça kas kuvvetleri, ayağın anatomik farklılıkları ile fonksiyonel hareketlerindeki bozukluklar ya da kalçanın internal-eksternal rotasyonlarının (İR-ER) dinamik dengeyle yakından ilişkili olduğu belirtilmektedir (1,5). Ayağın fonksiyonel hareketleri sırasında subtalar açıda meydana gelen supinasyon ve pronasyon hareketlerinin fonksiyonel önemi de literatürde vurgulanmıştır (6).

The Star Excursion Balance Test (SEBT) sporcuların dinamik postüral kontrol sistemlerini değerlendiren önemli bir testtir (3). SEBT birey tek bacağı üzerinde dengede iken, diğer bacağı ile 8 farklı yönde ulaşabildiği maksimum uzaklığı test eden bir testtir (1). Daha sonraları uygulama kolaylığı açısından SEBT'in sadece 3 yönünü içeren (anterior (A), posteromedial (PM), posterolateral (PL)) Y-Denge Testi (YDT) geliştirilmiştir. Nispeten ucuz, taşınabilir, kolay ve eğitim gerektirmeyen YDT ise klinikte yaralanma, yeniden yaralanma ve asimetriye bağlı riski tayin etmede oldukça etkili biçimde kullanılan bir testtir (1,7,8). Literatürde, alt ekstremite kas kuvveti, kalça eklem hareket açıklığı ve subtalar açının YDT ile ilişkisini değerlendiren bir çalışmaya rastlanmamıştır.

Bu çalışmada amaç, sağlıklı bireylerde alt ekstremite kas kuvveti, kalça eklem hareket açıklığı ve subtalar açının dinamik denge ile olan ilişkisini araştırmaktı.

## YÖNTEM

Bu kesitsel çalışma, Ocak 2020-Eylül 2020 tarihleri arasında 69 sağlıklı gönüllü birey ile Hacettepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Fakültesi'nde gerçekleştirildi. Çalışma için gerekli etik onay 03.12.2019 tarihinde 2019/28-37 karar numarası (GO 19/1144) ile Hacettepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu'ndan alındı.

Çalışmamıza bilinen bir hastalığı olmayan, 69 (21-27 yaş aralığı) gönüllü birey (47'si kadın, 22'si erkek) dahil edildi. Çalışmaya dahil edilmeme kriterleri; nörolojik, sistemik romatolojik hastalığı olan; lumbal bölge, pelvik bölge ve alt ekstremitede cerrahi öyküsü bulunan ve testleri tamamlamaya engel bir hastalığı bulunan bireyler olarak belirlendi. Çalışmaya katılmadan önce bireyler çalışma hakkında bilgilendirildi ve yazılı onamları alındı. Çalışmanın güç analizi G*Power 3.1.9.2 (versiyon 3.1.9.2 Universität Düsseldorf, Düsseldorf, Almanya) programıyla yapıldı. Çalışmaya, Gordon ve ark. çalışmasındaki sol kalça ER kuvveti ve sol PM uzanma arasındaki ilişki kullanılarak, 0,36 etki genişliğinde, $p<0,05$ düzeyinde, %90 güç elde edebilmek için 63 sağlıklı gönüllü birey alınması öngörüldü (9). Çalışmayı bırakma riski %20 olarak belirlendi. Bu sebeple çalışmaya 75 birey dahil edilerek başlandı ve çalışma sırasında 6 birey farklı nedenlerle çalışma dışı bırakıldı.

Bireylerin yaş, boy, vücut ağırlığı, vücut kütle indeksi, alt ekstremite dominantlığı, bacak uzunluğu gibi demografik bilgileri kaydedildi. Alt ekstremite dominantlığı topa vurduğu ayak olarak belirlendi (10).

Y Denge Testi: YDT, dinamik dengeyi değerlendirmek için kullanılan SEBT'in sadece 3 uzanma yönünü (A, PM ve PL) içeren modifiye edilmiş biçimidir (11). Posterior uzanma yönleri, anteriorla 135° yapacak şekilde konumlandırıldı. Yere bu açılara uygun olacak şekilde belirgin bantlar çekilerek bireylerden elleri bellerinde sabit, tek bacak üzerinde diğer bacaklarıyla uzanabildikleri en iyi mesafeye uzanarak geri dönmeleri istendi. Test sırasında bireylerden yumuşak spor ayakkabı giymeleri istendi. Bireylerden 3 yöne de 6 deneme yapmaları istenerek teste alışmaları sağlandı (12). Deneme tekrarları sonrasında 1'er dk mola verildi. Test sırasında her yön için 3'er uzanma gerçekleştirilerek (aralarında 30'ar sn dinlenme) aritmetik ortalamaları "cm" cinsinden kaydedildi. Sonuçların bireylerin bacak boyu

uzunluklarından etkilenmemesi için veriler "(mesafe/ bacak uzunluğu) × 100" formülü ile normalize edildi. Bireyler sabit bacakları üzerindeki duruşu koruyamadıklarında, uzanma ayağıyla yere bastıklarında ve/veya geri dönüşte başlangıç pozisyonuna dönemediklerinde deneme iptal edilip tekrar edildi (3). Test, her 3 yön için bireylerin dominant ve non-dominant bacakları için tekrar edildi. Üç uzanma yönü dışında bunların ortalaması ((YDTA+YDTPM+YDTPL) / 3 / bacak uzunluğu × 100) alınarak YDT kompozit (Kom) skoru oluşturuldu.

Alt Ekstremite Kas Kuvvetinin Değerlendirilmesi: Kuadriseps femoris, hamstring kas grubu ve kalça stabilite izometrik testi (HipSIT) ölçümleri maksimum kas kuvvetini ölçen, taşınması kolay, kullanımı basit, ucuz ve hafif olan el dinamometresi (A MicroFet 2 hand-held dynamometer (Model-01165, Lafayette Instrument Company, Lafayette IN, USA)) kullanılarak yapıldı. Çalışmaya alınan bireyler, ölçümlere başlamadan önce testin uygulanış tekniğiyle ilgili sözel olarak bilgilendirildi. Hareketin doğru yapılabilmesini sağlamak amacıyla testten önce bireylerden değerlendiricinin eline doğru submaksimal kasılma yapmaları istendi. Ölçümler için izometrik kas kasılmasını gerektiren "*break test*" tekniği uygulandı. *Break test* tekniği sırasında ölçümü yapan kişi, dinamometre ile maksimum kas kuvvetini aşıp ilgili eklemde kasın izometrik kasılmasını bozup gevşeme oluşuncaya kadar kuvvet uyguladı (13).

Kuadriseps femoris kas kuvveti oturma pozisyonunda (Kalça 90°, diz ise semi-fleksiyon pozisyonunda) eller göğüs üzerinde çaprazlanmış olacak şekilde ölçüldü. El dinamometresi, test sırasında ayak bileğinin ön yüzeyine yerleştirilerek ölçüm yapıldı (14).

Hamstring kas grubu kuvvet ölçümü yüzükoyun yatış pozisyonunda (Kalça nötr pozisyonu, diz fleksiyonu 90°) yapıldı. El dinamometresi, ayak bileğinin proksimal arka yüzeyine yerleştirilerek ölçüm yapıldı (15).

HipSIT testi, kalça kas gruplarının kuvvetinin, bu kasların tek tek ölçülmesine göre daha işlevsel olmasını sağlayarak daha üç boyutlu bir değerlendirme fırsatı sağlayan bir testtir (16). Bu ölçüm yöntemiyle kalça ekstansörleri, eksternal rotatörleri ve abduktörleri beraber değerlendirilebilmektedir. Bu ölçüm için bireylerden değerlendirilecek alt ekstremite üstte olacak şekilde istiridye pozisyonunda (Kalça 45°, dizler ise 90° fleksiyonda, topuklar temas halinde), yan yatması istendi. Topukların teması bozulmadan kalça abduksiyon, ER'e alındı. El dinamometresi diz lateralinin 5 cm üstüne gelecek şekilde yerleştirilerek ölçüm yapıldı. Kalça bölgesinde farklı bir hareket ortaya çıkmaması için bölge esnek olmayan bir bantla sabitlendi (16).

Kuadriseps femoris, hamstring kas grubu ve HipSIT testinin her birinin kuvvet ölçümü için, 30 sn dinlenme aralıkları ile 3 ardışık ölçüm yapıldı ve en iyi değer kaydedildi. Ölçümler, dominant ve non-dominant alt ekstremiteler için tekrarlandı.

Kalça Eklem Hareket Açıklığının Değerlendirmesi: Çalışmada kalça İR ve ER eklem hareket açıklıkları kullanıldı. Ölçümler "*universal gonyometre*" kullanılarak gerçekleştirildi. Bireyler ölçümler için yüzükoyun pozisyonda, dizleri 90° fleksiyonda ve yatak kenarında olacak şekilde uzandılar. Gonyometrenin pivot noktası tuberositas tibia, hareketli kol tibia kristası olarak belirlendi. Sabit kol yere dik olacak şekilde tutularak, hareketli kol tibia kristası ile hareket ettirilerek ölçümler gerçekleştirildi. Bireylerin kalçalarında ölçüm esnasında yukarı doğru hareket açığa çıkmamasına dikkat edildi (17).

Subtalar Açının Değerlendirilmesi: Subtalar açı, distal bacak uzun ekseni ve arka ayak uzun ekseni arasındaki açı olarak tanımlanmaktadır ve subtalar eklemin pozisyonu ile ilgili bilgi vermektedir (18). Subtalar açı, bireyler ayakta eklem üzerine vücut ağırlığı binerken ve yüzükoyun yatış pozisyonunda eklem üzerinde ağırlık olmadan "universal gonyometre" ile değerlendirildi. Eklem üzerinde vücut ağırlığı binen ölçüm, bireyler yerden yüksek bir platform üzerinde sırtı değerlendiriciye dönük şekilde ayakta dururken yapıldı. Ekleme vücut ağırlığı binmeyen ölçüm ise bireyler bir tedavi masası üzerinde ayakları masadan sarkacak şekilde yüzükoyun pozisyonda yatarken yapıldı.

### *İstatiksel Analiz*

İstatiksel analiz ve hesaplamalar için SPSS 20.0 (*IBM SPSS for Mac version, Chicago, ABD*) programı kullanıldı. Değişkenlerin normal dağılıma uygunluğu *Kolmogorov-Smirnov* testi kullanılarak değerlendirildi. Dominant ve non-dominant bacak ölçümleri arasındaki farkı belirlemek amacıyla normal dağılanlar için Bağımsız Örneklem t testi, normal dağılmayanlar için ise *Mann-Whitney U* testi kullanıldı. Korelas-

**Tablo 1.** Bireylerin Demografik Özellikleri

| n=69 | X± SS (min.- maks.) |
|---|---|
| Yaş (yıl) | 22,17±1,25 (21-27) |
| Vücut Ağırlığı (kg) | 63,52±12,55 (46-105) |
| Boy (m) | 1,69± 0,09 (1,52-1,92) |
| VKİ (kg/m$^2$) | 22,07±2,88 (16,49-29,71) |
| Sağ Bacak Uzunluğu (cm) | 88,85±5,60 (76-101) |
| Sol Bacak Uzunluğu (cm) | 86,82±5,64 (76-101) |

X: Ortalama; SS: Standart Sapma; min.:Minimum; maks.:Maksimum; VKİ: Vücut Kütle İndeksi

yon katsayısı r>0.60 ise güçlü ilişki, r=0,3-0,6 arasındaysa orta düzeyde ilişki ve r<0,3 ise zayıf ilişki olarak kabul edildi (19).

Bağımlı değişken YDT Kom'un en çok hangi bağımsız değişken(ler) (kalça kas kuvveti, kalça eklem hareket açıklığı, kuadriseps femoris, hamstring kas kuvveti ve subtalar açı) tarafından "belirteç" olarak kabul edilebileceğini saptamak için doğrusal regresyon analizinin *stepwise* adımı kullanıldı. Bağımsız değişkenlerin etki oranı $r^2$ ve Beta değerleri ile hesaplandı. İstatistiksel yanılma olasılığı p<0,05 olarak kabul edildi.

## SONUÇLAR

Çalışmaya 21-27 yaş aralığında (22,17±1,25 yıl) 69 birey katıldı. Bu bireylerin cinsiyet dağılımı 47 (%68) kadın, 22 (%32) erkek şeklindeydi. Bireylerin 63'ü (%91) sağ, 6'sı (%9) ise sol alt ekstremite dominantlığına sahipti. Değerlendirme sırasında 1

**Tablo 2.** Y Denge Testi, Kas Kuvveti ve Eklem Hareket Açıklığı Ölçümlerinin Tanımlayıcı İstatistikleri

| | Dominant (n=69) | Non-dominant (n=69) | p |
|---|---|---|---|
| | **X± SS (min.- maks.)** | **X± SS (min.- maks.)** | |
| YDT Kompozit (%) | 76,76 ± 7,12 (62,22-96,90) | 77,72 ± 7,39 (60,77-99,61) | 0,436 |
| YDT Anterior (%) | 74,02 ± 5,70 (62,96-90,70) | 74,15 ± 6,68 (59,67-90,70) | 0,898 |
| YDT PM (%) | 75,57 ± 10,10 (54,44-98,84) | 75,70 ± 10,44 (53,16-98,84) | 0,940 |
| YDT PL (%) | 80,68 ± 8,14 (62,96-101,16) | 83,31 ± 8,28 ( 66,30-109,30) | 0,063 |
| Kuadriseps femoris (N) | 226,08 ± 69,44 (105,00-383,40) | 216,25 ± 68,47 (108,50-407,20) | 0,422 |
| Hamstring (N) | 159,08 ± 55,96 (63,00-348,70) | 153,16 ± 56,62 (53,00-316,30) | 0,553 |
| HipSIT (N) | 240,97 ± 81,29 (112,00-435,90) | 249,83 ± 90,17 (97,70-468,00) | 0,561 |
| Kalça İR (°) | 48,57 ± 11,26 (20,00-74,00) | 46,02 ± 11,22 (18,00-75,00) | 0,185 |
| Kalça ER (°) | 43,15 ± 11,27 (19,00-66,00) | 41,71 ± 10,71 (12,00-75,00) | 0,440 |
| Subtalar Açı (ayakta) (°) (valgus) | 5,05 ± 2,6 (1,00-13,00) | 5,44 ± 3,0 (1,00-16,00) | 0,415 |
| Subtalar Açı (yüz üstü) (°)(varus) | 7,57 ± 3,94 (3,00-20,00) | 7,92 ± 4,19 (2,00-20,00) | 0,617 |

X: Ortalama; SS: Standart Sapma; YDT: Y Denge Testi; PM: Posterio-Medial; PL: Posterio-Lateral; İR: İnternal Rotasyon; ER: Eksternal Rotasyon; HipSIT: *Hip Stability Isometric Test*.

**Tablo 3.** Y Denge Testi ile Alt Ekstremite Değişkenlerinin İlişkisi

| Dominant- (n=69) | | | | | Non-Dominant (n=69) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Dominant** | | **YDTA** | **YDTPM** | **YDT Kom.** | **Non-Dominant** | | **YDTA** | **YDTPM** | **YDTPL** | **YDT Kom.** |
| Kuadriseps femoris | r | 0,339 | 0,398 | 0,416 | **Kuadriseps femoris** | r | 0,310 | 0,465 | 0,363 | 0,453 |
| | p | 0,006* | 0,001* | 0,001* | | p | 0,013* | <0,001* | 0,003* | <0,001* |
| Hamstring | r | 0,413 | 0,432 | 0,467 | **Hamstring** | r | 0,536 | 0,504 | 0,376 | 0,533 |
| | p | 0,001* | <0,001* | <0,001* | | p | <0,001* | <0,001* | 0,002* | <0,001* |
| HipSIT | r | 0,446 | 0,411 | 0,440 | **HipSIT** | r | 0,369 | 0,446 | 0,333 | 0,462 |
| | p | <0,001* | 0,001* | <0,001* | | p | 0,003* | <0,001* | 0,007* | <0,001* |
| Kalça İR | r | -0,037 | -0,156 | -0,097 | **İR** | r | -0,185 | -0,094 | -0,16 | -0,160 |
| | p | 0,765 | 0,2 | 0,427 | | p | 0,129 | 0,442 | 0,189 | 0,190 |
| Kalça ER | r | 0,314 | 0,174 | 0,275 | **ER** | r | 0,30 | 0,198 | 0,284 | 0,289 |
| | p | 0,009* | 0,154 | 0,022* | | p | 0,012* | 0,103 | 0,018* | 0,016* |
| Subtalar Açı (Ayakta) | r | -0,158 | -0,001 | 0,008 | **Subtalar Açı (Ayakta)** | r | -0,183 | 0,048 | -0,027 | -0,032 |
| | p | 0,195 | 0,991 | 0,948 | | p | 0,132 | 0,693 | 0,824 | 0,796 |
| Subtalar Açı (Yüzüstü) | r | -0,165 | 0,026 | -0,013 | **Subtalar Açı (Yüzüstü)** | r | -0,071 | 0,011 | -0,115 | -0,052 |
| | p | 0,176 | 0,834 | 0,915 | | p | 0,559 | 0,931 | 0,345 | 0,673 |

*p<0,05; r: korelasyon katsayısı; n: örneklem sayısı; YDTA: Y Denge Testi Anterior; YDTPM: Y Denge Testi Posterio-Medial; YDTPL: Y Denge Testi Posterio-Lateral; Kom.: Kompozit skoru; HipSIT: Hip Stability Isometric Test; İR: İnternal Rotasyon; ER:Eksternal Rotasyon

**Tablo 4.** Doğrusal Regresyon Analizi (*Stepwise*)

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | p |
|---|---|---|---|---|---|---|
| | | B | SH | Beta | | |
| 1 | Constant | 67,036 | 2,194 | | 30,560 | <0,001 |
| | Hamstring Non-dominant | 0,072 | 0,013 | 0,561 | 5,339 | <**0,001*** |
| 2 | Constant | 67,365 | 2,428 | | 27,740 | <0,001 |
| | Hamstring Dominant | 0,060 | 0,014 | 0,467 | 4,156 | <**0,001*** |

a. Bağımlı Değişken: YDT Kom: Y Denge Testi Kompozit Skoru;
b. Bağımsız Değişkenler: HipSIT, Kuadriseps Femoris ve Hamstring Kas Kuvveti, Kalça İnternal Rotasyonu, Kalça Eksternal Rotasyonu, Ayakta Subtalar Açı, Yüzüstü Subtalar Açı.
c. Belirteç(ler): Constant, Hamstring (Non-dominant/Dominant)

*p<0,05, Model 1: r=0,561; $R^2$=0,315; adjusted $R^2$: 0,304 (F=28,504). B: Standart olmayan regresyon katsayısı; SH: standart hata, Model 2: r=0,467; $R^2$=0,218; adjusted $R^2$: 0,205 (F=17,274)

kişi iş sebebiyle değerlendirmeyi tamamlayamadı, 5 kişi ise analiz için gerekli verilerdeki eksiklik sebebiyle analize dahil edilmedi. Çalışmaya katılan bireylerin tamamı için ayakta subtalar açıları valgus, yüzükoyun pozisyonundaki açıları varus yönündeydi. Bireylerin demografik bilgileri Tablo 1'de gösterildi.

Dominant ve non-dominant bacak üzerinde yapılan kas kuvveti ve eklem hareket açıklığı ölçümlerinin tanımlayıcı istatistikleri Tablo 2'de gösterildi (p<0,05).

YDT ile kalça kas kuvveti, kalça eklem hareket açıklığı, kuadriseps femoris, hamstring kas kuvveti ve subtalar açının ilişkisi Tablo 3'te verildi. YDT ile ilişkili olan değişkenler içerisinde kademeli doğrusal regresyon analizi sonucunda en önemli belirtecin hamstring kas kuvveti olduğu bulundu (Tablo 4). Buna göre hamstring kas kuvveti, dominant bacak YDT Kom skorunun %22, non-dominant bacak YDT Kom skorunun %32 oranında bir göstergesi olarak bulundu.

## TARTIŞMA

Sağlıklı bireylerde alt ekstremite kas kuvveti, kalça eklem hareket açıklığı, kuadriseps femoris, hamstring kas kuvveti ve subtalar açının YDT ile olan ilişkisini belirlemek amacıyla planladığımız bu çalışmanın sonucunda, hamstring kas kuvvetinin

YDT'nin en önemli belirteci olduğu bulundu. Hamstring kas kuvveti, dominant bacak YDT Kom skorunu %22, non-dominant bacak YDT Kom skorunu ise %32 oranında tahmin edebilmektedir. Ayrıca, Y denge testinin, kuadriseps femoris kas kuvveti, HipSIT testi ve kalça ER'i ile ilişkili olduğu ancak; kalça İR'i, ayakta ve yüzükoyun pozisyonda ölçülen subtalar açı ile ilişkili olmadığı bulundu.

Literatürde YDT'de dominant, non-dominant ya da sağ-sol bacak arasında fark olmadığını belirten çalışmalar mevcuttur (2, 20, 21). Shimwell ve ark., 20 erkek amatör koşucu üzerinde YDT, diz ekstansör, kalça dinamik kas kuvvetini inceledikleri çalışmalarında, bireylerin dominant ve non-dominant bacak YDT sonuçları ile diz ekstansör ve kalça dinamik kas kuvvetleri arasında bir fark olmadığını bildirmişlerdir (20). Gribble ve ark., SEBT'in ayak yapısı, kişinin boyu, bacak uzunluğu ve eklem hareket açıklığından etkilenip etkilenmediğini incelemek için yaptıkları çalışmalarında; SEBT değerinde sağ ve sol bacaklar arasında istatistiksel olarak anlamlı fark bulmadıkları için iki bacağın ortalama değerlerini kullandıklarını belirtmişlerdir (2). Bizim çalışmamızda da sağlıklı bireylerin YDT'nin 4 parametresinde, kas kuvvetleri ve eklem hareket açıklıkları açısından dominant ve non-dominant bacak arasında fark yoktu. Plisky ve ark. basketbol oyuncularını inceledikleri çalışmalarında SEBT'in anterior uzanma yönünde her iki bacak arasında fark 4 cm ve fazla olduğunda, azalmış sağ anterior, bilateral PL ve PM ve Kom skorlarının yaralanma riskini yüksek bir oranda tahmin edilebildiğini belirtmişlerdir (3).

Kesilmiş ve ark., yaş grubu 12-14 yıl olan bireylerde, dinamik dengeyi sadece tek ayak ve çift ayak üstünde duruşta, kas kuvvet ölçümlerini de bizden farklı şekilde ''make test'' tekniği ile değerlendirmişlerdir. Çalışmanın sonucunda bizim çalışmamızdan farklı olarak kuadriseps femoris ve hamstring kas kuvvetleri ile dinamik denge arasında ilişki olmadığını bildirmişlerdir (22). Literatürde YDT ile kuadriseps femoris ve hamstring kas kuvveti arasındaki ilişkiyi inceleyen çalışmalarda da birbirinden farklı görüşler bulunmaktadır (23-26). Clagg ve ark. ön çapraz bağ tamiri geçiren bireylerde spora dönüş kriterlerini tamamlamaları ardından yapılan YDT değerlendirmelerinde, etkilenmiş bacakta izokinetik dinamometre ile ölçülen kuadriseps femoris ve hamstring kas kuvvetinin PL uzanma ile ilişkili, anterior uzanma ile ilişkili olmadığını belirtmişlerdir (23). Shimwell ve ark. erkek amatör koşucuların modifiye SEBT sadece PL ile kuadriseps femoris arasında istatiksel olarak anlamsız bir ilişki olduğunu belirtmişlerdir (r=0,52, p=0,38). Anterior ve PM uzanım sonuçları ile kuadriseps femoris ve kalça abduktör kas kuvveti arasında bir ilişki olmadığını belirtmişlerdir (20). Çalışmamızda kas kuvvet ölçümü el dinamometresiyle ''break test'' tekniği kullanılarak yapılmıştır. Clagg ve ark. (23) kas kuvvet ölçümü için izokinetik dinamometre, Shimwel ve ark. (20) ise el dinamometresi kullanmalarına rağmen bunu bireylerin bacaklarına bağlayarak kendi izometrik kontraksiyonlarını kullanmışlardır. Bu yönüyle, bu çalışmaların kas kuvvet ölçüm yöntemleri çalışmamızdan farklıdır. Lee ve ark. ise 45-80 yaş arası sağlıklı kadın bireylerde YDT'nin 3 yönü ile diz fleksiyon ve kalça ekstansiyon kuvvetinin ilişkili olduğunu belirtmişlerdir (24). Lee ve ark., YDT sırasında bireylerin dengelerini korumak için öne ve arkaya doğru eğildiklerini ve diz fleksörlerinin gövde hareketine direnmek için eksentrik kasılması gerektiğini, bu şekilde vücut salınımı ileriden geriye doğru geldiğinde diz fleksörlerinin daha yüksek YDT mesafesine katkıda bulunduğunu belirtmişlerdir (24). Fakat, bu çalışmadaki bireylerin yaş ortalamaları (65,73) bizim çalışmamızdaki bireylere (22,17) göre daha yüksekti.

Myers ve ark. ön çapraz bağ tamiri sonrası etkilenen bacakta YDT'nin 3 yönünün de diz ekstansiyon ve fleksiyon kuvvetleri ile ilişki olduğunu, etkilenmeyen bacakta ise sadece diz fleksiyon kuvvetinin bu 3 YDT yönünün hepsiyle ilişkili olduğunu belirtmişlerdir (25). Robinson ve ark. antero-medial ve anterio-lateral yönlerde uzanmada diz fleksiyon açısının en güçlü belirteç olduğunu belirtmişlerdir (26). Gribble ve ark. SEBT sırasında kadınların daha fazla diz fleksiyon açısı kullandıklarını belirtmişlerdir (1). Çalışmaların sonuçları, kadın bireylerin çoğunlukta olduğu çalışmamızda, hamstring kas kuvvetinin YDT'nin en önemli belirteci olduğu sonucunu desteklemektedir. YDT'nin her 3 yönü için bireylerin hamstring kasının konsentrik kasılmasının gövdenin hareketi yardımıyla diz fleksiyon miktarını artırarak en iyi uzanmayı sağladığı, geri dönerken de eksentrik kasılarak duruş pozisyonu stabilize ettiğini düşünmekteyiz. Literatürde dominant ve non-dominant bacağın, tek bacak üzerinde denge sırasında postüral kontrol için optimal kont-

rol geri-bildirim teorisinden beslenen, farklı hareket stratejileri izlediği belirtilmektedir (27,28). Literatürdeki bu bilgiler, çalışmamızdaki hamstring kas kuvvetinin non-dominant bacakta, dominant bacağa göre daha güçlü bir belirteç olarak görülmesi durumunun bir açıklaması olabilir. Aynı zamanda kuadriseps femoris kas kuvveti YDT'nin 4 parametresi ile ilişkilidir. Fakat, diz ekstansiyon kuvveti, en iyi uzanma ve dönüş için hamstring kas kuvvetine yardım etmesine ve sonuçlarda YDT ile ilişkili olduğu görünmesine rağmen; bu durum regresyon analizine yansımamıştır. Bu sonucun kuadriseps femoris kasının zayıflığı durumunda, sağlıklı bireylerin bunu farklı kompansatuar mekanizmalar yardımıyla telafi etme çabasından kaynaklanmış olabileceğini düşünmekteyiz.

Literatürde kalça kas kuvvetleri ile YDT arasındaki ilişkiyi inceleyen çalışmalarda da hangi kuvvetin en etkin rol oynadığı konusunda tam olarak fikir birliğine varılamamıştır (23). Clagg ve ark., ACL sonrası spora dönüşte bireylerin etkilenmiş bacaktaki kalça abduksiyon kas kuvvetinin ise A, PL ve PM yönlerdeki uzanımlar ile ilişkili olduğunu belirtmişlerdir. Kontrol grubunda ise sadece non-dominant bacak kalça abduksiyon kas kuvveti ile PL uzanma arasında bir ilişki olduğunu belirtmişlerdir (21, 23). Wilson ve ark., sağlıklı bireylerde (40 erkek 33 kadın) YDT'nin 4 parametresi ile kalça abduksiyon, ekstansiyon ve ER kuvvetleri arasındaki ilişkiyi inceledikleri çalışmalarında, tüm değişkenler arasında ilişki olduğunu sadece kalça ER ve PL arasında ilişki olmadığını bildirmişlerdir. Ayrıca YDT'nin tüm parametreleri için kalça abduksiyonunun belirleyici bir faktör olduğu belirtilmiştir (21).

Gordon ve ark., 45 kadın lakros oyuncusu üzerinde yaptıkları ve modifiye SEBT ile sağ ve sol kalça ER kuvvetinin ilişkisini inceledikleri çalışmalarında, sağ kalça ER kuvvetinin sadece sol PM yön uzanmayla ilişkili olduğunu bildirmişlerdir. Sol kalça ER kuvvetinin sağ taraf bacak uzanmayla ilişkisini (sol bacak üzerinde dururken sağ bacakla uzanmayı) tam olarak açıklayamamışlardır. Bunda kalça ER kuvveti haricinde kalça ekstansiyonu, kalça abduksiyonu ya da bunların hepsinin birleşimini içeren bir kuvvetin alt ekstremite dengesinin değişiminde büyük rol oynayabileceğini belirtmişlerdir (9). Çalışmamızın güçlü yönlerinden birisi olarak tüm kalça kaslarını bir arada değerlendirilebilen HipSIT testi (16) kullanılmış ve YDT'nin tüm parametrelerinin bununla ilişkili olduğu bulunmuştur. Kalça için tek bir kas yerine, kalça abduksiyon, ekstansiyon ve ER kuvvetini toplu şekilde değerlendiren bu testin kullanımı bir kas grubu zayıfladığında diğer kas grubu tarafından kompanse edilebileceğinden dolayı kalçanın genel kuvveti hakkında daha iyi fikir sağlayabilmektedir. Fakat bu durum, regresyon analizine istatiksel olarak yansımamasının bir sebebi olabilir. Bu durum bize kalça kas grubu genel zayıflığının da gövde ya da alt ekstremite kas grupları tarafından kompanse edilmeye çalışılmış olabileceğini düşündürdü.

Gribble ve ark. kalça İR ve ER hareket açıklıklarının SEBT'in 8 yönüyle de ilişkisi olmadığını belirtmişlerdir. Buna gerekçe olarak ise maksimum uzanma mesafesi için sabit bir patern istememelerini, test sırasında kalça dışında gövde ve diğer alt ekstremite eklemleri de yer aldığı için kalça eklem hareket açıklığında olabilecek bir azalmanın diğer bir eklem hareketiyle kompanse edilebileceğini belirtmişlerdir (2). Bir başka çalışmada ise kalça rotasyonunun sadece kalça ve diz fleksiyonu ile beraber olduğunda SEBT'in uzanmalarını açıklamada anlamlı olduğu, çıkarılması durumunda kalça ve diz fleksiyonunun belirleyiciliğini değiştirmediği belirtilmiştir (26). Overmoyer ve ark. YDT yönleri ile alt ekstremite eklem açıklığı arasındaki ilişkiyi inceledikleri çalışmalarında sadece kalça fleksiyon ve ayak bileği dorsi fleksiyon açılarının YDT ile ilişkili olduğu, kalça İR ve ER'nin ise YDT ile ilişkili olmadığını belirtmişlerdir (29). Nakagava ve ark. ise YDT ve kalça İR arasında bir ilişki olmadığını belirtmişlerdir (30). Bizim çalışmamızda, literatürle benzer şekilde kalça İR ile YDT parametreleri arasında ilişki bulunmadı. Fakat literatürden farklı olarak, kalça ER ile YDT Kom skorlarının, A ve PL yönlerde ilişki bulunurken; PM yönü ile ilişki bulunmadı. Wilson ve ark. kalça ER kuvvetinin sadece PM yönü ile ilişkisi olmadığını diğer 3 YDT parametresi ile ilişkili olduğunu belirtmektedirler (21). Bu sonucumuz, bireylerin daha iyi bir kalça ER kas kuvveti açığa çıkarabilmek için daha fazla eklem hareket açıklığı ile hareketi gerçekleştirdiklerini düşündürdü. Aynı zamanda, bireyler PM yönde ER eklem hareket açıklıklarını çok fazla kullanmamalarına rağmen A ve PL yönde ER eklem hareket açıklığını kullanarak mesafeyi arttırmaya çalışmış olabilirler. Literatürde subtalar açı ile YDT'nin ilişkisini inceleyen bir çalışma bulunmamaktadır. Çalışmalar daha çok pes planus ve pes cavus ile ilişkilidir

(2,31). Cote ve ark. ayak tipine göre dinamik dengenin nasıl etkilendiğini inceledikleri çalışmalarında katılımcıları ayak tipine göre nötral, supin ve prone ayak olmak üzere üç gruba ayırmışlardır. Çalışmanın sonucunda dinamik dengenin ayak tipinden etkilendiğini ve bu testlerin kullanımında ayak tipinin de göz önünde bulundurulması gerektiğini bildirmişlerdir (31). Bunun aksine, Gribble ve ark. ise ayak tipleri (pes planus, pes cavus ve pes rektus) ile SEBT'in 8 yönü arasında bir ilişki olmadığını bildirmişlerdir. Bu sonucu, ayak tipinden bağımsız olarak bireylerin daha farklı ulaşma ve kompanse edici stratejileri geliştirmelerine bağlamışlardır (2). YDT ile 2 farklı pozisyonda subtalar açı (ayakta ve yüzükoyun pozisyonda) arasındaki ilişkiyi incelediğimiz çalışmamızda ayakta valgus ve yüzükoyun pozisyonda varus açıları ile YDT değerleri arasında bir ilişki saptanmadı. Bu durumun, çalışmaya katılan bireylerin, ayakta ölçülen subtalar açı ortalamalarının anatomik olarak normal kabul edilen açı değerlerinde (4-6 derece valgus aralığı) (18) olmasından kaynaklanmış olabileceği düşünülmüştür.

*Limitasyonlar*

Çalışmamızın birkaç limitasyonu bulunmaktadır. Normal eklem hareketi ölçümlerine ayak bileği dorsifleksiyon ve plantar fleksiyonu ile kalça ve diz eklemi fleksiyonunun dahil edilmemesi limitasyonlarımızdan biridir. HipSIT kalça ekleminin abduksiyon, ekstansiyon ve ER kuvvetini genel bir şekilde ele alırken; bu kuvvet ölçümlerine tek tek de bakılarak hangisiyle daha çok ilişkili olduğu da incelenebilirdi. Çalışmamıza dahil edilen bireylerin yaş aralığının 21-27 yıl olması nedeniyle, sonuçlarımızın tüm popülasyonlara genellenememesi çalışmamızın bir diğer limitasyonudur.

## Sonuç

Çalışmamızın en önemli bulgusu, sağlıklı bireylerde hamstring kas kuvvetinin YDT'nin yani dinamik dengenin en önemli belirteci olduğu sonucudur. Bu durum, non-dominant bacakta daha güçlü görülmektedir. Diz ekstansiyon kas kuvveti ile kalça kaslarını genel olarak değerlendiren HipSIT testi, YDT'nin tüm parametreleri ile orta seviyede ilişkili olmalarına rağmen; bu durum kademeli doğrusal regresyon analizine yansımamıştır. Sağlıklı bireylerin dinamik dengelerinde hamstring kas kuvvetinin önemli bir gösterge olması, alt ekstremite performansını ve yaralanma riskini etkileyebilecek bir bulgu olarak görülmektedir. Bu yönde daha ileri araştırmalara ihtiyaç vardır.

***Yazar Katkıları:*** Fikir/Kavram – YT, GİK, SB, HGD; Tasarım- YT, GİK, SB, HGD; Denetleme/Danışmanlık- YT, GİK, SB, HGD; Kaynaklar ve Fon Sağlama- YT, GİK, SB, HGD; Materyaller- YT, GİK, SB, HGD; Veri Toplama ve/veya İşleme- YT, GİK, SB, HGD; Analiz ve/veya Yorumlama- YT, GİK, SB, HGD; Literatür Taraması- YT, GİK, SB, HGD; Makale Yazımı- YT, GİK, SB, HGD; Eleştirel İnceleme- YT, GİK, SB, HGD.

***Çıkar Çatışması:*** Yok.

***Açıklamalar:*** Yok

***Destekleyen Kuruluş:*** Yok.

***Aydınlatılmış Onam:*** Katılımcılardan araştırmaya başlamadan önce katılım için gerekli onam alındı.

***Etik Onay:*** Hacettepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu'ndan 03.12.2019 tarihinde 2019/28-37 karar numarası (GO 19/1144) ile gerekli izin alındı.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)64-72*

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# EFFECT OF VIRTUAL REALITY TRAINING ON BALANCE AND FUNCTIONALITY IN CHILDREN WITH CEREBRAL PALSY: A RANDOMIZED CONTROLLED TRIAL

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** The aim of this study was to investigate the effectiveness of virtual reality training on balance and functionality in children with Cerebral Palsy.

**Methods:** Children with spastic Cerebral Palsy were randomly divided into the virtual reality training group (27 children, mean age: 9.2 years) and control group (25 children, mean age: 9.4 years). The virtual reality training group received virtual reality training using the XBox One Kinect gaming system and the control group received conventional physiotherapy training for eight weeks. The Pediatric Balance Scale, The Gross Motor Function Measurement-88, The Quality of Upper Extremity Skills Test, The Functional Reach Test, The Sit to Stand Test and The Pediatric Disability Evaluation Inventory were measured at baseline and after treatment sessions.

**Results:** Total motor function, upper extremity skills and balance in both groups improved after training ($p < 0.05$). A comparison between groups demonstrated that the improvements in upper extremity functions was greater in the control group than in the virtual reality training group ($p < 0.05$).

**Conclusion:** The results of our study showed that Kinect-based virtual reality training is beneficial in improving balance, motor function and upper extremity skills in children with Cerebral Palsy.

**Key Words:** Balance, Cerebral Palsy, Children, Virtual Reality

# SEREBRAL PALSİLİ ÇOCUKLARDA SANAL GERÇEKLİK EĞİTİMİNİN DENGE VE FONKSİYONELLİK ÜZERİNE ETKİSİ: RANDOMİZE KONTROLLÜ ÇALIŞMA

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Bu çalışmanın amacı, Serebral Palsili çocuklarda sanal gerçeklik eğitiminin denge ve fonksiyonellik üzerine etkisini araştırmaktır.

**Yöntem:** Spastik Serebral Palsili çocuklar rastgele sanal gerçeklik eğitim grubuna (27 çocuk, ortalama yaş: 9,2 yıl ) ve kontrol grubuna (25 çocuk, ortalama yaş: 9,4 yıl) ayrıldı. 8 hafta boyunca sanal gerçeklik eğitim grubuna XBox One Kinect oyun sisteminin kullanıldığı sanal gerçeklik eğitimi ve kontrol grubuna konvansiyonel fizyoterapi eğitimi verildi. Pediatrik Denge Ölçeği, Kaba Motor Fonksiyon Ölçeği-88, Üst Ekstremite Becerilerinin Kalitesi Testi, Fonksiyonel Uzanma Testi, Oturup Kalkma Testi ve Pediatrik Özürlülük Değerlendirme Envanteri başlangıçta ve tedavinin sonunda ölçüldü.

**Sonuçlar:** Her iki grupta da eğitim sonunda total motor fonksiyon, üst ekstremite becerileri ve dengede ilerleme görüldü ($p < 0,05$). Gruplar arası karşılaştırma üst ekstremite fonksiyonlarındaki ilerlemenin kontrol grubunda sanal gerçeklik eğitim grubuna göre daha fazla olduğunu gösterdi ($p < 0,05$).

**Tartışma:** Çalışmamızın sonuçları, Kinect tabanlı sanal gerçeklik eğitiminin Serebral Palsili çocuklarda denge, motor fonksiyon ve üst ekstremite becerilerini geliştirmede faydalı olduğunu göstermiştir.

**Anahtar Kelimeler:** Denge, Serebral Palsi, Çocuklar, Sanal Gerçeklik

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***Received:*** *17.11.2021 (Geliş Tarihi)*
***Accepted:*** *17.10.2022 (Kabul Tarihi)*

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## INTRODUCTION

CP is a complex disorder characterized by posture and movement impairments. Such impairments limit children's independence in activities in daily life and social participation (1,2).

Balance skills are an integral part of gross motor skills and affect functional capacity and independence in activities of daily living such as getting dressed. Postural balance also plays an important role in the development of upper extremity functions. Upper limb function is a critical determinant of the ability to perform daily activities and to participate in the home environment. Impaired muscle tone, abnormal postural control and muscle coordination and deficits of sensory organization effect balance capacity in children with CP (3,4). Inadequate postural control and balance reactions prevent the voluntary skills and independence in activities of daily living. Thus, balance training to improve general motor skills and level of independence in activities of daily living is one of the main goals of rehabilitation (3-5). CP cannot be cured, but several interventions focus on reducing the impairments and increasing the independence in daily life (6). Physical therapy, aims to improve motor function, balance and independence in activities of daily living, plays an important role in the treatment of disorders (2). This therapy involves a long process and this process can become exhausting and boring for children. It may reduce motivation and have negative effects on participation in treatment (7). Virtual reality training (VRT) is more effective in motivating and can continue to hold children's interest during intervention. Therefore, the use of virtual reality (VR) in CP rehabilitation has increased in recent years (7,8).

VRT increases the neuroplasticity and motor learning associated with active participation, motivation and active repetition (9,10). VR games promotes a systematic practice of functional movements and multi-sensory feedback. Practice of the goal-directed movements, audio-visual feedback and motivation are important components for motor gains. VR approach includes the main principles of the motor learning theories such as the repetition of functional tasks, the feedback mechanism and the patient's motivation. VRT has positive effects on postural control, balance, gross motor function and upper extremity functions in children with CP (9,10).

Although VRT is a relatively new rehabilitation method, currently its popularity on the rise. In the majority of studies, Nintendo Wii (79%) is preferred over XBox Kinect (13%) and Sony PlayStation (8%). This difference can be caused by the fact that the Nintendo Wii is the first gaming system that is easily accessible and can be easily integrated into rehabilitation programs (11). The Kinect has controller-free game play with the player using their body in a natural way. Kinect games enables users to interact with the virtual environment without any balance board or remote controller. It is easy to use and provides different environments to encourage repetitive tasks. However, there is a lack of studies addressing the effects of Kinect games in children with CP. Our aim was to evaluate the effect of Kinect games on balance, motor function and upper extremity skills in children with spastic CP.

## METHODS

This randomized controlled trial was conducted between October and January 2017. This trial was approved by the Ethical Committee of the İzmir Dokuz Eylül University Faculty of Medicine (Approval Date: 14.09.2017 and Approval Number: 2017/22-27). A written informed consent was obtained from parents, and all procedures were carried out according to the Helsinki Declaration.

### Participants

The study was carried out in a rehabilitation center for special children, in Kütahya. Inclusion criteria were as follows: (1) diagnosis of spastic cerebral palsy; (2) ability to walk with an assistive device or independently; (3) ability to understand and follow simple verbal instructions; (4) no excessive spasticity in any joint (score ⩽3 on the Modified Ashworth Scale).

Children who had any orthopedic surgery or botulinum toxin injection in the past 6 months, any limitation of ranges of motions preventing upper extremity movements, any visual or auditory impairments affecting the viewing of screen were excluded.

The sample size was calculated with the G-Power (ver. 3.1) software. Based on a similar study, estimated sample size was calculated to be at least 46 participants (effect size: 75%, α level: 0.05, desired power: (β), 80%) (12). 68 children who met the inclusion criteria were divided into two groups with simple randomization technique using envelope technique and sequentially numbered: VRT group (n = 34), was indicated as "1" and the control group (n = 34) was indicated as "2".

**Measurements**

Evaluations were performed before and after training. Demographic characteristics of the children were recorded.

**Primary Outcomes**

The Pediatric Balance Scale (PBS), a child-adapted version of The Berg Balance Scale, consists of 14 items that are scored from 0 points to 4 points with a maximum score of 56 points. The scale examines many of the functional activities such as sitting, standing, transfers and stepping (13). For Sit to Stand Test (STST) patients were asked to stand up straight from a chair and then sit down without support during 30 seconds. After three repetitions, the mean measurement was calculated and determined as the final score (14). The Functional Reach Test (FRT) measures the maximal distance that children can reach forward while maintaining a fixed base of support in the standing position. The normal values of FRT ranged from 23.0 to 36.5 cm for 6-12 years old Turkish children. A score between 6-10 inches indicates a moderate risk for falls (15,16).

**Secondary Outcomes**

The Gross Motor Function Measurement-88 (GMFM-88), was used to measure gross motor function quantitatively. GMFM consists of 88 items divided into five basic dimensions: lying & rolling, sitting, crawling & kneeling, standing and walking, running & jumping. Each item was given scores between 0 and 3; 0 means that the activity cannot be initiated, and three means the activity is completed (17).

The Quality of Upper Extremity Skills Test (QUEST) was used to assessment of quality of upper extremity movement and hand skills in four domains: dissociated movement, grasp, protective extension and weight bearing. For each domain, a percentage score was calculated and the scores of the four domains summed to a total percentage score. It has strong reliability for children aged 2-12 years (18).

The Pediatric Disability Evaluation Inventory (PEDI) was used to assess function, activity and participation of the children. The Functional skills section of PEDI consisting of 197 items was used. Summary scores of this items indicate the children's capacity of daily life skills in three domains; self-care, mobility and social-function (19).

**Intervention**

After the baseline measurements, children in both groups were applies an exercise training schedule that consist of 45 minutes/day, 2 days/8weeks. In the VRT group performed training using only video games and control group received neurodevelopmental treatment (NDT).

In the VRT group, Xbox Kinect (Xbox One Kinect, Microsoft, United States) game console, Kinect sensor, Kinect adapter, XBox One control and 82 inch LG monitor used. Seven games were selected to improve balance, reaction time, coordination, postural control, weight transfer and upper extremity functions. Each games performed at least 2 times. Rest periods were given between games.

In fruits Ninja games, children were asked to smash the fruits that appear on the screen by moving his arms up-down and right-left. There were some goals such as not detonating bombs, cutting power-up fruits, and exceeding 250 points in the game. During the tennis game, children were asked to hit the ball at the specified time by moving his arm up-down and front-back. Failing to hit the ball in time or throwing it out of bounds means losing points. In soccer game, the children represented the player who aims to score a goal and the goalkeeper who aims not to concede, respectively. They were asked to try to score a goal by hitting the ball. When the ball passed to the opposing team, they were asked to hold the ball by raising their arms to the side, up and reaching forward. The aim of the climbing game was to climb the wall by making bilateral upper extremity movements and jumping. In the

bowling game, children stretched his arms forward and picked ball up from the ground by flexing the fingers and wrists. Then, they were asked to throw the ball forward and try to break the clubs. In the targeting game, children were asked to try to hit the targets on the target board by moving their arms right-left, up-down. In the wake racing game, children were asked to pass through the green circles on the screen by using the watercraft by transferring weight to the right-left, forward-backward, and rotating left and right. The goal of the virtual reality games was to develop balance, weight transfer, weight shifting, active use of children's limbs and to increase attention and focus.

In the control group, appropriate to the functional level of each child, individualized NDT program was applied. This program included activities that improving tone-regulating activities, upper extremity activities, daily living activities such as getting dressed, grasping and reaching, balance and mobility training, sit to stand activities and walking exercises.

NDT session consisted of following exercises: balance exercises in sitting and standing position, balance training on different balance boards, reaching and ball throwing-keeping exercises on trampoline, weight bearing activities in different positions, walking exercises in different directions, stretching and strengthening exercises, exercises to increase upper extremity functions, activities of daily living which include dressing, writing, using kitchen equipment such as fork and spoon.

## Statistical Analysis

For data analysis, SPSS version 17.0 (SPSS Inc., Chicago, USA) was used. The distribution of the variables was measured with visual (plots/histograms) and analytical (Kolmogorov–Smirnov test) methods. Categorical data were reported in terms of frequency while continuous data were reported in terms of mean ± standard deviation (X±SD). Demographic characteristics of the children were compared using the chi-squared and Mann–Whitney U test. A Wilcoxon signed-rank test was used to test the mean differences between the pre and post-training process. The Mann–Whitney U test was used to determine whether the differences and changes between the scores in the study and control groups were statistically significant. The level of significance was set at $p < 0.05$. Cohen's d was used to determine the effect size and magnitude of difference between the measurements. Cohen classified effect sizes as small (0.2), medium (0.5), and large (≥ 0.8) (20).

## RESULTS

52 children completed the training: 27 in the VRT group and 25 in the control group. Figure 1 shows an overview of the study protocol. Both groups were statistically identical in terms of age, gender, height and weight ($p> 0.05$) (Table 1). There was a difference with regard to dominant hand and orthosis ($p< 0.05$). While most of the children in the VRT group were predominantly left-handed, in the control group the dominant hand was right. Orthosis use in VRT group was higher than control group.

**Table 1.** Demographic Characteristics of the Children

| | VRT group (n=27) X±SD | Control group (n=25) X±SD | x2 | p |
|---|---|---|---|---|
| Age (year), (X±SD) | 9.20±2.08 | 9.40±2.25 | -481 | 0.630 |
| BMI (kg/m²), (X±SD) | 16.53±3.87 | 16.45±4.30 | -303 | 0.762 |
| Sex, n (%) | | | | |
| Female | 10(37) | 11(44) | 0.261 | 0.609 |
| Male | 17(63) | 14(56) | | |
| Dominant hand, n (%) | | | | |
| Right | 10(37) | 17(68) | 4.985 | *0.026 |
| Left | 17(63) | 8(32) | | |
| Orthesis, n (%) | | | | |
| User | 20(74) | 11(44) | 4.877 | *0.027 |
| Not user | 7(26) | 14(56) | | |

*p <0.05; P: Mann–Whitney U test; x2: chi-square test; BMI: Body mass index

**Table 2.** Preintervention Group Similarities of Groups in Outcome Measures

| | VRT group (n=27) X±SD | Control group (n=25) X±SD | p |
|---|---|---|---|
| PBS (0-56) | 44.88±10.93 | 48.96±4.92 | 0.419 |
| FRT (cm) | 18.62±9.01 | 21.46±6.80 | 0.260 |
| STST (repetition) | 10.44±4.34 | 10.40±3.81 | 0.861 |
| GMFM -88(%) | 87.41±9.82 | 90.95±6.23 | 0.227 |
| QUEST (%) | | | |
| Total | 88.81±13.98 | 89.44±8.91 | 0.533 |
| Dissociated movement | 88.04±13.89 | 86.40±13.10 | 0.379 |
| Grasp | 82.16±20.85 | 85.73±11.47 | 0.941 |
| Protective extension | 95.57±11.43 | 92.99±11.73 | 0.638 |
| Weight bearing | 92.22±14.59 | 92.64±9.65 | 0.273 |
| PEDI (%) | | | |
| Total | 165.48±24.52 | 164.28±27.81 | 0.833 |
| Self-care | 59.92±10.41 | 56.32±13.02 | 0.359 |
| Mobility | 45.62±11.38 | 47.40±8.58 | 0.734 |
| Social function | 59.88±9.17 | 59.32±8.25 | 0.985 |

PBS: Pediatric Balance Scale; FRT: Functional Reach Test; STST: Sit to Stand Test; GMFM-88: Gross Motor Function Measurement-88; QUEST: Quality of Upper Extremity Skills Test; PEDI: Pediatric Disability Evaluation Inventory

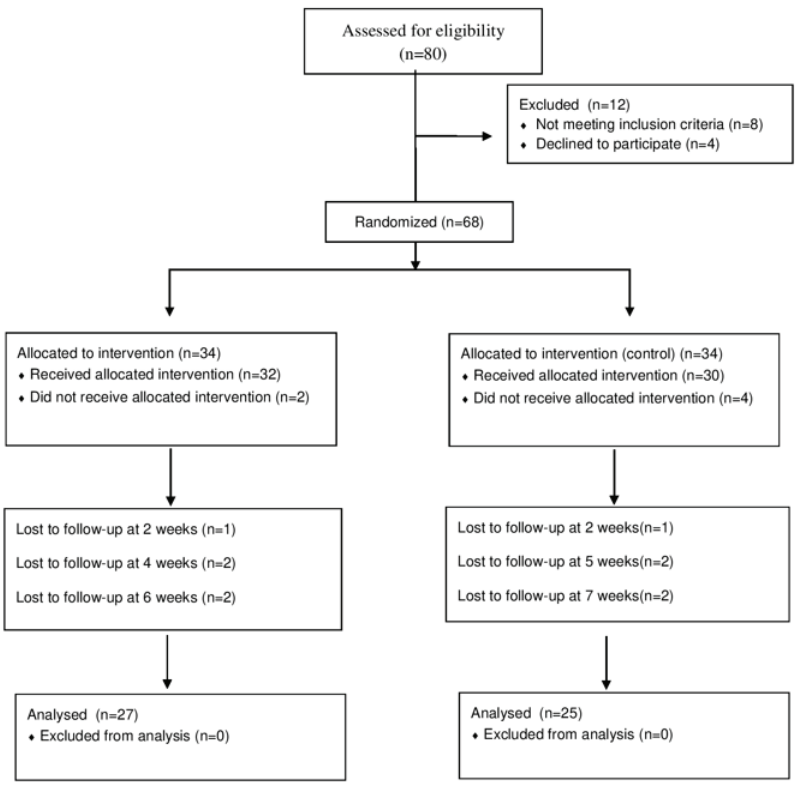


**Figure 1.** Flow Diagram of the Progress Through the Phases of a Randomized Trial of Two Groups

**Table 3:** Comparison of Outcome Measures at Baseline and After 8 Weeks in the Groups

| | VRT group (n=27) | | | | Control group (n=25) | | | |
|---|---|---|---|---|---|---|---|---|
| Preintervention X±SD | Postintervention X±SD | p | Effect size | Preintervention X±SD | Postintervention X±SD | p | Effect size | |
| PBS (0-56) | 44.88±10.93 | 46.85±8.54 | *0.001 | 0.2 | 48.96±4.92 | 49.96±4.82 | *0.001 | 0.2 |
| FRT (cm) | 18.62±9.01 | 22.62±8.90 | *0.000 | 0.44 | 21.46±6.80 | 26.30±5.62 | *0.000 | 0.77 |
| STST (repetition) | 10.44±4.34 | 11.37±3.70 | *0.007 | 0.23 | 10.40±3.81 | 12.16±4.15 | *0.000 | 0.44 |
| GMFM -88(%) | 87.41±9.82 | 89.09±9.00 | *0.000 | 0.18 | 90.95±6.23 | 92.13±5.57 | *0.000 | 0.2 |
| QUEST (%) | | | | | | | | |
| Total | 88.81±13.98 | 89.17±13.17 | *0.027 | 0.02 | 89.44±8.91 | 90.97±8.69 | *0.001 | 0.17 |
| Dissociated movement | 88.04±13.89 | 88.80±13.81 | 0.109 | 0.05 | 86.40±13.10 | 87.71±12.78 | *0.005 | 0.1 |
| Grasp | 82.16±20.85 | 82.84±20.31 | 0.102 | 0.03 | 85.73±11.47 | 86.33±11.53 | 0.180 | 0.05 |
| Protective extension | 95.57±11.43 | 95.57±11.43 | 1000 | 0 | 92.99±11.73 | 95.49±9.36 | 0.066 | 0.23 |
| Weight bearing | 92.22±14.59 | 92.22±14.59 | 1000 | 0 | 92.64±9.65 | 94.48±8.94 | *0.042 | 0.2 |
| PEDI (%) | | | | | | | | |
| Total | 165.48±24.52 | 167.70±23.83 | *0.001 | 0.09 | 164.28±27.81 | 166.16±27.46 | *0.001 | 0.07 |
| Self-care | 59.92±10.41 | 60.29±10.34 | 0.059 | 0.03 | 56.32±13.02 | 56.92±12.87 | *0.038 | 0.04 |
| Mobility | 45.62±11.38 | 47.40±9.98 | *0.001 | 0.17 | 47.40±8.58 | 48.64± 7.78 | *0.005 | 0.15 |
| Social function | 59.88±9.17 | 59.88±9.17 | 1.000 | 0 | 59.32±8.25 | 59.32±8.25 | 1.000 | 0 |

* p< 0.05.

There was no statistically significant difference in outcome measures between the two groups at initial assessments (p> 0.05, Table 2).

Comparisons of the outcome measures within the groups after 8 weeks are shown in Table 3. The PBS, FRT, STST and GMFM-88 scores changed statistically after treatment in both groups (p< 0.05). Only QUEST total score increased in the VRT group, whereas QUEST total scores and dissociated movement and weight bearing subscale scores increased significantly in the control group (p< 0.05). Total and mobility subscale scores of PEDI increased significantly in VRT group (p< 0.05). In control group self-care and mobility subparameters of PEDI and total PEDI scores increased significantly (p< 0.05).

Comparing the two groups, in VRT group, the degree of impact on FRT was moderate (Cohen's d: 0.30–0.80), while the impact on PBS, STST, GMFM, QUEST and PEDI were smaller (Cohen's d< 0.30) (Table 3). In control group, the degree of impact on PBS, STST, GMFM, QUEST and PEDI were smaller, while the degree of impact on FRT and STST was moderate (0.30–0.80).

Comparisons between the groups revealed significantly greater improvements in OUEST total scores and all of the subscale scores except for the grasp in the control group than in the VRT group (p< 0.05, Table 4).

## DISCUSSION

Our aim was to examine the effect of VRT on balance, motor functions and upper extremity functions of children with CP. It was found that VRT and NDT approaches which are applied in similar durations have a positive effect on balance, gross motor function, functional skills and upper extremity functions. The NDT group showed greater improvement in the upper extremity skills than the VRT group.

As inadequate postural control and balance reactions prevent the voluntary skills and independence in daily life, balance training is quite important in CP rehabilitation. Besides daily life activities such as self-care activities require a good upper extremity function (3,21).

Motivation is very important in the CP rehabilitation process because interventions take a long time to achieve targeted functional gains. Conventional training may become boring for children (7).

Because of the game features VR is a good motivator to use as a form of intervention for children with CP. VR games can provide children with disabilities the chance to participate in games otherwise inaccessible (9). In light of this knowledge, we chose VRT in our study.

Our study showed a significant improvement in balance after VRT. These results were consistent with the findings by some studies (22-25). Consistent with previous studies, the virtual environment may have improved the balance by stimulation of the learning mechanism through multi-sensory feedback, continuous repetition of movements, and active participation. VR games include unexpected body movements that threat postural stability. Users should maintain postural stability in space during training (26). Practice and feedback that are the essential components for motor gestures may have increased the balance scores by construction and coordination of new muscle synergies (23,24). In the present study there was no significant difference in balance scores between groups. We suggest that both modalities can be used for improving balance in CP.

In literature, the effects of VRT on gross motor function are conflicting (24-26). Brien and Sveistrup showed that there was no significant improvement in GMFM scores after VR-based balance training on 5 consecutive days. In this previous study, the training probably was not long enough to gain functional improvements. Arnoni et al found positive effects of VR-based therapy on GMFM in children with CP after eight weeks intervention using XBox Kinect games. Şahin et al showed that improvement in motor function in the VR group which combined with traditional occupational therapy was greater than control group. In our study, both groups showed improvement in GMFM total scores. Our results suggest that the VRT might have been able to provide motor gains through multi-sensory stimuli and active repetition. Also, there was no difference between groups. That's why we think that VRT can be an alternative method to conventional treatment.

Ko et al studied the effect of VR intervention for children with hemiplegic CP and reported improved hand function (27). VR intervention and strengthening exercises had similar effect. Zoccocilo et al trained 22 children with CP with Kinect and concluded that although VRT improved upper limb motor skills, conventional therapy stil was superior for improving performances in manual activities of daily living (28). Similar to this study, in our study, both treatment approach was effective for improving upper extremity functions, but NDT was superior to VRT. The result of this study showed that NDT was more effective to improve the quality of upper extremity skills, in particular dissociated movement and weight bearing, evaluated by QUEST. Kinect can very well detect the movements of proximal joints such as shoulder and arm, but not designed to detect distal joint movements such as wrist and fingers. In Kinect games, grasping and upper extremity movements on each joint can be performed separately but it is not designed to improve hand skills that are used in daily life activities. NDT is an effective therapeutic approach for improving hand functions and quality of upper limb movements. This approach includes exercises that improve hand functions and hand use in daily activities. Kinect games were all controlled by gross limb and hand movements, but NDT includes fine hand and finger movements that related to activities of daily living (28,29). We think that all of these reasons are reflected in the results.

Urgen et al. reported that the improvement of PEDI scores in the study using Nintendo Wii for 33 children with hemiplegic CP (30). Similar to the literature, in the present study there was a significant increase in PEDI total scores in both groups. In the VRT group, improvement was observed in the PEDI total and the mobility subscale scores. We think that significant improvements of balance scores are reflected in the PEDI results. Unlike the VRT group, in the control group the self-care subscale score was also increased. Self-scale subscale strictly related to activities of daily living seemed to benefit more by NDT.

First limitation of our study was about the heterogeneity of group related to the CP classification as in other studies in the literature. The VR games we used didn't contain daily life activities and Kinect device wasn't sensitive enough to detect fine hand movements. Our study is not evaluating the long-term effects of treatment programs. Another limitation is that the difference in dominant

hand type between the groups. Hand dominance is an important factor in the performance of motor skills. Gross manual dexterity and grip strength which are the best predicted the manual ability of children with CP differ in the dominant and non-dominant hand. Another limitation of our study is about the heterogeneity of groups about orthosis. The use of orthoses, which was closely related to functional limitation, differed between the groups.

As a conclusion, our study demonstrated that Kinect gaming system play a positive role in the improvement of the balance, motor function, upper limb skills and functional performance of children with CP. Although the VRT was not superior to NDT alone, VRT may also be a good alternative choice as it provided a positive effect. Therefore, we recommend that the addition of VRT as a supportive treatment to routine treatment of children with CP may be benefit for motor gains.

***Sources of Support:*** None.

***Conflict of Interest:*** The authors declare that they have no conflicts of interest.

***Author Contributions:*** Concept – AG, ÖF; Design - AG, ÖF; Supervision – AG; Resources and Financial Support - ÖF; Materials –ÖF; Data Collection and/ or Processing – ÖF; Analysis and/ or Interpretation - ÖF; Literature Research - ÖF; Writing Manuscript – AG, ÖF; Critical Review – AG, ÖF.

***Explanations:*** This study was presented as an oral presentation in "International Congress On Early Intervention and Rehabilitation (ICER-2018)", March 30 – April 1, 2018, and was published in the congress abstract book.

***Acknowledgements:*** The therapists work at the Special Education and Rehabilitation Center are thanked for their support.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)73-85*

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***Received:*** *21.11.2021 (Geliş Tarihi)*
***Accepted:*** *4.09.2022 (Kabul Tarihi)*

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# PHYSIOTHERAPY IN CERVICOGENIC HEADACHE FROM THE PERSPECTIVE OF CERTIFIED MULLIGAN CONCEPT® PRACTITIONERS - A DELPHI STUDY

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** Cervicogenic headache is a common disorder that physiotherapists may encounter in the clinic. There are many methods in the literature about the evaluation and treatment of this disorder. This study aims to create a consensus on the opinions of physiotherapist with certification Mulligan Concept Practitioners about Mulligan Concept and other frequently used physiotherapy approaches in people with cervical headache.

**Methods:** This study was planned to be completed in 3 internet-based survey rounds. The surveys were sent to physiotherapist certified as Mulligan Practitioner. The consensus was achieved when 70% of the experts agreed.

**Results:** Consensus was reached on 16 key messages. The most frequently preferred assessment methods are Visual Analogue Scale, Neck Disability Index, Flexion Rotataion Test, and Range of Motion. In addition to Mulligan mobilization, exercise therapy and patient education were the most commonly used treatment options.

**Conclusions:** It is thought that this study provides important key messages about Mulligan mobilization and physiotherapy methods that can be used in addition to this technique in the evaluation and rehabilitation of people with cervicogenic headache.

**Key words:** Cephalalgia, Manual Therapy, Physical Therapy Modalities

# SERTİFİKALI MULLIGAN MOBİLİZASYON UYGULAYICILARININ PERSPEKTİFİNDEN SERVİKOJENİK BAŞ AĞRISINDA FİZYOTERAPİ - BİR DELPHI ÇALIŞMASI

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Servikojenik baş ağrısı, fizyoterapistlerin klinikte karşılaşabilecekleri yaygın bir problemdir. Literatürde bu bozukluğun değerlendirilmesi ve tedavisi ile ilgili birçok yöntem bulunmaktadır. Bu çalışma, Sertifikalı Mulligan Mobilizasyon Uygulayıcısı olan fizyoterapistlerin servikojenik baş ağrısı olan kişilerde, Mulligan mobilizasyonu ve diğer sık kullanılan fizyoterapi yaklaşımları hakkında anahtar mesajlar oluşturmayı amaçlamaktadır.

**Yöntem:** Bu çalışmanın uluslararası olarak internet tabanlı 3 anket turunda tamamlanması planlandı. Anketler, Sertifikalı Mulligan Mobilizasyon Uygulayıcısı olan fizyoterapistlere gönderildi. Uzmanların %70'i aynı fikirde olduğunda fikir birliği sağlandı.

**Sonuçlar:** 16 anahtar mesaj üzerinde fikir birliğine varıldı. En sık tercih edilen değerlendirme yöntemleri; Görsel Analog Skala, Boyun Özür İndeksi, Fleksiyon Rotasyon Testi ve hareket açıklığı olarak belirlendi. Mulligan mobilizasyonu ile birlikte en sık kullanılan yaklaşımların da egzersiz ve hasta eğitimi olduğu görüldü.

**Tartışma:** Bu çalışmanın, servikojenik baş ağrısı olan kişilerin değerlendirme ve rehabilitasyonunda Mulligan mobilizasyonu ve bu tekniğe ek olarak kullanılabilecek fizyoterapi yöntemleri hakkında önemli anahtar mesajlar sunduğu düşünülmektedir.

**Anahtar Kelimeler**: Baş Ağrısı, Manuel Terapi, Fizik Tedavi Modaliteleri

## INTRODUCTION

Cervicogenic headache has become a problem that is frequently encountered by physiotherapists in clinics. According to previous studies, the most prominent features of cervicogenic headache are that it starts unilaterally from the neck region, spreads to the fronto-temporal region, usually does not change sides, and is triggered by neck movements (1). The studies have demonstrated that manual therapy and personalized exercise training are very effective (2). One study on this subject indicated that the most commonly used manual therapy methods were mobilization and manipulation (3).

Mulligan mobilization is a method which has been shown might be successful for the treatment of cervicogenic headache (4). Since Mulligan Concept is a very comprehensive method, many different techniques used in cervicogenic headaches are encountered in the literature (5,6). This makes it difficult to decide the effective technique for cervicogenic headaches. With the wide range of assessment and rehabilitation options, the determination of the most suitable and most frequently used for cervicogenic headache may be considered to be of importance.

The number of studies examining the effects of the Mulligan Concept on cervicogenic headache is insufficient. Details about the techniques used and frequency of application are not clear enough. Therefore, the objectives of this study were to reach a consensus on the most frequently used methods of physiotherapy and Mulligan Concept for cervicogenic headache used by physiotherapists with Certified Mulligan Practitioner (CMP) worldwide

The Delphi technique is used to systematically reach consensus on a complex problem from the views of relevant experts. This technique is known for flexibility and reflexivity, with various modification possibilities offered to the researcher. The researcher can configure the questionnaire, which is the data collection tool. In this way, it provides considerable flexibility in the design phase, as well as enables the collection of a rich and diverse data set. The internet-based Delphi technique involves the same processes, except for the usage of the online platform with classic Delphi. Since the internet-based delphi technique has significant advantages over classical delphi in terms of time, place and cost, its usage frequency has gradually increased (7). This technique was used to provide international information exchange and consensus with physiotherapists with CMP.

## METHODS

This internet-based Delphi study was conducted at Hacettepe University, Faculty of Physical Therapy and Rehabilitation, from June 1, 2019 to May 1, 2020. This study was planned to be completed in 3 rounds of emails on an online platform. The pre-determined questions were sent as a questionnaire via Google Forms. The questions were designed to be multiple choices, open-ended, and multi-response. The responses to all the questions were calculated as a percentage of the total participants. Each physiotherapist who was planned to be included in the study was sent a questionnaire with an explanation giving detailed information about the study. The responses were collected for an average of 3 weeks, and then the receipt of responses was turned off. This research has been approved by the University Non-Entrepreneurial Ethics Committee of the authors' affiliated institutions.

### Identification of Delphi Survey Items

In order to determine the questions, a detailed literature review was conducted and the studies conducted in this field were examined. Various evaluation and rehabilitation approaches used in cervicogenic headache were noted. Then, these approaches were determined, for which consensus had not yet been reached. The questions were generally aimed at examining the rate of use, method of application and effectiveness of these approaches. All questions in the survey for each of the 3 rounds are given in the tables. The two researchers with at least 4 years of experience in the field decided the questions together in each round.

### Participants

Physiotherapists that have Certified Mulligan Practitioner certification were included in this study. These physiotherapist who actively practice Mulligan mobilization, routinely treat people with cervicogenic headaches. Contact information of these experts were reached on the official site of the Mul-

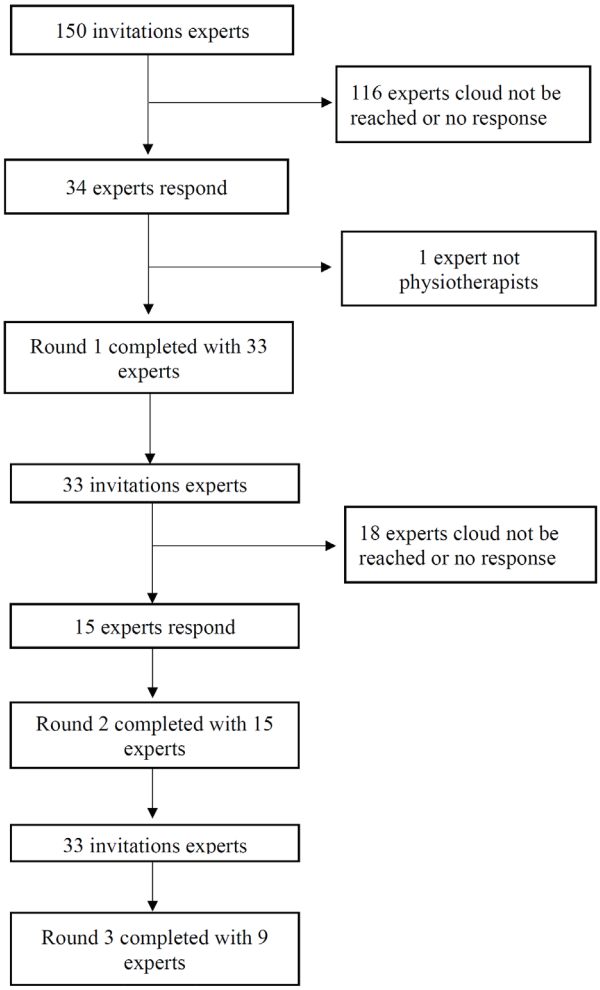



**Figure 1.** Flow Diagram

ligan Manual Therapy Concept, then the questionnaires were sent. As of 24 April 2019, a total of 150 experts were invited to participate in the first round by e-mail (Figure 1). In the second and third rounds, the questionnaires were sent only to those who responded in the first round to ensure consistency between the answers. Only the answers of physiotherapists were taken into consideration for all three rounds. The number of participants was 33 for the first round, 15 for the second round and 9 for the third round (Figure 1).

*Round 1.* The first questionnaire comprised a total of 26 questions. The first 5 questions were related to the gender of the participant, nationality, profession, the field of expertise and experience of cervicogenic headache. The remaining 21 questions for this round were created to reach the consensus with 6 questions about pre- and post-treatment evaluation of cervicogenic headache and 15 about different treatment techniques. Three of these questions were prepared for parameters such as duration, frequency, and the number of sessions of physiotherapy and rehabilitation for cervicogenic headache and 2 were about possible contraindications of rehabilitation.

*Round 2.* In the second questionnaire round, in addition to the first round items, 5 questions were added for which consensus had not been reached in the literature. This second questionnaire was sent to the same experts again to examine the consistency between the two rounds. Thus, it was aimed to give the experts the opportunity to rethink the same questions and to change their ideas if they so wished. To be able to reach a consensus on a subject, it is considered a key point that experts are given the opportunity to make changes to their ideas (8).

Two of the 5 newly added questions were related to the routine follow-up of people with cervicogenic headache. 3 additional items were added to obtain detailed information about Mulligan mobilization. These questions were selected due to some differences in the techniques applied in studies on Mulligan mobilization for cervicogenic headache (9, 10). One question asked whether Mulligan mobility has long-term effectiveness, and two questions were directed to the rotational component of Mulligan mobilization for cervicogenic headache.

*Round 3.* The third and final questionnaire included only questions for which consensus could not be reached in the first and second rounds. As in the previous two rounds, the first questions were related to the nationality, profession, specialty and experience of the participant. The remaining 9 questions were sent back to the physiotherapist with CMP. 3 questions were related to the use of different methods used in the evaluation, 3 questions were about Mulligan Concept, 2 questions were about session time and duration of treatment, and 1 question was about post-discharge follow-up.

## Data analysis

The purpose of a multi-round survey is to reach a consensus on the international platform through the opinions of physiotherapists with CMP. In this study, percentage values were calculated of the response scores given to all the questions. The percentage value was calculated according to the

**Table 1.** Expert Characteristics

| Characteristic | Round 1 (n=33) | Round 2 (n=15) | Round 3 (n=9) |
|---|---|---|---|
| | n(%) | n(%) | n(%) |
| Gender-female(%)-male (%) | 2 (6.06%)-31 (93.93%) | 0-15 (100%) | 2 (22.20%)-7 (77.80%) |
| Occupation | Researcher 7 (21.21%)<br>Clinician 25 (75.75%)<br>Other 4 (12.12%) | Researcher 2 (13.33%)<br>Clinician 15 (100%) | Researcher 2 (22.22%)<br>Clinician 8 (88.88%)<br>Other 1 (11.11%) |
| Health care profession | Physiotherapist 32 (97%)<br>Physiotherapist and Osteopathy 1 (3%) | Physiotherapist 15 (100%) | Physiotherapist 8 (88.88%)<br>Physiotherapist and Osteopathy 1 (11.11%) |
| Experience | 2-3 years 5 (15.10%)<br>4-6 years 5 (15.20%)<br>7-10 years 7 (21.20%)<br>More than 10 years 16 (48.50%) | 2-3 years 1 (6.66%)<br>4-6 years 2 (13.33%)<br>7-10 years 5 (33.33%)<br>More than 10 years 7 (46.66%) | 2-3 years 1 (11.11%)<br>4-6 years 0 (0%)<br>7-10 years 4 (44.44%)<br>More than 10 years 4 (44.44%) |
| Country-n (%) | Argentina 4 (12.12%)<br>Australia 1 (3.03%)<br>Belgium 3 (9.09%)<br>Brazil 6 (18.18%)<br>Bulgaria 1 (3.03%)<br>Canada 1 (3.03%)<br>Egypt 1 (3.03%)<br>France 1 (3.03%)<br>Greece 2 (6.06%)<br>India 3 (9.09%)<br>Japan 3 (9.09%)<br>Spain 1 (3.03%)<br>Turkey 2 (6.06%)<br>USA 4 (12.12%) | Argentina 3 (20%)<br>Australia 1 (6.66%)<br>Belgium 1 (6.66%)<br>Brazil 1 (6.66%)<br>Canada 1 (6.66%)<br>France 1 (6.66%)<br>Greece 2 (13.33%)<br>Japan 2 (13.33%)<br>Turkey 2 (13.33%)<br>USA 1 (6.66%) | Argentina 3 (33.33%)<br>Australia 1 (11.11%)<br>Brazil 1 (11.11%)<br>Greece 1 (11.11%)<br>Japan 1 (11.11%)<br>Turkey 1 (11.11%) |

number of answers to each question. 2 researchers coded the data. For any question, a response of 70% or higher was considered to be sufficient to reach consensus (11).

## RESULTS

A total of 150 certified Mulligan Practitioners were invited for the first round. Of these, 33 physiotherapists and 1 medical doctor responded. A detailed analysis of the responses is given in Table 1. 12.10% of the experts in the first round, 40% in the second round, and 22.22% in the third round were both clinicians and researchers.

### Round 1

The first survey round consisted of 21 questions, and with the exception of 5 questions about demographic information of the experts, consensus was reached on 8 questions. Of these, 3 were related to assessment, and 5 to treatment.

Of the assessment scales used, the experts agreed on the usage of the Neck Disability Index (NDI) (72.72%) and the Visual Analog Scale (VAS) (72.72%). Flexion-Rotation Test (FRT) (100%) and cervical Range of Motion (ROM) (75.78%) were the most commonly used physical assessment methods for the evaluation of cervicogenic headache patients. The most common parameters to evaluate the success of physiotherapy and rehabilitation for cervicogenic headache were personal factors (e.g. lifestyle, habits, social background, education, race/ethnicity) (87%), painkiller usage (72.72%), and activity (78.78%).

93.93% of the participating agreed on the use of exercise therapy. The most commonly used exercises were Mulligan home exercise (70.96%) and strengthening of deep cervical flexors (74.19%). There was consensus that no manipulation was performed (75.75%). In the first round, there was no consensus on whether there were contraindications for physiotherapy and rehabilitation in individuals with cervicogenic headache. However, according to experts who stated contraindicated conditions, these were that physiotherapy should

not be applied in cases of vertebrobasilar insufficiency (78%), cervical spine infection (73.68%), or neurological deficit (78%).

## Round 2

The second round consisted of a total of 26 questions consensus was reached on 15 questions. In 8 of these questions, consensus had already been reached in the first round. In the second round, consensus was continued on the use of VAS, and consensus was reached with the use of the Numeric Rating Pain Scale (NPRS) (83%) instead of NDI (66.66%) (Table 2). Painkiller usage (93.33%) and activity (80%) were the most frequently evaluated parameters for the success of the treatment. Consensus was reached that certain conditions in cervicogenic headache were contraindications for physiotherapy and rehabilitation (73.3%) (Table 3).

**Table 2.** Items Evaluation in Cervicogenic Headache and Added in 2. Round

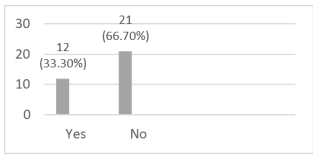
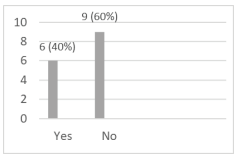
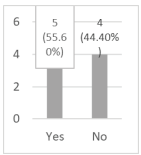
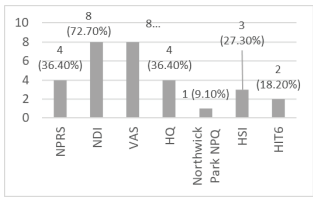
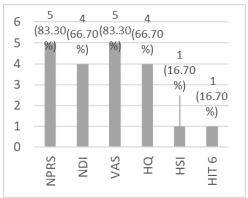
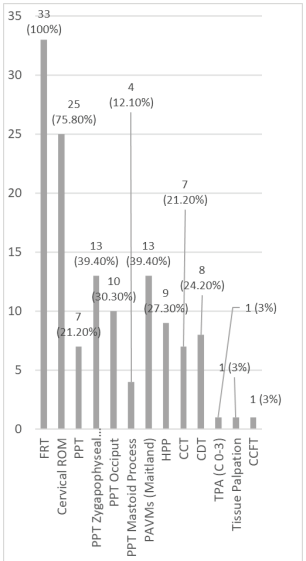
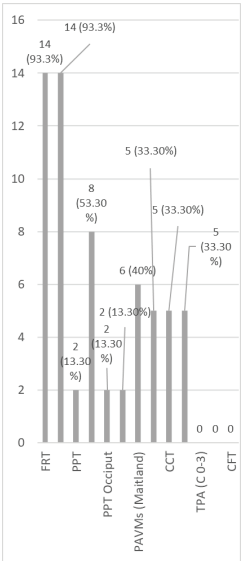
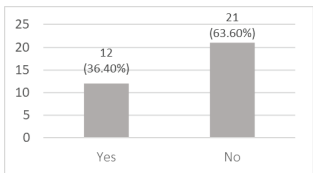
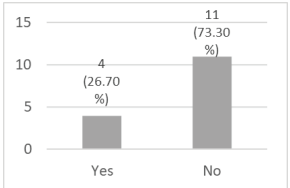
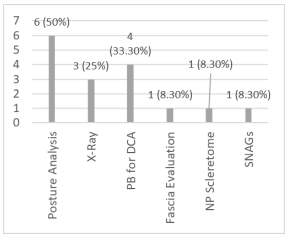
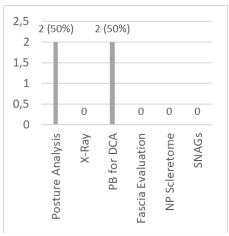
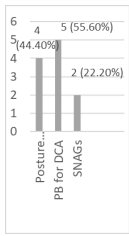
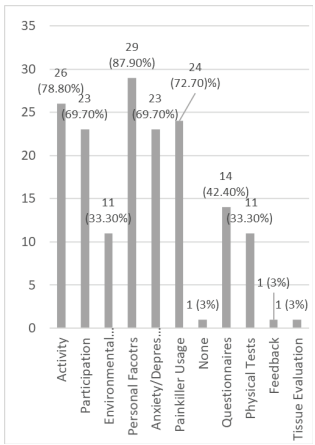
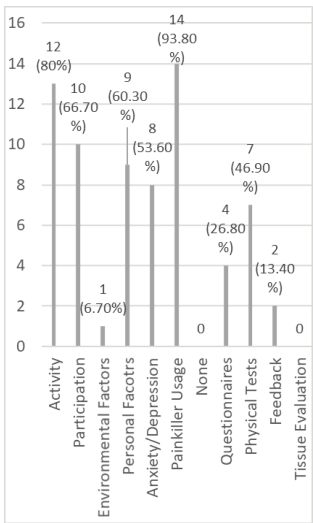
| | Round 1 | Round 2 | Round 3 |
|---|---|---|---|
| 1.Do you use any questionnaire to evaluate cervicogenic headache? |  |  |  |
| 2. If yes, what is/are their name/names? |  |  | |
| 3.What physical tests do you use to assess cervicogenic headache? |  |  | |
| 4.Do you use another method to evaluate cervicogenic headache? |  |  | |

**Table 2. (Continuous)** Items Evaluation in Cervicogenic Headache and Added in 2. Round

| | Round 1 | Round 2 | Round 3 |
|---|---|---|---|
| 5.If yes; which method/ methods? |  |  |  |
| 6.How do you evaluate the success of treatment in cervicogenic headache? |  |  | |



CCT: Cervical Compression Test, CDT: Cervical Distraction Test, CCFT: Cranio Cervical Flexion Test, DCA:Deep Neck Flexors Activation, FRT:Flexion-Rotation Test, HIT6: Headache Impact Test-6, HQ: Headache Questionnaire, HIS: Headache Severity Index, NDI: Neck Disability Index, NPQ: Neck Paib Questionnaire, NPRS: Numerical Pain Rating Scale, PAVMs: Posterior Anterior Vertebral Mobilization, PB: Pressure Biofeedback, PPT: Pressure-Pain Treshold, ROM:Range of Motion, TPA:Trigger Point Assessment, VAS:Visual Analog Scale

In the second round, consensus was reached in 4 of the 9 newly added questions. The first of these questions was re-assessment of the patient after discharge (73.33%). The remaining 3 questions were related to the details of Mulligan mobilization (Table 3).

### Round 3

The last round consisted of a total of 9 questions in addition to the demographic information of the certified Mulligan Practitioners. In this round, the questions were only those for which consensus could not be reached in both the previous rounds. Only one of these questions reached consensus (Table 3), which was that patients should be re-evaluated 1 month after discharge (75%). No other consensus was reached.

## DISCUSSION

This study was designed to identify the common assessment and rehabilitation methods used by physiotherapists with CMP for cervicogenic headache, using the Delphi technique. Consensus was reached in 8 questions in the first round, in 15 questions in the second round, and in 1 question in the third round. As a result, a total of 16 key messages were determined. These key messages may provide insights and guidance to those working with cervicogenic headaches on Mulligan Concept and other physiotherapy and rehabilitation approaches around the world.

### Assessment in cervicogenic headache

Numerous complex neural networks are thought to play an important role in the cervical-trigeminal nucleus in cervicogenic headache. Furthermore, the communication between the three upper cervi-

**Table 3.** Items About Treatment of Cervicogenic Headache and Added in 2. Round

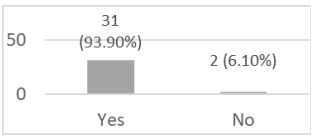
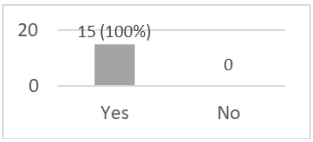
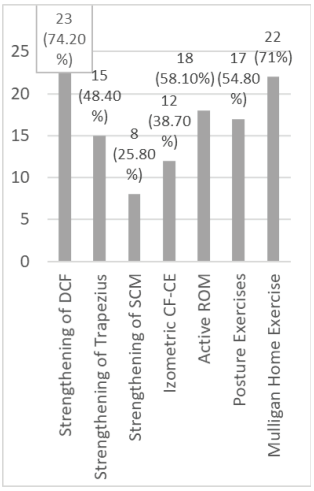
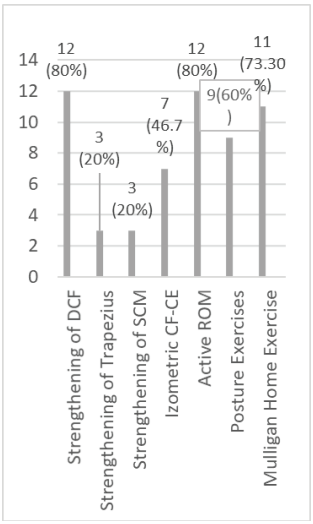
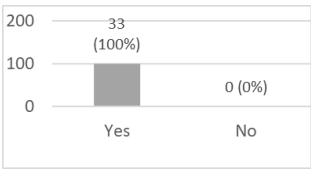
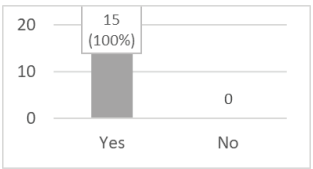
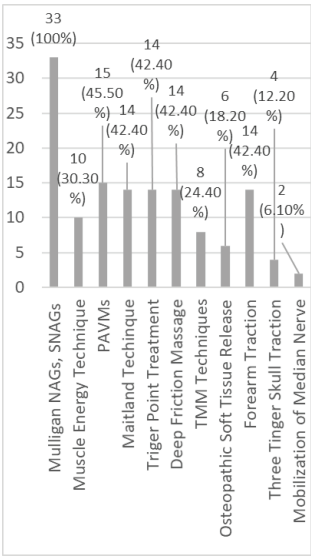
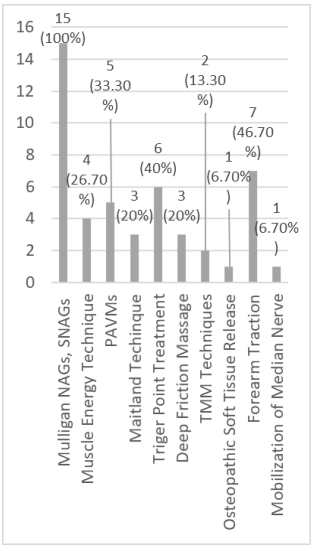
| | Round 1 | Round 2 | Round 3 |
|---|---|---|---|
| 7.Do you practice exercise training in the treatment of cervicogenic headache? |  |  | |
| 8.If yes; which exercises? |  |  | |
| 9.Do you do mobilization in the treatment of cervicogenic headache? |  |  | |
| 10.If yes; which techniques? |  |  | |

**Table 3. (Continuous)** Items About Treatment of Cervicogenic Headache and Added in 2. Round

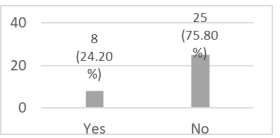
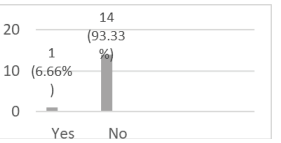
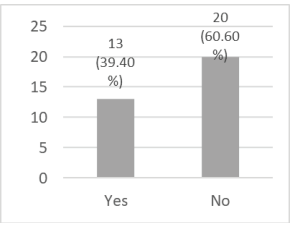
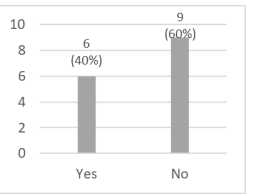
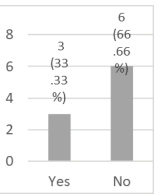
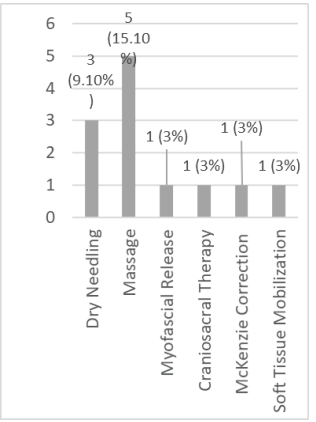
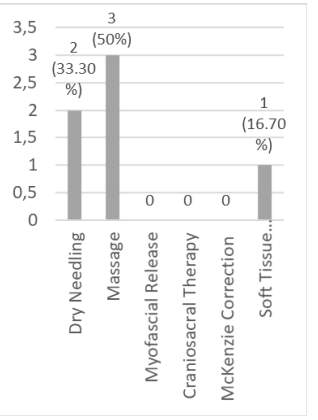
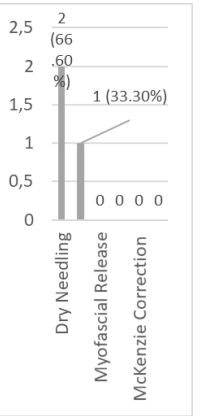
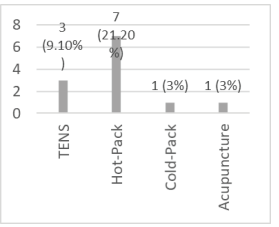
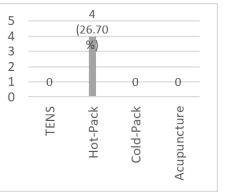
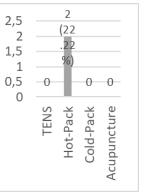
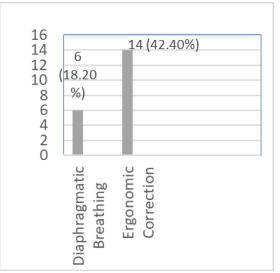
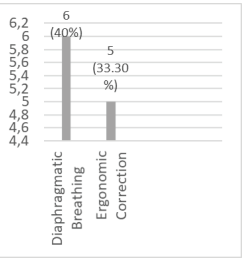
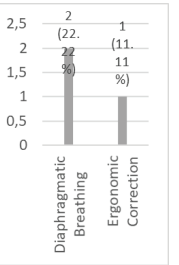
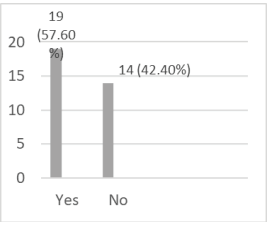
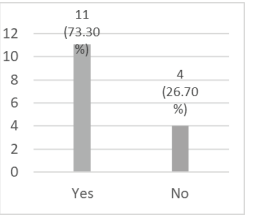
| | Round 1 | Round 2 | Round 3 |
|---|---|---|---|
| 11.Do you execute manipulation in the treatment of cervical headache? |  |  | |
| 12.Are you using any manual techniques other than these in the treatment of cervicogenic headache? |  |  |  |
| 13.If yes; which technique/techniques? |  |  |  |
| 14.Do you use the following agents in the treatment of cervicogenic headache? |  |  |  |
| 15.Which methods do you use in these options? |  |  |  |
| 16.Are there any cases of contraindication for Mulligan mobilization in cervicogenic headache? |  |  | |

**Table 3. (Continuous)** Items About Treatment of Cervicogenic Headache and Added in 2. Round

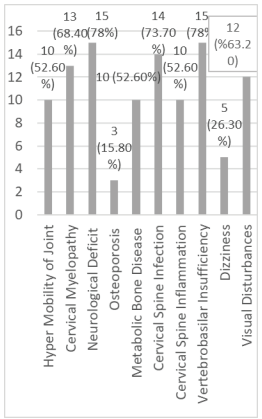
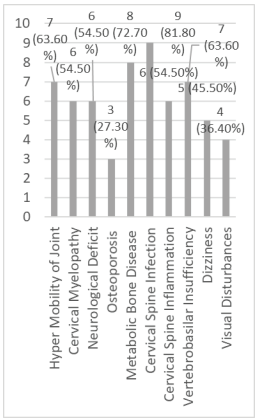
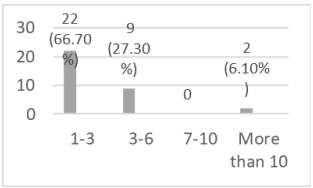
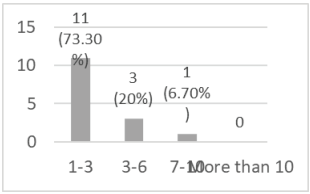
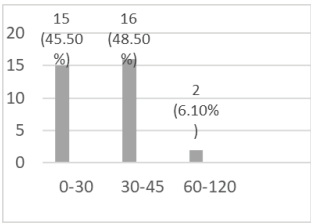
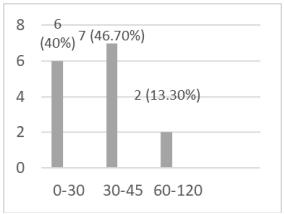
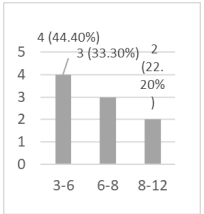
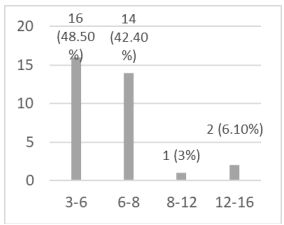
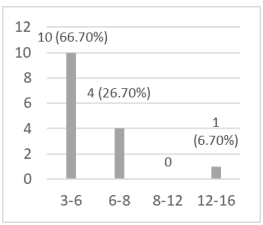
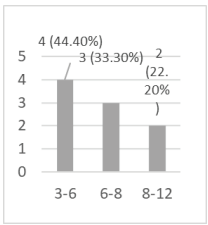
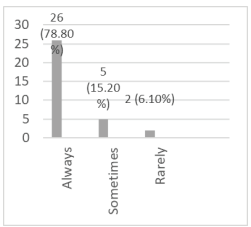
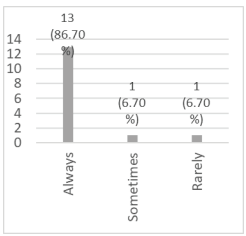
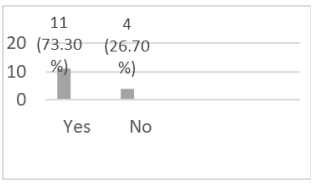
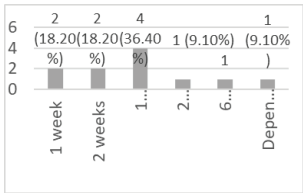
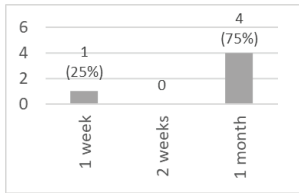
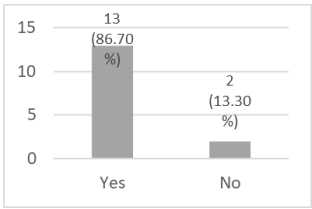
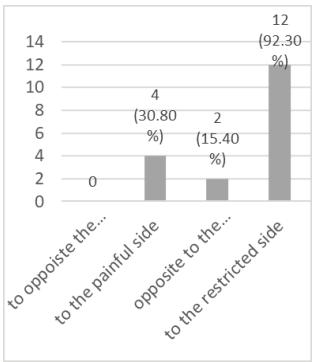
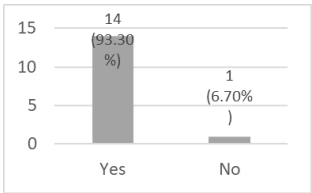
| | Round 1 | Round 2 | Round 3 |
|---|---|---|---|
| 17.If yes; which cases? |  |  | |
| 18.What is the number of treatment sessions of cervicogenic headache? |  |  | |
| 19.What should be the average session time of the treatment of cervicogenic headache? |  |  |  |
| 20.What is the duration of treatment for cervicogenic headache? |  |  |  |
| 21.Is the patient educated in cervicogenic headache (giving information about the treatment and disease)? |  |  | |
| 22.Do you re-evaluate your patients for post-discharge |  | | |

**Table 3. (Continuous)** Items About Treatment of Cervicogenic Headache and Added in 2. Round

| | Round 1 | Round 2 | Round 3 |
|---|---|---|---|
| 23.If yes; which frequency? |   |   | |
| 24.Do you ask the patient to perform cervical rotation while applying SNAG technique in Mulligan |   | | |
| 25.If yes; which direction? |   | | |
| 26.Do you think Mulligan mobilization has a long-term effect? |   | | |

PAVMs: Posterior Anterior Vertebral Mobilizations, SNAGs: Sustained Natural Apophyseal Glides, TENS: Transcutaneous Electrical Nerve Stimulation, TMM:Temparomandibular Mobilization

cal nerves and the trigeminal afferent-efferent is bi-directional (12). All these connections make it difficult to distinguish cervicogenic headache from other types of headache.

In a systematic review of evaluation options in individuals with cervicogenic headache, it was stated that the highest validity and reliability test for diagnosis was FRT (13). In the current study, FRT was the most commonly used physical test in both rounds and in the first round, it was seen that cervical ROM evaluation was used by 75.8% of the experts.

There are some studies in literature that have used questionnaires and scales to evaluate the efficacy of physiotherapy and rehabilitation in cervicogenic headache. However, a wide range of different questionnaires and scales were used in the studies (14,15). According to the current study results, VAS, NDI, and NPRS are the most frequently used questionnaires. Consensus was reached, especially in the use of VAS, in both rounds. In this study, the responses to the item "How do you evaluate the success of treatment in cervicogenic headache?" were personal factors, activity, and painkiller usage. As the effectiveness of painkillers is very short and there are many side-effects, the goal should be to reduce the usage of painkillers. Therefore, it

can be considered important to evaluate the usage of painkillers in determining the effectiveness of the treatment. In addition, recent studies of pain have emphasized the importance of evaluating the patient under the International Classification of Functioning, Disability, and Health (ICF) (16,17). In this context, the evaluation of personal factors and activity should be considered necessary for a biopsychosocial approach. In the literature, it has been stated that cervicogenic headaches can recur after various interventional and medical treatments (15). But, no responses could be found to the questions of "Do patients whose treatment is completed need to be checked again?" or "How often should patients be re-evaluated?". The results of this survey showed that for the question of "Do you re-evaluate your patients post-discharge?", which was added in the second round, the physiotherapists with CMP agreed as "Yes". Furthermore, their opinions about the frequency of this re-evaluation were clearly at 1 month.

**Rehabilitation in cervicogenic headache**

According to a systematic review, manual treatment techniques, scapular muscle strengthening, and cervical region-specific strengthening exercises may be the effective combination (15). Our results also show that manual and exercise therapy were frequently used by physiotherapists with CMP for cervicogenic headache. As expected, all participants were actively using Mulligan mobilization. Since this was the inclusion criterion, it was not considered a consensus. However, it was questioned to determine whether the participants were actively using Mulligan mobilization. In both rounds, physiotherapists with CMP agreed that the exercise component would be included in the treatment. Mulligan home exercise, deep cervical flexor strengthening, and active ROM exercises were the most commonly used exercises. Previous studies have also shown the positive effects of deep cervical strengthening exercises and Mulligan home exercise (18,19). In this respect, the results of the current study are consistent with the literature. The fact that all participants were using Mulligan mobilization in this Delphi study may have affected the conclusion that Mulligan home exercise was frequently used. However, Said et al. emphasized that the results of Mulligan home exercise and mobilization performed by the physiotherapist have similar effects (20). From this point of view, it is not surprising that Mulligan home exercise, which provides self-mobilization generally due to ease of application at home, is frequently used.

A systematic review in 2016 suggested that spinal manipulation significantly reduces symptoms in individuals with cervicogenic headache (21). Dunning et al. (2016) stated that manipulation is more effective than mobilization (14). However, it was concluded that the experts involved in this study did not use manipulation to a large extent. Experts may prefer not to use spinal manipulation because of the risk of adverse events, which have been frequently mentioned in the literature (22, 23).

In some studies, manual therapy was reported to be contraindicated when there are problems such as cervical hypermobility, osteoporosis, metabolic disease, neurological deficit, cervical myleopathy and vertebrobasilary artery insufficiency, and these have therefore been determined as exclusion criteria(24). However, to the best of our knowledge, no studies have reporting contraindicated conditions for physiotherapy applications other than manual therapy. According to the physiotherapists with CMP in the current study, there was a consensus that physiotherapy should not be applied in the presence of vertebrobasilar insufficiency, cervical spine infection, neurological deficit, and metabolic bone disease. However, there is a need for more detailed studies on which physiotherapy approaches are contraindicated for cervicogenic headache.

Recent studies have highlighted the importance of patient self-management in the treatment of chronic pain. Self-management improves lifestyle modifications and the patient's ability to cope with symptoms. The patient plays a central role in the treatment, so may easily overcome some of the barriers that prevent the maintenance of requirements such as exercising and increasing the level of physical activity (25). To the best of our knowledge, no studies have examined the effect of patient education on cervicogenic headache. Therefore, the physiotherapists with CMP were asked "How often do you educate the patient on cervicogenic headache (information about treatment and disease)?". Consensus occurred as "always" in the first and second rounds. From this conclusion, con-

sidering the possibility of recurrence and chronicity, patient education can be seen to be necessary for patients with cervicogenic headache. No answers could be found in the literature to the questions of "Should the people with cervicogenic headache be re-checked after discharge?" and "What should be the frequency?". The experts agreed that patients should be checked at 1-month intervals after discharge. Since all of the experts participating in the study applied Mulligan mobilization, questions about the details of Mulligan mobilization applications for cervicogenic headache were added in the second round. In the literature, it is seen that the use of SNAG technique is common in individuals with cervicogenic headache, and this technique is often used with cervical rotation in the direction of the restricted rotation (26-28). The official SNAG definition of the Mulligan Concept states that the technique is performed with cervical rotation (29). However, some studies have indicated that the SNAG technique is applied without using cervical rotation (9,10). According to the results of the current study, the SNAG technique should be applied with cervical rotation in the direction where movement is restricted. In this respect, the current study results are consistent with the majority of studies in the literature and the official definition of the technique in the Mulligan Concept.

### Limitations

The number of experts involved in the study seems to be low. But, this could be due to the low number of physiotherapists with Certified Mulligan Practitioner working on cervicogenic headaches. Şahin et al. stated that the minimum number of participants in a Delphi study should be 7 (30). For these reasons, it was thought that the sample size would be sufficient. In addition, the Mulligan home exercise recommendation should be interpreted with caution, given that all participants in the study used Mulligan mobilization.

## CONCLUSION

In conclusion, beside Mulligan Concept, many assessment and rehabilitation methods are also used by physiotherapists with CMP in cervicogenic headache. Of these assessment methods, VAS, NDI, FRT, and ROM are the most frequently preferred. In addition, painkiller usage, personal factors, and activity are usually evaluated. In addition to Mulligan mobilization (SNAG technique with cervical rotation), exercise therapy and patient education were seen as the most frequently used treatment options. Vertebrobasilar insufficiency, cervical spine infection and neurological deficit were determined as contraindications to physiotherapy for cervicogenic headache. However, consensus has still not been reached on some questions. For people with cervicogenic headache, patient education, manual therapy approaches, and exercise applications are thought to contribute to the effectiveness of the treatment and decrease the symptoms of the patient.

***Sources of Support:*** The authors received no financial support for the research, authorship, and/or publication of this article.

***Conflict of Interest:*** No

***Ethical Approval:*** This research has been approved by the Hacettepe University Non-Entrepreneurial Ethics Committee of the authors' affiliated institutions. Confirmation number: 2019/09-38

***Informed Consent:*** Not necessary

***Author Contributions:*** Yasemin Özel Aslıyüce: Design, Data collecting and processing, Literature review, Writing Özlem Ülger: Concept, Design, Data collecting, Processing, Critical review

***Acknowledgements:*** This text has been proof-read and edited by Caroline Walker, a university graduate English native-speaker, with over 10 years of experince in teh field of translating, proof-reading and editing for medical journals.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)86-92*

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# A COMPARISON OF ACADEMIC PERFORMANCE AND ATTITUDES TOWARD E-LEARNING ACCORDING TO THE LEARNING STYLES OF TURKISH PHYSIOTHERAPY STUDENTS IN DISTANCE EDUCATION DURING THE COVID-19 PANDEMIC PROCESS

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** Learning style plays a crucial role in the education process and academic performance. However, there exists no study investigating the academic performance and attitudes toward e-learning according to the learning styles of Turkish physiotherapy students in distance education. Therefore, this study aimed to compare academic performance and attitudes toward e-learning according to the learning styles of Turkish physiotherapy students in distance education.

**Methods:** The study was designed as a cross-sectional study type. Physiotherapy students were divided into 4 groups according to learning styles (visual, n=39, auditory, n=30, tactile, n=37, and kinesthetic, n=30). Their attitudes towards e-learning including the tendency to use technology (TUS), satisfaction, motivation, and usefulness were assessed with the Attitude Scale Towards e-learning (ASTE). Academic grade point averages (AGPA) for the 2020-2021 academic year fall semester were recorded.

**Results:** The visual group had the highest AGPA ($p<0.050$). The auditory group had a higher AGPA than the tactile group ($p=0.001$). The TUS score of the visual group was higher than the tactile ($p=0.004$) and the kinesthetic ($p=0.004$) groups. The total ASTE score in the visual group was higher than in the tactile group ($p=0.003$).

**Conclusion:** The visual group was better than other groups in terms of academic performance, attitude toward e-learning, and tendency to use technology. To get the highest level of efficiency from distance education, determining the learning styles of the students in e-learning environments, and supporting the students according to these learning styles can contribute to the improvement of their academic performance.

**Keywords:** Academic Success, Covid-19, Distance Education, Physiotherapy, Students

# KOVİD-19 PANDEMİSİ SÜRECİNDE UZAKTAN EĞİTİM GÖREN TÜRK FİZYOTERAPİ ÖĞRENCİLERİNİN ÖĞRENME STİLLERİNE GÖRE AKADEMİK PERFORMANSLARININ VE E-ÖĞRENMEYE YÖNELİK TUTUMLARININ KARŞILAŞTIRILMASI

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Öğrenme stili, eğitim sürecinde ve akademik performansta çok önemli bir rol oynamaktadır. Ancak uzaktan eğitimde Türk fizyoterapi öğrencilerinin öğrenme stillerine göre akademik performans ve e-öğrenmeye yönelik tutumlarını araştıran bir çalışma bulunmamaktadır. Bu nedenle, bu çalışma uzaktan eğitim sürecindeki Türk fizyoterapi öğrencilerinin öğrenme stillerine göre akademik performans ve e-öğrenmeye yönelik tutumlarının karşılaştırılmasını amaçladı.

**Yöntem:** Çalışma kesitsel araştırma tipinde tasarlandı. Fizyoterapi öğrencileri öğrenme stillerine göre 4 gruba ayrıldı (görsel, n=39, işitsel, n=30, dokunsal, n=37 ve kinestetik, n=30). Öğrencilerin E-öğrenmeye yönelik tutumları teknolojiyi kullanma eğilimi (TKE), memnuniyet, motivasyon ve kullanışlılık başlıklarını içeren E-öğrenmeye yönelik tutum ölçeği (EYTÖ) ile değerlendirildi. 2020-2021 akademik yılı güz dönemi akademik not ortalamaları (ANO) kaydedildi.

**Sonuçlar:** Görsel grup en yüksek ANO'ya sahipti ($p<0,050$). İşitsel grubun ANO'su dokunsal gruba göre daha yüksek bulundu ($p=0,001$). Görsel grubun TKE skoru, dokunsal ($p=0,004$) ve kinestetik ($p=0,004$) gruplara göre daha yüksekti. Görsel grubun toplam EYTÖ puanının dokunsal gruba göre daha yüksek olduğu saptandı ($p=0,003$).

**Tartışma:** Görsel grup akademik performans, e-öğrenmeye yönelik tutum ve teknolojiyi kullanma eğilimi açısından diğer gruplardan daha iyiydi. Uzaktan eğitimden en üst düzeyde verim alabilmek için e-öğrenme ortamlarında öğrencilerin öğrenme stillerinin belirlenmesi ve öğrencilerin bu öğrenme stillerine göre desteklenmesi akademik performanslarının artmasına katkı sağlayabilir.

**Anahtar Kelimeler:** Akademik Başarı, Covid-19, Fizyoterapi, Öğrenciler, Uzaktan Eğitim

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***Received:*** *01.12.2021 (Geliş Tarihi)*
***Accepted:*** *21.11.2022 (Kabul Tarihi)*

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## INTRODUCTION

In response to the transmission and exposure of the coronavirus disease 2019 (Covid-19), governments declared health emergencies and preventive measures in education, business, and social life (1), which created huge challenges in the education system. In Turkey, a distance education decision was taken by the Council of Higher Education on March 23, 2020 in order not to interrupt education (2). Distance education is defined as a kind of education that uses one or more technologies to deliver instruction to students who are separated from the instructor and to support regular and substantive interaction between the students and the instructor synchronously or asynchronously, and its popularity has increased in recent years (3). Moreover, in the near future, it is predicted that distance education will become the main ground of education instead of being an auxiliary to face-to-face learning (4).

Learning style, depending on the individual's traits and perspective and the method of data collection, is a broad concept playing a crucial role in educational consequences and academic performance (5,6). Learning style models appear in a wide variety. Among these, sensory learning styles (visual, auditory, kinesthetic, and tactile) are frequently preferred (5,7,8). Individuals with a visual learning style learn better by visually presented information such as pictures, diagrams, and maps. (7,9). Individuals with an auditory learning style learn better when information is presented verbally (7,10). The kinesthetic learning style involves any activity such as being physically active instead of sitting, listening, and watching in classrooms (7,11). Tactile learners prefer learning with their hands through the manipulation of resources such as lab experiments and building models (11,12).

Assessment of the learning style of physiotherapy students is important to develop educational strategies and an effective curriculum depending on students' perspectives (13). Many studies have focused on investigating the learning styles of physiotherapy students (14-16). However, studies conducted on Turkish physiotherapy students are scarce (17,18).

Since distance education has gained more importance during the Covid-19 pandemic, studies that investigated the attitudes of physiotherapy students towards e-learning reported that students have positive and negative attitudes towards e-learning and their attitudes towards e-learning depend on their personal traits (17,18). Moreover, one study, conducted on medical students, indicated that learning styles were significant predictors of attitudes toward e-learning (19). Although learning styles have an important role in attitudes toward e-learning, no study has investigated the attitudes toward e-learning according to the learning styles of Turkish physiotherapy students.

Although there exist various studies related to academic performance, attitudes towards e-learning, and learning style of physiotherapy students (14,16-18), to the best of the authors' knowledge, there exists no study investigating the academic performance and attitudes towards e-learning according to the learning styles of Turkish physiotherapy students in distance education. Therefore, the current study aimed to compare the academic performance and attitudes towards e-learning according to the learning styles of Turkish physiotherapy students in distance education during the Covid-19 pandemic.

## METHODS

### Study Design and Participants

This cross-sectional study was carried out as a web-based assessment via an online form. Ethical approval was obtained from the Ankara Yıldırım Beyazıt University Ethics Committee (Approval Number: 2021-18) and it was conducted in line with the principles of the Declaration of Helsinki. Data collection was performed in March and April 2021. Students of the physiotherapy and rehabilitation department who received distance education in the 2019-2020 academic year fall semester were included in the study. The participants were excluded if they were unable to fill out the questionnaires, with missing data in the assessment form, and not volunteering to participate in the study. Participants were selected through the snowball sampling method in accordance with the inclusion and exclusion criteria among undergraduate bachelor students in the Department of Physiotherapy and Rehabilitation of universities in Turkey. Participants were informed about the study and their consent was obtained online.

### Outcomes

The learning style, attitudes toward e-learning, and academic performance of the participants were assessed. Age, gender, grade level, and the course attendance status of the participants (synchronous, asynchronous, both synchronous and asynchronous) were recorded. Permission to use the questionnaires was obtained from the corresponding authors of them via e-mail. Learning style was assessed with the Learning Styles Scale for University Students in Health Sciences, developed by Otrar and Kuyucak. The valid and reliable scale consists of 36 five-point Likert-scale items. The scale has four factors as tactile (10 items), auditory (10 items), visual (9 items), and kinesthetic (7 items). The dominant learning style is determined by dividing the answers by the number of items in the factor after collecting the answers separately. The highest factor score is considered to be the dominant learning style (20). According to the results of the scale, participants were divided into four groups, as tactile, auditory, visual, and kinesthetic.

The attitudes towards e-learning of participants were assessed with the Turkish version of the Attitude Scale Towards E-Learning (ASTE). It consists of 23 items and 4 subgroups, namely, the tendency to use technology, satisfaction, motivation, and usefulness. It is a 4-point Likert-type scale. The higher score indicates a more positive attitude towards e-learning for the total and each subgroup (21).

Students were asked to declare their academic grade point averages (AGPA) for the fall semester of the 2020-2021 academic year in order to determine their academic performance in the distance education process. In the evaluation form, it was clearly stated that the students should write the fall semester grade point average, not the cumulative grade point average. The AGPA shown on the students' transcripts was in a four-point grading system.

### Statistical Analysis

A statistical power analysis program (G*Power Version 3.0.10, Franz Faul, Universität Kiel, Germany) was used to calculate the sample size of the study (22). Five participants from each group were randomly recruited for the pilot study and the AGPA scores were used to estimate the sample size. The analysis demonstrated that a sample consisting of 116 participants (29 per group) with a 20% drop rate was needed to obtain 90% power with f = 0.394 effect size, $\alpha = 0.05$ type I error and $\beta = 0.10$ type II error.

Statistical analyses were carried out via IBM SPSS Statistics 25.0 program (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp). The distributions of the continuous variables were examined using visual (histograms, probability plots) and analytical methods (Shapiro–Wilk test). All of the continuous variables such as age, ASTE scores, and AGPA were not normally distributed. Therefore, median and interquartile range (IQR) were used in descriptive analyses of continuous variables. For categorical variables (class, gender, and lesson follow-up), frequency (n), and percentage (%) are presented. The Chi-square test was used for comparing categorical variables. The Fisher's exact test was used when the Chi-square test could not satisfy the assumptions (if the lowest expected value was below two or the eye-cell count, which is the expected value less than five, was above 20%). To compare the continuous variables of the groups, the Kruskal-Wallis test was used. Pairwise comparisons were carried out using the Mann-Whitney U test and Bonferroni correction. Any p-value < 0.050 was considered statistically significant.

## RESULTS

One hundred and fifty-two participants from 10 universities were included in the study. Sixteen were excluded because of missing data in the assessment form and the study was completed with 136 participants. Using the results of the AGPA scores, the post hoc power of the study was calculated as 99% with an effect size of 0.612 and a significance level of 0.05.

Participants were divided into four groups according to learning styles as visual (n=39), auditory (n=30), tactile (n=37), and kinesthetic (n=30). The age, gender, grade level, and course attendance status of the groups were similar (p>0.050) There was no difference between the groups in terms of the class distribution of the students (p=0.521). The course patterns (synchronous, synchronous + asynchronous, or asynchronous) of the groups were similar (p= 0.323) (Table 1).

**Table 1.** Demographic Characteristics and Educational Information of Groups

| Parameters | Visual Group (n=39) | Auditory Group (n=30) | Tactile Group (n=37) | Kinesthetic Group (n=30) | p |
|---|---|---|---|---|---|
| **Age (year, median (IQR))** | 20(19-22) | 21(20-21) | 20(20-21) | 21(20-22) | 0.193[a] |
| **Gender** n (%)<br>Female<br>Male | 37(94.90)<br>2(5.10) | 27(90)<br>3(10) | 33(89.20)<br>4(10.80) | 25(83.30)<br>5(16.70) | 0.480[b] |
| **Grade level,** n (%)<br>Class 1<br>Class 2<br>Class 3<br>Class 4 | 16(41)<br>5(12.80)<br>12(30.80)<br>6(15.40) | 12(40)<br>6(20)<br>6(20)<br>6(20) | 13(35.10)<br>5(13.50)<br>15(40.50)<br>4(10.80) | 6(20)<br>7(23.30)<br>10(33,30)<br>7(23.30) | 0.521[c] |
| **Course attendance status** (n, %)<br>Synchronous<br>Synchronous+Asynchronous<br>Asynchronous | 14(35.90)<br>22(56.40)<br>3(7.70) | 9(30)<br>20(66.70)<br>1(3.30) | 6(16.20)<br>26(70.30)<br>5(13.50) | 7(23.30)<br>18(60)<br>5(16.70) | 0.323[b] |

*p<0.050, [a]:Kruskal Wallis test, [b]:Fisher's exact test, [c]:Chi-square test, IQR: Inter Quartile Range

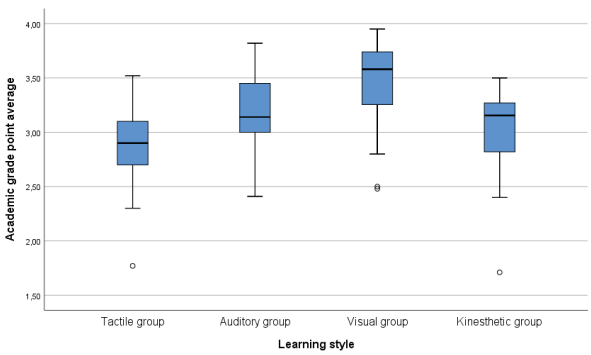


**Figure 1.** AGPA According to the Learning Styles of the Group

The fall semester AGPA scores of groups were different (p=0.001) (Fig 1.). The visual group had higher AGPA scores than the auditory (p=0.002), tactile (p=0.001), and kinesthetic (p=0.001) groups. The auditory group had a higher AGPA than the tactile group (p=0.001). No difference was found between the other groups in terms of the AGPA (p>0.050).

The total score of the ASTE (p=0.024) and the tendency to use technology subgroup score (p=0.007) of the groups were different. The total score of the ASTE in the visual group was higher than the tactile group (p=0.003). The tendency to use technology score of the visual group was higher than the tactile (p=0.004) and the kinesthetic (p=0.004) groups. ASTE Satisfaction (p=0.198), ASTE motivation (p=0.180), and ASTE usefulness (p=0.065) subgroup scores of the groups were not different (Table 2).

## DISCUSSION

This is the first study that compares the academic performance and attitudes towards e-learning according to the learning styles of Turkish physiotherapy students in distance education during the Covid-19 pandemic. The current study yielded the following findings: Turkish physiotherapy students' learning styles affected their academic performance in the distance education process. Students with a visual learning style had higher academic performance than the others. The academic performance of the students with an auditory learning style was higher than students with a tactile learning style. Moreover, the attitudes toward e-learning in students with a visual learning style were found to be more positive than students with a tactile learning style. In addition, the tendency to use technology in students with a visual learning style was higher than in students with a tactile or kinesthetic learning style.

Each student has a unique learning style based on their personal traits. Studies focusing on learning styles emphasize that learning style is an important factor for academic performance (14,16,23). Studies conducted on physiotherapy students revealed that learning style was associated with academic

**Table 2.** Comparison of AGPA and Attitudes Towards E-Learning of Groups

| AGPA and subscales of ASTE | Visual Group (G1) Median (IQR) | Auditory Group (G2) Median (IQR) | Tactile Group (G3) Median (IQR) | Kinesthetic Group (G4) Median (IQR) | P0 | P1 | P2 | P3 | P4 | P5 | P6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **AGPA** | 3.58 (3.23-3.76) | 3.14 (3.00-3.44) | 2.90 (2.70-3.10) | 3.16 (2.82-3.27) | 0.001* | 0.002** G1>G2 | 0.001** G1>G3 | 0.001** G1>G4 | 0.001** G2>G3 | 0.290 | 0.018 |
| **ASTE-Usefulness** | 15 (12-17) | 13.50 (12-16) | 13 (12-15) | 13 (11-16) | 0.198 | 0.169 | 0.065 | 0.070 | 0.919 | 0.710 | 0.770 |
| **ASTE-Motivation** | 13 (11-15) | 12 (10-15) | 12 (8-14) | 13 (10-15) | 0.180 | 0.287 | 0.020 | 0.447 | 0.378 | 0.941 | 0.262 |
| **ASTE-Satisfaction** | 13 (11-14) | 11 (11-13) | 11 (10-13) | 11 (10-13) | 0.065 | 0.129 | 0.013 | 0.046 | 0.353 | 0.590 | 0.799 |
| **ASTE-Tendency to use technology** | 16 (15-18) | 15 (14-17) | 15 (13-17) | 15 (12-17) | 0.007* | 0.135 | 0.004** G1>G3 | 0.004** G1>G4 | 0.207 | 0.140 | 0.722 |
| **ASTE-Total score** | 56 (51-62) | 51.50 (46-61) | 51 (46-58) | 54 (43-58) | 0.024* | 0.600 | 0.003** G1>G3 | 0.043 | 0.426 | 0.673 | 0.668 |

Kruskal Wallis test, Mann Whitney U test, *p<0.050, **p<0,008 (Bonferroni correction), P0: comparison of all groups, P1: comparison of visual and auditory groups, P2: comparison of visual and tactile groups, P3: comparison of visual and kinesthetic groups, P4: comparison of tactile and auditory groups, P5: comparison of kinesthetic and auditory groups, P6: comparison of tactile and kinesthetic groups, G1: Visual group, G2: Auditory group, G3: Kinesthetic group, G4: Tactile group AGPA: Academic grade point average, ASTE: Attitude Scale Towards E-Learnig

performance (16,23). Ilcin et al. indicated that participants' learning style was associated with higher academic performance (16). Olivier et al. stated that students with competitive learning styles were more successful in academic performance (23). Although it has been reported that learning style may affect the academic performance of physiotherapy students, these studies have been carried out during an in-class education period. Ergun and Kurnaz found that active learning style and independent learning style were related to academic performance in an e-learning environment (24). The current study found that learning style can affect academic performance and physiotherapy students with visual learning styles are more successful in e-learning environments. The reason for this is thought to be that students with a visual learning style are more successful when information is presented visually and the use of technological devices such as computers facilitates learning in students in this group (7,9). The physiotherapy education program involves practical courses predominantly. Students with a visual learning style in the present study may be more successful in e-learning environments than other groups because practical courses in formal physiotherapy education are presented to students with videos, photographs, and drawings during the distance education process.

One of the findings of the study was that students with an auditory learning style had lower academic performance than students with a visual learning style, but higher academic performance than those with a tactile learning style. Such students need to listen to the lessons and participate in discussions in the class for a more efficient education (10). Distance education generally takes place in a more mono-directional way (teacher talks and students listen) than face-to-face education. Therefore, in e-learning environments, it may be effective to encourage students with auditory learning styles to follow the lessons synchronously and to provide them with a discussion environment. The current study also showed that the academic performance of students with kinesthetic and tactile learning styles was lower than those with other learning styles. Students with a kinesthetic learning style learn better by doing, and students with a tactile learning style learn better by touching and feeling (12). The academic performance of students with this learning style was found lower maybe because activations involving touching and doing are more limited in distance education. Therefore, for benefiting from distance education maximally, these students should be allowed to practice during the courses, and home assignments with practical content should be increased.

One of the main focuses of our study was to investigate the attitudes towards e-learning according

to learning styles in Turkish physiotherapy students in distance education. The study revealed that the learning styles of physiotherapy students may influence their attitudes toward e-learning. Results reported in different student populations are in line with our findings (19,25). Yurdal et al. stated that learning styles may be important predictors of attitudes toward online education and the audio-visual learning style was determined as the highest predictive factor for attitudes toward online education in medical students (19). Seyal et al. demonstrated that there was a relationship between learning style (kinesthetic-doing) and attitudes towards e-learning in computer science and business students (25). In our study, which was carried out on physiotherapy students, it was found that the general attitudes towards e-learning in students with a visual learning style were found to be more positive than students with tactile learning styles. In addition, it was found that the tendency to use technology, which can affect the e-learning attitude, was higher in students with a visual learning style than in students with a tactile or kinesthetic learning style. This finding may be attributed to the ways of visual learners for getting information. The best way to get information for them is by using technological devices such as computers and videos (7,9,26). Therefore, the tendency to use technology in visual learners may be found higher. The reason why the general attitude of students with a visual learning style toward e-learning is more positive than students with a tactile learning style may be that their tendency to use technology is higher.

The current study had some limitations. First, we included physiotherapy students from all classes. Further studies should assess each class separately. The learning styles of the participants were assessed according to the sensory-based model. Further studies may also include cognitive or physiological models. As previously reported, many factors can affect academic performance. The current study only focused on the effects of learning style on academic performance. To conclude certainly, further studies should also focus on other parameters. One of the limitations of the study is that the physiotherapy training received may also affect critical thinking disposition and learning styles at the age and class level.

The current study presents that the learning styles of Turkish physiotherapy students in distance education may influence their academic performance and their attitudes toward e-learning. Visual learners had a higher academic performance than others. Moreover, attitudes toward e-learning in visual learners were higher than in tactile students, and their tendency to use the technology was higher than in tactile and kinesthetic students. The findings of our study may be important to enhance educational strategies for physiotherapy programs, support the students according to these learning styles, and improve their academic performance in distance education.

***Sources of Support:*** None

***Conflict of Interest:*** The authors declare that they have no conflicts of interest.

***Ethical Approval:***Ethical approval was obtained from the Ankara Yildirim Beyazit University Ethics Committee (Approval Number: 2021-18).

***Informed Consent:***Written informed consent was obtained from all participants.

***Author Contributions:***Conceptualization: AA, OM, STC. Design: AA, OM, STC. Supervision: STC. Resources and Financial Support: AA, OM, STC. Materials: AA, OM, STC. Data Collection and/or Processing: AA, OM. Analysis and/ or Interpretation: AA, OM, STC. Literature Research: AA, OM, STC. Writing Manuscript: AA, OM, STC. Critical Review: AA, OM, STC

***Explanations:***This study has been never presented or published in a scientific platform.

***Acknowledgement:***None

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)93-101*

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# A COMPARISON OF MANUAL THERAPY AND EXTRACORPOREAL SHOCKWAVE THERAPY IN PATIENTS WITH CARPAL TUNNEL SYNDROME

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** To investigate the effects on pain, symptom severity, and functionality of different physiotherapy methods applied to patients with carpal tunnel syndrome and to evaluate the advantages of these over each other.

**Methods:** A total of 75 patients (69 females, 6 males) aged 25-60 years were separated into 3 groups. The patients in Group 1 were given a home exercise program (HP), including median nerve and tendon gliding exercises. Group 2 received the same HP plus manual therapy (MT), including soft tissue and joint mobilisation. Group 3 received the same HP plus extracorporeal shockwave therapy (ESWT). Pain severity was evaluated with a Visual Analog Scale. Symptom severity and levels of functionality were evaluated with the Boston Carpal Tunnel Syndrome Questionnaire and the Cochin Hand Function Questionnaire. All the patients were evaluated before and after treatment.

**Results:** While there was a significant decrease in the resting and activity pain levels of each 3 groups after the treatment ($p<0,05$), no significant difference was found between MT and ESWT groups ($p> 0.05$). However, the pain values of these two groups were significantly decreased compared to the EP group ($p <0.05$). The pain values of both groups were significantly lower than those of the HP control group ($p <0.05$). A statistically significant increase was determined in the level of functionality in all the groups after treatment ($p<0.05$). The decrease in symptom severity and the increase in functionality were significantly greater in the MT and ESWT groups compared to the HP group ($p<0.05$). After the treatment, there were no superiorities with respect to the pain, symptom severity, and functionality values of the MT and ESWT groups ($p>0.05$).

**Conclusion:** In our study, the MT and ESWT applications we used in patients with CTS patients provided significant improvement compared to HP exercises only. We speculate that some differences that are not seen in the early period can be seen in long-term follow-up. Further studies should be performed to assess the long-term results.

**Keywords:** Carpal Tunnel Syndrome, Nerve Gliding, Tendon Gliding, Manual Therapy, Extracorporeal Shockwave Therapy

# KARPAL TÜNEL SENDROMLU HASTALARDA MANUEL TEDAVİ VE EKSTRAKORPOREAL ŞOK DALGA TEDAVİSİNİN ETKİLERİNİN KARŞILAŞTIRILMASI

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Karpal tünel sendromlu hastalarda farklı fizyoterapi yöntemlerinin ağrı, semptom şiddeti, fonksiyonellik düzeyleri üzerindeki erken dönem etkilerini araştırmak ve birbirlerine üstünlüğünü değerlendirmektir.

**Yöntem:** Çalışmamıza 25-60 yaş aralığında 75 hasta (69: K, 6: E) dahil edildi. Hastalar 3 gruba ayrıldı. Birinci gruba median sinir ve tendon kaydırma egzersizlerini içeren ev programı (EP) verildi. İkinci gruba aynı ev programına ilaveten yumuşak doku ve eklem mobilizasyonu içeren manuel tedavi (MT) uygulandı. Üçüncü gruba da aynı ev programına ilaveten ekstrakorporeal şok dalga tedavisi (ESWT) uygulandı. Ağrı şiddeti Vizuel Ağrı Skalası ile, semptom şiddeti ve fonksiyonellik düzeyleri Boston Karpal Tünel Sendromu Anketi ve Cochin El Fonksiyon Anketi ile değerlendirildi. Hastaların ölçümleri tedaviden önce ve sonra yapıldı.

**Sonuçlar:** Tedaviden sonraki değerlendirmelerde her 3 grubun istirahat ve aktivite ağrılarında anlamlı düşüş bulunurken ($p<0,05$), MT ve ESWT grupları arası fark bulunmadı ($p>0,05$). Ancak iki grubun ağrı değerlerinde EP grubuna göre anlamlı azalma görüldü ($p<0,05$). Tüm gruplarda fonksiyonellik düzeylerinde anlamlı artış bulundu ($p<0,05$). Semptom şiddetinde azalma ve fonksiyonellik düzeylerindeki artış, MT ile ESWT gruplarında EP grubuna göre anlamlı bulunurken ($p<0,05$), MT ile ESWT grupları arasında fark bulunmadı ($p>0,05$). Tedaviden sonra MT ve ESWT gruplarının ağrı, semptom şiddeti ve fonksiyonellik değerleri karşılaştırmasında grupların birbirlerine üstünlükleri bulunmadı.

**Tartışma:** Çalışmamızda KTS hastalarında kullandığımız MT ve ESWT uygulamasının yalnızca EP egzersizlerine göre anlamlı iyileşme sağladığı görüldü. Erken dönemde görülmeyen bazı farkların, uzun dönem takiplerde görülebileceğini düşünüyoruz. Uzun dönem sonuçları değerlendirmek için ileri çalışmalar yapılmalıdır.

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***Received:*** *08.12.2021 (Geliş Tarihi)*
***Accepted:*** *23.11.2022 (Kabul Tarihi)*

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## INTRODUCTION

Carpal tunnel syndrome (CTS) is a median neuropathy trap caused by paresthesia, pain, numbness, and other symptoms. It is one of the most common neuropathies, having a negative effect on the quality of life (1,2). Diagnosis of CTS is made from a detailed history, electrophysiological examinations, and clinical examination. Clinical findings are important parameters in diagnosis. There are some specific tests for CTS diagnosis, and while positivity in the tests strengthens the diagnosis, negativity does not affect the diagnosis (3).

The general principle in CTS treatment is to eliminate pain for the patient and accelerate the process of returning to daily living functions. Treatment methods applied to patients, most of whom recover with conservative treatment, include exercises to improve daily activities, various electrotherapeutic applications, manual therapy approaches, orthoses, banding, deep friction, ESWT, anti-inflammatory drug use, and surgical approaches (4). In the literature on CTS, flexor tendon and nerve gliding exercises have been reported to reduce synovial edema, provide feeding of the tissues by the nerve bundles through the provision of venous return, and accelerate the rate of axonal transmission (4,5).

Tendon gliding exercises are thought to increase nerve transmission through the support of tissue feeding and axonal transmission (4-6). Neural mobilisation, in which the nerve glides, is also a neurodynamic treatment method used to treat the peripheral nerve system and the surrounding tissues. Thus, it contributes to neural tissues regaining flexion capability and allows the re-stimulation of the normal physiological function of neural structures (7). In studies that have examined the effect of neural mobilisation techniques in addition to conservative treatment, there has been observed to be a more significant improvement in the functionality levels of the neural mobilisation group (6-8).

Manual therapy increases joint mobility by stimulating mechanoreceptors. Increased joint mobility increases tissue strength and flexibility in the surrounding structures (9). Deep friction and myofascial release, which are soft tissue manual therapy techniques are used for the benefit of the analgesic effect (10). An increase in intra-articular movement and surrounding soft tissues stimulates synovial fluid movement and accelerates circulation. In a study by Fernandez et al. of females with CTS, it was concluded that MT and surgery were similarly effective in improving functionality in the symptomatic hand, symptom severity, and fingertip grip strength (11). By forming potential treatment with myofascial release of the flexor retinaculum, an improvement is provided in flexion in the carpal ligament and the impaired nerve functions. Thus, pain and protective muscle spasms are reduced.

ESWT is a shock wave treatment that has an analgesic effect with accelerated tissue repair and cell growth by focusing on the affected area in CTS treatment (12,13). ESWT is thought to increase the inhibitory control of the dorsal radical brain through serotonergic activation and provides hyperstimulation analgesia. The anti-inflammatory effect of ESWT has been investigated and proved (13). In recent years, ESWT has become a non-invasive treatment method used in soft tissue diseases (14,15).

Physiotherapists should prefer efficient, safe, and easily appliable treatment modalities due to serious econonic losses of CTS, commonly observed disease. In the literature, CTS research studies on treatment modalities including exercise therapy alone as well as combined with nerve and tendon gliding (6-8, 16), MT approaches (10-18), and ESWT applications (15,19,20) reported successful results. However, we did not come across a study comparing these different applications in the literature. Therefore, we believe our study will have an important contribution to the literature as well as to the physiotherapists who may consider working in this field.

The aim of this study was to investigate the effects on pain, symptom severity, and levels of functionality of exercise, MT, and ESWT approaches applied to CTS patients and to evaluate the superiority of these to each other. The hypothesis of the study was that there would be a difference in respect of pain and functionality between the results of the CTS patients who applied tendon and nerve gliding exercises, MT, and ESWT methods.

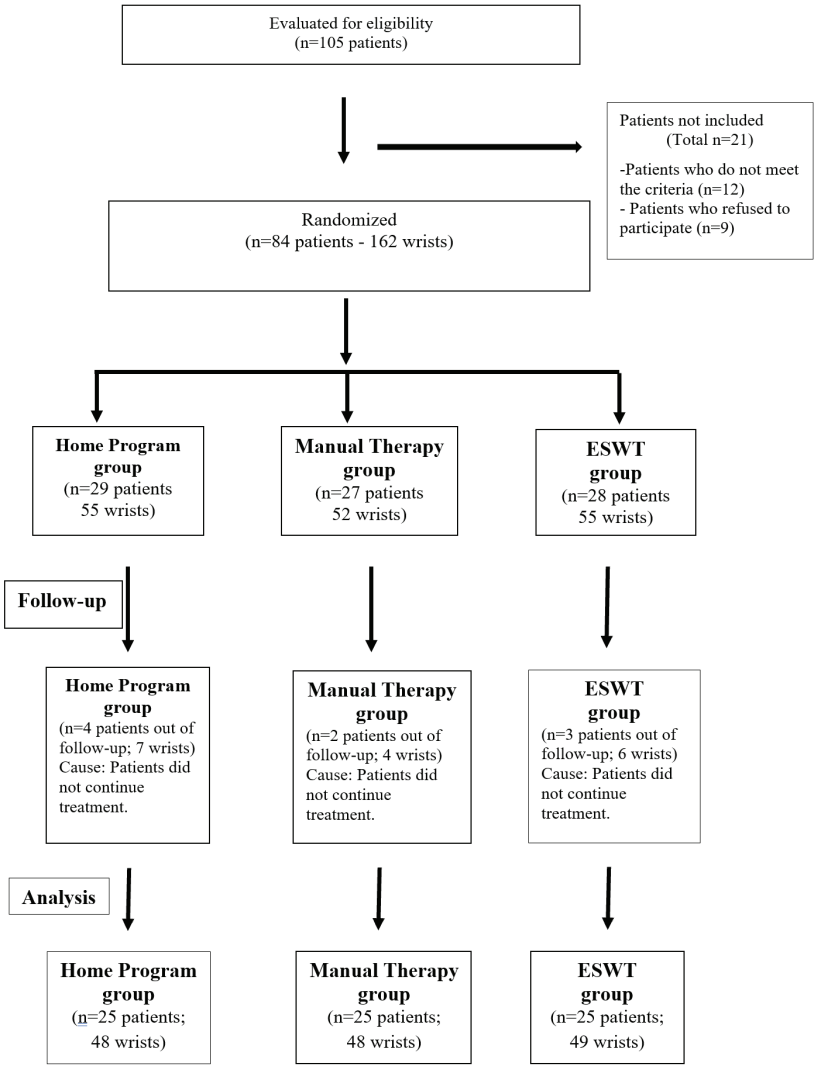


**Figure 1.** Flow-Chart

## METHODS

Approval for the study was granted by the Non-Interventional Research Ethics Committee of Hasan Kalyoncu University Health Sciences Faculty (decision no:2018/04, dated:02.05.2018). The study included patients aged 25-60 years diagnosed with CTS by their physician who agreed to participate in the study. Exclusion criteria were defined as pregnancy, the presence of a malignant tumour, cardiac pacemaker, a history of surgery in the wrist region, the use of analgesics in the treatment process, those who had received physical therapy for the wrist region within the last 6 months, and those who did not wish to participate in the study. This single center, randomized, controlled study was conducted in the Physical Medicine and Rehabilitation General Polyclinic of 25 Aralık Public Hospital. A total of 75 patients who met the study criteria were separated into 3 groups with a list randomization method, taking the order of presentation as reference (Figure 1). The patients in Group 1 were given a home exercise program (HP), including neurodynamic median nerve mobilisation and tendon gliding exercises. Group 2 received the HP plus manual therapy (MT), including soft tissue and joint mobilisation. Group 3 received the HP plus extracorporeal shockwave therapy (ESWT). Informed consent for voluntary participation in the study was obtained from all the patients.

In the evaluation of the pain of patients at rest and during activity, a Visual Analog Scale (VAS) was used. Patients were instructed to mark the level of

**Figure 2.** Carpal Joints Ventral Mobilisation

pain felt on a line 10 cm in length, marked from 0= no pain to 10 = intolerable pain (21).

Patients with CTS received Tinel, Phalen, and carpal compression tests, provocative tests of special clinical examination bilaterally applied by the physiotherapist (NT). The purpose of these tests is to detect symptoms by increasing the intercarpal pressure. For example, the Tinel test is positive when a tingling or pricking sensation is felt in the median nerve distribution with gentle percussion applied to the distal wrist (2). The Phalen test was applied by keeping both wrists in full flexion position for 30-60 seconds. The emergence of or increase in pain, numbness, and paresthesia during the test was evaluated as positivity (3). In the carpal compression test, the pressure was applied with two fingers over the median nerve in the wrist. Positivity in the test was defined as pain, numbness, and paresthesia in the area affected by the nerve (3).

The Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ) was used to evaluate the functional level and symptom severity. The questionnaire comprises two sections of symptom severity and functional capacity, and the total points obtained in each section are divided by the number of questions to provide an average score for each section. Higher scores indicate decreased functional capacity and increased symptom severity (22). In addition, Cochin Hand Function Scale was used (CHFS) to evaluate functional performance and activity limitations related to the hand (23). The scale includes 18 activities in daily functions, and the performance of the subject for each parameter is scored from 0 (no difficulty) to 5 (I cannot do this).

All the patients in the study received general training about the mechanism of CTS, progression, and preventative measures. Furthermore, patients were taught how to apply home exercises comprising neurodynamic median nerve mobilisation and tendon gliding exercises.

During the application the neurodynamic median nerve mobilisation, it was instructed that the shoulder was in depression, abduction, and external rotation; the elbow was in extension, the forearm in supination, and the wrist and fingers in extension. Following the head in lateral flexion at the end of these movements, tension was applied to the median nerve (16). Nerve gliding was applied as the head was brought into lateral flexion, the wrist and fingers were brought into flexion, the head was returned to a neutral position, and by moving the hand and fingers into extension (23). Lastly, as part of the tendon glide exercises, fingers were held in five positions, straight, hook, fist, tabletop, and long fist, respectively (2,3). These home exercises were performed as 10 repetitions in each session, 5 days a week for 4 weeks. A reminder message was sent to all the patients once a week.

For the MT group, in addition to the HP, MT techniques were applied by the physiotherapist (NT). As part of soft tissue mobilisation, the myofascial release was applied to the anterior, mid, and posterior scalene, the pectoralis major and minor, the biceps brachii muscles, and the flexor retinaculum. For joint mobilisation, cervical tractions and mobilisation were applied to the distal and proximal radio-ulnar, radiocarpal (Figure 2), and intercarpal joints (6-8,9). While the patient was in supine position, general, and segmental traction to the cervical region was applied by the physiotherapist taking the patient's head in one hand and applying traction to all the cervical vertebrae, first as general than as segmental to each cervical segment starting from caudal to cranial. Furthermore, the myofascial release was applied to the anterior, medial and posterior scalene muscles, then to the pectoralis major and minor and the biceps brachii muscles. Joint gliding was applied as anterior and posterior mobilisations to the distal and proximal

radioulnar joints and towards dorsal and volar to the radiocarpal and intercarpal joints. Later, mobilisation with traction was applied to the metacarpophalangeal joints. Last, during the deep friction and myofascial release techniques of the flexor reticulum, while the wrist was in dorsiflexion, the thumb of the physiotherapist was positioned on the lateral edges of the flexor reticulum. This was applied until release was obtained in the flexor reticulum. In patients with an increase in CTS symptoms with the wrist in dorsiflexion, the application was made without bringing the wrist into dorsiflexion. MT interventions were applied for a total of 12 sessions 3 days a week, 10 repetitions for 4 weeks by the physiotherapist (NT).

For the ESWT group, in addition to the HP, a total of 12 ESWT sessions were applied 3 days a week for 4 weeks by the physiotherapist (NT). The ESWT therapy was applied with a Vibrolith ESWT device (Elmed Medical Systems, Orlando, FL, USA) at 1.5 bar pressure, 2000 shots, and 10 Hz. frequency, with the ESWT probe, placed perpendicular to the median nerve. As the area of application was narrow, the median nerve did not have a deep course in the carpal tunnel, therefore, low pressure was preferred to minimize complications (12). The patients were followed up until the end of the study, and no local tissue effect was reported.

### Statistical Analysis

Data obtained in the study were analyzed by IBM® SPSS© 21.0 software (SPSS Inc., Chicago, IL, USA) (24). The conformity of the variables to normal distribution was examined with the Kolmogorov-Smirnov test. Descriptive statistical methods were used, and results were stated as mean±standard deviation values, number(n), and percentage (%). Paired t-test was used to assess VAS (resting and activity), Boston symptom intensity, Boston functional status, and Cochin hand function scores within the groups. One-way Anova test was used in comparisons between the groups. The results are presented using the standard deviations. Tukey Post-hoc test was used to compare the pain, symptom severity, and functionality values the groups after the treatment. Considering the evaluation of Tinel, Phalen, and Carpal compression test values before and after the treatment, Wilcoxon sign test was used within the groups; chi-square test was used between the groups. 95% confidence interval, and statistical significance level of $p<0.05$ were considered. Power analysis was applied to calculate the sample size using G-power 3.19 software (25). A moderate effect size (effect size = 0.5) was set based on Cohen's d, and the significance level was assigned to a = 0.05 and power = 0.8, resulting in a minimum of 22 subjects per group required. Considering a drop-out rate of 20%, the minimum number per group was set at 25.

## RESULTS

The mean age of the patients was 49.12 years (range, 25-60 years), and the mean body weight was 81.14 kg. The groups were similar in respect of age, gender, affected wrists, and body weight ($p>0.05$) (Table 1).

In the comparison of the pre-treatment pain values, no difference was determined between the groups

**Table 1.** Comparison of Demographic Characteristics of the Groups

| | | HP (n=25) X±SD | MT (n=25) X±SD | ESWT (n=25) X±SD | p |
|---|---|---|---|---|---|
| **Age (year)** | | 46.84±9.46 | 50.68±9.84 | 49.84±8.63 | 0.316[a] |
| **Body weight (kg)** | | 82.80±13.40 | 79.00±20.77 | 81.64±13.03 | 0.746[a] |
| **Gender** | Female | 23 (%92) | 23 (%92) | 23 (%92) | 0.349[b] |
| | Male | 2 (%8) | 2 (%8) | 2 (%8) | |
| **Affected wrist** | R- Hand | 2 (%8) | 2 (%8) | 1 (%4) | 0.807[b] |
| | L-Hand | 0 (%0) | 0 (%0) | 0 (%0) | |
| | Both Hands | 23 (%92) | 23(%92) | 24(%96) | |

*$p<0.05$, p[a]: One-way ANOVA test, p[b]: Pearson Chi-Square, X: Arithmetic Mean, SD: Standard Deviation, HP: Home Program, MT: Manual Therapy, ESWT: Extracorporeal Shock Wave Therapy, R: Right, L: Left

**Table 2.** Comparison of pain and functionality values before and after treatment within and between groups

| | | HP (n=25) X±SD | MT (n=25) X±SD | ESWT (n=25) X±SD | p[b] |
|---|---|---|---|---|---|
| **Resting VAS (cm)** | Before treatment | 6.96±1.98 | 6.88±1.76 | 6.52±1.47 | 0.642 |
| | After treatment | 3.80±1.75 | 2.48±1.71 | 2.52±1.89 | 0.016* |
| | **p[a]** | <0.001* | <0.001* | <0.001* | |
| **Activity VAS (cm)** | Before treatment | 7.08±1.63 | 7.28±1.30 | 7.56±1.50 | 0.521 |
| | After treatment | 3.48±1.47 | 2.80±1.44 | 3.00±1.93 | 0.324 |
| | **p[a]** | <0.001* | <0.001* | <0.001* | |
| **Boston Symptom Severity Score** | Before treatment | 3.21±0.49 | 3.18±0.44 | 3.21±0.39 | 0.980 |
| | After treatment | 1.96±0.49 | 1.62±0.28 | 1.61±0.53 | 0.010* |
| | **p[a]** | <0.001* | <0.001* | <0.001* | |
| **Boston Functional Status Score** | Before treatment | 3.23±0.43 | 3.10±0.51 | 3.04±0.46 | 0.333 |
| | After treatment | 1.80±0.39 | 1.47±0.34 | 1.45±0.54 | 0.010* |
| | **p[a]** | <0.001* | <0.001* | <0.001* | |
| **Cochin Hand Function Questionnaire** | Before treatment | 1.98±0.65 | 1.90±0.51 | 1.96±0.54 | 0.888 |
| | After treatment | 0.75±0.52 | 0.43±0.36 | 0.47±0.52 | 0.040* |
| | **p[a]** | <0.001* | <0.001* | <0.001* | |

*p<0.05, p[a]: Within-group comparison Paired T-test, p[b]: Between-group comparison One-way ANOVA test, X: Arithmetic Mean, SD: Standard Deviation, VAS: Visual Analog Scale, HP: Home Program, MT: Manual Therapy, ESWT: Extracorporeal Shock Wave Therapy

(p>0.05). The greatest reduction in the difference between the pre and post-treatment mean values was in the MT group for the resting pain values and in the ESWT group for the activity pain values. No statistically significant difference was determined between the groups in the pre-treatment evaluations of symptom severity and function. In the post-treatment evaluations, a statistically significant difference was determined in all the test mean values (p<0.05) (Table 2).

When the groups were compared in respect of post-treatment resting and activity pain values, a statistically significant difference was determined in the MT and ESWT groups compared to the HP group (p<0.05). No difference was seen between the MT and ESWT groups (p>0.05). In the comparison of the functionality results, a statistically significant difference was seen in the MT group compared to the home exercise program group (p<0.05), and no significant difference was determined between the MT and ESWT groups (p>0.05). In the comparison of the BCTSQ values between the home exercise program group and the ESWT group, the values were found to be significantly better in the ESWT group (p<0.05) (Table 3).

The results of the Tinel, Phalen, and carpal compression specific tests showed no significant differences between the groups in the comparisons made

**Table 3.** Comparison of Pain, Symptom Severity, and Functionality Values of the Groups After Treatment

| | | HP- MT | HP- ESWT | ESWT- MT |
|---|---|---|---|---|
| **Resting VAS** | **p** | 0.029* | 0.036* | 0.997 |
| **Activity VAS** | **p** | 0.311 | 0.555 | 0.902 |
| **Boston Symptom Severity Score** | **p** | 0.025* | 0.019* | 0.993 |
| **Boston Functional Status Score** | **p** | 0.026* | 0.019* | 0.992 |
| **Cochin Hand Function Questionnaire** | **p** | 0.050* | 0.102 | 0.947 |

*p<0.05, p: Tukey Post-hoc test, VAS: Visual Analog Scale, HP: Home Program, MT: Manual Therapy, ESWT: Extracorporeal Shock Wave Therapy

**Table 4.** Comparison of Tinel, Phalen, and Carpal Compression Test Values Before and After Treatment within and between Groups

| Tests | | HP N (%) | MT N (%) | ESWT N (%) | p[b] |
|---|---|---|---|---|---|
| Tinel Test | Before treatment | 24 (%96) | 24 (%96) | 24 (%96) | 1.000 |
| | After treatment | 5 (%20) | 1 (%4) | 3 (%12) | 0.220 |
| | p[a] | <0.001* | <0.001* | <0.001* | |
| Phalen Test | Before treatment | 22 (%88) | 24 (%96) | 24 (%96) | 0.424 |
| | After treatment | 3 (%12) | 1 (%4) | 3 (%12) | 0.532 |
| | p[a] | <0.001* | <0.001* | <0.001* | |
| Carpal Compression Test | Before treatment | 24 (%96) | 24 (%96) | 24 (%96) | 1.000 |
| | After treatment | 4 (%16) | 1 (%4) | 2 (%8) | 0.332 |
| | p[a] | <0.001* | <0.001* | <0.001* | |

*p<0.05, p[a]: Within-group evaluation Wilcoxon sign test, p[b]: Between-group evaluation Chi-square test, HP: Home Program, MT: Manual Therapy, ESWT: Extracorporeal Shock Wave Therapy

pre- and post-treatment. In the comparisons within the groups, a statistically significant difference was determined between the pre-and post-treatment test results in all the groups (p<0.05) (Table 4).

## DISCUSSION

The aim of this study was to investigate the effects on pain, symptom severity, and levels of functionality of ESWT and MT approaches applied to patients with CTS and to evaluate the advantages of either method over the other. The hypothesis that there would be a difference between the results of the home exercise program applied as tendon and nerve gliding exercises and the MT and ESWT methods in respect of pain and functionality was partly confirmed. No difference was determined between the MT and ESWT groups in the improvements obtained in pain and functionality, whereas the results of the MT and ESWT groups were better than those of the group applied with the home exercise program alone. This study can be considered of value in respect of showing the 4-weeks term efficacy of these treatment methods applied for CTS.

CTS is a frequently seen peripheral entrapment neuropathy. Several different techniques and applications have been used in treatment, but very few studies in the literature have compared physiotherapy approaches. In a systematic review that investigated the efficacy of tendon and nerve gliding exercises for CTS, it was reported that when these exercises are combined with traditional treatments, there can be a positive effect for CTS patients, but it was also emphasized that there is a need for further, randomized controlled studies designed to evaluate the effect of tendon and nerve gliding exercises alone (6). In a recent, randomized controlled study of 80 patients, the study group was applied with tendon and gliding exercises together with a wrist splint, and the control group was treated with a wrist splint only. A certain amount of improvement was seen in symptom severity and the functional status scores in both groups, and it was reported that the exercises provided no extra benefit to the wrist splint treatment (8). In contrast, Hamzet et al. reported that the combination of neuromobilisation techniques with exercises compare to only home exercises was more effective in improving clinical findings (26). In the current study, median nerve mobilisations and tendon sliding exercises were applied as a home exercise program to all 3 groups. The support with active tendon and nerve gliding exercises was effective on the pain, symptom severity, and functionality levels of the CTS patients and was thought to be supported by the other treatment approaches.

In a study by Miranda-Medina et al., a significant therapeutic benefit of neurodynamic techniques as conservative treatment was reported in the pres-

ence of light and moderate CTS (27). İn another study, 189 patients with CTS have been separated randomly into the manual therapy group (including neurodynamic techniques) or the control group (without therapy). At the end of the treatment, they found significant differences in the MT group which also included neurodynamic techniques, but no differences in the control group. It is stated that MT had a positive effect on the overall health status of people with CTS (28). In our study, a significant difference was determined in respect of resting and activity pain values, symptom severity, and levels of functionality between the group applied with the home exercise program of nerve mobilisations and the group that received joint and soft tissue mobilisation applied by a physiotherapist in addition to the home exercise program. This difference was thought to have been created by the support to the home exercise program of the MT approach applied in person to the patient 3 times a week (26,28).

ESWT applications have increased significantly in recent years in patients with CTS and positive results of the efficacy of ESWT have been documented (15,19,20,29,30). In a study by Kocak Ulucakoy et al., ESWT alone was seen to be as effective as splint treatment, and it was reported that ESWT should not be ignored in the conservative treatment of CTS (15). To date, there are no standard guidelines about the frequency of application and the total number of doses for the use of ESWT in CTS patients. A short-term effect has been shown in a single session of ESWT, and most studies have applied 3 sessions (30). The results of our study demonstrated a significant difference in the resting and activity pain values, symptom severity, and levels of functionality in the ESWT group. However, when compared with MT, no superiority was determined between the applications of ESWT and MT. Both applications were seen to provide a greater improvement in pain and symptom severity than the nerve and tendon gliding exercises applied as the home exercise program alone. Similarly, in the functionality level results, the positive improvements in symptom severity and functionality level were seen to be greater in the MT and ESWT groups than in the HP group, with no difference between the MT and ESWT techniques. Our results were found to be consistent with findings in the literature. Studies have supported the application of MT techniques together with classical physiotherapy and have reported that combined treatments are more effective in improving symptoms and clinical findings (17,18,26,28).

The results of our study showed that all methods in the three groups reduced pain and symptom severity and increased functionality in 4-weeks treatment program. It was found that education and applied exercises and reminder text messages per week in the home exercises group alone had a positive effect on the patients. We emphasize the importance of home exercises to support CTS patients. On the other hand, direct application of ESWT to the wrist; local and central effects of joint and soft tissue MT techniques might improve the positive outcomes of our study results (16,26,28). MT and ESWT approeaches reduced the symptoms and significantly increased the functionality compared to the home program exercise after the treatment.

There were some limitations to this study, primarily that only the 4-weeks term efficacy was examined, and there were no long-term comparisons. There is a need for further larger, longer-term studies to confirm these results. Another limitation was that although a reminder was sent to the patients, adherence, and compliance with the exercises is an important problem in patients undertaking a home exercise program, which could have affected the results. Therefore, placebo-controlled studies are required to make long-term comparisons.

In conclusion, it can be said that nerve and tendon gliding exercises, soft tissue and joint mobilisations, and the application of ESWT provided an improvement in CTS patients, and these methods can be safely applied. At the end of the treatment period, the applications of MT and ESWT were found to be equally effective in reducing pain and increasing functionality in CTS patients. ESWT is a practical treatment method with no side effects. With the addition of MT approaches in patients with CTS degree, pain, neuropathic symptoms, and limitations will be reduced, and function increased. In addition, to encourage patients to be active during and after the treatment process, it can be considered important to teach nerve and tendon gliding exercises and give these as a home exercise program. Further studies should be performed to evaluate the long-term results.

***Source of Support:*** The authors did not receive any financial support for this study.

***Conflict of Interest:*** The authors have no conflict of interests to declare.

***Author Contributions:*** NT: Concept, Design, Data Collection and Processing, Analysis and/or Interpretation, Literature Review, Article Writing. AT: Concept, Consulting, Analysis and/or Interpretation, Article Writing, Review

***Explanations:*** None.

***Acknowledgement:*** None

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)102-114*

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***Received:*** *20.01.2022 (Geliş Tarihi)*
***Accepted:*** *08.02.2023 (Kabul Tarihi)*

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# BİLATERAL TOTAL DİZ PROTEZİ SONRASI ERKEN İLERLEYİCİ KAPALI KİNETİK ZİNCİR EGZERSİZLERİNİN STANDART EGZERSİZ PROGRAMINA GÖRE ETKİLERİ - RANDOMİZE KONTROLLÜ ÇALIŞMA

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Bu çalışma ilerleyici kapalı kinetik zincir egzersiz (KKZE) programının, açık kinetik pozisyonda verilen standart egzersiz programına göre bilateral total diz protezi (TDP) hastalarında ağrı şiddeti, ödem, eklem hareket açıklığı ve fonksiyonel durum üzerine kısa dönem etkilerini belirlemek amacıyla yapıldı.

**Yöntem:** Çalışmaya yaş ortalaması 65,22 ± 6,81 yıl olan ve bilateral TDP uygulanan 36 hasta (72 diz) dahil edildi. Hastalar KKZE grubu (KKZE, n=16) ve standart egzersizlerden oluşan kontrol grubu (KG, n=16) olarak iki gruba ayrıldı. Ameliyat sonrası 1. haftada tüm hastalara aynı fizyoterapi programı uygulandı. Ameliyat sonrası 2. haftada hastalar iki gruba ayrıldı ve gruplarına uygun egzersiz eğitimine başlandı. Haftada 3 gün ve toplamda 6 hafta uygulanan programlarda hastaların ağrı, ödem, eklem hareket açıklığı ölçümleri, başlangıçta ve ameliyat sonrası 4. ve 7. haftada yapıldı. Fonksiyonel durum değerlendirmesi ise sadece son ölçümde yapıldı.

**Sonuçlar:** Her iki grupta da ağrı, ödem, diz eklemi hareketlerinde 6 hafta sonunda istatistiksel olarak anlamlı iyileşmeler oldu ($p<0,05$). 4. hafta ölçümlerinde ağrı şiddetindeki değişim KG'de daha fazla idi ($p<0,05$) ancak tüm diğer parametrelerdeki başlangıca göre olan değişimler her iki grupta da benzerdi ($p>0,05$).

**Tartışma:** Post-akut erken dönemde verilen dirençli KKZE programının bilateral TDP hastaları için etkilidir ve programlara eklenebilir. Ancak tek başına KKZE programının standart egzersiz programına kısa dönemde ek bir üstünlüğü yoktur.

**Anahtar Kelimeler:** Diz Protezi, Kapalı Kinetik Zincir Egzersizi, Post-Akut Rehabilitasyon

# THE EFFECTS OF EARLY PROGRESSIVE CLOSED KINETIC CHAIN EXERCISES IN COMPARISON WITH STANDARD EXERCISE PROGRAM AFTER BILATERAL TOTAL KNEE ARTHROPLASTY - RANDOMIZED CONTROLLED STUDY

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** This study was conducted to determine the short-term effects of a progressive closed kinetic chain exercise (CKCE) program on pain severity, edema, range of motion and functional status in patients with bilateral total knee arthroplasty (TKA) compared to standard exercise program given in open kinetic position.

**Methods:** 36 patients (72 knees) with a mean age of 65.22 ± 6.81 years and bilateral TKA were included in the study. The patients were divided into the CKCE group (CKCE, n=16) and the control group (CG, n=16) consisting of standard exercises. The same physiotherapy program was applied to all patients in the first postoperative week. In 2nd post-operative week, the patients were divided into two groups and started exercise training appropriate for their groups. Pain, edema, range of motion measurements of the patients were evaluated at the beginning and at post-operative 4th and 7th weeks in the programs applied 3 days a week and for 6 weeks in total. The functional status assessment was performed only in the last measurement.

**Results:** There were statistically significant improvements in pain, edema and knee range of motions at the end of the 6 weeks in both groups ($p<0.05$). In the 4th week measurements, the change in pain was more distinctive in CG ($p<0.05$), but the changes from baseline in all other measured parameters were similar in both groups ($p>0.05$).

**Conclusion:** The study reveals that the progressive CKCE program in the early post-acute period seems effective for bilateral TKA patients and can be embedded in the postoperative exercise programs. However, more than the CKCE program is needed to have an additional advantage over the standard exercise program in the short term.

**Keywords:** Closed Kinetic Chain Exercise, Knee Arthroplasty, Post-Acute Rehabilitation

## GİRİŞ

Total diz protezi (TDP) uygulamaları, konservatif tedaviyle iyileşmesi mümkün olmayan diz eklemi hastalarının tedavisinde ortopedistler tarafından en sık uygulanan cerrahi yöntemlerdendir (1,2). TDP sıklıkla osteoartritin ileri evresinde ağrıyı azaltmak, hareketi restore etmek ve hastanın yaşam kalitesi ve fonksiyonelliğini arttırmak amacıyla uygulanır (3-7). Yaşam süresinin uzaması, diz osteoartriti görülme oranını arttırmakta ve böylece TDP uygulama sıklığı artmaktadır. Bu artışın oranına göre 2030 yılından sonra dünya genelinde yılda 3,5 milyon TDP uygulamasının olabileceği öngörülmektedir (3,8-11).

Diz osteoartritine (OA) bağlı diz ekleminde kronik ağrı, hareket kısıtlılığı ve fonksiyonel kayıplar en önemli bulgulardandır. Yapılan çalışmalarda TDP uygulamalarından sonra kuadriseps kuvvetinde yaklaşık %41'lik bir kayıp, adım uzunluğunda %28 azalma ve merdiven çıkma hızında yaklaşık %105 oranında yavaşlama olduğu gösterilmiştir (3). Özellikle ameliyat sonrası ilk aylarda bu kayıplar ciddi problemlere neden olabilmekte hastalarda düşme korkusu ve anksiyeteyi arttırmaktadır (5,11).

Son yıllarda TDP uygulama sayılarındaki artış sağlık sistemlerine olan maddi yükü arttırdığı için ameliyat sonrası erken dönem fizyoterapi uygulamalarının önemi daha da artmıştır. Fizyoterapi uygulamaları hastalarda TDP sonrası ortaya çıkan bulgu ve semptomların azaltılması, hastaneden taburcu olma sürelerini kısaltması, uygulanan protezin uzun yıllar kullanımı ve tedavi maliyetlerinin azaltılmasına büyük katkı sağlamaktadır (4,5,11-13).

Ameliyat sonrası birinci gün erken akut fizyoterapi protokolü uygulamalarını içeren fizyoterapi uygulamaları; taburculuk işlemlerinden sonra ağrı ve efüzyona yönelik uygulamalar, eklem hareket açıklığı ve özellikle fonksiyonel kuvvetlendirme ve denge eğitimini içeren egzersiz programları ile devam etmektedir. Genellikle ev programı ile takip edilen hastalar hareket kısıtlılıkları veya egzersiz programına uyum sağlanamadığı durumlarda ayaktan tedaviye alınmaktadır (3,6-8).

TDP uygulamaları sonrası, post-akut erken ve geç dönemlerde ortaya çıkan bu yetersizliklerin devam etmesi, fizyoterapi programlarında daha erken ve daha yüklemeli egzersiz programlarına yönelimi arttırmıştır. Bu alanda yapılan çalışmalar olmakla birlikte hala rehabilitasyon yaklaşımları ile ilgili çalışma sayılarının ve mevcut çalışmalardaki uygulamaların kanıt değerlerinin yetersiz olduğu görülmektedir (7).

Son dönemlerde ameliyat sonrası 2. haftadan itibaren yüksek şiddetli egzersizlerin TDP sonrası rehabilitasyonda uygulanabileceği ve sonraki dönemde devam eden fonksiyonel yetersizlikleri azaltmada etkili olabileceği savunulmakla birlikte sonuçlar tartışmalıdır. Düşük şiddetli veya standart fizyoterapi programları ile yapılan karşılaştırmalı çalışmalarda sonuçların benzer olduğu da ileri sürülmektedir (3,14,15).

TDP uygulamalarından sonraki postoperatif erken dönemde verilen egzersiz programları incelendiğinde açık kinetik zincir pozisyonundaki ya da yüklenmesiz leg-press, topuk kaydırma gibi egzersizlerin daha çok tercih edildiği görülmektedir. Kapalı kinetik zincir egzersizleri (KKZE) pozisyonunda özellikle vücut ağırlığı ile yapılan egzersizlerin aksiyal yüklenmeye bağlı kompresif stresleri artırması ve bu durumun TDP uygulamalarından sonra ağrı ve ödemi artırarak hareket kısıtlılıklarına neden olabileceği düşünüldüğü için bu tip egzersizler geç dönemde programa eklenmektedir (9,11). Diğer taraftan KKZE'nin ön çapraz bağ yaralanmaları ve rekonstrüksiyon cerrahilerinden sonra ko-kontraksiyon özelliği ile eklem stabilizasyonunu arttırması, erken yüklenmeye olanak sağlaması ve nöromuskuler sistemde (denge, propriosepsiyon) daha erken gelişmelere neden olması gibi avantajları nedeniyle daha çok tercih edildiği görülmektedir (12,13).

Vücut ağırlığı ile yapılan ve günlük yaşam aktiviteleri (GYA) benzeri olan KKZE'nin erken dönem olumlu etkilerine ait mevcut literatür bilgileri referans alınarak yapılan çalışmamızda, TDP sonrası erken dönemde KKZE'nin standart egzersiz programına göre ağrı, ödem, hareket kısıtlılığı ve fonksiyonel düzey üzerine üstünlüğü olup olmadığını belirlemek amaçlanmıştır. Çalışmanın hipotezi "KKZE ağrı ve ödemin azaltılmasında, diz ekstansiyon/fleksiyon hareketi ve fonksiyonel durumun geliştirilmesinde açık kinetik zincir pozisyonunda verilen standart fizyoterapi programı kadar etkilidir." olarak belirlenmiştir.

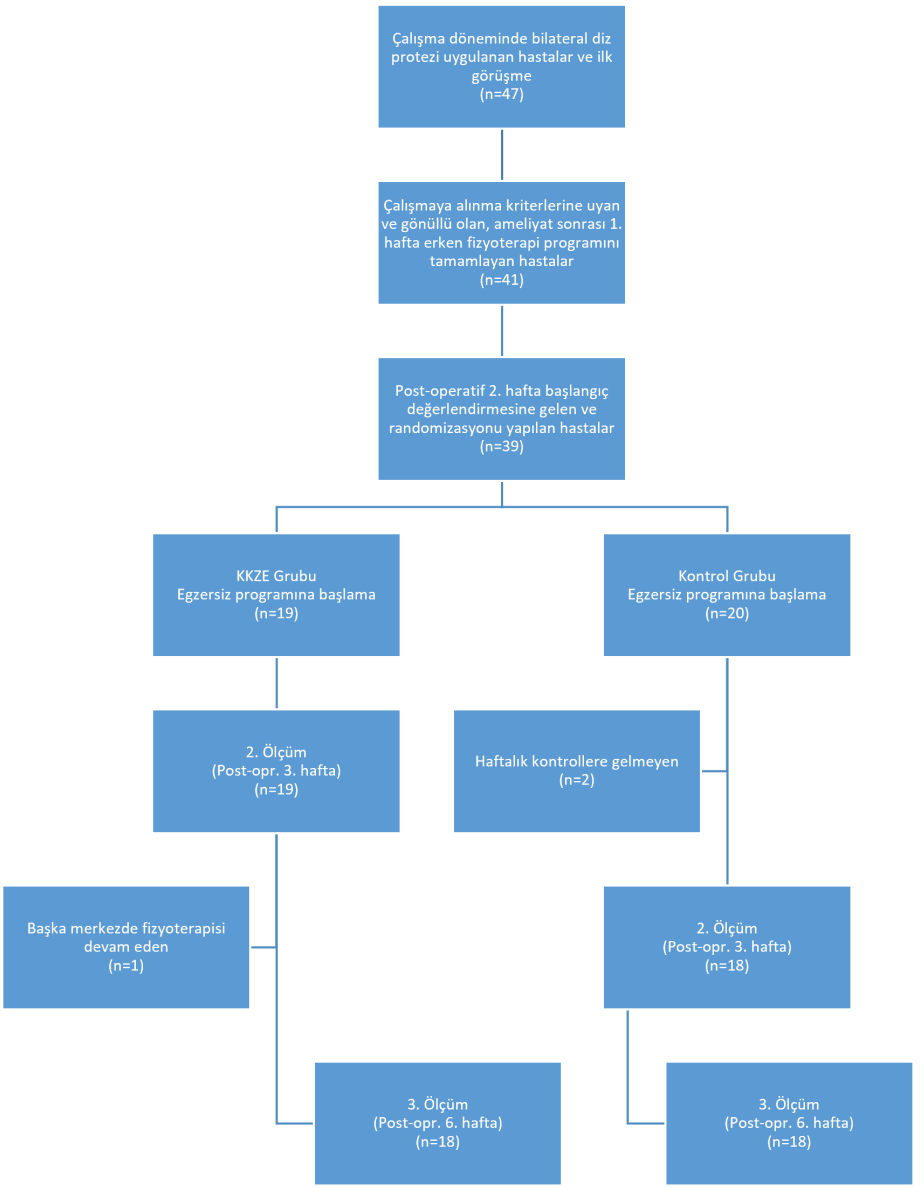
## YÖNTEM

### Araştırma tipi ve katılımcılar

Prospektif randomize kontrollü olan bu çalışma Ocak 2017 - Aralık 2018 yılları arasında, sementli bilateral TDP uygulanan hastalarda yapıldı. Çalışmaya dahil edilme kriterleri, primer osteoartrite bağlı bilateral TDP uygulaması olmak, 45-80 yaş aralığında ve okur yazar olmaktı. Revizyon TDP operasyonu geçirmiş olan, kanser tedavisi gören, stabil olmayan diyabet ve hipertansiyonu olan ve hastanın fonksiyonelliğini sınırlayan farklı ortopedik cerrahi müdahalesi olan, herhangi bir nedenle (enfeksiyon varlığı vb.) 3 günden fazla serviste yatan ve ek sağlık sorunu olan hastalar (nörolojik, kardiyopulmoner, nöromuskuler sistem problemleri gibi) çalışmaya dahil edilmedi.

Çalışma özel bir hastanenin Ortopedi ve Travmatoloji bölümünde yapıldı. Çalışma öncesi tüm hastalara bilgilendirilmiş gönüllü olur formu okundu ve hastalardan onam alındı. Çalışmanın etik kurul onayı 18.05.2017 tarih ve 2017/12-29 karar numarası ile Dokuz Eylül Üniversitesi Girişimsel Olmayan Araştırmalar Etik Kurulu'ndan alındı.

Bilateral TDP uygulaması yapılan hastaların ame-




**Şekil 1.** Çalışma Şeması

liyat gününde ameliyat sonrası ilk fizyoterapist görüşmesi gerçekleşti. Hastalar bu görüşmede çalışma hakkında bilgilendirildi ve gönüllü olan hastaların iletişim bilgileri alındı ve ameliyat sonrası akut faz fizyoterapi programına başlandı. Hastane çalışma protokolü gereği hastalar ameliyat sonrası 3. gün taburcu edildi. Ameliyat sonrası 0. gün ile taburcu olunan 3. gün arasında tüm hastalara hastane içi aynı fizyoterapi programı uygulandı. Hastane içi fizyoterapi ve rehabilitasyon programı kapsamında hastalara her gün; (1) soğuk paket (10-15 dk günde 2-3 kez), (2) sürekli pasif hareket (SPH) (seansta 30 dk ve günde 3 kez), (3) tüm bacak elevasyon, (4) rutin egzersiz programı (ayak bileği pompa egzersizleri, izometrik kuadriseps egzersizleri, topuk kaydırma ve oturmada diz ekstansiyon egzersizleri, düz bacak kaldırma egzersizleri) ve (5) yürüteç yardımlı her gün 2 kez yürüme eğitimi uygulandı. 3. gün taburcu olmadan önce tüm hastalara merdiven eğitimi verildi. Taburculuk sırasında ameliyat sonrası 1. hafta standart TDP fizyoterapi protokolü tüm hastalara ev programı olarak verildi ve soğuk paket uygulamasını aynı şekilde evde yapmaları ve 2. hafta kontrole gelene kadar bu programa devam etmeleri istendi.

Ameliyat sonrası 2. hafta hastalar kontrole çağrıldı, basit rastgele örnekleme yöntemi ile randomize edildi ve KKZE grubu ve standart egzersizlerden oluşan kontrol grubu olarak iki gruba ayrıldı. Hastaların ilk değerlendirmeleri yapıldı. Değerlendirme sonrası aynı seansta, gruplarına uygun egzersizler hastalara öğretildi bir sonraki hafta randevuları oluşturuldu, egzersiz takip kartları verilerek gönderildi. Aynı zamanda egzersizlerin video kayıtları cep telefonlarına yüklenerek hastaların egzersizleri karıştırması veya yanlış yapması önlenmeye çalışıldı. Haftada bir defa fizyoterapist kontrolüne gelen hastaların egzersiz programındaki ilerlemeleri düzenli olarak takip edildi. İkinci değerlendirme ameliyat sonrası 4. haftada (ilerleyici egzersiz programının 3. haftası tamamlandığında), son değerlendirme ise ameliyat sonrası 7. haftada (egzersiz eğitiminde 6. hafta tamamlandığında) yapıldı.

Çalışma için planlanan düzenli takip dönemi ve gruplara uygun egzersiz programları 3. ölçümün tamamlanması ile birlikte sonlandırıldı. Sonraki dönem hastaların tedavilerinin aksamaması için tüm hastalara rutin TDP egzersizleri ev programı olarak verildi ve hastalar taburcu edildi.

Örneklem büyüklüğü protez cerrahisi sonrası erken dirençli egzersiz uygulamalarının etkilerinin araştırıldığı referans çalışmaya göre %95 güven aralığında, %80 güç analizi yapılarak hesaplandı, kayıplar da göz önüne alınarak %10 yedekle birlikte KKZE grubu için 18 hasta, KG için 18 hasta alınmasına karar verildi (14).

**Tedavi protokolü**

2. haftanın başından itibaren hastalara, gruplarına uygun egzersiz programı (KKZE ve standart egzersiz programı) başlatıldı. İlerleyici dirençli egzersiz programı 6 hafta boyunca uygulandı.

KG Egzersiz Programı;

- Kuadriseps izometrik egzersizi

- Diz terminal ekstansiyon egzersizi

- 4 yönlü düz bacak kaldırma egzersizleri (Kalça fleksiyonu, hiperekstansiyonu, addüksiyonu, abdüksiyonu),

- Yüzükoyun diz fleksiyon egzersizi,

- Oturmada aktif diz ekstansiyon egzersizi

Tüm egzersizlerin 10 tekrar, günde 2 seans ve haftada 3 gün olacak şekilde yapılması istendi. Egzersiz programında ilerleme aşağıdaki gibi yapıldı;

1. hafta 10 tekrar X 1 set;

2. hafta: 10 tekrar X 2 set

3. hafta 1-2 kg (toleransına göre) serbest ağırlık ile 10 tekrar X 1 set

4. hafta aynı ağırlık ile 10 tekrar X 2 set

5. hafta 3-4 kg serbest ağırlık ile 10 tekrar X 1 set

6. hafta aynı ağırlık ile 10 tekrar X 2 set

KKZE Grubu Egzersiz Programı

- Yatakta ve duvarda topuk kaydırma egzersizi, ayakta diz ekstansiyonu

- Sandalyeden kalkma egzersizi (1-2. hafta sandalyeden destek alarak; 3-4. hafta sandalye desteksiz; 5-6. hafta alçak sandalyeden tutunmadan ve diz 90°-100° fleksiyonda),

- Mini çömelme (1-2. hafta: 30° ; 3-4. hafta: 45°-50°; 5-6. hafta: 50°-60° diz fleksiyonu ile),

- Basamak egzersizleri (1-2. hafta: basamak çıkma; 3-4. hafta: basamak çıkma + yan basamak çıkma; 5-6. hafta: basamak çıkma + yan basamak çıkma + basamaktan inme),

- **Öne hamle (lunge) egzersizi (3-4. hafta: çift el destekli başlandı; 5-6. hafta: tek el destekli) olarak ilerletildi.**

Tüm egzersizlerin aşağıda belirtilen tekrar sayılarıyla günde 2 seans ve haftada 3 gün olacak şekilde yapılması istendi. Egzersiz programında ilerleme aşağıdaki gibi yapıldı;

1. hafta: 10 tekrar X 1 set; 2. hafta: 10 tekrar X 2 set

3. hafta: 12 tekrar X 1 set; 4. hafta: 12 tekrar X 2 set

5. hafta: 15 tekrar X 1 set; 6. hafta: 15 tekrar X 2 set

### Değerlendirmeler

Hastaların yaş, cinsiyet, boy uzunluğu, vücut ağırlığı, vücut kütle indeksi (VKİ) gibi demografik özellikler veri kayıt formuna kaydedildi.

Diz çevre ölçümü (Ödem değerlendirmesi): Hastaların diz çevresi ödem değerlendirilmesinde diz çevre ölçüm yöntemi kullanıldı, çevre ölçümü mezura ile yapıldı. Ölçümler patella orta noktası, patellanın 5 cm, 10 cm superioru ve inferiorundan alındı ve her bir diz için toplam çevre ölçümü tek bir veri olarak kaydedildi (16).

Eklem hareket açıklığı (EHA): Aktif ve pasif diz fleksiyon/ekstansiyon hareket açıklıkları evrensel gonyometre kullanılarak ölçüldü. Ölçümlerden diz fleksiyonu yüzükoyun yatış pozisyonunda, ekstansiyonu ise oturma pozisyonunda ölçüldü. Ölçümler 3 kez tekrarlandı ve en yüksek değer kaydedildi (17).

*Ağrı şiddetinin değerlendirmesi: Hastaların istirahat ve aktivite (yürüme) sırasındaki ağrı şiddetleri Görsel* Analog Skala (GAS) kullanılarak belirlendi. Ölçüm için yatay olarak iki uçtan sabitlenmiş ve 0-10 cm aralığında rakamların olmadığı bir cetvel kullanıldı. Her iki dizdeki istirahat ve aktivite ağrısı ayrı ayrı işaretlenmesi istenmesine rağmen hastalar her iki dizde de benzer ağrı hissettiklerini belirttiler. Bu nedenle sağ ve sol diz istirahat ağrı şiddeti ortalaması tek veri ve aktivite ağrı şiddeti ortalaması tek veri olarak kaydedildi (18).

*Fonksiyonel durum değerlendirmesi:* Türkçe geçerlilik ve güvenirlilik çalışması Tüzün ve diğ. tarafından yapılan "Western Ontario and McMaster Universities Arthritis Index (WOMAC) ölçeği" kullanıldı (19). Ölçek içindeki değerlendirmelerin tamamının yapılabilmesi için WOMAC ölçeği 7. haftadaki son değerlendirmede yapıldı. Osteoartrit için geliştirilen ve Türkçe versiyonu olan bu ölçek ağrı şiddeti, eklem sertliği ve fiziksel fonksiyon olmak üzere üç alt başlıkta 24 soruyu içermektedir. Her bir soru Likert skalasına göre 0=yok, 1=hafif, 2=orta, 3=şiddetli, 4=çok şiddetli kabul edilerek puanlanır ve her bir bölümün puanı kendi içinde hesaplanır. Toplam puan 0 ile 100 arasında değişir, yüksek puanlar ağrı ve sertlikte artışı, fiziksel fonksiyonda bozulmayı gösterir.

### İstatistiksel analiz

Araştırmada elde edilen verilerin analizi SPSS 20.0 for Windows programı (IBM Corp. Armonk, New York, ABD) kullanılarak yapıldı. Bağımlı ve bağımsız değişkenlerin tanımlayıcı istatistikleri frekans değerleriyle gösterildi, ortalama değerler ve standart sapma değerleri verildi. Değişkenlerin normal dağılıma uygunluğunu belirlemek için Shapiro-Wilk testi kullanıldı. Çoğu değişkenin normal dağılıma uymadığı görüldüğünden parametrik olmayan testler kullanıldı. Gruplar arası ölçümlerdeki farkları belirlemek için *Mann-Whitney U Testi* yapıldı ve anlamlılık düzeyi 0,05 kabul edildi. Bağımlı gruplarda tekrarlanan ölçümleri karşılaştırmak için *Friedman Varyans Analizi* kullanıldı. Elde edilen istatistiksel sonuçlarla ortaya çıkan anlamlı farkın hangi ölçümlerden kaynaklandığını belirlemek için *Bonferronni düzeltmeli Wilcoxon İşaretli Sıralar Analizi* yapıldı ve düzeltme sonucu elde edilen anlamlılık düzeyi 0,05:3 = 0,0167 olarak kabul edildi.

## SONUÇLAR

Çalışmamız özel bir hastanenin Ortopedi ve Travmatoloji bölümünde bilateral total diz protezi uygulaması yapılan toplam 36 hasta ve 72 diz ile tamamlandı. Araştırmaya katılan 36 hastanın %22'si erkek, %78'i kadındı. Çalışmaya dahil edilen hastaların demografik özellikleri karşılaştırıldığında cinsiyet dışında her iki grubun benzer olduğu ve aralarında istatistiksel olarak anlamlı fark olmadığı belirlendi (p>0,05) (Tablo 1).

Her iki grupta hastaların ağrı şiddeti ve eklem ha-

**Tablo 1.** Katılımcıların Demografik Özellikleri

| | | KKZE n (%) | KG n (%) | p |
|---|---|---|---|---|
| **Cinsiyet** | K | 11 (30,5) | 17 (47,2) | **0,018*** |
| | E | 7 (19,4) | 1 (2,7) | |
| | | **Ort ± SS (Min – Maks)** | **Ort ± SS (Min – Maks)** | |
| **Yaş (yıl)** | | 66,22 ± 6,46 (57,0 – 77,0) | 64,22 ± 7,16 (51,0 – 79,0) | 0,295§ |
| **Boy uzunluğu (m)** | | 1,64 ± 0,10 (1,50 – 1,85) | 1,60 ± 0,06 (1,50 – 1,75) | 0,181§ |
| **Vücut Ağırlığı (kg)** | | 85,44 ± 13,99 (70,00 – 117,00) | 84,89 ± 13,72 (60,00 – 120,00) | 0,824§ |
| **VKİ (kg/m²)** | | 31,70 ± 4,75 (26,45 – 45,70) | 33,13 ± 5,01 (24,22 – 42,19) | 0,235§ |

*: $x^2$ Testi, §: Mann-Whitney U Testi, KKZE: Kapalı Kinetik Zincir Egzersiz Grubu, KG: Kontrol Grubu,

VKİ: Vücut Kütle İndeksi, Ort: Aritmetik Ortalama, SS: Standart Sapma

reket açıklıklarına ait başlangıç ölçümlerinin (ameliyat sonrası 2. hafta başında) benzer olduğu, aradaki farkın istatistiksel olarak anlamlı olmadığı belirlendi (p>0,05) (Tablo 2).

## Grup içi ölçümlerin karşılaştırılması

### KKZE grubu

KKZE grubu hastaların hem istirahat hem de aktivite ağrı şiddeti ölçümleri arası farklarda istatistiksel

**Tablo 2.** KKZE ve Kontrol Grubu (KG)'nun Ağrı Şiddeti, Diz EHA, Ödem Başlangıç Ölçümlerinin Karşılaştırılması

| | KKZE Ort ± SS (Min – Maks) | KG Ort ± SS (Min – Maks) | Mann-Whitney-U P |
|---|---|---|---|
| **Ağrı Şiddeti (GAS)** | | | |
| **İstirahat** | 2,50 ± 2,75 (0 – 9,00) | 2,61 ± 3,11 (0 – 8,00) | 0,734 |
| **Aktivite** | 2,39 ± 2,03 (0 – 6,00) | 2,28 ± 2,63 (0 – 8,00) | 0,685 |
| **Sağ Diz Ödem (cm)** | 236,61 ± 16,80 (207,00 – 272,50) | 259,13 ± 24,64 (215,50 – 341,50) | **0,040** |
| **Sol Diz Ödem (cm)** | 239,75 ± 20,178 (208,00 – 276,00) | 258,08 ± 23,51 (211,50 – 348,00) | **0,018** |
| **Sağ Diz Fleksiyonu (°)** | | | 0,318 |
| **Aktif** | 76,17 ± 14,61 (55,00 – 100,00) | 70,22 ± 15,67 (42,00 – 95,00) | 0,127 |
| **Pasif** | 83,89 ± 11,55 (70,00 – 102,00) | 76,83 ± 15,16 (50,00 – 100,00) | |
| **Sol Diz Fleksiyonu (°)** | | | 0,228 |
| **Aktif** | 76,39 ± 11,67 (52,00 – 98,00) | 69,67 ± 15,55 (40,00 – 93,00) | 0,246 |
| **Pasif** | 85,33 ± 10,29 (65,00 – 105,00) | 79,17 ± 13,95 (52,00 – 100,00) | |
| **Sağ Diz Ekstansiyonu (°)** | | | 0,307 |
| **Aktif** | -15,17 ± 5,90 (-30,00 – -5,00) | -13,28 ± 6,37 (-30,00 – -5,00) | 0,389 |
| **Pasif** | -10,17 ± 4,99 (-22,00 – -3,00) | -8,61 ± 5,93 (-22,00 – 0) | |
| **Sol Diz Ekstansiyonu (°)** | | | 0,737 |
| **Aktif** | -13,83 ± 5,30 (-28,00 – -5,00) | -13,11 ± 6,57 (-30,00 – 0) | 0,699 |
| **Pasif** | -9,11 ± 4,43 (-20,00 – -2,00) | -8,39 ± 5,17 (-22,00 – 0) | |

GAS: Görsel Analog Skala, Ort: Aritmetik Ortalama, SS: Standart Sapma

**Tablo 3.** KKZE Grubu'nun Ağrı Şiddeti, Ödem ve Diz EHA Tekrarlı Ölçümlerinin Karşılaştırılması

| | | | Başlangıç Ölçümü Ort ± SS (Min – Maks) | 2. Ölçüm Ort ± SS (Min – Maks) | 3.Ölçüm Ort ± SS (Min – Maks) | Friedman Varyans Analizi P |
|---|---|---|---|---|---|---|
| **Ağrı şiddeti (GAS)** | | | | | | |
| **İstirahat** | | | 2,50 ± 2,75 (0 – 9,00) | 4,11 ± 2,97 (0 – 10,00) | 3,39 ± 3,18 (0 – 9,00) | 0,057 |
| **Aktivite** | | | 2,39 ± 2,03 (0 – 6,00) | 1,94 ± 1,64 (0 – 6,00) | 1,89 ± 2,51 (0 – 8,00) | 0,645 |
| **Diz Çevre Ölçümü (cm)** | | | | | | |
| **Sağ** | | | 238,47 ± 23,04 (203,5-297) | 231,30 ± 18,77 (200,5-268) | 224,08 ± 19,23 (192,5-262) | **0,001** |
| **Sol** | | | 239,33 ± 22,37 (212,5-297) | 231,25 ± 17,20 (202-266) | 224,13 ± 19,04 (190,5-252) | **0,001** |
| **Diz Fleksiyon(°)** | **Aktif EHA** | **Sağ** | 76,17 ± 14,61 (55,00 – 100,00) | 91,33 ± 11,39 (65,00 – 110,00) | 103,44 ± 9,28 (85,00 – 120,00) | **0,001** |
| | | **Sol** | 76,39 ± 11,67 (52,00 – 98,00) | 92,11 ± 11,46 (58,00 – 110,00) | 105, 11 ± 10,31 (80,00 – 124,00) | **0,001** |
| | **Pasif EHA** | **Sağ** | 83,89 ± 11,55 (70,00 – 102,00) | 97,72 ± 11,04 (70,00 – 115,00) | 110,44 ± 7,51 (100,00 – 125,00) | **0,001** |
| | | **Sol** | 85,33 ± 10,29 (65,00 – 105,00) | 99, 11 ± 11,02 (65,00 – 115,00) | 110,56 ± 9,26 (90,00 – 126,00) | **0,001** |
| **Diz Ekstansiyon (°)** | **Aktif EHA** | **Sağ** | -15,17 ± 5,90 (-30,00 – -5,00) | -13,11 ± 6,09 (-25,00 – -2,00) | -9,33 ± 5,81 (-20,00 – 0) | **0,001** |
| | | **Sol** | -13,83 ± 5,30 (-28,00 – -5,00) | -11,06 ± 4,81 (-22,00 – -5,00) | -7,06 ± 5,68 (-22,00 – 0) | **0,001** |
| | **Pasif EHA** | **Sağ** | -10,17 ± 4,99 (-22,00 – -3,00) | -7,67 ± 6,01 (-20,00 – 0) | -4,39 ± 4,62 (-12,00 – 0) | **0,001** |
| | | **Sol** | -9,11 ± 4,43 (-20,00 – -2,00) | -6,50 ± 5,20 (-20,00 – 0) | -3,17 ± 5,20 (-30,00 – 0) | **0,001** |

GAS: Görsel Analog Skala, EHA: Eklem Hareket Açıklığı, Ort: Aritmetik Ortalama, SS: Standart Sapma

anlamlılık bulunmadı (p>0,05). Diz çevresi ödemde ise her iki ekstremitede de 2. ve 3. ölçümde başlangıç ölçümüne göre istatistiksel olarak anlamlı azalma vardı (p<0,05) (Tablo 3).

KKZE grubundaki hastalarda her iki diz hem aktif hem de pasif diz fleksiyon ve ekstansiyon hareket açıklığı ölçümleri başlangıç ölçümüne göre istatistiksel olarak anlamlı artış görüldü (p<0,05). Varyans analizine göre anlamlı çıkan çevre ölçümleri ve EHA ölçümlerinin post-hoc analizleri yapıldı. Sonuç olarak 2. ve 3. ölçümde kaydedilen verilerin başlangıçtaki verilere göre olan artışlarının istatistiksel olarak anlamlı olduğu belirlendi (p<0,0167) (Tablo 3).

### Kontrol grubu

KG hastalarının istirahat ve aktivite ağrı şiddetlerinde ölçümler arası karşılaştırmada istatistiksel olarak anlamlı fark vardı (p<0,05). Post-hoc analizde KKZE grubuna benzer şekilde ağrı şiddeti başlangıç ölçüme göre 2. ölçümde arttı ancak 3. ölçümde 2. ölçüme göre azaldı (p<0,0167) (Tablo 6). Diz çevresi ödem ölçümünde ise başlangıç ölçümüne göre 2. ve 3. ölçümlerde azalma oldu (p<0,05) ve post-hoc analizde 1. ve 2. ölçümler ile 2. ve 3. ölçümler arası karşılaştırmalarda farklar istatistiksel olarak anlamlı idi (p<0,0167) (Tablo 4).

KG hastalarının her iki diz hem aktif hem de pasif diz fleksiyon ve ekstansiyon EHA ölçümleri başlangıç ölçümüne göre anlamlı olarak arttı (p<0,005) (Tablo 4). Ayrıca bu anlamlı değişimin hangi iki ölçüm farkından kaynaklandığını belirlemek için yapılan post-hoc analizde 1. ve 2. ölçümler ile 2. ve 3. ölçümler arası karşılaştırmalarda EHA değerlerinin arttığı ve ölçümler arası farkların da istatistiksel olarak anlamlı olduğu görüldü (p<0,0167).

### Gruplar arası ölçüm farklarının (deltalarının-Δ) karşılaştırılması

KKZE programı ile standart egzersiz programının etkilerini karşılaştırmak için grupların egzersiz programlarına başlamadan önceki ve egzersiz programı tamamlandıktan sonraki (3. Ölçüm – Başlangıç) farkları (Δ) alındı. Farkların (Δ) gruplar arası karşılaştırılmasında, istirahat ve aktivite ağrı şid-

**Tablo 4.** Kontrol Grubu'nun Ağrı Şiddeti, Ödem ve Diz EHA Tekrarlı Ölçümlerinin Karşılaştırılması

| | | | Başlangıç ölçümü Ort ± SS (Min – Maks) | 2. Ölçüm Ort ± SS (Min – Maks) | 3. Ölçüm Ort ± SS (Min – Maks) | *Friedman Varyans Analizi* p |
|---|---|---|---|---|---|---|
| **Ağrı şiddeti (GAS)** | | | | | | |
| **İstirahat** | | | 2,61 ± 3,11 (0 – 8,00) | 4,50 ± 3,55 (0 – 10,00) | 2,17 ± 3,26 (0 – 9,00) | **0,024** |
| **Aktivite** | | | 2,28 ± 2,63 (0 – 8,00) | 2,56 ± 2,04 (0 – 7,00) | 0,94 ± 1,16 (0 – 4,00) | **0,013** |
| **Diz Çevre Ölçümü (cm)** | | | | | | |
| **Sağ** | | | 259,14 ± 24,64 (217 – 310) | 244,39 ± 25,46 (212 – 301) | 238,47 ± 23,08 (203,5 – 297,5) | **0,001** |
| **Sol** | | | 258,08 ± 23,51 (211,5 – 312) | 246,08 ± 24,32 (214 – 307) | 239,33 ± 22,37 (212 – 297) | **0,001** |
| **Diz Fleksiyon (°)** | **Aktif EHA** | **Sağ** | 70,22 ± 15,67 (42,00 – 95,00) | 88,39 ± 14,42 (52,00 – 112,00) | 97,78 ± 14,42 (70,00 – 115,00) | **0,001** |
| | | **Sol** | 69,67 ± 15,55 (40,00 – 93,00) | 87,72 ± 15,00 (55,00 – 110,00) | 97,72 ± 13,71 (65,00 – 115,00) | **0,001** |
| | **Pasif EHA** | **Sağ** | 76,83 ± 15,16 (50,00 – 100,00) | 95,39 ± 14,56 (60,00 – 115,00) | 103,72 ± 14,00 (75,00 – 120,00) | **0,001** |
| | | **Sol** | 79, 17 ± 13,95 (52,00 – 100,00) | 93,67 ± 14,95 (60,00 – 115,00) | 103,89 ± 14,00 (70,00 – 120,00) | **0,001** |
| **Diz Ekstansiyon (°)** | **Aktif EHA** | **Sağ** | -13,28 ± 6,37 (-30,00 – -5,00) | -10,78 ± 5,08 (-20,00 – -4,00) | -7,28 ± 4,11 (-18,00 – -2,00) | **0,001** |
| | | **Sol** | -13,11 ± 6,57 (-30,00 – 0) | -11,83 ± 5,12 (-20,00 – -4,00) | -8,00 ± 4,52 (-18,00 – -2,00) | **0,003** |
| | **Pasif EHA** | **Sağ** | -8,61 ± 5,93 (-22,00 – 0) | -7,72 ± 6,20 (-22,00 – 0) | -3,00 ± 3,54 (-10,00 – 0) | **0,001** |
| | | **Sol** | -8,39 ± 5,17 (-22,00 – 0) | -7,67 ± 5,10 (-18,00 – 0) | -2,39 ± 3,27 (-10,00 – 0) | **0,001** |

GAS: Görsel Analog Skala, Ort: Aritmetik Ortalama, SS: Standart Sapma, EHA: Eklem Hareket Açıklığı

detindeki azalma, diz eklemi pasif/aktif hareketteki artışlar ve ödemdeki azalma her iki grupta benzerdi ve gelişmeler açısından grupların birbirine üstünlüğü yoktu (p>0,05) (Tablo 5). Son değerlendirmede elde edilen WOMAC alt skorları ve toplam skorlar açısından iki grup arasında fark yoktu (p>0,05) (Tablo 5).

## TARTIŞMA

TDP uygulanan hastalarda ameliyat sonrası erken dönemde (7. ile 10. günlerde) ilerleyici dirençli egzersizlerin hastalar tarafından tolere edilebildiği bilinmektedir (20). Ancak vücut ağırlığı ile yapılan, fonksiyonel hareketleri içeren (çömelme, oturup kalkma, basamak inip-çıkma gibi) kapalı kinetik zincir pozisyonundaki egzersizlerin erken dönemde aynı şekilde güvenli olup olmadığı veya akut dönem semptomlarını arttırıp arttırmadığı (ağrı, efüzyon, hareket açıklığı gibi) ile ilgili kesin veriler bulunmamaktadır. Bu çalışma ameliyat sonrası 2. haftada başlanan, ilerleyici dirençli egzersiz programı olarak planlanan ve toplam 6 hafta boyunca uygulanan KKZE programının ameliyat sonrası erken dönem semptomları (ağrı, ödem, eklem hareket açıklığı) üzerine etkilerini belirlemek ve standart egzersiz programına göre etkilerini karşılaştırmak amacıyla yapıldı. Çalışmadan elde ettiğimiz sonuçlarımız erken dönemde deneyimli bir fizyoterapist kontrolünde uygulanan KKZE programının, standart egzersiz programında yer alan egzersizler kadar iyi tolere edilebildiğini ancak erken dönem semptomlar üzerine etkileri açısından standart egzersiz programı ile karşılaştırıldığında ek bir üstünlüğü olmadığını gösterdi.

Diz ekleminde travma veya cerrahi işleme bağlı akut inflamasyon ve proliferasyon dönemlerinde en önemli semptomlar ağrı, ödem/efüzyon, eklem hareket açıklığında yetersizlikler ve fonksiyonel kayıplardır (20,21). Bu dönemde iyileşmekte olan dokuları korumak, semptomları arttırmadan fonksiyonel iyileşmeyi sağlamak fizyoterapi uygulamalarının en önemli amaçlarındandır (3). Bu amaçlar doğrultusunda uygulanan egzersiz programlarına bakıldı-

**Tablo 5.** KKZE ve KG'nun Başlangıç Ölçümleri ile 3. Ölçümleri Arasındaki Farkların (Δ) ve WOMAC Skorlarının Karşılaştırılması

| | KKZE<br>Ort ± SS<br>(Min – Maks) | KG<br>Ort ± SS<br>(Min – Maks) | Mann-Whitney U<br>P |
|---|---|---|---|
| **Ağrı Şiddeti (GAS)** | | | |
| **İstirahat** | 1,61 ± 2,00<br>(1 – 6) | 1,72 ± 3,00<br>(4 – 8) | 0,833 |
| **Aktivite** | 1,72 ± 1,70<br>(1 – 5) | 1,73 ± 2,60<br>(2 – 8) | 0,661 |
| **Diz Çevre Ölçümü (cm)** | | | |
| **Sağ** | 12,52 ± 6,79<br>(2,5 – 27,5) | 16,56 ± 19,13<br>(2,5 – 30,5) | 0,060 |
| **Sol** | 15,61 ± 13,10<br>(1 – 60,5) | 18,75 ± 14,90<br>(1 – 66) | 0,334 |
| **Diz Fleksiyon EHA (°)** | | | |
| **(Sağ) Aktif** | 27,28 ± 12,76<br>(2 – 50) | 27,55 ± 15,44<br>(2 – 65) | 0,949 |
| **(Sağ) Pasif** | 26,55 ± 10,26<br>(10 – 45) | 26,88 ± 14,80<br>(1 – 55) | 0,962 |
| **(Sol) Aktif** | 28,72 ± 12,05<br>(5 – 49) | 28,05 ± 12,44<br>(6 – 50) | 0,849 |
| **(Sol) Pasif** | 25,22 ± 12,11<br>(5 – 43) | 24,72 ± 11,81<br>(4 – 43) | 0,862 |
| **Diz Ekstansiyon EHA (°)** | | | |
| **(Sağ) Aktif** | 6,67 ± 7,19<br>(0 – 28) | 6,16 ± 5,66<br>(0 – 19) | 0,924 |
| **(Sağ) Pasif** | 6,33 ± 5,46<br>(0 – 22) | 5,72 ± 5,10<br>(0 – 15) | 0,811 |
| **(Sol) Aktif** | 7,33 ± 6,45<br>(3 – 26) | 6,17 ± 6,05<br>(0 – 20) | 0,536 |
| **(Sol) Pasif** | 6,50 ± 4,90<br>(0 – 20) | 7,00 ± 4,01<br>(0 – 14) | 0,577 |
| **WOMAC Skoru** | | | |
| **Ağrı Şiddeti** | 3,22 ± 1,73<br>(0 – 6,00) | 3,11 ± 3,12<br>(0 – 11,00) | 0,461 |
| **Eklem sertliği** | 1,89 ± 1,49<br>(0 – 5,00) | 2,17 ± 1,50<br>(0 – 6,00) | 0,669 |
| **Fiziksel Fonksiyon** | 8,06 ± 6,58<br>(0 – 27,00) | 8,00 ± 7,69<br>(0 – 26,00) | 0,612 |
| **Toplam Skor** | 13,39 ± 8,13<br>(1,00 – 31,00) | 13,06 ± 9,87<br>(1,00 – 37,00) | 0,812 |

GAS: Görsel Analog Skala, EHA: Eklem Hareket Açıklığı, Ort: Aritmetik Ortalama, SS: Standart Sapma

ğında sıklıkla açık kinetik pozisyonda veya vücut ağırlığı taşıtılmadan yapılan egzersizlerin verildiği görülmektedir. Erken dönemde vücut ağırlığı ile kapalı kinetik pozisyondaki egzersizler ise sıklıkla ön çapraz bağ yaralanmaları/rekonstrüksiyonlarındaki fizyoterapi protokollerinde yer almaktadır (13,15). Bu egzersizler ön çapraz bağ rekonstrüksiyonu sonrası erken dönemde ağrı ve ödemi arttırabileceği ve buna bağlı kuadriseps kas aktivasyonunu geciktirebileceği endişesiyle en erken 3. veya 4. haftalarda başlanmaktadır (13).

TDP ameliyatı geçiren hastalara ameliyat gününden itibaren hastane içinde ve 1. hafta fizyoterapi programlarında standart uygulamalar olan akut inflamasyona yönelik soğuk paket, bandaj, elevasyon, ayak bileği pompalama egzersizleri ile SPH, izometrik egzersizler ve aktif yardımlı/aktif kalça - diz egzersizleri uygulanmaktadır. Aynı zamanda standart program kapsamında hastalara taburculuğa kadar yürüteç/koltuk değneği ile yürüme eğitimi ve merdiven eğitimi verilmektedir (22-26). Diğer taraftan literatürde yapılan çalışmalar incelendiğinde 2. haftadan itibaren TDP hastalarına verilen egzersiz programlarında bazı farklılıkların olduğu görülmektedir (3,20,21)

Özellikle son yıllardaki çalışmalar, TDP uygulanan

hastaların fonksiyonel yetersizliklerinin uzun süre devam etmesi nedeniyle 7-10. günden itibaren yüksek dirençli egzersizlerin verilebileceğini destekler niteliktedir (20). Konuyla ilgili Bade ve diğ. yaptıkları çalışmada ameliyat sonrası 7. günde başlanan gözetimli dirençli egzersizlerin hastalar tarafından tolere edilebildiği, ancak geç dönem fonksiyonel sonuçlara ek bir katkı sağlamadığı gösterilmiştir (3). Jakobsen ve diğ. de TDP sonrası fast-track protokolünü uygulayarak dirençli leg-press ve diz ekstansiyon egzersizlerine 7-10. günlerde başlamışlar, benzer şekilde hastalar dirençli egzersizleri erken dönemde iyi tolere edebiliyorken geç dönemde fonksiyonel sonuçlara dirençli egzersizlerin üstünlüğünün olmadığını belirtmişlerdir (20). Farklı dirençli egzersizlerin uygulandığı her iki çalışmada da TDP hastalarına verilen dirençli egzersizlerin vücut ağırlığı ile yapılan kapalı kinetik pozisyondaki kinetik zincir egzersizlerini içermediği görülmektedir.

Çalışmamızda mevcut çalışmalardan farklı olarak vücut ağırlığı ile GYA benzeri ilerleyici kapalı kinetik pozisyondaki egzersizlerden (oturup-kalkma, çömelme, basamak inip-çıkma, öne hamle gibi) oluşturulan program uygulanmıştır. Egzersizlere 7-8. gün başlanmış ve toplam 6 hafta boyunca uygulanmıştır. İlk günden itibaren bu alanda deneyimli bir fizyoterapist tarafından düzenli kontrollerle takip edilen egzersiz programı, hastaların semptomlarını arttırmamıştır. Egzersiz programının 4. haftasında yapılan değerlendirmede istirahat ve aktivite ağrı şiddetlerinde egzersiz eğitimi öncesi değerlendirmeye göre artış gözükse de bu artışın olası nedeni ilk değerlendirmede hastaların ameliyat sonrası başlanan ilaç tedavisinin (antibiyotik, nonsteroid antienflamatuar ve ağrı kesici ilaçlar) standart olarak ilk 10 gün süresince devam etmesi ve ilk değerlendirmenin bu döneme denk gelmesidir. Kontrol grubunda da ağrının benzer şekilde artması bu görüşü destekler niteliktedir.

Bilateral TDP uygulanan hastalarda uyguladığımız çalışmada sonuçlarımız vücut ağırlığı ile yapılan KKZE programının tolere edilebileceğini gösterse de standart egzersizlere göre semptomların iyileştirilmesinde daha üstün etkilere neden olacağı hipotezimizi desteklememiştir. Açık kinetik pozisyondaki ilerleyici dirençli egzersizlerden oluşan programı uyguladığımız kontrol grubu hastalarda da ağrı şiddeti, dizin sertliği (WOMAC-sertlik skoru), diz çevresi ödem ve EHA sonuçları KKZE grubu ile benzer bulunmuş ve bu durumun birkaç faktöre bağlı olabileceğini düşünülmüştür.

Bunlardan ilki ilerleyici dirençli egzersizlerin doğasında olan gelişmelerdir. Çalışmamızda hem KKZE grubu hem de standart egzersiz grubunda egzersizler direnç, seans sayısı, set sayısı ve tekrar sayıları ile ilerletilmiştir. İlerleyici dirençli egzersizlerin hem kas dokuda hem de nöromuskuler sistemde meydana getirdiği kas hipertrofisi, nöral adaptasyonun artması, kas kuvvetinin artması gibi olumlu gelişmelerin, egzersizlerin tipinden bağımsız her iki grupta da haftalık düzenli kontrollerle hastaların programı aksatmadan yapmasına bağlı olduğu düşünülmektedir (27,28). Sadece kapalı kinetik pozisyonlardaki egzersizlerden oluşan bir programın TDP hastalarda çalışıldığı başka bir çalışmaya rastlanılmadığı için, içinde vücut ağırlığı olmaksızın verilen KKZE programının uygulandığı çalışma sonuçları ile sonuçlarımız tartışılmaya çalışılmıştır.

Hendersen ve diğ. meta analiz çalışmasında TDP sonrası uygulanan rehabilitasyon programlarının standardize edilebilmesi için çalışmaların hala yetersiz olduğunu belirtmişlerdir (7). Erken dönemde yüksek şiddetli dirençli egzersiz programı uygulayan az sayıda çalışmaya rastlanmıştır. Husby ve diğ. çalışmalarında TDP sonrası erken dönemde (ameliyat sonrası 7-10. günlerde) yüksek şiddetli açık kinetik zincir egzersizleri (AKZE) ve KKZE egzersizlerden oluşan programı standart fizyoterapi programı ile karşılaştırmışlardır. 8 hafta uyguladıkları programın değerlendirmesini ameliyat sonrası 10. hafta ve 12. ayda yapmışlar, kas kuvvetinde erken dönemde dirençli egzersizlerin daha fazla etkisi olabileceğini ancak ağrının azaltılması ve fonksiyonellikte hem kısa dönem hem de uzun dönem etkilerinin standart fizyoterapi ile benzer olduğunu bulmuşlardır (15). Jakobsen ve diğ. de benzer şekilde 50-60 dakikalık fast-track eğitimden sonra 7 haftalık erken kombine (eksentrik, konsantrik, izometrik dirençli egzersiz, germe egzersizleri) egzersiz programı ile standart fizyoterapi programını karşılaştırmışlar, ağrı ve fonksiyonel performans üzerine hem kısa dönem hem de uzun dönem etkilerin benzer olduğunu belirtmişlerdir (20). Bade ve diğ. ise 7. günde bir gruba yüksek şiddetli, bir gruba düşük şiddetli dirençli egzersizleri açık ve kapalı kinetik pozisyonda uygulamışlar ve sonuçta diğer

çalışmalara benzer şekilde erken yüksek şiddetli egzersizlerin ek bir üstün etkisi olmadığını belirlemişlerdir (3). Tüm çalışmalarda ortak görüş erken dönem yüksek dirençli egzersizlerin TDP'li hastalar tarafından tolere edildiği, ancak ek bir etki farkı ortaya koyamadığıdır. Bahsi geçen ve ilgili çalışmalarda ve bizim çalışmamızda (vücut ağırlığı ile yapılan KKZE programının) benzer sonuçların çıkmasında olası ikinci faktör aktif kas inhibisyonunun (AKİ) varlığıdır (29-32). TDP uygulamalarından sonra yaklaşık %85 hastada AKİ'nin görülebildiği ve bu durumun da 1. ayda %72 oranlarında devam ettiği gösterilmiştir (3,7). Araştırmacılar özellikle diz kaslarında görülen AKİ'nin, egzersiz şiddeti veya tipi ne olursa olsun egzersize bağlı gelişmeleri sınırlayabileceği veya benzer etkiye neden olabileceğini belirtmişlerdir. AKİ'nin varlığının sonuçlarda etkili olabileceği çalışmamız içinde düşünülse bile böyle bir değerlendirme yapmadığımız için benzer sonuçlar için faktörlerden biri olarak AKİ'yi iddia etmek doğru bulunmamıştır.

6 hafta ilerleyici olarak uygulanan KKZE programının TDP sonrası görülen semptomların iyileştirilmesinde veya fonksiyonel durumun standart fizyoterapi ile benzer çıkmasında diğer bir faktör hasta, hekim ve fizyoterapist uyumunun iyi olmasından kaynaklanabileceğidir. Yapılan çalışmalarda kalça ve diz artroplasti uygulamalarından sonraki süreçte özellikle taburculuk sonrası rehabilitasyon uygulamalarındaki başarıda ekip çalışmasının önemi, uyumu ve buna bağlı hastanın tedaviye katılım ve sürdürebilirliğinde büyük etkisi olduğu gösterilmiştir (3,7,31,32). Çalışmamıza aynı cerrahi ekip tarafından bilateral TDP uygulanan hastalar dahil edilmiş ve egzersiz programı bu alanda deneyimli aynı fizyoterapist tarafından uygulanmıştır. Hastaların her hafta kontrollere çağrılması, haftalık egzersiz yapma günlerinin düzenli kontrol edilmesi, her hafta egzersizlerinin ilerletilmesine ait yeni programın birebir ilgilenilerek öğretilmesi, ayrıca da hastaların kontroller dışında hekimine ve fizyoterapistine kolayca ulaşabilmesi tedaviye olan uyumun sağlanmasında büyük rol oynamıştır. Bu durum hem ilerleyici dirençli KKZE hem de ilerleyici dirençli standart egzersizlerin hastalar tarafından düzenli yapılmasını sağlamıştır. Semptomların her iki grupta da iyileşmesi ve aynı zamanda gelişmelerin benzer olması, çalışma ekibi ve hasta uyumunun iyi olmasına, her iki egzersiz programının düzenli yapılmasına, egzersiz progresyonlarının da tamamlanmasına ve gelişmelerin son değerlendirmede de devam etmesine neden olmuştur.

Çalışmamızda bazı limitasyonlar bulunmaktadır. Çalışmanın yapıldığı merkezdeki olanakların sınırlılığı nedeniyle hastalarda kasa ait (kas kuvveti, aktif kas inhibisyon varlığı gibi) bazı değerlendirmeler ile alan yetersizliği nedeniyle performansa dayalı bazı testlerin (merdiven inip çıkma testi, 6 dakika yürüme testi gibi) yapılamaması çalışmanın önemli limitasyonlarındandır. WOMAC değerlendirmesinin yalnızca 7. haftada yapılıp tedavi başlangıcında grupların ilk durumu bilinmeden sadece son değerlerin karşılaştırılmış olması bir diğer limitasyondur. Çalışmanın başında uzun dönem takip planlanmasına rağmen araştırmacının tayin nedeniyle başka bir şehre taşınmasına bağlı sonraki takiplerin yapılamaması da çalışmamızın limitasyonlarından biridir.

Diğer taraftan çalışmamızın güçlü yanı erken dönemde dirençli KKZE programının uygulandığı ilk çalışma olmasıdır. Çalışmamız ayrıca erken dönem dirençli açık kinetik zincir egzersizleri gibi günlük yaşam aktivitelerine benzer oluşturulan dirençli KKZE'lerinin de TDP'li hastalar tarafından cerrahi sonrası erken dönemde semptomları arttırmadan kolay tolere edilebileceğini göstermiştir.

Çalışmada uyguladığımız KKZE programı veya kısa dönemde elde ettiğimiz sonuçlar, bu alanda araştırmacı veya klinikte çalışan fizyoterapistler için referans olabilecek özelliktedir. Ancak bilateral veya tek taraflı TDP'li hastaların fizyoterapi programına KKZE egzersizlerinin erken dönemde eklenmesi veya rutin program içinde yer alabilmesi için ileriki çalışmalara ihtiyaç vardır. Tek veya çift kör, uzun dönem takip sonuçlarını içeren çalışmalar ile daha kesin sonuçlar ortaya konulabileceği düşünülmüştür. Ayrıca gelecekte performansa dayalı testlerin de yer aldığı çalışmaların yapılması ile KKZE egzersizlerin etkinliği daha kapsamlı ortaya konulabilir.

***Destekleyen Kuruluş:*** Destek alınan kuruluş bulunmamaktadır.

***Çıkar Çatışması:*** Yok.

***Yazar Katkıları:*** Fikir/Kavram- EKC, MT, NG; Tasarım- EKC, MT, NG; Denetleme/Da- nışmanlık; EKC, MT, NG, Kaynaklar ve Fon Sağlama- EKC, MT, NG; Materyaller- EKC, MT, NG; Veri Toplama ve/veya İşleme- EKC, MT, NG; Analiz ve/veya Yorumlama-

EKC, MT, NG; Literatür Taraması- EKC, MT, NG; Makale Yazımı- EKC, MT, NG; Eleştirel İnceleme- EKC, MT, NG.

***Açıklamalar:*** Yazı özet ve/veya bildiri şeklinde daha önce sunulmadı.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

2023 34(1)115-124

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# NÖROMUSKÜLER HASTALIKLARDA GÖRÜLEN POSTÜR BOZUKLUĞU İLE HASTALIK ŞİDDETİ, FONKSİYONEL KAPASİTE, GÜNLÜK YAŞAM AKTİVİTELERİ VE DENGE ARASINDAKİ İLİŞKİNİN ARAŞTIRILMASI

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Bu çalışmanın amacı, nöromusküler hastalığa sahip erişkin bireylerde postür bozukluklarını araştırmak ve postür bozukluklarının hastalık şiddeti, fonksiyonel kapasite, günlük yaşam aktiviteleri, denge ve düşme ile ilişkisini belirlemektir.

**Yöntem:** Çalışmaya nöromusküler hastalık tanısı konan ve yaş ortalaması 36,34 ± 14,03 yıl olan 47 hasta dahil edilmiştir. New York Postür Derecelendirme Ölçeği (NYPD) ile genel vücut postürü, fleksible ruler ile torakal kifoz açısı (TKA)- lumbal lordoz açısı (LLA) değerlendirilmiştir. Skolyometre kullanılarak olası skolyoz varlığı ve pelvik asimetri değerlendirilmiştir. Üst Ekstremite (ÜEFS) ve Alt Ekstremite Fonksiyon İndeksi (AEFS) ile hastalık şiddeti, 2 Dakika Yürüme Testi (2DKYT) ile fonksiyonel kapasite, Zamanlı Kalk Yürü Testi (ZKYT) ile denge ve düşme riski, Fonksiyonel Bağımsızlık Ölçeği (FIM) ile günlük yaşam aktiviteleri kaydedilmiştir.

**Sonuçlar:** Postüral deformitelerin değerlendirilmesi sonucunda hastaların NYPD'si ortalamasının 40,24±9,56 olduğu belirlenmiştir. Yapılan ölçümlerde hastaların %46,34'ünde TKA'nın, %24,39'unda ise LLA'nın açısının norm değerlerin dışına çıktığı ve skolyometre ölçümleri sonucunda 30 hastada (%73,2) olası skolyoz varlığı, 11 hastada (%26,8) spinal asimetri olduğu, 27 hastada (%65,9) ise pelvik asimetri olduğu bulunmuştur. NYPD ile ÜEFS, 2DKYT, FIM ve ZKYT arasında istatiksel olarak anlamlı ilişki olduğu belirlenmiştir ($p < 0,05$).

**Tartışma:** Rehabilitasyon programları planlanırken vücut biyomekaniğini etkileyen postüral bozuklukları detaylı değerlendirmenin ve bu değerlendirme sonuçlarına uygun müdahale planları oluşturmanın hastaların günlük yaşam aktivitesi performanslarını, fonksiyonel kapasitelerini, denge ve düşme risklerini olumlu yönde etkileyebileceği düşünülmektedir. Ancak sonuçların genelleştirilebilmesi için daha fazla sayıda hasta ile ve farklı NMH gruplarının dahil edildiği çalışmalara ihtiyaç duyulmaktadır.

**Anahtar Kelimeler:** Nöromusküler Hastalıklar, Omurga Deformiteleri, Skolyoz, Spinal Asimetri

# INVESTIGATION OF THE RELATIONSHIP BETWEEN POSTURE DISORDER AND DISEASE SEVERITY, FUNCTIONAL CAPACITY, ACTIVITIES OF DAILY LIFE AND BALANCE IN NEUROMUSCULAR DISEASES

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** This study was conducted to examine postural problems in adults with neuromuscular diseases, the incidence of these disorders and to determine the relationship of posture problems with disease severity, functional capacity, activities of daily living, balance and falling.

**Methods:** 47 patients diagnosed with neuromuscular disease with a mean age of 36.34 ± 14.03 years were included in the study. General body posture was evaluated with New York Posture Rating Scale (NYPR) and thoracic kyphosis (TKA) - lumbar lordosis angles (LLA) was evaluated with flexible ruler. Possible scoliosis and pelvic asymmetry were evaluated using a scoliometer. Disease severity was measured with the Upper (UEFI) and Lower Extremity Function Index (LEFI), functional capacity with 2 Minute Walk Test (2MWT), and balance and fall risk with the Timed Up and Go Test (TUG), and daily living activities were recorded with Functional Independence Measure (FIM).

**Results:** The evaluation of postural deformities indicated that the mean NYPR of the patients was 40.24±9.56. The angle of kyphosis was observed in 46.34 % of the patients and the angle of the LLA was out of the norm values in 24.39 %. Scoliometer measurements showed that possible scoliosis was found in 30 (73.2%), spinal asymmetry was found in 11 (26.8%), and pelvic asymmetry was found in 27 patients (65.9%). The correlation between NYPR and UEFI, 2MWT, FIM and TUG was statistically significant ($p < 0.05$).

**Conclusion:** When planning rehabilitation programs, it is thought that detailed evaluation of postural disorders affecting body biomechanics and creating intervention plans appropriate to the results of these evaluations may positively affect the patients' performance of daily living activities, functional capacities, balance and fall risks. However, studies with larger numbers of patients and including different NMD groups are needed to generalize the results.

**Key Words:** Neuromuscular Diseases, Spinal Deformities, Scoliosis, Spinal Asymmetry

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***Received:*** *06.10.2022 (Geliş Tarihi)*
***Accepted:*** *26.01.2022 (Kabul Tarihi)*

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## GİRİŞ

Nöromusküler hastalıklar (NMH), kalıtımsal veya sonradan gelişen, ön boynuz motor hücrelerinde, periferik sinirlerde, nöromusküler kavşakta veya kastaki bir anormalliğin neden olduğu heterojen bir grup hastalıktır (1).

Nöromusküler hastalıklarda görülen en önemli bulgu ilerleyici kas kuvvet kaybıdır. Hastalığın prognozunu önemli derecede etkileyen diğer semptomlar ise postüral deformiteler, atrofi, ağrı, yorgunluk, aktivite limitasyonları, solunum problemleri, egzersiz kapasitesinde azalma, eklem limitasyonları ve kontraktürlere kadar gidebilen geniş bir yelpazeyi kapsar (2). Hastalıkta tam iyileşme sağlayan bir tedavi yöntemi henüz yoktur. Literatür incelendiğinde iyi yapılandırılmış bir fizyoterapi programının yavaş ilerleyen NMH'larda kas kuvvet kaybını yavaşlattığı ve hastanın ikincil problemlerinde iyileşme sağladığı gösterilmiştir (2-4).

NMH'larda kas zayıflığı ve bu zayıflığın asimetrik dağılımı omurgada asimetrik yüklenmeye neden olur. Omurgadaki bu durum uzun vadede postüral anomalilere ve deformitelere yol açar, zamanla yapısal hale gelir. Postüral deformiteler doğuştan veya zamanla gelişebilir (5).

Literatür incelendiğinde nöromusküler hastalıklarda postürü inceleyen çalışmaların daha çok Duchenne Musküler Distrofi (DMD), Chatcot-Marie Tooth (CMT) gibi birkaç hastalıkta ve çocuk grubunda yoğunlaştığı göze çarpmaktadır. Yapılan çalışmalarda Distal Konjenital Motor Nöropati'li çocukların dörtte birinde, konjenital motor ve duyusal nöropati veya Chatcot-Marie Tooth'lu çocukların %20'sinden azında skolyoz geliştiği, Konjenital Musküler Distrofi'li çocuklarda spinal kontraktürler ve deformiteler geliştiği bildirilmektedir (5). Nöromusküler hastalık grubunda ortaya çıkan skolyoz, genellikle tüm torasik ve lomber omurgayı kapsayan ve pelvik asimetriyi de içeren geniş C şeklinde eğridir (6). Bu durum vücut biyomekaniğini etkileyebilir ve anormal duruşların ortaya çıkması nihai olarak günlük yaşamı ve işlevselliği etkileyebilir. DMD'li çocuklarda ise pelvik anteversiyon ve kas zayıflığından dolayı kompanzatuar yürüyüş bozuklukları görülmektedir ve bu anormallikleri kompanse etmek için hiperlordoz geliştiği belirtilir. Benzer şekilde Miyotonik Distrofi Tip 1 (MD1)'li çocuklarda kalça dislokasyonu, skolyoz gibi problemler yaygın olarak görülmektedir (5). Postüral deformitelerin, başlangıç yaşı ve ilerleyişi her hastalık grubunda farklılık gösterir. Ancak hemen her NMH grubunda görülen postüral deformitelerin hastalık ile ilişkili denge, düşme ve fonksiyonel kapasite gibi semptomlarla ilişkisi araştırılmamıştır.

Literatürde erişkin NMH gurunda postüral deformitelerle ilgili çok az yayın mevcuttur (7). Oysaki özellikle omurga postürünü korumak ve varsa deformiteleri kontrol altında tutmak hastalığın seyrinde önemli bir yer tutmaktadır. Özellikle erişkin NMH'a sahip bireylerde postürün değerlendirilmesi ve yönetimi eksik kalmakta, bu nedenle hastaların optimal tıbbi ve rehabilite edici hizmetleri almasında yetersizlik açığa çıktığı öngörülmektedir (7-11). Nöromusküler hastalıkların bazı tiplerinde skolyoz gelişimi, lordoz ve kifoz açısı artışı, kalça, diz, ayak bileği deformite varlığı araştırılmış olmakla birlikte, postür bozukluklarının görülme sıklığı ve diğer semptomlarla ilişkisi araştırılmamıştır.

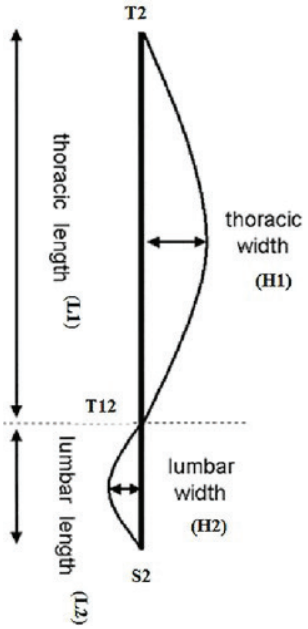
Bu çalışmanın amacı iyi ve orta düzeydeki NMH'a sahip erişkin bireylerde postür bozukluklarını detaylı bir şekilde incelemek ve hastalık şiddeti, fonksiyonel kapasite, günlük yaşam aktiviteleri ve denge ile postüral bozuklukların ilişkisini açığa çıkarmaktır.

## YÖNTEM

### Bireyler

Bu çalışma bir Kesitse Çalışma olup, Ocak 2018 ile Aralık 2020 tarihleri arasında Hacettepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Fakültesi Nörolojik Rehabilitasyon Ünitesi'nde gerçekleştirildi. Çalışma öncesinde Hacettepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu'ndan gerekli izin ve onay alındı (GO 18/111). Çalışmaya dâhil olmayı kabul eden bireylere, çalışma detaylıca anlatıldı ve aydınlatılmış onam formu ile imzalı onayları alındı.

Çalışmaya, nörolog tarafından kas hastalığı teşhisi konmuş olan, primer olarak kas zayıflığı etkilenimi olan, 18-65 yaş aralığında, kognitif problemi olmayan (Mini Mental Test > 24), bağımsız yürüyebilen (yürüme yardımcısı kullanabilir) hastalar dâhil edildi. Kas hastalığı dışında herhangi bir nörolojik veya ortopedik hastalık tanısı olanlar ve tekerlekli sandalye seviyesinde olan hastalar ise çalışma dışı bırakıldı.




**Şekil 1.** Fleksible Ruler ile Lumbal Lordoz Ölçümü

**Şekil 2.** Torakal Kifoz ve Lumbal Lordoz Açı Hesaplanmasında Formülasyonda Kullanılan H ve L Değerleri (18).

## Değerlendirmeler

Hasta değerlendirmelerine demografik ve fiziksel özellikler ile hastalık hikâyesinin kaydedilmesi ile başlandı. Hastalara Mini Mental Test yapılarak kognitif problemleri olup olmadığı değerlendirildi. Sonrasında uygulanan değerlendirmeler aşağıda listelendi:

• Postür değerlendirmesi, (Genel vücut postürü, kifoz, lordoz ve skolyoz ölçümleri)

• Hastalık şiddetinin değerlendirilmesi,

• Fonksiyonel kapasite ölçümü,

• Denge bozukluğu ve düşme riskinin değerlendirilmesi,

• Günlük yaşam aktiviteleri değerlendirmesi.

Ayrıca çalışmada Fleksible Ruler kullanılarak değerlendirme yapılan kişiden fotoğrafın makalede kullanılması için yazılı izin ve yayın onayı alındı.

### *Kognitif Problemlerin Değerlendirmesi*

Kognitif bozukluğun nicel bir değerlendirmesini sağlamak için Mini Mental Test kullanıldı. Test 11 basit soru veya görevden oluşmaktadır. Bunlar 6 bilişsel alana ayrılır; zaman oryantasyonu, mekân oryantasyonu, 3 kelimelik kayıt, dikkat ve hesaplama, 3 kelimeyi hatırlama, dil ve görsel yapı. Toplam 30 puan üzerinden hesaplanan bu testte; 24 – 30 arası puan kognitif bir bozukluk olmadığını göstermektedir (12).

### *Postür Değerlendirmeleri*

Hastaların genel vücut postürü New York Postür Derecelendirme Ölçeği (NYPD) ile değerlendirildi (13). NYPD, anatomik pozisyonda çeşitli vücut bölümlerinin doğru ve yanlış hizalanmasını değerlendirmek amacıyla geliştirilmiştir. NYPD; baş, boyun, omuzlar, bel ve sırt, kalça, diz ve ayak bilekleri dâhil olmak üzere 13 vücut bölümünde meydana gelebilecek muhtemel postür bozukluklarının resim yoluyla değerlendirilmesini sağlayan bir ölçektir. Çalışma kapsamında 13 vücut bölümünden hastaya uygun olan 3 seçenekten biri fizyoterapist tarafından belirlendi. Hasta normal postürde ise 5 puan, orta derecede bir bozulma var ise 3 puan, postürde ciddi bir bozulma var ise 1 puan verilerek değerlendirme tamamlandı. Değerlendirme sonuçları 13-65 puan arasında değişmekte olup, yüksek puan doğru postürü ifade etmektedir (14).

Hastaların torokal kifoz açısı (TKA) ve lumbal lordoz açısı (LLA) fleksible ruler (Mr. Pen- Ruler, US) kullanılarak değerlendirildi. Fleksible ruler kullanarak yapılan açı ölçümünde değerlendirmeyi yapan fizyoterapist, hastadan ayakta rahat ve normal anatomik pozisyonda durmasını istedi ve hastanın

arkasında durarak belirlenen anatomik noktalarda işaretlemeleri yaptı. Bu işaretlenen noktalar torakal kifoz için C7 ve T12, lumbal lordoz için L1 ve S2 vertebraların orta noktaları olarak belirlendi. Fleksible ruler önceden işaretlenmiş bu noktalar arasına boşluk kalmayacak ve omurganın tam şeklini alacak şekilde yerleştirildi. Daha sonra flexibl ruler şekli bozulmadan milimetrik kâğıda geçirildi. Şekil 1.'de fleksible ruler kullanılarak yapılan lumbal lordoz değerlendirme örneği gösterilmiştir.

Yapılan ölçümlerin sonuçları belirlenen θ=4 arc tan 2 h/L formülü ile açı hesaplanır. Bu formüle göre eğri kâğıt üzerine kopyalandığında iki nokta arasındaki uzaklık 'L' olarak ifade edilir ve metre (m) cinsinden kaydedilir. Formüldeki h harfi ise L mesafesinin eğrinin en üst noktası arasındaki yüksekliği ifade eder ve sonuç metre (m) cinsinden kaydedilir. Fleksible ruler yönteminin lumbal lordoz ve torokal kifoz açısı ölçümünde geçerliliği ve güvenilirliği yapılan birçok çalışmada gösterilmiştir (15,16). Şekil 2.'de h ve L mesafeleri bir örnek üzerinden gösterilmiştir.

Literatürde, sağlıklı yetişkinler üzerinde yapılan ve altın standart olan radyografi ölçümleri sonucu torakal kifoz için normal değerler 10°-40°, lumbal lordoz için 30–80° olarak tanımlanmış ancak bu değerlerin yaşa, cinsiyete ve patolojik koşullara göre değişebileceği belirtilmiştir (17).

Skolyoz ve spinal asimetri değerlendirmesi için skolyometre (GIMA s.p.A.- Via Marconi, 1-20060 Gessate, İtaly) kullanılmıştır. Skolyometre, gövde kenarları arasındaki aksiyal rotasyon derecelerini ölçen bir eğim ölçerdir. Eğrilikleri teşhis ve takip etmek için altın standart olan radyografi olmadığı veya kullanılamadığı durumlarda, skolyometre ile Cobb açısının hesaplanabildiği ve olası skolyoz varlığının gösterildiği (19), ve skolyometre ile skolyoz değerlendirmesinin orta-yüksek arası kanıt değerine sahip olduğu gösterilmiştir (20). Skolyometre ile ölçüm sonrası tahmini Cobb açısını hesaplanabileceği, 10°'nin üstündeki değerlere olası skolyoz var şeklinde ve 10° altındaki eğriliklere ise spinal asimetri var şeklinde yorumlanabileceği çalışmalarda rapor edilmiştir (21).

Skolyoz değerlendirmesi şu şekilde yapıldı; Fizyoterapist eğrilik en fazla göze çarpar duruma gelinceye kadar hastadan öne doğru eğilmesini istedi. Hastanın 45° kadar öne eğilmesi sırt bölgesindeki rotasyonel deformitenin en iyi şekilde görülmesini sağladı. Hastadan daha fazla öne eğilmesi istendiğinde sırasıyla torakalumbal ve lumbal bölgeler yer düzlemi ile paralel konuma getirildi. İlk olarak Spina İliaca Posterior Superior (SİPS)'ler işaretlendi. Sabit durumda skolyometredeki bu değer kaydedildi. Daha sonra skolyometre sırta yerleştirilerek torakaldeki ve sonrasında ise hastadan biraz daha öne eğilip lumbal bölgedeki eğrilik dereceleri ölçüldü. Eğriliğin en fazla olduğu seviyeye göre skolyometrede eğriliğin rotasyon derecesi okunarak değerlendirme tamamlandı. Eğrilik olan bölgenin yeri (torakal, lumbal veya torakalumbal) ve derecesi kaydedildi (22). Skolyometre ile ölçüm sonrası 0° bulunan hastalar, spinal eğrilik yok olarak belirlendi. Skolyometre ölçümü sonucu 10° üzerinde bir değer bulunduğunda ise, tahmini Cobb açısı hesaplandı ve 10°'nin üstündeki değerlere skolyoz var şeklinde kaydedildi. 0-10 derece arasındaki eğrilikler ise spinal asimetri var şeklinde kaydedildi (21).

Ayrıca skolyometre SİPS noktasındayken bulunan değer 0° ise pelvik asimetri yok, 0°'den farklı bir değer ise pelvik asimetri var şeklinde kaydedildi (21).

### *Hastalık Şiddetinin Değerlendirilmesi*

Bireylerin hastalık şiddeti Ekstremite Fonksiyon İndeksi ile ölçüldü. Bu ölçek NMH grubunda özürlülüğün şiddetini ölçmek amacıyla geliştirilmiştir. Ekstremite fonksiyon indeksi iki alt indeksten oluşmaktadır. Üst ekstremite için "Üst Ekstremite Fonksiyon İndeksi (ÜEFS)", alt ekstremite için ise "Alt Ekstremite Fonksiyon İndeksi (AEFS)" kullanılarak değerlendirme gerçekleştirildi (23,24). Her ölçek, fonksiyonel sorunları değerlendiren 20 maddeden oluşmaktadır. Fizyoterapist hastadan indeks içerisindeki fonksiyonel görevleri yapmasını ister ve hastanın performansına göre puanlar. Maddeler, 0'dan (son derece zor veya etkinlik yapamayan), 4'e (zorluk olmadan) kadar puanlanır. Her iki ölçek için de puanlar toplanır ve hasta 0 ile 80 arasında değişen bir toplam puan alır. Değerlendirme sonucu yüksek puanlar, yüksek işlevsel seviyeyi göstermektedir. AEFS Türkçe versiyonu Çankaya ve diğ. ve ÜEFS Türkçe versiyonu Aytar ve diğ. tarafından yapılmıştır (25,26).

### *Fonksiyonel Kapasitenin Değerlendirilmesi*

Fonksiyonel kapasitenin değerlendirilmesi amacıyla 2 dakika yürüme testi (2DKYT) kullanıldı. Bu çalış-

mada 2DKYT, 25 metre (m) uzunluğundaki sessiz bir koridorda uygulandı. Hastaların 2 dakika içinde aldığı mesafe ölçüldü ve metre cinsinden kaydedildi. Nöromusküler hastalığı olan bireylerde yürüme kapasitesinin değerlendirilmesi amacıyla kullanılan 2 ve 6 dakikalık yürüme testlerinin geçerliği ve güvenirliği daha önceki çalışmalarda kanıtlanmıştır (27,28).

### *Denge Bozukluğu ve Düşme Riskinin Değerlendirilmesi*

Hastaların düşme risklerini değerlendirmek amacıyla Zamanlı Kalk Yürü Testi (ZKYT) kullanıldı. Hastadan, 3 metre uzaklıktaki bir çizgiye doğru yürümesi, çizginin etrafından dönmesi, sandalyeye doğru aynı mesafeyi tekrar yürümesi ve oturması istendi. Hastanın kalçası sandalyeye değdiği anda test sona erdirildi. Hastalara, test sırasında rahat ve güvenli bir yürüyüş hızı kullanma talimatı verildi. Testi yapmak için bir kronometre kullanıldı ve sonuçlar saniye (sn) olarak kaydedildi. Sağlıklı bir birey ZKYT'yi 10 sn'nin altında tamamlayabilmektedir. Sürenin 10 sn'yi geçmesi, artmış düşme riski anlamına gelmektedir (29).

### *Günlük Yaşam Aktivitelerinin Değerlendirilmesi*

Çalışmamızda Günlük Yaşam Aktivitelerinin (GYA) değerlendirilmesi için Fonksiyonel Bağımsızlık Ölçeği (FIM)'in Türkçe versiyonu kullanılmıştır (30). Nöromusküler hastalıklarda FIM GYA'daki bağımsızlık düzeyini belirlemek amacıyla çok sık kullanılmaktadır. FIM, dört motor (kendine bakım, sfinkter kontrolü, transfer ve hareket) ve iki kognitif aktivitenin (ilişki kurma ve sosyal iletişim) değerlendirildiği 18 maddeden oluşan bir ölçektir. Her maddenin değerlendirilmesi 1 ile 7 puan arasında değişir; 1 tam bağımlılığı ve 7 puan ise tam bağımsızlığı ifade eder. Değerlendirme sonucunda hastalar, toplamda 18 ile 126 arasında puan alır. Skorun yüksek olması GYA'daki bağımlılığın azaldığını ifade eder.

### İstatistiksel Yöntem

Veriler SPSS 25.0 (IBM SPSS Statistics 25 software (Armonk, NY: IBM Corp.)) paket programıyla analiz edildi. Sürekli değişkenler veriler normal dağılıyorsa ortalama ± standart sapma, veriler normal dağılıma sahip değilse ortanca, çeyrekler arası aralık (ÇAA) ve en küçük-en büyük değerler ile kategorik değişkenler ise sayı ve yüzde olarak ifade edildi. Verilerin normal dağılıma uygunluğu Shapiro-Wilk testi ile incelendi. Sayısal değişkenler arasındaki ilişkilerin incelenmesinde ise normal dağılım gösteren verilerde Pearson korelasyon katsayısı, normal dağılım göstermeyen verilerde ise Spearman korelasyon katsayısı kullanıldı. Sonuçlar %95 güven aralığında değerlendirildi. Tüm analizlerde $p<0,05$ istatistiksel olarak anlamlı kabul edildi (31).

Korelasyon analizinde korelasyon katsayısı (r) 0,0 değeri aldı ise ilişki yok, 0,01-0,29 arasında ise düşük düzeyde ilişki, 0,3-0,7 değeri arasında ise orta düzeyde ilişki, 0,71-0,99 arasında ise yüksek düzeyde ilişki olduğu kabul edildi (31).

Örneklem büyüklüğünün hesaplanmasında G Power (Windows versiyon: 3.1.9.3) istatistik programı kullanıldı. Hesaplama α:0,05, β:0,05 (1-β: %95'lik güç değerinde) yöntemi ile 2 Dakika Yürüme Testi temel alınarak yapıldı. Referans çalışmada elde edilen etki büyüklüklerinin oldukça kuvvetli olduğu (r=0,46) görüldü. Bu etki büyüklüklerinden daha düşük düzeyde bir etki büyüklüğü de elde edebileceğimizi varsayarak yaptığımız güç analizi sonucunda, r=0,40 etki büyüklüğü için çalışmaya en az 34 kişi alındığında %95 güven düzeyinde %80 güç elde edilebileceği hesaplandı (31,32).

## SONUÇLAR

Çalışma için 55 hastadan oluşan bir örneklem grup oluşturuldu ancak 8 hasta çalışmaya katılmak istemedi. Kalan 47 hastadan bir tanesi yorgunluğa bağlı olarak NYPD değerlendirmesini, 6 hasta ise TKA, LLA ve skolyoz değerlendirmesi için ön koşul olan üst gövde kıyafetlerini çıkarmak istemediği için tamamlayamadı. Sonuç olarak çalışmaya yaş ortalaması 36,34 ± 14,03 yıl olan, 12 kadın (%25,5) ve 35 erkek (%74,5) olmak üzere toplam 47 hasta dâhil edildi. Yapılan analize göre çalışmanın %90 güç düzeyinde olduğu belirlendi.

Çalışmaya dâhil edilen hastaların, 17'si miyopati (%36,2), 9'u myotonik distrofi (%19,1), 6'sı becker musküler distrofi (%12,8), 4'ü limb girdle musküler distrofi (%8,5), 3'ü fasioskapulohumeral musküler distrofi (%6,4), 3'ü spinal musküler atrofi (%6,4), 2'si bethlem miyopatisi (%4,3), 1'i miyotonia konjenita (%2,1), 1'i inklüzyon cisimcik myopatisi (%2,1) ve 1'i ise Duchenne musküler distrofi (%2,1) tanısı aldıkları kaydedildi.

Değerlendirilen hastalarımızın hastalık hikâyeleri incelendiğinde; 26'sının (%55,3) anne ve babası

**Tablo 1.** Hastaların Tanımlayıcı Özellikleri

| | | n | X ± SS | Med (min – maks) |
|---|---|---|---|---|
| **Yaş (yıl)** | | 47 | 36,34 ± 14,03 | 33 (18 – 77) |
| **Boy (cm)** | | 47 | 168,7 ± 9,33 | 170 (138 – 186) |
| **Vücut Ağırlığı (kg)** | | 47 | 65,51 ± 12,28 | 66 (40 – 98) |
| **VKİ (kg/m²)** | | 47 | 23,15 ± 3,78 | 22,46 (14,5 – 33,91) |
| | | **n** | | **%** |
| **Cinsiyet** | **Kadın** | 12 | | 25,5 |
| | **Erkek** | 35 | | 74,5 |
| **Dominant taraf** | **Sağ** | 42 | | 89,4 |
| | **Sol** | 5 | | 10,6 |

X: Aritmetik Ortalama; SS: Standart Sapma; Med (min – maks): Ortanca (en küçük – en büyük değerler) VKİ: Vücut Kitle İndeksi

**Tablo 2.** Postür Değerlendirmeleri, Hastalık Şiddeti, Fonksiyonel Kapasite, Günlük Yaşam Aktiviteleri ve Denge ile İlgili Tanımlayıcı Bulgular

| | n | X ± SS | Med (min – maks) | Ortanca | Çeyreklikler Arası Genişlik (Ç3 – Ç1) |
|---|---|---|---|---|---|
| **NYPD (13-65)** | 46 | 40,24 ± 9,56 | 39 (17- 61) | | |
| **TKA (°)** | 41 | 38,89 ± 9,16 | 39,22 (23,62 – 61,4) | | |
| **LLA (°)** | 41 | 42,34 ± 14,88 | 40,73(15,78–73,14) | | |
| **Olası Skolyoz (°)** | 41 | 12,52 ± 3,46 | 12,1 (7,92 – 23,16) | | |
| **AEFS (0 – 80)** | 47 | 51,3 ± 13,63 | 48 (17- 80) | 48 | (43 – 57) |
| ÜEFS (0 – 80) | 47 | 64,36 ± 14,9 | 68 (25- 80) | 68 | (53 – 77) |
| **FIM (18 – 126)** | 47 | 120,2 ± 8,79 | 123 (82- 126) | 123 | (117- 125) |
| **2DKYT (m)** | 47 | 138,5± 39,2 | 140,67(60-237) | | |
| **ZKYT (sn)** | 47 | 9,6 ± 4,47 | 7,97 (5,27 – 24,15) | 7,97 | 6,8 – 10,21 |

X: Aritmetik Ortalama; SS: Standart Sapma; Med (min – maks): Ortanca (en küçük – en büyük değerler) **Ç1: 25. Yüzdelik değeri, Ç3: 75. Yüzdelik değeri.** NYPD: New-York Postür Değerlendirme Ölçeği, TKA: Torakal Kifoz Açısı, LLA:Lumbal Lordoz Açısı AEFS: Alt Ekstremite Fonksiyonel Skala ÜEFS: Üst Ekstremite Fonksiyonel Skala, 2DKYT: İki Dakika Yürüme Testi, ZKYT:Zamanlı Kalk Yürü Testi

arasında akraba evliliği olduğu görüldü. Çalışmaya katılan 47 hastanın hastalık durasyonu ortalaması 109,72 ± 105,44 aydır. Ek olarak bu hastalardan sadece 1 tanesi (%2,1) yardımcı cihaz kullanıyordu ve kullanılan cihaz bastondu, geri kalan 46 hasta (%97,9) bağımsız yürüyebiliyordu. Hastaların tanımlayıcı özellikleri Tablo 1'de gösterildi.

Hastaların NYPD ortalaması 40,24±9,56 puan, 41 hastanın TKA ortalaması 38,89°±9,16°, LLA ortalaması 42,34°±14,88° olarak hesaplandı (Tablo 2). Yapılan ölçümlerde hastaların %46,34'ünde (19 hasta) TKA'nın, %24.39'unda (10 hasta) ise LLA'nın norm değerlerin dışına çıkmış olduğu bulundu. TKA norm değerlerine göre (10° - 40°), %46,34'ünün (19 hastanın) tamamının TKA sonuçlarının 40°'nin üzerinde olduğu bulundu. LLA norm değerlerine (30° - 80°) göre ise %24.39'unun (10 hastanın) 9 tanesinin LLA sonuçlarının 30°'nin altında olduğu ve diğer 1 hastanın ise 30,01° ölçüm sonucuna sahip olduğu tespit edildi.

Gövde postürüne odaklandığımızda; skolyometre ile yapılan ölçümlerin sonucunda 30 hastada (%73,2) skolyoz, 11 hastada (%26,8) spinal asimetri, 27 hastada (%65,9) ise pelvik asimetri olduğu bulundu. Spinal eğrilik yerine göre yapılan değerlendirme sonucunda 20 hastada (%48,8) torakal bölgede, 21 hastada (%51,2) lumbal bölgede eğrilik bulundu. Torasik bölgede eğriliği olan 20 hastanın eğriliği

**Tablo 3.** NYPD ile Hastalık Şiddeti, Fonksiyonel Kapasite, GYA ve Denge Arasındaki İlişki

| | NYPD | |
|---|---|---|
| | r | p |
| AEFS (0-80) | 0,262 | 0,079 |
| ÜEFS (0-80) | 0,371 | **0,011*** |
| 2DKYT (m.) | 0,341 | **0,021*** |
| FIM (18-126) | 0,294 | **0,048*** |
| ZKYT (sn.) | -0,363 | **0,013*** |

*p<0,05 istatistiksel olarak anlamlı ilişki; r: Spearman korelasyon katsayısı NYPD: NewYork Postür Değerlendirme Ölçeği ÜEFS: Üst Ekstremite Fonksiyonel Skala AEFS: Alt Ekstremite Fonksiyonel Skala, 2DKYT: 2 dakika yürüme testi, FIM: Fonksiyonel Bağımsızlık Ölçümü, ZKYT: Zamanlı Kalk Yürü Testi

ortalama 11,67° ± 2,86° iken lumbal bölgede eğrilik ortalaması 13,34° ± 3,85° olarak bulundu.

Genel postür bozukluklarının diğer klinik bulgular ile ilişkisi sorgulandığında NYPD ile ÜEFS ve 2DKYT arasında, pozitif yönde ve orta düzeyde, NYPD ile FIM arasında pozitif yönde düşük düzeyde, NYPD ile ZKYT arasında ise, negatif yönde ve orta düzeyde ilişki olduğu bulundu (p<0,05) (Tablo 3).

## TARTIŞMA

Nöromusküler hastalığa sahip bireylerde postür bozukluklarının incelendiği ve diğer parametrelerle ilişkisinin araştırıldığı bu çalışmada iki önemli sonuç ortaya çıkmıştır. İlk sonuç, postüral bozuklukların NMH grubunda sık görüldüğü, ikinci önemli sonuç ise postür bozukluğu sonuçları ile fonksiyonel kapasite, hastalık şiddeti, denge, düşme riski ve GYA arasında ilişki bulunmuş olmasıdır. Birçok çalışmada NMH'ların bulguları arasında postür bozuklukları listelenmekle birlikte bu bozuklukların özellikle erişkin grupta ne oranda görüldüğü yer almamaktadır. Bununla birlikte postüral bozukluklar ile ilgili sınırlı çalışma bulunmaktadır. Literatürdeki bu eksiğe ışık tutmak için bu çalışma, erişkin NMH'a sahip bireylerde postür bozukluklarını detaylı bir şekilde inceleyen ve hastalık şiddeti, fonksiyonel kapasite, denge ve GYA gibi parametrelerle ilişkisini araştıran ve önemli sonuçlar veren ilk özgün çalışma niteliğindedir.

Çalışmamızda temel merak konularından ilki olan postür bozuklukların ne oranda görüldüğü ile ilgili bulgularımıza göre, hastaların %73,2'sinde skolyoz varlığı, %26,8'inde spinal asimetri, %48,8 'inde torakal, %51,2 'sinde lumbal bölgede spinal eğrilik bulunduğu, %46,3'ünün torakal kifoz açısında artış, %24,4'ünün lumbal lordoz açısında azalma olduğu bulundu. Bu sonuçlar ile erişkin NMH grubunda spinal bozukluklarının azımsanmayacak derecede görüldüğü belirlenmiştir. Kinali Maria ve diğ. çalışmalarında skolyoz, kifoz ve lordoz açısında değişiklikler gibi postüral olumsuzlukların NMH'ların ortak ve yaygın bulguları olduğunu yazmışlardır. Spinal düzgünlük birçok değişkenin koordineli uyumu ile sağlanır. Normal vertebra gelişimi, kas gücü, denge, tonus simetrisi, kuvvet ve santral yolların normal kontrolü ile duyusal geri bildirim mekanizması normal postüral uyum ve düzgünlük üzerinde etkisi olan önemli parametrelerdir (8). Erişkin NMH grubunda bu parametrelerin hemen hepsi etkilenmiştir bu nedenle bu kadar yüksek oranda spinal deformite görülmesi normal karşılanmıştır.

İkinci merak konumuz postürün etkileyebileceği veya ilişkili olabileceği semptomlardı. NYPD ile değerlendirilen genel vücut postürü sonuçlarımız ile fonksiyonel kapasite, hastalık şiddeti, denge, düşme riski ve GYA arasında ilişki bulunmuş olmasıdır. Postüral deformitelerin oturma dengesinde bozulma, dik durma ve pozisyonlamada zorluk, ağrı ve solunum problemleri gibi birçok farklı soruna yol açtığı bilinmektedir (31). Bozgeyik ve diğ. 2016 yılında DMD'li çocuklar üzerinde yaptıkları çalışmada NYPD ile değerlendirdikleri postüral düzgünlüğün 6 DKYT, ambulasyon indeksi, fonksiyonel kapasite ve yürüme hızı ile ilişkili olduğunu rapor etmişlerdir. Yazarlar ayrıca fiziksel performansı iyi olan çocukların postüral düzgünlüklerinin de daha iyi olduğunu belirtmişlerdir. Sonuçlarımız, Bozgeyik ve diğ.'nin sonuçları ile benzerlik göstermektedir (34). Hammarén ve diğ. 2014 yılında yaptıkları çalışmada ise yetişkin DM1 hastalarının kas kuvveti, yürüyüş ve performansa dayalı denge durumlarını 5 yıl boyunca takip etmişlerdir. Beş yıl sonunda hastaların zamanlı yürüyüş ve performansa dayalı dinamik denge ölçümlerinde istatistiksel olarak anlamlı bir düşüş olduğu ve dinamik denge probleminin postüral kontrol kaybı ile ilişkili olduğu ifade edilmiştir

(32). Çalışma sonuçlarımıza göre NYPD ile değerlendirilen vücut postürü sonuçları ile AEFS ilişkili bulunmazken, ÜEFS ile zayıf bir ilişki bulunmuştur. Bu sonucu değerlendirirken ilk olarak hastalarımızın ortalama 36 yaş civarında olan, 2DKYT göre fonksiyonel kapasiteleri yüksek, ZKYT ortalamasına göre düşme riski olmayan, sağlıklı birey ZKYT sonuçlarını veren ve bağımsızlık seviyesi 120/126 olan bir gruptan oluştuğunu göz önüne aldık. İkinci olarak limb girdle musküler distrofi ve fasioskapulohumeral musküler distrofi tanılı hastalarımızın, ÜEFS'de üst ekstremite etkilenimi daha baskın olduğu için genel ortalamayı etkilemiş olabileceğini düşünmekteyiz. Tüm bunlarla birlikte sonuçlarımızı yorumlarken, üst ekstremite fonksiyonelliği anatomik ve fizyolojik olarak daha kompleks ve ince detayların bütünlüğe bağlı olduğu için çok küçük postüral değişikliklerin bile ÜE fonksiyonelliğini AE'den daha çok etkileyebileceğini düşünmekteyiz.

Çalışmamızda hastaların TKA'nda artış olduğu bulunmuştur. Çalışmamızdaki ilginç sonuçlardan bir tanesi hastalarımızın çoğunda LLA açısının norm değerler içerisinde kalması ve hastaların sadece %24'ünün LLA açısının azalmış olduğunun bulunmasıdır. Özellikle pediatrik alanda yapılan çalışmalarda (35,36) NMH'ların LLA'larının çok büyük oranda artmış olduğu yazmaktadır. Çalışmamızın sonuçlarının literatür ile uyumlu olmamasının iki nedeni olabileceğini öngörüyoruz. Bunlardan ilki erişkin grup hastalarımızın hastalık şiddeti ve GYA'ndeki bağımsızlık düzeyi iyi seviyedeydi (Hastalarımız ortalama 36 yaş civarında olan ve bağımsızlık seviyesi 120/126 olan bir gruptan oluşmakta idi.). Bu nedenle hastalarımız LLA'yı artırmak gibi bir kompanzasyona ihtiyaç duymamış olabilirler. İkincisi ise hastalarımız yürürken LLA açılarını artırıyor olabilirler ancak ayakta sabit duruş sırasında bu kompanzasyona ihtiyaç duymayabilirler. Çalışmamızda LLA'yı ayakta sabit durma pozisyonunda ölçtüğümüz için bu sonuçlarla karşılaşmış olabiliriz. Bu limitasyonu ortadan kaldırmak amacıyla gelecekteki çalışmalarda hareket analiz sistemleri veya kamera kullanarak LLA değerlendirilmelidir.

Literatür gözden geçirildiğinde NMH grubunda skolyoz ile ilgili yapılan çalışmalarda daha çok solunum problemleri ve kas kuvveti üzerinde durulduğu görülmektedir. Spinal yapı bozukluğu, omuz asimetrisi, gövde dengesizliği ve pelvik obliklik NMH'ta skolyozun altında yatan fiziksel bulgulardır (37,38). Bu çalışmada radyolojik ölçümlerin sağlık açısından olumsuz sonuçları göz önünde bulundurulduğundan röntgen yerine skolyometre kullanılmış ve skolyoz varlığı ve spinal asimetri varlığı olarak ifade edilmiştir. Çalışmamızda skolyometre ile yapılan ölçümlerin sonucunda 30 hastada (%73,2) skolyoz varlığı, 11 hastada (%26,8) spinal asimetri olduğu bulunmuştur. Bu veriler özellikle alanda çalışmanın az olduğu erişkin NMH grubunda tanımlayıcı bilgiler olarak literatüre katkı sağlayacaktır. Literatür spinal asimetri varlığının, hastaların fonksiyonel aktiviteleri gerçekleştirirken düşme riskini arttırması nedeniyle dikkate alınması gerektiğini vurgulamaktadır (21). Skolyoz ve spinal asimetri olan hastalarda, denge problemi ve düşme riskinde artış olduğu DMD'li çocuklarda yapılan çalışmalarda gösterilmiştir (39).

Çalışmamızda 27 hastada (%65,9) ise pelvik asimetri olduğu bulunmuştur. Stępień, A.ve diğ. 2020 yılında 74 SMA'lı çocukta postüral deformiteleri ve pelvik asimetriyi değerlendirdikleri ve sağlıklı grup ile karşılaştırdıkları bir çalışma yayımlamışlardır. Pelvik asimetri skolyometre kullanılarak değerlendirilmiş ve SMA II'li 35 (%97) ve SMA III'lü 15 (%88,2) hastada pelvik asimetri oluştuğu belirtilmiştir. Ek olarak 2-4 yaş arası SMA'lı çocukların %92'sinde asimetri varken, pelvik eğriliğin yaşla birlikte arttığı vurgulanmaktadır (40). Pelvik asimetrinin vücut duruşunu, fonksiyonelliğini ve dengeyi etkileyecek birçok postüral bozuklukla ilişkili olduğu belirtilmektedir. Literatürdeki çalışmalar skolyoz ve/veya pelvik asimetrisi olan hastaların kontrol grubuna kıyasla postüral asimetrisi, ağırlık aktarma problemleri ve kassal kontraksiyon dengesizliği olduğunu belirtmiştir (41). McCarthy ve_diğ. pelvik asimetrinin, gövde dengesini zorlaştırdığı ve dik duruş pozisyonunda gövde için dengesiz bir destek yüzeyine yol açtığını bildirmiştir. Pelvis asimetrisi olan hastalarda, yürüme ve fonksiyonel kapasitenin azalabileceği ve düşme riskinin artabileceği McCarthy ve diğ.'nin ve Missaoui ve diğ.'nin raporlarıyla desteklenmektedir (42,43). Pelvik asimetrinin erken belirlenmesi ve uygun tedavinin uygulanması, spinal deformitelerin ilerlememesi ve vücut mekaniğinde bir kısır döngü oluşmaması açısından çok önemlidir. Çalışmamız NMH'da ortak ve önemli bir sorun olan denge bozukluğunun kas kuvveti dışında ilişkili olduğu parametreleri işaret etmesi açısından

da literatüre değerli katkılar sağlamaktadır.

Literatürde postür bozukluğunun, hastanın hayatındaki önemi birçok çalışmada ortaya konmuştur (44). Çalışmamızda da genel vücut postürü ile GYA arasında ilişki çıkması literatürü desteklemektedir. Omurga deformitesi hastanın kendi imajı ve sosyal etkileşimler için çok önemlidir. Spinal deformiteler sonucu hastanın bağımsızlığını kaybetmesi, yardımcıya olan bağımlılığın artması ve kişinin sosyal rollerinin azalması ve ileri dönemlerde sosyal izolasyon gibi durumlar görülmektedir. Postüral bozuklukların artması veya var olan deformitelerin ilerlemesi hastalık şiddetinin de artmış olabileceğini göstermesi açısından değerlidir.

Çalışmamızın en önemli limitasyonu çalışma grubumuzun hastalık tipi açısından heterojen NMH grubundan oluşması ve her bir hastalık grubunun farklı etkilenimleri olmasıdır. Spesifik bir NMH grubunda veya tüm NMH grubunu kapsayan ancak daha fazla sayıda hastanın dahil edildiği bir örneklemde, postür bozukluklarının diğer parametrelerle ilişkisinin incelenmesi daha objektif bilgi sağlayabilirdi. Diğer bir limitasyonumuz ise sağlıklı bir kontrol grubumuzun olmamasıydı. Sonraki çalışmalarda deformiteleri daha objektif karşılaştırabilmek için kontrol grubunun oluşturulmasına ihtiyaç vardır. Ayrıca çalışmaya dâhil edilen hastaların fonksiyonel kapasitelerinin yüksek, hastalık şiddetlerinin düşük olması çalışmamızın sonuçlarının genelleştirilmesinin önündeki en önemli engeldir. Bu nedenle taban tavan etkisinden arındırılmış bir hasta grubunda yapılan benzer metodolojiye sahip çalışmalara ihtiyaç vardır.

Çalışmamızın NMH'ları bütüncül yaklaşımla değerlendiren ve postür bozuklukların, NMH'ları etkileyen diğer parametreler ile ilişkisini araştıran objektif bir çalışma olmasıyla literatüre katkı sağlayacağını düşünmekteyiz. Çalışmamızın sonuçları, pelvik asimetri, skolyoz, spinal asimetri, TKA ve LLA'larındaki artma/azalma gibi postüral bozuklukların NMH grubunda sık görüldüğü, denge, düşme riski, fonksiyonel kapasite, hastalık şiddeti ve GYA parametreleriyle ilişkili olduğunu göstermiştir. Rehabilitasyon programları planlanırken vücut biyomekaniğini pek çok açıdan etkileyen omurga düzgünlüğünü korumanın, postüral bozuklukları değerlendirmenin ve bu değerlendirme sonuçlarına uygun müdahale planları oluşturmanın hastaların GYA'lerini, fonksiyonel kapasitesini, denge ve düşme risklerini olumlu etkileyeceğini düşünmekteyiz. Hastalıklar ilerleyici ve kronik olduğu için erken dönemden itibaren gövde rehabilitasyonuna önem verilmesi gerektiği unutulmamalıdır.

**Destekleyen Kuruluş:** Yok.

**Çıkar Çatışması:** Herhangi bir çıkar çatışması bulunmamaktadır.

**Yazar Katkıları:** Konsept ve Tasarım – İD, MK, Kaynaklar ve Finansal Destek- MK; Materyaller- İD, Veri Toplaması ve/veya İşleme- İD; Analiz ve Yorumlama: İD, MK; Literatür Tarama- İD; Makale Yazımı: İD, MK; Eleştirel İnceleme: MK.

**Açıklamalar:** Bulunmamaktadır.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)125-132*

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***Received:*** *3.02.2022 (Geliş Tarihi)*
***Accepted:*** *24.07.2022 (Kabul Tarihi)*

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# COVID-19 PHOBIA AND PHYSICAL ACTIVITY LEVEL IN PATIENTS WITH NON-CYSTIC FIBROSIS BRONCHIECTASIS DURING COVID-19 PANDEMIC

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** The COVID-19 pandemic period may affect physical and mental health of non-cystic fibrosis (CF) bronchiectasis patients. The aim of this study was to compare COVID-19 phobia, quality of life, health anxiety, physical activity level and sleep quality during the pandemic between patients with non-CF bronchiectasis and healthy controls.

**Methods:** Thirty non-CF bronchiectasis patients and 44 healthy controls were included. COVID-19 phobia (Coronavirus 19 Phobia Scale (CP19-S)), quality of life (Nottingham Health Profile (NHP)), health anxiety (Health Anxiety Inventory (HAI)), physical activity level (short form of the International Physical Activity Questionnaire (IPAQ-SF)) and sleep quality (Pittsburgh Sleep Quality Index (PSQI)) were evaluated.

**Results:** NHP energy, pain, and physical mobility scores and moderate-intensity physical activity levels were significantly lower; PSQI sleep disturbance score was significantly higher in patients compared with controls ($p<0.05$). Total CP19-S and HAI scores were similar between groups ($p>0.05$). The majority of patients and controls did not meet the recommended levels of moderate or high-intensity physical activity per week.

**Conclusion:** The COVID-19 pandemic has resulted in a decline in quality of life, reduced moderate-intensity physical activity, and increased sleep disturbances among non-CF bronchiectasis patients. Both patients and healthy individuals have experienced coronaphobia and exhibited low levels of physical activity. These results reveal the importance of providing physical activity counseling during the pandemic period.

**Key Words:** Anxiety, Bronchiectasis, COVID 19, Life quality, Phobia, Physical Activity

# COVID-19 PANDEMİSİ SIRASINDA KİSTİK FİBROZİS DIŞI BRONŞEKTAZİ HASTALARINDA COVID-19 FOBİSİ VE FİZİKSEL AKTİVİTE DÜZEYİ

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** COVID-19 pandemi dönemi, akistik fibrozis (KF) dışı bronşektazi hastalarının fiziksel ve mental sağlığını etkileyebilir. Bu çalışmanın amacı, pandemi sırasında COVID-19 fobisi, yaşam kalitesi, sağlık anksiyetesi, fiziksel aktivite düzeyi ve uyku kalitesini KF dışı bronşektazi hastaları ve sağlıklı kontroller arasında karşılaştırmaktı.

**Yöntem:** Otuz KF dışı bronşektazi hastası ve 44 sağlıklı kontrol dahil edildi. COVID-19 fobisi (Koronavirüs-19 Fobisi Ölçeği (CP19-S)), yaşam kalitesi (Nottingham Sağlık Profili (NHP)), sağlık anksiyetesi (Sağlık Anksiyete Ölçeği (HAI)), fiziksel aktivite (Uluslararası Fiziksel Aktivite Anketi kısa formu (IPAQ-SF)) ve uyku kalitesi (Pittsburgh Uyku Kalitesi İndeksi (PSQI)) değerlendirildi.

**Sonuçlar:** NHP enerji, ağrı ve fiziksel hareketlilik skorları ve orta şiddette fiziksel aktivite düzeyleri anlamlı olarak daha düşük; PSQI uyku bozukluğu skoru hastalarda kontrollere göre anlamlı olarak daha yüksekti ($p<0,05$). Toplam CP19-S ve HAI skorları gruplar arasında benzerdi ($p>0,05$). Hastaların ve kontrollerin çoğu önerilen haftalık orta veya şiddetli fiziksel aktivite düzeyini karşılamıyordu.

**Tartışma:** COVID-19 pandemisi, KF dışı bronşektazi hastalarında yaşam kalitesinde düşüşe, orta şiddette fiziksel aktivite düzeyinde azalmaya ve uyku bozukluklarında artışa neden olmuştur. Hem hastalar hem de sağlıklı bireyler koronafobiye ve düşük düzeyde fiziksel aktivite seviyesine sahipti. Bu sonuçlar, pandemi döneminde fiziksel aktivite danışmanlığı verilmesinin önemini ortaya koymaktadır.

**Anahtar Kelimeler:** Anksiyete, Bronşektazi, COVID 19, Yaşam Kalitesi, Fobi, Fiziksel Aktivite

## INTRODUCTION

The first coronavirus disease 2019 (COVID-19) case was recorded in Wuhan, China, in December 2019 and spread out quickly across the world. In Turkey, the first case was announced on March 11, 2020, and the epidemic continues to increase dramatically (1). The outbreak has not been fully controlled yet. Therefore, the number of deaths due to COVID-19 has been rising. Because of the deaths, people often experience psychological symptoms, including fear, panic and phobia during pandemics. The natural or human-made disasters could cause phobic conditions. In addition to environmental factors, genetic, personal and physiological features may also bring along phobia (2). During the pandemic, experiencing fear and anxiety have affected the health-related quality of life (3). COVID-19 outbreak has overwhelmed people's physical activity. Closing universities, schools and gyms, restrictions on public movements, flexible working hours and teleworking have affected people's daily activities (4). On the other hand, staying at home, social distancing, working from home and changes in sleeping patterns have impaired sleep quality (5). The most common cause of death in COVID-19 patients is pneumonia leading to respiratory failure. For this reason, existing lung diseases may cause COVID-19 to occur more frequently (6). During the pandemic period, restriction in daily activities and isolation have been recommended to reduce the risk of COVID-19 transmission and protect the patients at high risk. In addition to the positive effects of these recommendations, they may disturb patients' physical and mental health (7). Lung disease patients' life quality might be affected because of the isolation period and decreased outpatient visits (8, 9). There exist no studies assessing physical and mental health in non-cystic fibrosis (CF) bronchiectasis during COVID-19 pandemic. Hence, the aim of the present study was to compare COVID-19 phobia, quality of life, health anxiety, physical activity level and sleep quality during COVID-19 pandemic between non-CF bronchiectasis and healthy controls.

## METHODS

### Study design

The cross-sectional study was performed between June 2020 and October 2020 at Hacettepe University, Faculty of Physical Therapy and Rehabilitation. Hacettepe University Non-Interventional Clinical Research Ethics Board (GO 20/602; 23.06.2020) approved the study, and all participants read and confirmed the informed consent form before agreeing to participate in this study.

### Study population

The patients obtained from the unit database were reached by phone calls and the patients were informed about the study. The patients aged 18-60 years who diagnosed with non-CF bronchiectasis, had no acute exacerbation or infection in the last two weeks and were willing to participate were included. The patients who had a cognitive problem and were unable read and/or write were excluded. The healthy controls aged 18-60 years who were relatives of the researchers, the university staff, students, and willing to participate were included. The healthy controls who had a cardiopulmonary disease and were unable read and/or write were excluded.

### Data Collection and Assessments

The data were collected using Google Forms. By using the forms, demographic information, smoking status, and physical characteristics were recorded. The modified Medical Research Council Dyspnea Scale (mMRC) was used for evaluation of dyspnea perception (10).

### COVID-19 phobia

COVID-19 phobia was evaluated using the Coronavirus 19 Phobia Scale (CP19-S). The scale consists of psychological (6 items), somatic (5 items), social (5 items), and economic (4 items) subdimension. The total C19P-S score is calculated by sum of the subdimension scores. High scores demonstrate tendency to COVID-19 phobia both for subdimensional and general (2).

### Quality of life

Quality of life was evaluated using the Nottingham Health Profile (NHP). The NHP consists of six subgroups including pain, emotional reactions, sleep, social isolation, physical activity, energy. The score changes from 0 to 100, and the quality of life varies inverse proportionality according to NHP (11, 12).

### Health anxiety

Health anxiety was evaluated using the Health Anxiety Inventory (HAI). The score range of the scale is between 0 and 54 for 18 items, and higher score indicates higher level of health anxiety (13,14). The cut-off point for moderate health anxiety and hypochondriasis are 18 and 27, respectively (15).

### Physical activity level

The short form of the International Physical Activity Questionnaire (IPAQ-SF) was used to evaluate physical activity level. The IPAQ-SF assesses walking, moderate, and vigorous activities and sitting time over the last 7-days. The physical activity score is calculated by multiplying the metabolic equivalent (MET) value corresponding to the duration of each activity, and then summing all these values excluding the sitting time (16,17). The total score is interpreted as low, moderate, and high levels of physical activity according to the reference values (18).

### Sleep quality

The Pittsburgh Sleep Quality Index (PSQI) was used to evaluate sleep quality. The last 5 of 24 questions are excluded in the PSQI scoring (19,20). PSQI score of >5 is indicative of sleep disturbance (21).

The Turkish versions of the questionnaires were used and the required permissions were obtained for the present study.

### Statistical analysis

The SPSS for Mac (Version 20.0, IBM Inc., Armonk, NY, USA) was used for statistical analysis. Before the study, sample size calculation (G*Power 3.0.10 system) was performed to detect the number of participants is needed. By performing this calculation, two independent means/groups for an α value of 0.05, the effect size of 0.50, 80% power were used. The result of calculation revealed that including at least 14 participants for each group is necessary (22). Descriptive statistics were expressed as mean±SD, minimum-maximum, frequency, and percentage. Normality was tested visually (histograms and probability plots) as well as using Kolmogorov-Smirnov test. Normally distributed variables were compared using Student's t test. Mann Whitney U test was performed for the comparison of non-normally distributed variables. The relationships between the parameters were analyzed assessed using Pearson or Spearman's rank correlation coefficients accordingly to the normality. The probability of error was taken as $p<0.05$ (23).

## RESULTS

Forty-six non-CF bronchiectasis and 60 healthy controls were evaluated regarding to the aforementioned criteria. Out of the initial group, seven patients and 15 healthy controls did not volunteer, three patients passed away, the contact details of six patients were missing, and one healthy con-

**Table 1.** Demographic Characteristics of Patients with Non-CF Bronchiectasis and Healthy Controls

| Characteristics | Patients (n=30) Mean±SD /median (min-max) | Healthy (n=44) Mean±SD/median (min-max) | p |
|---|---|---|---|
| **Age, years** | 29.97±12.57 | 30.43±7.95 | 0.858 |
| **Sex (Female/male), n (%)** | 16 (53.3%)/14 (46.7%) | 25 (56.8%)/19 (43.2%) | 0.815 |
| **Height, cm** | 167.80±10.68 | 170.48±8.66 | 0.239 |
| **Weight, kg** | 63.80±17.08 | 69.18±16.61 | 0.180 |
| **Body mass index, kg/m²** | 22.45±4.54 | 23.68±4.73 | 0.267 |
| **Smoking history, pack-year** | 1.43±4.33 | 1.89±3.47 | 0.219 |
| **Smoking, n (%)** | | | |
| **Current smoker** | 1 (3.3%) | 8 (18.2%) | |
| **Ex-smoker** | 4 (13.3%) | 6 (13.6%) | 0.151 |
| **Non-smoker** | 25 (83.3%) | 30 (68.2%) | |
| **mMRC (0-4)** | 2 (1-2) | 0 (0-2) | **<0.001*** |

Descriptive analyses were presented using (mean ± SD) and median (min-max) for normally and non-normally distributed variables, respectively. Mann–Whitney U-test *p < 0.05. mMRC: modified Medical Research Council Dyspnea Scale.

**Table 2.** Comparison of COVID-19 Phobia, Quality of Life, Health Anxiety, Physical Activity, and Sleep Quality between Patients with Non-CF Bronchiectasis and Healthy Controls

| Parameters | Patients (n=30) Mean±SD/median (min-max) | Healthy (n=44) Mean±SD/median (min-max) | p |
|---|---|---|---|
| **CP19-S** | | | |
| **Psychological** | 19.30±6.93 | 18.95±6.67 | 0.830 |
| **Somatic** | 9 (5-15) | 9 (5-25) | 0.846 |
| **Social** | 13.90±5.97 | 13.82±4.96 | 0.949 |
| **Economic** | 8 (4-15) | 8 (4-20) | 0.876 |
| **Total (20-100)** | 49.90±16.48 | 49.68±16.30 | 0.955 |
| **NHP (0-100)** | | | |
| **Energy** | 66.67 (0-100) | 100 (0-100) | **0.004*** |
| **Pain** | 100 (37.5-100) | 100 (50-100) | **0.004*** |
| **Emotional reactions** | 83.33 (0-100) | 88.89 (11.11-100) | 0.669 |
| **Sleep** | 80 (0-100) | 90 (20-100) | 0.120 |
| **Social isolation** | 80 (20-100) | 100 (0-100) | 0.163 |
| **Physical mobility** | 87.50 (50-100) | 100 (25-100) | **<0.001*** |
| **HAI** | 19 (4-31) | 15 (5-36) | 0.050 |
| **IPAQ-SF** | | | |
| **Total (MET-min/week)** | 510 (0-13668) | 982.5 (0-9333) | 0.232 |
| **Moderate (MET-min/week)** | 0 (0-2880) | 120 (0-4000) | **0.019*** |
| **Vigorous (MET-min/week)** | 0 (0-9600) | 0 (0-7680) | 0.813 |
| **Walking (MET-min/week)** | 396 (0-4620) | 495 (0-6930) | 0.260 |
| **Sitting (min/day)** | 408.62±214.75 | 424.88±186.54 | 0.734 |
| **PSQI** | | | |
| **Subjective sleep quality** | 1 (0-3) | 1 (0-3) | 0.189 |
| **Sleep latency** | 1 (0-3) | 1 (0-3) | 0.581 |
| **Sleep duration** | 0 (0-3) | 0 (0-12) | 0.219 |
| **Sleep efficiency** | 0 (0-3) | 0 (0-2) | 0.236 |
| **Sleep disturbance** | 1 (0-2) | 1 (0-3) | **0.030*** |
| **Use of sleep medication** | 0 (0-3) | 0 (0-3) | 0.350 |
| **Daytime dysfunction** | 0 (0-2) | 1 (0-3) | 0.056 |
| **Global score (0-21)** | 4.5 (0-13) | 6 (1-20) | 0.544 |

Descriptive analyses were presented using (mean ± SD) and median (min-max) for normally and non-normally distributed variables, respectively. Mann–Whitney U-test *p < 0.05., CP19-S: Coronavirus 19 Phobia Scale, MET: metabolic equivalent for task, NHP: Nottingham Health Profile, HAI: Health Anxiety Inventory, IPAQ-SF: short form of the International Physical Activity Questionnaire, PSQI: Pittsburgh Sleep Quality Index.

trol had a history of COVID-19. Consequently, 30 non-CF bronchiectasis and age and sex matched 44 healthy controls were included. Physical characteristics, dyspnea, and smoking history of the participants and comparison of these parameters between the groups were shown in Table 1. There was no statistically significant difference in terms of age, sex, height, body weight, and body mass index were found between the groups (p>0.05). Patients' dyspnea perception was significantly higher than that of controls (p<0.05, Table 1). The occupations of the participants were classified as full-time employment (23.3% of patients, 61.1% of controls), part-time employment (0% of patients, 6.8% of controls), unemployed (13.3% of patients, 6.8% of controls), retired (13.3% of patients, 2.3% of controls), housewives (10% of patients, 2.3% of controls) and students (40% of patients, 20.5% of controls).

The comparison of COVID-19 phobia, quality of life, health anxiety, physical activity, and sleep quality between the patients with non-CF bronchiectasis and controls was shown in Table 2. No statistically significant differences were found in total CP19-S score, all CP19-S subdimension scores; NHP emotional reactions, sleep, and social isolation scores between the groups ($p>0.05$). The NHP energy, pain, and physical mobility scores of the patients were significantly lower than those of controls ($p<0.05$, Table 2).

The HAI score was similar between the groups ($p=0.05$, Table 2). The 56.7% of the patients and 36.4% of controls had HAI score ≥18, while 16.7% of the patients and 9.1% of controls had HAI score ≥27.

The 53.3% of the patients and 31.8% of controls had low physical activity level, 30% of the patients and 52.3% of controls had moderate physical activity level, and 16.7% of the patients and 15.9% of controls had high physical activity levels ($p=0.129$). Merely a small proportion of the patients (less than 7%) and a slightly larger percentage of the controls (just over 18%) participated in moderate-intensity physical activity for a minimum of 150 minutes per week, whereas more than 83% of the patients and 81.8% of the controls failed to complete at least 75 minutes of vigorous-intensity physical activity per week. The patients had significantly lower moderate physical activity level than that of controls ($p<0.05$). Total, vigorous, and walking physical activity levels and total sitting time were similar between the two groups ($p>0.05$, Table 2).

The PSQI total score and all domains except for PSQI sleep disturbance domain were similar between the patients and controls ($p>0.05$). The PSQI sleep disturbance score of the patients was significantly higher than that of controls ($p<0.05$). The 53.3% of the patients and 45.5% of controls had PSQI score >5. The 53.3% of the patients and 27.7% of controls failed to adhere to the recommended 7–9 hours of sleep per day.

There was a negative correlation between PSQI sleep disturbance and NHP energy ($r=-0.506$ $p=0.004$), pain ($r=-0.483$ $p=0.007$), sleep ($r=-0.455$ $p=0.011$), social isolation ($r=-0.446$ $p=0.013$) and physical mobility subscales ($r=-0.568$ $p=0.001$) in the patients.

## DISCUSSION

To the best of our knowledge, this is the first study comparing COVID-19 phobia, quality of life, health anxiety, physical activity level, and quality of sleep during the pandemic between non-CF bronchiectasis patients and healthy controls. The remarkable findings of our study are that the patients have impaired quality of life, reduced moderate-intensity physical activity and common sleep disturbance during the pandemic.

Coronaphobia and fear of COVID-19 have been used to describe the fear of dealing with COVID-19. In the present study, we have shown that coronaphobia was similar in the non-CF bronchiectasis patients and healthy controls. Similarly, Haktanir et al. showed no difference in fear of COVID-19 between patients with chronic disease and healthy controls (24). Another study reported no significant differences between oncological patients and healthy controls regarding fear of COVID-19. Furthermore, the researchers stated that both groups' fear of COVID-19 was increased (25). From these results, we infer that COVID-19 pandemic causes similar levels of coronaphobia in both healthy controls and patients with various chronic diseases including bronchiectasis.

In the present study, the quality of life of the patients was found to be negatively affected during COVID-19 pandemic. The patients experienced a lack of energy, musculoskeletal pain, and decreased physical mobility. Reduced physical activity can cause musculoskeletal pain (26). Furthermore, physical activity is a protective factor against fatigue and lack of energy (27). The moderate physical activity level of the patients was lower than that of healthy controls, and more than half of the patients (53.3%) had low level of physical activity. Celenay et al. found that individuals who stayed at home during COVID-19 period had more pain perception compared with those who continued working (28). In this study, the vast majority of the patients (76.7%) were staying at home during COVID-19 pandemic. Staying at home a long time and physical inactivity may have contributed more musculoskeletal pain perception and lack of energy in non-CF bronchiectasis than healthy controls.

In the present study, the groups had similar levels of health anxiety during COVID-19 pandemic. Ac-

cording to the cut-off points, 56.7% of the patients and 36.4% of healthy controls had moderate health anxiety; 16.7% of the patients and 9.1% of healthy controls were identified as hypochondriasis. During COVID-19 pandemic, Landi et al. found that 33.8% of adults had moderate health anxiety, and 8.1% of individuals had hypochondriacal concerns (15). These findings were similar to the findings of our study. However, the percentage of the bronchiectasis patients were higher than the findings of Landi et al. A previous study conducted in Turkey during COVID-19 pandemic reported that the mean HAI scores were 17.9±7.6 in individuals with chronic disease and 14.6±6.7 without chronic disease (29). Consistent with these findings (29), we found a higher mean HAI score in patients with chronic diseases compared with healthy controls. On the other hand, the mean HAI score of the healthy controls in our study (16.4±7.0) during the COVID-19 pandemic were similar to the results (16.6±6.7) of Aydemir et al.'s healthy controls before the pandemic (13). Despite a numerical difference between groups, we did not observe a statistically significant difference in HAI scores between patients and healthy controls. Therefore, it is recommended to evaluate a larger sample size to reconsider the results and enhance the generalizability of the findings.

The COVID-19 pandemic has caused an increase in sedentary time and reduced physical activity in healthy population (30). Our study showed that moderate-intensity physical activity level was reduced in the patients with non-CF bronchiectasis during COVID-19 pandemic. While most of the patients (53.3%) had low level of physical activity, more than half of the healthy controls (52.3%) had moderate physical activity level. O'Neill et al. reported that the median values for total (2700 MET-min/week), vigorous (0), moderate (1620 MET-min/week) intensity physical activity and walking (561 MET-min/week) in patients with bronchiectasis before COVID-19 pandemic. In our study, median values for total IPAQ-SF score (510 MET-min/week), moderate-intensity physical activity and walking score (396 MET-min/week) in the patients were lower than the findings of O'Neill et al. during COVID-19 pandemic (31). Similar to our results, Lopez-Sanchez et al. found that moderate-intensity physical activity level was reduced in a chronic condition, including lung diseases during COVID-19 quarantine compared to before COVID-19 quarantine (32). In addition to daily life restrictions due to COVID-19 pandemic period, higher perception of shortness of breath may have affected the physical activity level of the patients.

Adults should engage minimum 150 min of moderate or 75 min of vigorous-intensity physical activity per week according to World Health Organization (33). In the present study, most patients and controls did not meet these recommendations for health-enhancing physical activity level. Recent meta-regression analysis suggests that adults should spend their time for sitting fewer than 9 hours a day to reduce all-cause mortality (34). In the present study, 36.7% of the patients and 36.4% of healthy controls were sitting more than 9 hours per day during COVID-19 pandemic. Although sedentary behavior was similar in both of the groups, non-CF bronchiectasis is expected to be more affected by sedentary behavior due to present chronic lung disease.

The life changes, including working from home, sleep late, and social isolation have affected sleep quality during COVID-19 pandemic (5). In this study, 53.3% of the patients and 45.5% of the healthy controls had sleep disturbance. Furthermore, sleep disturbance domains of sleep quality deteriorated in the patients. Gao et al. stated that sleep disturbance was common in patients with steady-state bronchiectasis (56.9%) than healthy individuals (28.8%) (21). Our results showed a higher rate of sleep disturbances perception in the healthy controls (45.5%) compared to Gao et al. results. In a new study conducted during the pandemic period reported that insomnia score was higher in individuals with chronic diseases than individuals without chronic diseases (35). Another study reported the presence of a higher prevalence of sleep disturbances in females and individuals with chronic disease during COVID-19 pandemic (36). The National Sleep Foundation recommends 7–9 hours of sleep per day for adults aged 18-64 years (37). In this study, 53.3% of the patients and 27.7% of healthy controls did not meet the recommendation for sleep duration during COVID-19 pandemic. On the other hand, sleep disturbance domains of sleep quality were negatively correlated with energy, pain, sleep, social isolation, and physical mobility

domains of quality of life in these patients. During COVID-19 pandemic, sleep disturbance may have caused the impaired quality of life in patients with non-CF bronchiectasis.

The current study has some limitations. First, we were unable to assess pre-pandemic period physical activity levels of the participants. Second, the study population included participants in Turkey. Cultural factors can affect physical activity habits of both the patients and healthy individuals.

To conclude, the present study demonstrated that the COVID-19 pandemic has resulted in a decline in quality of life, reduced moderate-intensity physical activity, and increased sleep disturbances among non-CF bronchiectasis patients. Furthermore, COVID-19 pandemic threatens not only non-CF bronchiectasis patients but also healthy controls, since both patients and healthy individuals have experienced coronaphobia and exhibited low levels of physical activity. Failing to meet the recommended physical activity levels for health benefits, as observed in the participants, may increase the risk of mortality. Therefore, future pandemic-related studies should consider assessing the effect of sedentary behavior and physical inactivity during COVID-19 pandemic on mortality. On the other hand, telerehabilitation programs, particularly those that offer physical activity counselling, have become crucial for both non-CF bronchiectasis patients and healthy individuals during the isolation and pandemic period. Furthermore, incorporating behavioral and psychosocial interventions may be an effective strategy for minimizing coronaphobia during the same period.

***Sources of Support:*** None.

***Conflict of Interest:*** All authors declare no conflicts of interest.

***Author Contributions:*** Concept- MF, NVY; Design-MF, NVY; Supervision-NVY, MS, DII, LC, ECK; Materials-MF, AC, NVY, MS; Data Collection and/or Processing- MF, NVY, AC, ECK, MS, LC, DII; Analysis and/ or Interpretation-MF, AC, ECK, MS, NVY; Literature Search- MF, AC; Manuscript Writing-MF, AC, MS, ECK, NVY; Critical Review-NVY, DII, LC; Final Approval-All authors.

***Explanations:*** This study was presented as a e-poster presentation in European Respiratory Society (ERS) International Congress, September 2021, and was published in the European Respiratory Journal 2021 58: PA346.

***Acknowledgements:*** The authors would like to thank the participants of the study for their participation.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)133-140*

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***Received:*** *22.02.2022 (Geliş Tarihi)*
***Accepted:*** *23.05.2022 (Kabul Tarihi)*

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# EVALUATION OF THE QUALITY AND RELIABILITY OF EXERCISE AND PHYSIOTHERAPY VIDEOS SHARED ON YOUTUBE FOR PATIENTS WITH HEMOPHILIA: A CROSS SECTIONAL STUDY

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** To evaluate the quality and reliability of shared on YouTube videos pertaining to exercises and physiotherapy in haemophilia.

**Methods:** The terms "exercise in haemophilia" and ''physiotherapy in hemophilia'' were entered on YouTube, First 300 videos were independently analyzed by two physiotherapists and were classified as reliable or non-reliable. Video demographics were analyzed according to speakers and uploaders of the video. Video Power Index (VPI) was calculated for each video. Modified DISCERN and Global Quality Scores (GQS) were used to assess the reliability and overall quality of the videos.

**Results:** Eighty-five videos were included and 51.7 % were non-reliable. The median GQS and DISCERN scores of the videos were significantly higher in the reliable group and where the speakers were physician and physiotherapist ($p<0.001$). According to the video source, the GQS and DISCERN scores of the videos shared by haemophilia patients and personal trainers were found to be significantly lower in all pairwise comparisons of other groups ($p<0.001$). Although the VPI was higher in the reliable group, no significant difference was found in all group comparisons ($p=0.185$).

**Conclusions:** It was determined that most of the exercise and physiotherapy videos shared on YouTube in hemophilia were non-reliable and quite low quality. Although the popularity of the videos shared by Haemophilia Associations/Universities/physician or physiotherapists is not high, their reliability and quality are relatively higher. Considering the difficulties of hemophilic individuals in reaching physiotherapist who maintains their joint health, it may be recommended that musculoskeletal specialist physiotherapists share original, detailed and interesting videos.

**Key words:** YouTube, Haemophilia, Exercise, Arthropathy, Physiotherapy

# HEMOFİLİ HASTALARINA YÖNELİK YOUTUBE'DA PAYLAŞILAN EGZERSİZ VE FİZYOTERAPİ VİDEOLARININ KALİTE VE GÜVENİLİRLİĞİNİN DEĞERLENDİRİLMESİ: KESİTSEL BİR ÇALIŞMA

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Hemofilide egzersiz ve fizyoterapi ile ilgili YouTube'da paylaşılan videoların kalitesini ve güvenilirliğini değerlendirmek amacıyla yapılmıştır.

**Yöntem:** "Hemofilide egzersiz" ve "hemofilide fizyoterapi" terimleri YouTube'a girildi, İlk 300 video iki fizyoterapist tarafından bağımsız olarak analiz edildi ve güvenilir veya güvenilmez olarak sınıflandırıldı. Video demografisi, konuşmacılara ve videoyu yükleyenlere göre analiz edildi. Video Güç İndeksi (VGİ) her video için hesaplandı. Videoların güvenilirliğini ve genel kalitesini değerlendirmek için Modifiye DISCERN ve Global Kalite Skoru (GKS) kullanıldı.

**Sonuçlar:** Seksen beş video dahil edildi ve 51,7 % 'si güvenilir değildi. Videoların medyan GKS ve DISCERN puanları güvenilir grupta ve konuşmacıların hekim ve fizyoterapist olduğu grupta anlamlı olarak daha yüksekti ($p<0,001$). Video kaynağına göre, hemofili hastaları ve kişisel antrenörler tarafından paylaşılan videoların GKS ve DISCERN puanları, diğer grupların tüm ikili karşılaştırmalarında anlamlı derecede düşük bulundu ($p<0,001$). Güvenilir grupta VGİ daha yüksek olmasına rağmen, tüm grup karşılaştırmalarında anlamlı bir fark bulunmadı ($p=0,185$).

**Tartışma:** Hemofilide YouTube'da paylaşılan egzersiz ve fizyoterapi videolarının çoğunluğunun güvenilir olmadığı ve oldukça düşük kalitede olduğu tespit edildi. Hemofili Dernekleri/Üniversiteler/hekim veya fizyoterapistler tarafından paylaşılan videoların popülaritesi yüksek olmasa da güvenilirliği ve kalitesi nispeten daha yüksektir. Hemofilik bireylerin eklem sağlığını koruyan fizyoterapiste ulaşmada yaşadıkları zorluklar düşünüldüğünde kas iskelet sistemi uzmanı fizyoterapistlerin özgün, detaylı ve ilgi çekici videolar paylaşmaları önerilebilir.

**Anahtar Kelimeler:** YouTube, Hemofili, Egzersiz, Artropati, Fizyoterapi

## INTRODUCTION

The expected number of patients with haemophilia (PwH) in the world is more than one million and the majority of the severe type (1). Spontaneous recurrent bleeding, especially in the musculoskeletal system, is one of the most important causes of disability and is of serious concern as it affects functioning (2). Exercise therapy in the care of haemophilia is very important because it is non-invasive and easy and inexpensive to administer by the PwH (3).

PwH's traditional habit of consulting a physician or physiotherapist to learn about musculoskeletal problems have turned to online research, especially with the recent pandemic. Of those who relied on internet-based information, 80 % were individuals with chronic disease who accessed health-related information online (4). The internet is today the first source of medical information for patients with concerns about their disease, and they use it to learn more about their disease and search for people who share a similar health problem (5). Many patients believe that health-related information on the internet is equal or even better than the information provided by physicians, and many patients do not report their search results to their physicians (5,6).

YouTube is one of the most widely used platforms that contributes to online access of health-related information by reaching 95 % of all internet users (7). As of January 2022, YouTube has reportedly more than 2 billion logins per month and more than 500 hours of video uploads per minute (8). According to the Global Internet Phenomena Report released in 2019, YouTube is currently responsible for 8.7 % in megabytes of worldwide downstream traffic (9). Since videos shared on this platform have varying quality and reliability, there is a potential risk of spreading misleading information, which can pose a significant challenge in providing optimum healthcare. Previous research showned that YouTube to be a useful and misleading source of information during public health crises, including the H1N1, Ebola and Zika outbreaks (10-12). This situation reveals the necessity of evaluating the quality and accuracy of the video content available on YouTube.

The reliability and quality of YouTube videos for various disease of medical information (13-15) and exercises (16-18) has been evaluated previously. However, to our knowledge, the reliability and quality of YouTube videos regarding exercise and physiotherapy in haemophilia has not been yet investigated. The present study was designed to evaluate the quality and reliability of shared on YouTube videos pertaining to exercises and physiotherapy in haemophilia.

## METHODS

### Search Strategy and Data Collection

The video-sharing website YouTube was queried in January of 2021 using the keywords '' exercise in haemophilia'' and '' physiotherapy in haemophilia''. More than 90 % of users tended to watch the first pages of the search result. The top 300 videos were sorted by "relevance" due to this situation. The inclusion criteria of the study were as follows; YouTube videos with appropriate titles (including exercise or physiotherapy in hemophilia), both real and animations, videos with a length of 30 sec or longer and English videos. Advertisements, one of the duplicate videos, irrelevant videos and non-English videos were excluded from the study.

### Video Characteristics and Scoring System

The videos were independently assessed at different locations simultaneously to avoid bias during assessment by two physiotherapists specializing in haemophilia. In order to evaluate the accuracy of the YouTube videos included in current study, they were examined in two subgroups as reliable and non-reliable information, and the detailed group description were as follows:

Reliable information: If the video contains scientifically correct information about exercise and physiotherapy in haemophilia, such as indications, contraindications and appropriate exercise.

Non-reliable information: If the video contains information that has no scientific value, and also if the video contains untrusted information as well as reliable information, it was classified in this group. While the number of videos containing reliable information was 41, the number of videos containing unreliable information was 44.

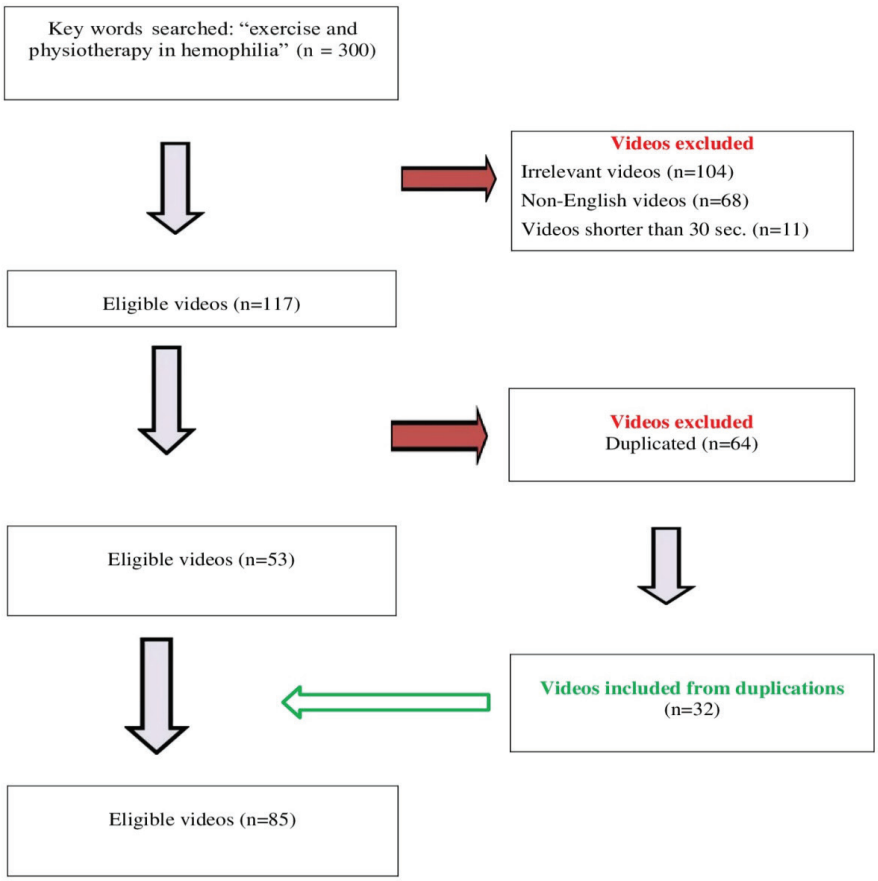


**Figure-1.** Flow Diagram

This method has already been used in previos studies (13,15,19). For each video, count of view/like/dislike/comment and video length were recorded. The loading times of videos were also recorded to avoid deviating from a video's period on YouTube. Video uploaders were seperated into 4 groups as follows: (1) Haemophilia associations/universities and non-profit physiotherapists/physicians; (2) PwH (patient experience); (3) Health channels/TV programs or non-haemophilia associations and (4) Fitness coach/personal trainer. Participants in the videos were divided into five groups according to who was giving the explanation; (1) physician, (2) physiotherapist, (3) patient, (4) non-health professional and (5) external voice.

## Modified DISCERN Tool

DISCERN is a 5-point scale consisting of 15 questions developed to enable patients and information providers to judge the quality of written information about treatment options. We used modified DISCERN tool consisting of 5 questions, used in recent studies, to score the reliability of the information (13,19,20). It is validated tool to evaluate the quality of consumer health-related information. Its scoring is as follows: Reliability (1 point per question if answered yes); 1. Are the explanations given in the video clear and understandable; 2. Are useful reference sources given (publication cited, from valid studies); 3. Is the information in the video balanced and neutral; 4. Are additional sources of information given from which the viewer can benefit; 5. Does the video evaluate areas that are controversial or uncertain.

## Global Quality Score (GQS)

GQS is a scale, scored from 1 to 5, to rate the streaming and usability of videos available online on the internet and the overall quality of the video (15,19). Its scoring is as follows: 1. Poor quality, poor flow, most information missing, not helpful for patients; 2. Generally poor, some information given but of limited use to patients; 3. Moderate quality, some important information is adequately

**Table 1.** Analysis of Video Features By Reliability

| | Reliable information n =41 | Non-reliable information n =44 | p |
|---|---|---|---|
| **Views** [1] | 755 (150-5411) | 345.5 (212-1002) | 0.228 |
| **Likes** [1] | 10 (1-63) | 15.5 (5.5-46) | 0.702 |
| **Comments** [1] | 0 (0-2) | 3 (0-13) | **0.001**** |
| **Video length (minutes)** [1] | 4.37 (2.55-8.55) | 5.69 (2.32-10.85) | 0.799 |
| **Duration on youtube (months)** [1] | 23 (9-57) | 21.5 (12.5-56) | 0.799 |
| **Views per month** [1] | 43.96 (15-137.73) | 15.42 (9.4-34.55) | **0.012*** |
| **VPI** [1] | 0.94 (0.18-4.59) | 0.51 (0.31-1.15) | 0.185 |
| **DISCERN** [1] | 3 (2-4) | 0 (0-1) | **<0.001**** |
| **GQS** [1] | 4 (3-5) | 0 (0-1) | **<0.001**** |
| **Source of upload** [2] | | | **<0.001**** [b] |
| **Haemophilia Associations/ Universities/ non-profit physician or physiotherapist** | 31 (75.6) | 9 (20.5) | |
| **Health channels/TV programs** | 10 (24.4) | 9 (20.5) | |
| **PwH** | 0 (0) | 21 (47.7) | |
| **Fitness coach/Personal Trainer** | 0 (0) | 5 (11.4) | |
| **Speaker** [3] | | | **<0.001**** [b] |
| **Physician** | 8 (19.5) | 0 (0) | |
| **Physiotherapist** | 20 (48.8) | 2 (4.5) | |
| **PwH** | 4 (9.8) | 28 (63.6) | |
| **Non-health professional** | 1(2.4) | 9 (20.5) | |
| **External voice** | 8 (19.5) | 5 (11.4) | |

[a] Mann-Whitney U-test, [b] Chi-square test; [1] median (percentile 25-75 %), [2] n (%); VPI : Video Power Index, DISCERN : modified DISCERN score, GQS : Global Quality Score, PwH: Patient with hemophilia; Values of $p < 0.05$ were accepted as significant and marked bold

discussed; 4. Good quality good flow, most relevant information is covered, useful for patients; 5. Excellent quality and excellent flow, very useful for patients

Popularity was assessed by the Video Power Index (VPI). VPI= (likes x 100/(likes+dislikes)) x (views/day)/100 (14,15,21).

### Statistical Analysis

The data were analyzed with IBM SPSS 24.0 software (Statistical Package for Social Sciences Inc. Chicago, IL, USA). The Kolmogorov-Smirnov test was used to were calculated normality in the distribution of the sample. Descriptive statictics of the variables (median and percentile 25-75 %) were given. The inter-observer agreement was determined using Cohen's kappa score. Inter-observer reliability was quantified by calculating the intraclass correlation coefficient. Comparisons of two groups that did not show normal distribution were calculated with the Mann-Whitney U Test, and comparisons with more than 2 groups were calculated with the Kruskal-Wallis H Test. Non-parametric post-hoc tests were used in multi-group comparisons in which the difference between groups was determined, and test statistics were tested with Bonferroni correction. Significance level was accepted as $p < 0.05$.

## RESULTS

Each keyword was filtered by relevance on YouTube, and the top 150 videos were retrieved in the study. In a total of 300 videos scan, irrelevant videos (n=104). A total of 117 videos were included after the exclusion of irrelevant videos (n=104), non-English videos (n=68), and videos shorter than 30 sec. (n=11). It was determined that 64 of these 117 videos were duplicated. Final analyzes were made on 85 eligible videos by adding 53 videos meeting the criteria to 32 videos, half of which were 64 duplicated videos (Fig-1). Half of 64 duplicate videos (n=32) were analysed. Cohen's kappa coefficient representing inter-rater reliability was calculated as 0.929 for evaluating the reliability of the videos, 0.811 for the GQS score and 0.849 for the modifed DISCERN score. These scores represent excellent agreement between the two researchers for

within the instruments (95 % confidence interval, 0.81–1.00).

The results according to the reliability of the videos included in the study were shown in Table-1. Accordingly, 48.2 % of the videos were defined as reliable, 51.7 % as non-reliable. While the median views per month were significantly higher in reliable group, the number of comments was also lower. There were no significant difference were found between the groups in the VPI, number of views,-likes and dislikes, the length and duration of videos. The modified DISCERN and GQS median scores of the videos were found to be statistically higher in favor of the reliable group ($p$<0.001). Most of the videos with reliable information were found to be uploaded by haemophilia association/university or non-profit physiotherapist and physician (n=31). Most of the videos containing misleading information have PwH as a speaker (n=28).

While the modified DISCERN and GQS scores were not differ from each other in the videos where the source was PwH and Fitness coach/personal trainer, it was seen that these two source groups were significantly lower in other pairwise comparisons. It was found that the number of video comments in the videos where the source was PwH was significantly higher than the other groups. On the other hand, there was a significant difference in the duration of broadcasting on YouTube in the PwH or TV program group of the video source (Table-2).

Analysis by speakers in the videos found that the PwH and non-health personnel group had significantly lower modified DISCERN and GQS scores in all other group comparisons. There was no difference in these scores in the comparison of these two groups within (PwH and non-health professional) and the remaining 3 groups (physician, physiotherapist and external voice). The number of comments in the videos where the speakers were PwH was found to be higher than the videos where the speakers were healthcare professionals. The video length was found to be significantly lower in the videos where the speaker was external voice compared to the groups where the speaker was a physiotherapist or PwH (Table-3).

## DISCUSSION

The results of this study revealed that although the accuracy and quality of the videos in the reliable group were relatively better, they were still quite low. It also revealed that the number of videos that

**Table 2.** Analysis of Video Properties By Uploader Spource

| | Haemophilia Associations/ Universities/ non-profit physician or physiotherapist (n=40) | Health channels/ industry and TV programs (n=19) | PwH (n=21) | Fitness coach/ Personal Trainer (n=5) | p |
|---|---|---|---|---|---|
| **Views** | 483.5 (171.5- 1354) | 1021 (150-7305) | 250 (195-579) | 492 (395-1155) | 0.166 |
| **Likes** | 7.5 (1.5-42.5) | 12 (3-62) | 22 (12-43) | 52 (32-64) | 0.148 |
| **Comments** | 0 (0-1.5) | 0 (0-3) | 8 (3-29) | 10 (7-18) | **<0.001**** |
| **Video length (minutes)** | 4.27 (3.1-.10.6) | 4.05 (1.52-7.46) | 7.21 (4.02-19.2) | 3.5 (3.3-4.48) | 0.121 |
| **Duration on youtube (months)** | 23 (8.5-56) | 40 (17-107) | 18 (9-20) | 41 (19-66) | **0.027*** |
| **Views per month** | 21.63 (10.3-93.2) | 31.45 (8.16-182.6) | 23 (12-34.76) | 17.15 (16.73-21.94) | 0.956 |
| **VPI** | 0.6 (0.17-3.1) | 0.4 (0.17-6.08) | 0.76 (0.4-1.15) | 0.57 (0.55-0.73) | 0.989 |
| **DISCERN** | 2.5 (1.5-3.5) | 1 (1-2) | 0 (0-0) | 0 (0-0) | **<0.001**** |
| **GQS** | 4 (3-5) | 2 (1-3) | 1 (1-1) | 1 (1-1) | **<0.001**** |

Median (Percentile 25-75 %) , Kruskal-Wallis Test ; Values of p < 0.05 were accepted as significant and marked bold; PwH: Patient with hemophilia, VPI : Video Power Index, GQS : Global Quality Score, DISCERN : modified DISCERN score,

**Table 3.** Analysis of Video Properties By Speakers

| | Physician (n=8) | Physiotherapist (n=22) | PwH (n=32) | Non-health providers (n=10) | External voice (n=13) | p |
|---|---|---|---|---|---|---|
| **Views** | 871 (365.5-1136.5) | 358 (128-1130) | 327 (195.5-1032) | 1088 (395-1768) | 1029 (241-7881) | 0.334 |
| **Likes** | 10.5 (6.5-20.5) | 5 (0-22) | 22 (10-63.5) | 13.5 (7-32) | 18 (5-87) | 0.054 |
| **Comments** | 0 (0-0.5) | 0 (0-0) | 5.5 (1-20.5) | 1.5 (0-4) | 0 (0-5) | **<0.001**** |
| **Video length (minutes)** | 5.83 ( 3.03-54.12) | 5.85 (3.57-17.09) | 5.8 (3.32-14.18) | 5.4 (1.52-7.57) | 3.03 (1.16-3.3) | **0.021*** |
| **Duration on youtube (months)** | 18.5 (6-31.5) | 20 (6-48) | 19 (9.5-46) | 88 (31-145) | 26 (23-65) | **0.003**** |
| **Views per month** | 26.73 (15.03-67.56) | 28.97 ( 9.84-79.32) | 21.74 (12.58-44.17) | 10.87 (8.16-21.94) | 44.73 (9.26) | 0.552 |
| **VPI** | 0.89 (0.5-2.25) | 0.46 (0-2.64) | 0.72 (0.4-147) | 0.36 (0.25-0.73) | 1.49 (0.3-4.78) | 0.352 |
| **DISCERN** | 2.5 (2-4) | 3 (2-4) | 0 (0-1) | 0 (0-1) | 2 (1-2) | **<0.001**** |
| **GQS** | 4 (3-4.5) | 4.5 (4.5) | 1 (1-2) | 1 (1-1) | 3 (2-4) | **<0.001**** |

Median (Percentile 25-75 %) , Kruskal-Wallis Test ; Values of $p < 0.05$ were accepted as significant and marked bold; PwH: Patient with hemophilia, VPI : Video Power Index, GQS : Global Quality Score, DISCERN : modified DISCERN score

did not include reliable information (mostly shared by patients) besides the videos that contain reliable information about exercise and physiotherapy in haemophilia is substantial.

YouTube is one of the most popular tools that provides many users access to research on diseases. Considering the current pandemic, the information shared YouTube has become very valuable. To date, many studies have been performed on the reliability and quality of YouTube videos, but these studies have produced conflicting results. A systematic review included 37 studies reported that related health-care videos on YouTube were mostly non-reliable (22). Similarly, some studies evaluated videos on specific health topics on YouTube found that most videos were non-reliable (23-25). The higher number of non-reliable videos in our study was in line with the literature. Contrary to our study, there were studies included more reliable information (26-28). The reliability of the videos can be expected to vary depending on the source of the video and the expertise of the speaker. Patients, health channels and personal trainers share more unreliable information in the field of health. Consistent with the literature in the non-reliable video group, the majority were uploaded by PwH (47.7 %), health channels (20.5 %), and fitness coach/personal trainer (11.4 %). In current study, most of the reliable videos (75.6 %) were uploaded by haemophilia associations/universities or physiotherapist/physician, and most of the speakers (68.3 %) were healthcare professionals. In the study on osteoporosis, it was reported that all of the YouTube videos sourced by universities/professional institutions, and 87 % of the videos published by healthcare professionals contain useful information (27).

The median modified DISCERN and GQS scores were significantly higher in the reliable video group, and these results were in accordance with the results of previous studies (15,19,29). It showed that the accuracy and overall quality of these reliable videos were not sufficient, as the average value of both scores was 3 and 4 out of 5, respectively. The scores of the videos uploaded by the haemophilia society/university or the physiotherapist/physician, showing the reliability and overall quality, are 2.5 and 4, respectively. This situation is consistent with the literature (27). However, in the study claiming to the contrary, it was reported that these scores would not differ according to the video source. The probable reason for this study may be that only 7 out of 59 videos were contain to be misleading information (28). In current study, the videos with the highest reliability and quality are those in which the speakers are physiotherapists. The decline in reliability scores of these videos was due to the vast majority of videos not assessing contoversial or uncertain areas for exercise in haemophilia and

not providing additional sources of information from which the viewer can benefit.

The number of monthly views was significantly higher in reliable group indicates that PwH can distinguish the contents in the long term. The reason for the high number of comments on non-reliable videos (especially videos shared by PwH) may be due to the fact that the videos in the haemophilia association/university were closed to comments and thinks that PwH can understand them better. There were no significant difference between the groups regarding views, likes, video length, duration on YouTube and VPI. This shows that individuals watch both reliable and also non-reliable videos about exercise and physiotherapy in haemophilia at similar rates. It has been emphasized in many other publications that video metrics and popularities were not related to video content (15,27). It has been reported that the popularity of low-quality videos is significantly lower in the classification made by video quality, but we did not make such a classification in our study (14).

In conclusion many YouTube videos, often shared by patients, were encountered that did not contain reliable information about exercise and physiotherapy in haemophilia. YouTube videos shared by Haemophilia Societies/Universities/non-profit physician or physiotherapists where healthcare professionals are speakers have higher reliability and quality, but lower popularity. With increased awareness of this study, haemophilia associations and healthcare professionals involved in haemophilia care should be encouraged to share comprehensive and accurate YouTube video information that is appropriately determined to meet the needs of patients in a way that allows the improvement of haemophilia care. It is also very important that evidence-based reliable and high-quality videos become more popular so that more patients can access them easily.

The main limitation of the present study is that it was a cross-sectional study that captured YouTube videos at a particular moment in time. The most important feature of YouTube is that new videos are constantly being uploaded and video interaction parameters are changing rapidly. It does not include videos uploaded after the search date, and videos included in the search may have been unshared for certain reasons. Our second main limitation is that there is no consensus in the literature on evaluating the reliability and quality of the videos. However, the evaluation parameters used in our study are among the most commonly used methods in previous studies (13,15,19,20). Finally, we analyzed the English videos only available on the YouTube platform. It is the most common health-related platform people use and English is the most dominant language in the world.

Considering the difficulties of hemophilic individuals in reaching physiotherapist who maintains their joint health, it may be recommended that musculoskeletal specialist physiotherapists share original, detailed and interesting videos. Physiotherapists can also suggest reliable and helpful YouTube videos for home-care patients with hemophilia. As a result of a multidisciplinary study with authorized official institutions, including health institutions, hemophilia associations and universities, a guideline hemophilia treatment video can be produced and shared for healthcare professionals we can recommend, making the process more practical and reaching more patients.

## Declarations

**Conflict of Interest:** The authors stated that they had no interests which might be perceived as posing a conflict or bias.

**Ethics Approval and Formal Consent:** Ethical approval and informed consent were not obtained as publicly accesible YouTube videos were used and no human/animal participants were included in the study.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

**Turkish Journal of Physiotherapy and Rehabilitation**

*2023 34(1)141-147*

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***Received:*** *29.01.2022 (Geliş Tarihi)*
***Accepted:*** *17.10.2022 (Kabul Tarihi)*

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# EFFECTIVENESS OF DIFFERENT PHYSICAL THERAPY EXERCISE TECHNIQUES IN CHRONIC LOW BACK PAIN: A RANDOMIZED CONTROLLED STUDY

**ORIGINAL ARTICLE**

## ABSTRACT

**Purpose:** Exercise therapy is the most common conservative treatment for low back pain. Exercise has generally been associated pain and kinesiophobia. In this context, especially paraspinal muscles need to be focused on. For this reason, the aim of our study is to evaluate different types of exercises that will help increase neuromuscular facilitation and core stability in paraspinal muscles by considering patient satisfaction.

**Methods:** A total of thirty-seven female patients with chronic low back pain were included in the study. The Oswestry Low Back Pain Questionnaire was used to assess functionality. Core stability was evaluated with a stabilizer. Pain intensity and satisfaction were measured with Visual Analog Scale. Patients' kinesiophobia levels were assessed by using Tampa Kinesiophobia Scale. Patients were randomized into three groups according to the interventions as: Proprioceptive Neuromuscular Facilitation exercise group (n = 9), core stability exercise group (n = 14) and control (n = 14) group. The duration of applications was 3 days per week with a total of 6 weeks.

**Results:** There were group differences for core muscle strength (p = .045), Oswestry scores (p = .001), pain intensity score (p = .003) and Tampa score (p = .001). There were significant gains for Core muscle strength and Oswestry scores for Proprioceptive Neuromuscular Facilitation and Core stability groups (p < .05).

**Conclusion.** Core stabilization exercises have additional effects to improve rehabilitation outcomes for patients. Besides that, the level of patient satisfaction was importantly different between all groups in favor to Core stability in chronic low back pain.

**Keywords:** Core Stability, Exercise, Low Back Pain, Patient Satisfaction, Proprioceptive Neuromuscular Facilitation.

# KRONİK BEL AĞRISINDA FARKLI FİZYOTERAPİ EGZERSİZ TEKNİKLERİNİN ETKİNLİĞİ: RANDOMİZE KONTROLLÜ BİR ÇALIŞMA

**ARAŞTIRMA MAKALESİ**

## ÖZ

**Amaç:** Bel ağrısı için en yaygın konservatif tedavi egzersizdir. Egzersiz genellikle ağrı ve kinezyofobi ile ilişkilendirilmiştir. Bu bağlamda özellikle paraspinal kaslara da odaklanılması da gerekmektedir. Bu nedenle çalışmamızın amacı, paraspinal kaslarda nöromüsküler fasilitasyon ve core stabilitesini artırmaya yardımcı olacak farklı egzersiz türlerini hasta memnuniyetini göz önünde bulundurarak değerlendirmek idi.

**Yöntem:** Kronik bel ağrısı olan otuz yedi kadın hasta çalışmaya dahil edildi. Fonksiyonellik değerlendirilmesi için Oswestry Bel Ağrısı Ölçeği kullanıldı. Core stabilizasyon stabilizatör ile değerlendirildi. Ağrı şiddeti ve memnuniyet Vizüel Analog Skala ile ölçüldü. Hastaların kinezyofobi düzeyleri Tampa Kinezyofobi Ölçeği ile değerlendirildi. Hastalar rastgele üç gruba ayrıldı; Proprioseptif Nöromuskuler Fasilitasyon egzersiz grubu (n=9), Core stabilizasyon grubu (n=14) ve kontrol grubu. Uygulama süresi haftada 3 gün toplam 6 hafta idi.

**Sonuçlar:** Core kas kuvveti (p = 0,045), Oswestry skoru (p = 0,001), ağrı şiddet skoru (p = .003) ve Tampa skoru (p = 0,001) gruplar arasında farklılık gösterdi. Proprioseptif Nöromuskuler Fasilitasyon ve Core stabilizasyon egzersiz grubunda Core kas kuvveti ve Oswestry skorlarında anlamlı kazanımlar elde edildi (p <0,05).

**Sonuçlar:** Kronik bel ağrısında Core stabilizasyon egzersizlerinin hastaların rehabilitasyon sonuçlarını geliştirmek için ek etkileri vardır. Bunun yanı sıra Core stabilizasyon lehine hasta memnuniyet düzeyi tüm gruplar arasında önemli ölçüde farklı idi.

**Anahtar Kelimeler:** Core stabilizasyon, Egzersiz, Bel Ağrısı, Hasta Memnuniyeti, Proprioseptif Nöromuskuler Fasilitasyon.

## INTRODUCTION

Low back pain (LBP) is widespread medical situation for those living with a disability; in most countries, it is also the medical situation requiring rehabilitation (1). LBP is constantly, treated as a symptom, not an illness. When the physiology of the pain is not fully known it defined as non-specific low back pain. Pain in people may be due not only to physical factors but also to psychosocial factors, and this limits people's activities of daily living (2). If people could learn to cope with their pain and exercise regularly instead of being afraid, their recovery will be positively affected, but if they engage in fear behavior instead, this can lead to reduced daily activity levels, muscle weakness and increased pain, leading to disability. Kinesiophobia is defined as the fear of physical activity or motion owing to feel pain and the incidence of fear due to low back pain is % 57.3. Physical exercises are the most used way to dealing with kinesiophobia in patients with LBP (3). It is thought that exercises are beneficial in patients with LBP (4).

Unfortunately, the superiority of any of these treatments over the other has not yet been definitively demonstrated in the literature (5). Core stability exercises (CSE) enhance the ability of the neuromuscular and motor control systems by providing improvement lumbopelvic and abdominal control and it helps to prevent spinal injury. It has been stated that core stabilization exercises are effective on pain, quality of life and disability in female (2,6). Proprioceptive Neuromuscular Facilitation (PNF) exercises are also recommended to reduce pain intensity and improve functional disability in patients with LBP (7). PNF exercise has been advised for sensorimotor control training as well as for stimulating lumbar muscle proprioception. Thus, it enhances joint coordination, muscle strength, movement control, stability, and mobility. However very low-to-moderate-quality proof shows that motor control exercises with a focus on muscle strengthening of the deep muscles, coordination exercises, and core stabilization have a significant effect for chronic LBP. Many different modalities are used to treat LBP. The recommendations to treat patients with LBP include the use of nonpharmacological treatment (6). However, the evidence for nonpharmacologic treatments is still limited (8).

The aim of the research was to examine the effectiveness of alternative exercise techniques on core stability, functionality, pain, kinesiophobia and patients' satisfaction in individuals with chronic LBP.

## METHODS

A total of thirty-seven female patients (mean age 50.05 ± 13.43 years) who were admitted to the outpatient clinic of a tertiary level hospital, between March 2018 and September 2018 with a complaint of chronic LBP were included in the study.

Patients aged 18-65 years who had LBP for at least 3 months and had no neurological deficit were included in the study. Patients with specific spinal pathology, back or lower extremity surgery were not included in the study.

This study was approved by Baskent University Institutional Review Board and Ethics Committee (Project no: KA18/27) and supported by Baskent University Research Fund. The study was registered with clinical trial number as NCT03493438. Written informed consent was signed by all participants.

### Sample Size

The sample size required for the study was calculated by power analysis according to significant differences on mean difference (Δ) and common standard deviation (σ) of Oswestry disability scores of a pilot study as primary outcome. The sample size was determined as 10 but the number of participants were increased in each group in case of dropouts with the alpha level set at 0.05 to achieve 95% power (8).

Randomization procedure was performed using an online random-allocation software program (Figure 1) (9). Patients were randomized into three groups according to the interventions as: PNF exercise group (n = 9), CSE group (n = 14) and control (n = 14) group.

### Interventions

All patients regardless of group allocation were commenced with a physical therapy program. It consists of hot pack and conventional transcutaneous electrical nerve stimulation (TENS). TENS was applied 100 Hz frequency and 60 μs pulse duration

with Chattanoga Intelect® stimulator. Treatment duration was 20 minutes. Afterwards the patients in each group received the randomized related exercise therapy under the supervision of a physiotherapist for 20 minutes as described below. Applications were made 3 times a day for 6 weeks

### Proprioceptive Neuromuscular Facilitation Group

In order to increase the neuromuscular effect by stimulating the proprioceptors in the trunk muscles, PNF was applied by giving manual resistance (11). Chopping and lifting patterns were used to train the core muscles to activate prior to movement helping to stabilize the spine. Facilitation applied when patients were in sitting position. Each pattern was performed for 30 minutes.

### Core Stability Group

Core stabilization exercises were given to the patients with respiratory control. Different visual imaging techniques were used while performing the exercises, and the patients were asked to maintain their spine straightness while doing the exercises (11). After teaching the neutral spine position, posterior pelvic tilt, cat-cow and shoulder bridge exercises were shown, respectively. exercise started with 8 reps and increased up to 20 reps.

### Control Group

The control group was treated with physical therapy agents. and were informed about the importance of exercise but no exercise was given.

### Outcome Measures

Descriptive characteristics of the patients were recorded at admission. Core stability, functionality, pain and kinesiophobia were evaluated at pre-intervention and at the end of 6 weeks therapy. Functionality and core stability were the primary outcome measures of the study while pain, kinesiophobia and satisfaction were secondary outcome measures.

Descriptive characteristic of the patients was recorded at admission. Core stability, functionality, pain, kinesiophobia were evaluated at pre interventions and at the end of 6 weeks therapy. Functionality and core stability were the primary outcome measures of the study while pain, kinesiophobia and satisfaction were secondary outcome measures.

### Functionality

The Oswestry Low Back Pain Questionnaire was used to evaluate functionality in activities of daily living. The questionnaire composed of 10 questions. There are options between 0 and 5 points for each question. The patient was asked to select the statement that best explain the situation. The maximum score is 50. 1-10 points indicate mild dysfunction, 11-30 show moderate dysfunction, and 31-50 demonstrate severe dysfunction. The Turkish version of the questionnaire is valid (13).

### Core Stability

Core stability was evaluated with a pressure device (Stabilizer Pressure Biofeedback Unit, USA, Chattanooga Group, Hixson, TN). While the patients were lying on their back with their knees flexed at 90°, they were allowed to do the exercises by contracting their pelvic floor muscles by slowly pulling their lower abdomen in as if they were holding their urine with respiratory control to strengthened transversus abdominus (TrA) and multifidus (MF) muscle. The last part of the pressure device was placed on the posterior superior iliac spine. The pressure gauge was situated to indicate 40 mmHg before the drawing-in maneuver start. Subjects were asked to increase the pressure by 10 mmHg and maintain the state for 5 seconds (14-16).

### Pain Intensity

Pain intensity was measure with visual analog scale (VAS). Patients express their pain by marking on a 100 mm scale according to its degree. “0” represents the absence of pain, and “100” represents the most severe pain. The space between the specified point and the beginning of the line is measured in millimeters and the numerical value recorded (17).

### Kinesiophobia

Patients’ kinesiophobia measured by Tampa Kinesiophobia Scale. The survey consists of 17 questions. It measures the people’s fear of movement / re-injury. It also includes the parameters of injury / re-injury and fear-avoidance in work-related activities. A 4-point Likert scale (1=strongly disagree, 4=strongly agree) is used in the scale. Four items

**Table 1.** Descriptive Clinical Characteristics of Patients.

| | PNF (n=9) | Core Stability (n=14) | Control (n=14) | Total (n=37) | p |
|---|---|---|---|---|---|
| Age (year, $\bar{x}\pm sd$) | 55.55±11.94 | 45.64±12.89 | 50.92±14.22 | 50.05±13.42 | 0.326 $^{\mu}$ |
| Body Mass Index ($kg/cm^2$, $\bar{x}\pm sd$) | 25.36±2.46 | 27.46±4.37 | 30.35±5.06 | 28.04±4.63 | 0.256 $^{\mu}$ |

PNF: Proprioceptive Neuromuscular Facilitation, VAS: Visual Analog Scale, $^{\chi}$: Chi-square test, n: number of patients, %: percentage, X: mean, SD: standard deviation, kg: kilogram, $cm^2$: centimeters-square.

(4, 8, 12 and 16) were reverse coded. The total score ranges from 17 to 68, with higher values indicating more severe kinesiophobia. The Turkish version of the questionnaire was verified, and its reliability was checked (18).

### Patient Satisfaction

We used VAS to evaluated Patient satisfaction. Patient show on diagram his satisfaction or unsatisfaction. The numeric value in the diagram is saved.

### Statistical Analysis

SPSS 25 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp) was used to analysis. Descriptive statistics (mean, standard deviation, median, minimum value, maximum value, and percentile) for discrete and continuous variables were given. The homogeneity of the variances was controlled with Levene's test. We used the Shapiro-Wilk test to assumpted of normality. If parametric test prerequisites were gratified, we used the student's t test to compare the differences between the two groups, when not Mann Whitney–U test was used. To compare the differences between three and more groups, one-way analysis of variance was used when the parametric test prerequisites were gratified, and the Kruskal Wallis test was used when such prerequisites were not. The Bonferroni correction method was used to examine the significant results concerning three and more groups. Repeated measures of analysis of variance were analyzed by Mauchy's sphericity test and Box's Test of Equality of Covariance Matrices. We used Repeated Measures Analysis of Variance for repeated measures. If parametric tests (factorial design for repeated measures analysis) do not provide the preconditions, Greenhouse-Geisser correction or Huynh-Feldt correction was used for corrections to the Degrees of Freedom or Friedman Test. We used Bonferroni test for multiple comparisons.

## RESULTS

The descriptive characteristics of patients were given in Table 1. The comparison of 3 groups across time points for outcome measures of TrA and MF muscle strength, Oswestry scores, VAS pain intensity and Tampa scores revealed the exact different responses of group-by-time interaction. There was a group difference for TrA and MF muscle strength ($p = .055$), Oswestry score ($p = .001$), VAS pain intensity score ($p= .001$) and Tampa score ($p = .001$). There were significant gains for TrA and MF muscle strength and Oswestry scores for PNF and core stability groups ($p < .05$). Core group show a time-dependent modify in all parameters. There was a significant reduce in pain and Tampa scores for core stability group ($p < .05$) (Table 2). The level of satisfaction was importantly different between all groups in favor to core stability ($p < .05$) (Table 3).

## DISCUSSION

In this study, we investigated the effectiveness of different exercise groups on core stability, functionality, pain, kinesiophobia, and satisfaction in patients with chronic LBP. The results of this study showed that; muscle strength, disability, pain intensity and kinesiophobia scores differed between the groups. Significant gains were seen in muscle strength and disability scores for both the PNF and core stability groups, while a significant decrease was observed in pain and kinesiophobia scores in the core stability group. It was determined that the satisfaction levels of the patients differed in all groups, and the highest satisfaction was observed in the core stability group.

**Table 2.** Treatment Outcomes of The Patients After Interventions.

| | | PNF (n=9) $\bar{x}\pm sd$ Min-Max | Core Stability (n=14) $\bar{x}\pm sd$ Min-Max | Control (n=14) $\bar{x}\pm sd$ Min-Max | Total (n=37) $\bar{x}\pm sd$ Min-Max | Group X Time Effect p |
|---|---|---|---|---|---|---|
| TrA and MF Muscle Strength | Pre- intervention | 35.00±3.42<br>30.00-40.00 | 36.00±2.96<br>30.00-40.00 | 38.07±1.89<br>35.00-41.00 | 36.54±2.94<br>30.00-41.00 | F=3,166<br>p =0.055 |
| | Post-intervention | 38.55±4.74<br>34.00-50.00 | 39.50±1.09<br>37.00-40.00 | 38.50±1.69<br>36.00-41.00 | 38.89±2.59<br>34.00-50.00 | |
| | Mean difference | 3.556 | 3.500 | 0.429 | | |
| | p | F=8.651<br>p=0.006* | F=13.040<br>p=0.001** | F=0.196<br>p=0.651 | | |
| Oswestry Score | Pre- intervention | 53.40±24.95<br>14.00-86.00 | 34.42±13.56<br>14.00-62.00 | 27.85±7.90<br>14.00-42.00 | 36.55±18.15<br>14.00-86.00 | F=21,580<br>p=0.001* |
| | Post-intervention | 45.11±20.56<br>10.00-64.00 | 19.00±11.52<br>2.00-46.00 | 27.57±7.31<br>14.00-38.00 | 28.59±16.30<br>2.00-64.00 | |
| | Mean difference | 8.289 | 15.429 | 0.286 | | |
| | p | F=16.613<br>p<0.001** | F=89.536<br>p<0.001** | F=0.031<br>p=0.862 | | |
| VAS Pain Intensity Score | Pre- intervention | 4.34±2.45<br>0.00-6.80 | 4.22±2.39<br>0.90-8.60 | 3.55±2.22<br>0.80-7.30 | 3.99 ±2.35<br>0.00-8.60 | F=9,180<br>p =0.001* |
| | Post-intervention | 3.23± 1.96<br>0.00-5.35 | 1.55±1.10<br>0.00-4.60 | 3.48±2.24<br>0.75-8.00 | 2.69±1.98<br>0.00-8.00 | |
| | Mean difference | 1.106 | 2.664 | 0.068 | | |
| | p | F=4.238<br>p=0.047 | F=38.291<br>p<0.001** | F=0.025<br>p=.876 | | |
| Tampa Score | Pre- intervention | 42.77±2.22<br>39.00-45.00 | 44.21±5.82<br>35.00-56.00 | 42.00±8.72<br>27.00-61.00 | 43.02±6.46<br>27.00-61.00 | F=7,641<br>p =0.001* |
| | Post-intervention | 40.66± 3.00<br>37.00-45.00 | 39.21±3.68<br>33.00-46.00 | 41.85±8.70<br>27.00-62.00 | 40.56±5.97<br>27.00-62.00 | |
| | Mean difference | 2.111 | 5.000 | 0.143 | | |
| | p | F=3.680<br>p=0.064 | F=32.110<br>p<0.001** | F=0.026<br>p=0.872 | | |

TrA: Transversus Abdominus, MF: Multifidus, PNF: Proprioceptive Neuromuscular Facilitation, VAS: Visual Analog Scale, test, n: number of patients, Min: minimum, Max: maximum, $\bar{x}\pm sd$ : mean ±standard deviation, * p<0.05, **p<0.001.

**Table 3.** Satisfaction Results According to The Groups

| | PNF (n=9) $\bar{x}\pm sd$ Min-Max | Core Stability (n=14) $\bar{x}\pm sd$ Min-Max | Control (n=14) $\bar{x}\pm sd$ Min-Max | Total (n=37) $\bar{x}\pm sd$ Min-Max | p $^{\mu}$ |
|---|---|---|---|---|---|
| Patients' Satisfaction for Functionality | 4.56±1.56<br>2.00-8.00 | 6.72±1.45<br>4.50-8.60 | 6.45±1.49<br>2.80-8.10 | 5.19±1.88<br>1.14-8.60 | **0.027*** |
| Patients' Satisfaction for Pain | 4.08±1.34<br>1.14-6.00 | 6.50±1.42<br>4.10-8.60 | 4.60±1.89<br>1.90-8.00 | 6.09±1.70<br>2.0-8.60 | **0.017*** |

n: number of patients, Min: minimum, Max: maximum, $\bar{x}\pm sd$ : mean ±standard deviation, $^{\mu}$: Kruskal Wallis test, *: p<.05.

There are various studies about exercise treatment in LBP. There are differences in the literature regarding exercises. In one review it was reported that improvement in pain and disability was better in the PNF group than in the core exercise and conventional physiotherapy group, but the quality of evidence was low to moderate (6). PNF exercises commonly used to reduce pain and enhance the muscle strength on upper and lower extremities (19). Areeudomwong et al. showed that a 4-week PNF training period help to reduce pain intensity and functional disability as well as improve patient satisfaction and quality of life (7). According to our results, PNF exercise beneficial for functionality and muscle strength. On the other hand, we can say that core stabilization exercises are better for muscle strength, disability, pain, kinesiophobia and patient satisfaction in LBP.

The main reason for this result could be the more activation and strengthening of deeper trunk muscles, especially transversus abdominus in both groups. All techniques of PNF training in this study were performed in spiral and diagonal patterns, helps to activate of superficial muscles over their patterns. It may be said that PNF exercises may not strengthen inner abdominal muscles as transversus abdominus as much as core stability exercise program. Areeudomwong et al. showed PNF exercises are more effective on superficial muscles of trunk (7).

In the literature within the pelvis, spine, and kinetic chain, and CSE is an exercise treatment regimen for LBP conditions. Beomryong and Yim compared three different exercise groups and showed that the core stability of the individuals in the exercise group was affected more positively than those in the sham group (22). In our study, an increase in core muscle strength was observed in both PNF and CSE groups. In a review of Core Stability Exercises, it is said that scales such as VAS, Numerical Rating System are reliable and effective measures for rating pain in Patients with Non-Specific Low Back Pain (23). In this study, VAS was also used to evaluate pain, and a significant difference was observed in the pre- and post-treatment pain values of the people in the core stability exercise group. In patients with subacute or chronic low back pain, the minimum clinically significant change (MCIC) indicated for VAS is at least 20 mm (24). Akhtar et al. showed that both general physical therapy (PT) exercises and CSE effective in managing LBP but CSE have more reductions in pain scores compared to general PT. The mean VAS score changes in CSE 3.08 whereas 1.71 in PT group (21). Osteloand et.al. indicate that the MCIC value should be at least 10 in the oswestry index used to measure functional disability (24). The statistical significance values we obtained for pain and disability in our study are also clinically significant for the core stabilization exercise group. In our study, statistically significant results were obtained in the results of kinesiophobia, muscle strength and satisfaction in the core stabilization group. However, since the clinical significance values of these parameters were not found in the literature, no comparison was made with our study results.

The effectiveness of exercise mainly depends on the individuals themselves and the individual desire to be healthy. Exercise selection according to the patient's global health status, talents and skills is very important for the efficacy of exercise treatment. Core stability exercise program is a very popular exercise program since pilates programs started to spread. It is important to remember that generally people are influenced by what is commonly used in popular culture. This culture may have led to the belief that core stability exercises will be more curative than other exercises. Pain is not only related to the physiology of the individual but also the social environment, beliefs, and psychology, which is affected by many factors is a concept that should be considered multiple. Therefore, it may be an advantage to do an exercise that the individuals believe and have an awareness from social environment. This could be another reason for the core stability exercise group to be superior to other exercise interventions as well as high satisfaction scores in the core group also supports these results.

Supervision of exercise and motivation-enhancing behavior therapy may also play a considerable role in increasing the efficacy of exercise therapy. That is why we are planning based on different supervised exercise programs. We could speculate that patients with chronic LBP who core stability exercises benefits more and should be encouraged to

exercise with strength and mindful techniques together.

The limitation of our study was the lack of double-blind long-term follow-up results to determine intervention gains for exercise programs.

## CONCLUSION

All interventions with supervision especially core stabilization exercises have favorable effects to improve rehabilitation outcomes for patients with chronic low back pain. Further research is necessary to understand longer term outcomes and to understand how differences among patients and interventions influence outcomes.

***Sources of Support:*** This study was supported by Baskent University Research Fund.

***Conflict of Interest:*** The authors report no conflict of interest.

***Ethical Approval:*** This study was approved by Baskent University Institutional Review Board and Ethics Committee (Project no: KA18/27).

***Disclosure of Funding and Ethics:*** This study was approved by Baskent University Institutional Review Board and Ethics Committee (Project no: KA18/27) and supported by Baskent University Research Fund

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# *IV. ULUSAL KIBRIS TÜRK FİZYOTERAPİ VE REHABİLİTASYON KONGRESİ*

# *"İNFLAMASYONDA FİZYOTERAPİ VE REHABİLİTASYON YAKLAŞIMLARI KONGRESİ"*

15-17 Aralık 2022
Colony Hotel, Girne/KKTC

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| 9 | Doç. Dr. | Ceren Gürşen | Hacettepe Üniversitesi | Fizik Tedavi ve Rehabilitasyon Fakültesi |
| 10 | Doç. Dr. | Ramadan Özmanevra | Uluslararası Kıbrıs Üniversitesi | Ortopedi ve Travmatoloji Anabilim Dalı |
| 11 | Dr. | Ayşe Sel | Uluslararası Kıbrıs Üniversitesi | Sağlık Bilimleri Fakültesi |
| 12 | Dr. | Jale Refik Rogers | Kuzey Kıbrıs Türk Cumhuriyeti Cumhuriyet Meclisi | - |
| 13 | Dr. | Pervin Yiğit | Türk Maarif Koleji | - |
| 14 | Dr. Vet. Hek. | Gül Akbaş Güngör | Yakın Doğu Üniversitesi | Veteriner Fakültesi |
| 15 | Dr. Fzt. | Nazemin Gilanlıoğulları | Lefke Avrupa Üniversitesi | Fizyoterapi ve Rehabilitasyon Bölümü |
| 16 | Uzm. Dr. | Reşat M. Baha | Dr. Burhan Nalbantoğlu Devlet Hastanesi | Kardiyoloji Anabilim Dalı |
| 17 | Uzm. Dr. | Yonca Moris | Dr.Burhan Nalbantoğlu Devlet Hastanesi | İç Hastalıkları ve Romatoloji Uzmanı |
| 18 | Fzt. | Handan Bilgehan Mert | Dr.Burhan Nalbantoğlu Devlet Hastanesi | Fizyoterapi ve Rehabilitasyon Bölümü |
| 19 | Uzm. Fzt. | Kezban Dana | Sağlık Bakanlığı Yataklı Tedavi Kurumları Dairesi | Fizyoterapi ve Rehabilitasyon Bölümü |
| 20 | Fzt. | Nafia Bekiroğu | Nafia Bekiroğlu Fizik Tedavi ve Rehabilitasyon Merkezi | Fizyoterapi ve Rehabilitasyon Bölümü |
| 21 | Fzt. | Sibel Karaca | Sağlık Bakanlığı Yataklı Tedavi Kurumları Dairesi | Fizyoterapi ve Rehabilitasyon Bölümü |

## IV. ULUSAL KIBRIS TÜRK FİZYOTERAPİ VE REHABİLİTASYON KONGRESİ
## "İNFLAMASYONDA FİZYOTERAPİ VE REHABİLİTASYON YAKLAŞIMLARI KONGRESİ"

### 15 ARALIK 2022 KONGRE I. GÜNÜ

08:30-09:30 KAYIT
09:30-10:15 AÇILIŞ KONUŞMALARI

- 10:15-10:45 KONGRE AÇILIŞ PANELİ (İNFLAMASYONA BAKIŞ)
  Oturum Başkanları: KTFB Başkanı Uzm. Fzt. Şahveren Yücel – KTFB Asbaşkanı Uzm. Fzt. Münevver Özakalın
  İnflamasyonun Patofizyolojisi – Prof. Dr. Mitat Koz

10:45-11:00 KAHVE MOLASI

- 11:00-12:30 ROMATOLOJİK REHABİLİTASYON OTURUMU
  ROMATİZMAL HASTALIKLARDA İNTERDİSİPLİNER İNFLAMASYON YÖNETİMİ
  Oturum Başkanları: Prof. Dr. Mehtap Malkoç, Uzm. Dr. Yonca Moris, Yrd. Doç Dr. Tuba Yerlikaya
  - İnflamasyona Romatolog Bakış Açısı – Uzm. Dr. Yonca Moris
  - İnflamasyon Kontrolünde Egzersizin Rolü – Prof. Dr. Edibe Ünal
  - Güncel Kılavuzların Önerileri: Pasif vs Aktif Tedavi- Yrd. Doç. Sevim Öksüz
  - Rehabilitasyondaki Bariyerleri Nasıl Aşabiliriz? – Uzm. Fzt. Göktuğ Er
  - Kronik Ağrı Yönetilebilir mi? – Uzm. Fzt. Beraat Alptuğ

12:30-13:30 ÖĞLE ARASI

- Fizyoterapi ve Rehabilitasyon Öğrenci Yarışması-Yarışma Başkanları; Uzm. Fzt. Cemaliye Hürer, Uzm. Fzt. Yelda Kıngır

- 13:30-14:30 ORTOPEDİK REHABİLİTASYON OTURUMU
  ORTOPEDİK PROBLEMLERDE İNFLAMASYON VE YÖNETİMİ
  Oturum Başkanları: Prof. Dr. İnci Yüksel, Doç. Dr. Berkiye Kırmızıgil
  - Cerrahi ve Travma Sonrası Kırık İyileşmesi –Doç. Dr. Ramadan Özmanevra
  - Manuel Terapi – Prof. Dr. İnci Yüksel
  - Egzersiz Yaklaşımları – Doç. Dr. Ender Angın
  - İnflamasyon ve Ortez – Doç. Dr. Yasin Yurt

- 14:30-15:30 PEDİATRİK REHABİLİTASYON OTURUMU
  PEDİATRİK İNFLAMATUVAR HASTALIKLARDA REHABİLİTASYON YAKLAŞIMLARI
  Oturum Başkanları: Dr. Fzt. Hülya Özbeşer, Dr. Fzt. Melis Sahilli Bağkur
  - Juvenil İdiyopatik Artritte Fizyoterapi ve Rehabilitasyon – Prof. Dr. Emine Handan Tüzün
  - Obez Çocuklarda Sistemik İnflamasyon ve Fizyoterapi Yaklaşımları – Yrd. Doç. Dr Zehra Güçhan Topçu
  - Çocuklarda Kronik Ağrının Yönetiminde Fizyoterapi - Yrd. Doç. Dr. Ünal Değer

15:30-15:45 KAHVE MOLASI

- 15:45-16:30 KARDİYAK REHABİLİTASYON OTURUMU
  İNFLAMASYON TEMELİNDE KARDİYAK REHABİLİTASYON
  Oturum Başkanları: Prof. Dr. Hülya Harutoğlu, Prof. Dr. Finn Rassmusen, Uzm. Fzt. Ayşe Volkan
  - Covid-19'e Bağlı Ani Ölümler – Uzm. Dr. Reşat M. Baha
  - Torasik Cerrahiler Sonrası İnflamasyon ve Yönetimi – Doç. Dr. Özlem Balcıoğlu
  - Covid-19 Çağında Kardiyak Rehabilitasyon Yaklaşımları – Yrd. Doç. Dr. Musa Muhtaroğlu

- 16:30-17.15 PELVİK TABAN SAĞLIĞI OTURUMU
  KRONİK PELVİK AĞRI ILE NASIL BASA ÇIKALIM?
  Oturum Başkanları: Prof. Dr. Elçin Yoldaşcan – Yrd. Doç. Dr. Ayşe Sel
  - Kronik Pelvik Ağrıda Güncel Tanı ve Tıbbi Tedavi Yaklaşımları – Doç. Dr. Ahmet Bindayı
  - Kronik Pelvik Ağrının Yönetiminde ''Biyopsikososyal Model Işığında Fizyoterapi ve Rehabilitasyon'' – Doç. Dr. Ceren Gürşen
  - Kronik Pelvik Ağrı Sendromunun Yönetiminde Pelvik Taban Fizyoterapisi – Uzm. Fzt. Batuhan Dericioğlu

17:15-17:30 KAHVE MOLASI

- 17:30-18:15 SÖZEL BİLDİRİ SUNUMLARI
  Oturum Başkanları: Yrd. Doç. Dr. Özge Çakır Topukçu, Uzm. Fzt. Burcu Dericioğlu Tokgöz

## 16 ARALIK 2022 KONGRE II. GÜNÜ

- 09:00-09:45 KORUYUCU FİZYOTERAPİ OTURUMU
  İNSANLIĞI İNFLAMASYONDAN KORUYABİLİR MİYİZ?
  Oturum Başkanları: Doç. Dr. Beliz Belgen Kaygısız, Yrd. Doç. Dr. Jale Refik Rogers
  - Toplumsal Anksiyetenin Davranışsal Yansımaları – Yrd. Doç. Dr. Pervin Yiğit
  - Anti-İnflamatuar Etkili Postüral Farkındalık – Yrd. Doç. Dr. Özge Çakır Topukçu
  - Fonksiyonel Yeterliliğin Ölçütü Fiziksel Uygunluk – Fzt. Yeliz Kuset

- 09:45-10:45 PULMONER REHABİLİTASYON OTURUMU
  SESSİZ YANGIN İNFLAMASYON VE PULMONER SİSTEM
  Oturum Başkanları: Prof. Dr. F. Füsun Yıldız, Yrd. Doç. Dr. Özge Özalp
  - Obezite ve Pulmoner Sistem Sorunlarında Fizyoterapi ve Rehabilitasyon- Prof. Dr. Mehtap Malkoç
  - Yoğun İnflamasyon Tedavisinde Kullanılan İlaçların Rehabilitasyona Etkisi – Dr. Fzt. İlker Yatar
  - Post Covid Long Term Etkilerde Pulmoner Rehabilitasyon – Uzm. Fzt. Ayşe Volkan

10:45-11:00 KAHVE MOLASI

- 11:00-12:15 SPORCU SAĞLIĞI OTURUMU
  SPORCULARDA İNFLAMASYON YOLCULUĞU AKUTTAN KRONİĞE
  Oturum Başkanları: Prof. Dr. Hayri Baran Yosmaoğlu, Doç. Dr. Ender Angın
  - Akut İnflamasyon DOMS –Doç. Dr. Berkiye Kırmızıgil
  - Hamstring Strain – Uzm. Fzt. Sergen Summakoğulları
  - Lateral Ayakbileği Spraini – Yrd. Doç. Dr. Tuğçe Kalaycıoğlu
  - Overuse Yaralanmaları – Uzm. Fzt. Kamil Bayraklı
  - İnflamasyon Baskılanmalı mı? – Uzm. Fzt. Erdoğan Çetintaş

- 12:15-12:45 HAYVANLARDA FİZYOTERAPİ OTURUMU
  KÜÇÜK HAYVANLARDA İNFLAMASYON VE FİZYOTERAPİ
  Oturum Başkanları: Doç. Dr. Yasin Yurt, Uzm. Fzt. Batuhan Dericioğlu
  - Doku İyileşmesinin Gecikmesi Klinikte Ne Gibi Problemlere Yol Açıyor? – Dr. Vet. Hek. Gül Akbaş Güngör
  - Küçük Hayvanlarda LLLT Doku İyileşmesini Hızlandırıyor mu? – Yrd. Doç. Dr. Neyran Altınkaya

12:45-14:00 ÖĞLE ARASI
Fizyoterapi ve Rehabilitasyon Öğrenci Yarışması-Yarışma Başkanları; Uzm. Fzt. Rigina Rakhmatova, Uzm. Fzt. Hüzeyin Özkader

- 14:00-14:30 ONKOLOJİK REHABİLİTASYON OTURUMU
  İNFLAMATUVAR DURUMLARDA OLUŞAN LENFÖDEMDE FTR YAKLAŞIMLARI
  Oturum Başkanları: Prof. Dr. Adile Öniz Özgören, Uzm. Fzt. Caniz Tonyalı
  - İnflamatuvar Durumlarda Oluşan Lenfödemde Uygulanan FTR Yaklaşımları ve Klinik Vakalar – Uzm. Fzt. Emine Kütüküt
  - Kıbrıs'ın Kuzeyinde Lenfödem Uygulamaları – Uzm. Fzt. Nazemin Gürsoy

- 14:30-15:30 NÖROLOJİK REHABİLİTASYON OTURUMU
  NÖROLOJİK HASTALIKLARDA İNFLAMASYONUN ETKİSİ
  Oturum Başkanları: Prof. Dr. Refik Mas, Yrd. Doç. Dr. Sevim Öksüz
  - Nöroinflamasyon Sürecine Pozitif ve Negatif Bakış – Doç. Dr. Beliz Belgen Kaygısız
  - İnme Sonrasında Fizyoterapinin Nöroinflamasyondaki Etkisi – Doç. Dr. Gözde Iyigün
  - Parkinson Hastalığında Fizyoterapi ve Rehabilitasyonun Nöroinflamasyondaki Etkisi – Dr. Fzt. Nazemin Gilanlıoğulları
  - Multiple Sklerozda Fizyoterapinin Nöroinflamasyondaki Etkisi – Uzm. Fzt. Aytül Özdil

15.30-15:45 KAHVE MOLASI

- 15:45-17:15 GERİATRİK REHABİLİTASYON OTURUMU
  GERİATRİK HASTALIKLARDA İNFLAMASYONUN ETKİSİ
  Oturum Başkanları: Prof. Dr. Salih Angın, Doç. Dr. Gözde İyigün
  - İnflamasyon ve Senesens – Prof. Dr. Refik Mas
  - İnflamasyon ve İmmobilizasyon – Prof. Dr. Salih Angın
  - Kırılgan Yaşlıda İnflamasyonun Etkileri ve Fizyoterapi Yaklaşımları – Yrd. Doç. Dr. Aydın Meriç
  - Alzheimer'da İnflamasyon ve Egzersizin Etkinliği – Uzm. Fzt. Betül Bilgin

- 17:15-18:00 SÖZEL BİLDİRİ
  Oturum Başkanları: Prof. Dr. İpek Ergür, Uzm. Fzt. Mehmet Miçooğulları

18:00-18:15 KAPANIŞ

## IV. ULUSAL KIBRIS TÜRK FİZYOTERAPİ VE REHABİLİTASYON KONGRESİ
## "İNFLAMASYONDA FİZYOTERAPİ VE REHABİLİTASYON YAKLAŞIMLARI KONGRESİ" (15-16 Aralık 2022, Colony Hotel, Girne/KKTC)

**S001.** **Gonartrozlu Hastalarda WOMAC İndeksi İle Klinik Fonksiyonel Testlerin İlişkisinin İncelenmesi**
**Investigation of the Relationship Between WOMAC Index and Clinical Functional Tests in Patients with Gonarthrosis**
Buse GÜZ, Sıddıka Fatma UYGUR, Hatice REŞORLU

**S002.** **Bir Kedide Gözlenen Isırık Yarasında Klasik Yara Pomadlarının Kullanımı Ve Düşük Doz Laser Uygulamasının Uzun Dönem Sonuçları: Olgu Sunumu**
**The Use of Classical Wound Pomades and Low-Dose Laser Therapy in a Cat With Bite Wound: A Case Report**
Gül Çıray AKBAŞ GÜNGÖR, Neyran ALTINKAYA

**S003.** **Fizyoterapi Ve Rehabilitasyon Dergilerinde Kaynak Kullanım Hataları**
**Investigation of Reference Errors in Physiotherapy and Rehabilitation Journals**
Büşra BAL, Salih ANGIN

**S004.** **Kuzey Kıbrıs'ta Yaşayan Yaşlılarda Düşme Sıklığı Ve** İçsel **Risk Faktörleri İle Düşmeler Arasındaki** İlişki
**Fall Prevalence Among Elderly People in Northern Cyprus and Association Between İntrinsic Risk Factors and Falls**
Hatice HACIKÜÇÜK, Emine Handan TÜZÜN, Levent EKER

**S005.** **Türk Fizyoterapistlerinin Elektrofiziksel Ajanların Kullanımı Hakkında Bilgi, Tutum Ve Görüşleri**
**Turkish Physiotherapists on Knowledge, Attitudes and Opinions About the Use of Electrophysical Agents**
**Özge** ÇAKIR, Hatice HACIKÜÇÜK, Emine Ahsen ŞENOL

**S006.** **Türk Fizyoterapistlerinin Kanıta Dayalı Uygulama Modeline Bakışı**
**The View of Turkish Physiotherapists on Evidence-Based Practice Model**
**Özge** ÇAKIR, Emine Ahsen ŞENOL, Hatice HACIKÜÇÜK

**S007.** **Renal Replasman Tedavisi Alan Kronik Böbrek Hastalarında Yorgunluk** Şiddetinin **Karşılaştırılması**
**A Comparison of Severity of Fatigue in Patients with Chronic Renal Replacement Treatment**
Rigina RAKHMATOVA, İ. Batuhan DERİCİOĞLU, Özge ÖZALP

**S008.** **El-El Bileği Cerrahisi Geçirmiş Ve Geçirmemiş Hastalarda Propriyoseptif Duyunun Karşılaştırılması**
**Comparison of Proprioceptive Sense in Patients Who Had and Who Had Not Undergone Hand-Wrist Surgery**
Zehra DEMİR, Mehmet MİÇOOĞULLARI, Batuhan DERİCİOĞLU, Fatma UYGUR

**S009.** **Kuzey Kıbrıs'ta Yaşayan Yaşlılarda Fiziksel Aktivite Düzeyi Ve** İlişkili **Engeller/Kolaylaştırıcıların Belirlenmesi**
**Determination of Physical Activity Level and Associated Barriers/Facilitators of Elderly Living in Northern Cyprus.**
Beliz Belgen KAYGISIZ, Zehra Güçhan TOPCU, Aydın MERİÇ, Havva GÖZGEN, Fahriye ÇOBAN, Aluvuddin KURBONBOYEV, Necati ÖZLER, Nurcihan ALTUN, Emine Ahsen ŞENOL

**S010.** **Üniversite Öğrencilerinde Premenstrüal Sendrom Semptomları Ve Ağrı Alanlarının İncelenmesi: Ön Çalışma**
**Examination of Premenstrual Syndrome Symptoms and Pain Areas in University Students: Preliminary Study**
Melis BAĞKUR, Batuhan İ. DERİCİOĞLU, Tuba YERLİKAYA, Atakan BAKLACI

**S011.** **Genç Yetişkinlerde Fiziksel Performans Düzeyinin, Dengenin Ve Core Stabilizasyonun İkili Görev Yeteneği İle İlişkilerinin Değerlendirilmesi**
**Evaluation of the Relationship Between Physical Performance Level, Balance, and Core Stabilization with Dual Task Ability in Young Adults**
Caniz TONYALI, Sıddıka Fatma UYGUR

**S012.** **Yaşlı Bireylerde Telerehabilitasyonun Uyku** Üzerine **Etkisi**
**The Effect of Telerehabilitation on Sleep in the Elderly**
Melis BAĞKUR, Tuba YERLİKAYA, Gonca INANC, Adile ÖNİZ

**S013.** **Covid-19 Karantinası Sırasında Ve Sonrasında Kıbrıs'ın Kuzeyindeki Bireylerin Haftalık Fiziksel Aktivite Durumlarının** İncelenmesi
**Examination of Participants' Weekly Physical Activity Frequencies During and After the Covid-19-Related Lockdown in the Northern Side of Cyprus**
Melis BAĞKUR, Taygun DAYI, Müjgan ÖZTÜRK

**S001 - Gonartrozlu hastalarda WOMAC indeksi ile klinik fonksiyonel testlerin ilişkisinin incelenmesi**

Buse Güz[1], Sıddıka Fatma Uygur[1], Hatice Reşorlu[2]

[1]Uluslararası Kıbrıs Üniversitesi, Sağlık Bilimleri Fakültesi, Fizyoterapi ve Rehabilitasyon, KKTC

[2]Çanakkale Onsekiz Mart Üniversitesi, Tıp Fakültesi, Fiziksel Tıp ve Rehabilitasyon, Çanakkale

**Amaç:** Bu çalışmanın amacı, diz osteoartriti (gonartroz) olan hastalarda Western Ontario ve McMaster Üniversiteleri Osteoartrit İndeksi (WOMAC)'nin klinik fonksiyonel testler ile ilişkisini araştırmaktır.

**Yöntem:** Çalışmaya Kellgren-Lawrence skalasına göre evresi 2-4 olan 30 hasta (kadın/erkek: 25/5) dahil edildi. Hastalara WOMAC indeksi, klinik fonksiyonel testler olarak kendi hızında yürüme testi (SPWT), sandalye 'ye otur – kalk testi (CST), merdiven çıkma testi (SCT), kaldır ve taşı testi (LCT) ve araba görevi uygulandı.

**Sonuçlar:** Hastaların WOMAC skorları ile SPWT, CST, SCT, LCT ve araba görevi süresi değerleri arasında istatistiksel olarak anlamlı, orta kuvvette ve pozitif yönlü korelasyonların olduğu saptandı ($P_{spwt}$=0,023 $P_{cst}$=0,002 $P_{sct}$= 0,000 $P_{lct}$ = 0,002 $P_{araba\ görevi}$=0,000).

**Tartışma:** WOMAC skorunun, olguların fonksiyonel becerileri ile örtüşmesi WOMAC indeksinin klinik geçerliliğinin bir göstergesi olarak da kabul edilebilir.

**Anahtar kelimeler:** Diz, Fonksiyonel Performans, Osteoartrit, WOMAC

**S001 - Investigation of the relationship between WOMAC index and clinical functional tests in patients with gonarthrosis**

Buse Güz[1], Sıddıka Fatma Uygur[1], Hatice Reşorlu[2]

[1]Cyprus International University, Faculty of Health Sciences, Physiotherapy and Rehabilitation, TRNC

[2]Çanakkale Onsekiz Mart University, Faculty of Medicine, Department of Physical Medicine and Rehabilitation, Çanakkale

**Purpose:** The aim of this study was to investigate the relationship between the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and clinical functional tests in patients with knee osteoarthritis (gonarthrosis).

**Methods:** Thirty patients (female/male: 25/5) with stage 2-4 according to the Kellgren-Lawrence scale were included in the study. WOMAC index, self-paced walk test (SPWT), chair stand test (CST), stair climb test (SCT), lift and carry test (LCT) and car task as clinical functional tests were applied to the patients.

**Results:** Statistically significant, moderately strong and positive correlations were found between the WOMAC scores and SPWT, CST, SCT, LCT, car task duration ($P_{spwt}$ =0.023 $P_{cst}$ =0.002 $P_{sct}$ = 0.000 $P_{lct}$ = 0.002 $P_{car\ task}$ =0,000).

**Conclusion:** The fact that the time required to carry out the functional activities coincides with the WOMAC score may be seen as an indicator of the clinical validity of the WOMAC index.

**Keywords:** Knee, Functional Performance, Osteoarthritis, WOMAC

**S002 - Bir kedide gözlenen ısırık yarasında klasik yara pomadlarının kullanımı ve düşük doz laser uygulamasının uzun dönem sonuçları: olgu sunumu**

Gül Çıray Akbaş Güngör[1], Neyran Altınkaya[2]

[1]Yakın Doğu Üniversitesi, Veteriner Fakültesi, Cerrahi Anabilim Dalı, Lefkoşa, KKTC

[2]Uluslararası Final Üniversitesi, Sağlık Bilimleri Fakültesi, Fizyoterapi ve Rehabilitasyon Bölümü, Girne, KKTC

**Amaç:** Isırık yarası olan Scottish Fold ırkı kedide klasik yara pomadlarının ve düşük doz laser uygulamasının yara iyileşmesi üzerine etkisini araştırmaktır.

**Yöntem:** Isırıldıktan 2 hafta sonra hastaneye getirilen 2 yaşlı erkek Scottish Fold ırkı kedinin yarasınının büyüklüğü Digimizer® (Version 5.6.0, 2005-2021 MedCalc Software Ltd) programı kullanılarak değerlendirildi. Yaranın kontraksiyonunu hızlandırmak amacıyla 8 hafta boyunca her gün önce 8 J/cm² düşük doz laser (Carci ®Physical biostimulation laser Lasermed 4098), sonra nitrofuzoran (Furacin ®, 56 gr Zontiva) ve Dexapanthenol pomadlı bandaj (Bepanthen ®, 0,5 Bayer) günde bir kez uygulandı. Değerlendirmeler 7., 14., 21. ve 56. Günde tekrarlandı.

**Sonuçlar:** İlk ölçümde yara büyüklüğü 10,60 cm çapında (88,20 cm²), 7. günde 10,20 cm (81,6 cm²), 14. günde 8,60 cm (58,00 cm²), 21. Günde 8 cm (50,24 cm²), 56. günde 2 cm (3,14 cm²) idi.

**Tartışma:** Isırık yarasında pomadlı bandaj uygulamasının ve düşük doz lazerin yara iyileşmesinin her aşamasında etkili olduğu gözlendi. Hem Dexapanthenol hem de lazerin epitelizasyonu ve kontraksiyonu hızlandırarak yara iyileşmesine katkı sağladığı, ayrıca düşük doz lazerin anjiyogeneze, kollajenizasyona ve granülasyon dokusunun oluşumunu desteklediğini düşünmekteyiz.

**Anahtar kelimeler:** Düşük Doz Lazer, Isırık Yarası, Kedi, Yara İyileşmesi

**S002 - The use of classical wound pomades and low-dose laser therapy in a cat with bite wound: a case report**

Gül Çıray Akbaş Güngör[1], Neyran Altınkaya[2]

[1]Near East University, Faculty of Veterinary Medicine, Department of Surgery, Nicosia, TRNC

[2]Final International University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Kyrenia, TRNC

**Purpose:** To investigate the effect of classical wound pomades and low-dose laser therapy (LLLT) on wound healing in Scottish Fold cat with bite wound.

**Methods:** 2 years old male Scottish Fold cat brought to the hospital 2 weeks after being bitten. Cats wound size was evaluated using Digimizer® (Version 5.6.0, 2005-2021 MedCalc Software Ltd) program. In order to accelerate the contraction of the wound, 8 J/cm2 low-dose laser (Carci ®Physical biostimulation laser Lasermed 4098) then nitrofuzoran (Furacin ®, 56 gr Zontiva) and Dexapanthenol pomade bandage (Bepanthen ®, 0.5 Bayer) was applied once a day for 8 weeks. Evaluations were repeated on days 7, 14, 21, and 56.

**Results:** Wound size was at first measurement 10.60 cm in diameter (88.20 cm²), 10.20 cm in diameter (81.60 cm²) at day 7, 8.60 cm in diameter (58.00 cm²) at day 14, 8 cm in diameter (50.24 cm²) at day 21, 2 cm in diameter (3.14 cm²) on day 56.

**Conclusion:** It was observed that pomad bandage application and low-dose laser were effective in all stages of wound healing in the bite wound. We think that both Dexapanthenol and laser contribute to wound healing by accelerating epithelialization and contraction. While low-dose laser supports angiogenesis, collagenization and the formation of granulation tissue.

**Keywords:** Low-Dose Laser, Bite Wound, Cat, Wound Healing

**S003 - Fizyoterapi ve rehabilitasyon dergilerinde kaynak kullanım hataları**

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**Amaç:** Kanıta dayalı yöntemler kullanılarak yapılan çalışmalar kaynak olarak kullanılırken künyeleri hatalı yazılabilmektedir. Düşük ve yüksek etki faktörlü dergilerde farklı olup olmadığını belirlemek amacıyla fizyoterapi ve rehabilitasyon alanında yapılan çalışmaların yayınlandığı dergilerin kaynak kullanım hata oranları incelenmiştir.

**Yöntem:** European Journal of Physiotherapy, Physiotherapy Theory and Practice, Physical Therapy Reviews, Disability and Rehabilitation, Journal of Physiotherapy, Journal of Orthopaedic & Sports Physical Therapy (JOSPT) dergileri etki faktörleri bakımından ikiye ayrıldı. Ocak 2015-Aralık 2020 yılları arasında yayınlanan araştırma makalelerinin kaynakları incelendi. Yayınlanan ilk makalenin ilk kaynağından başlayarak ardışık olarak numaralandırıldı. Düşük etki faktörlü dergilerden (DEF) 24374 kaynak, yüksek etki faktörlü dergilerden (YEF) 23033 kaynak tespit edildi. Toplam 47407 kaynak arasından rastgele 1500 tanesi seçildi. Makalenin başlığı, yazarların adları, dergi ismi, yayın tarihi, cilt ve sayfa numaraları orijinal makalenin künyesi ile karşılaştırılıp kontrol edildi. Herhangi bir tutarsızlık varsa hatalı olarak varsayıldı. İki grup

arasında incelenen hata oranları bakımından istatistiksel fark olup olmadığına bakıldı.

**Sonuçlar:** YEF dergilerde hata oranının daha yüksek olduğu belirlenmiştir (p<0,05). Hata oranlarını etkileyen faktörler incelendiğinde yazar ve dergi adları ile yayın yılına ilişkin hata oranlarında kaynak olarak kullanılan makalelerin yayın yılının etkili olduğu bulunmuştur (p<0,05). Kaynağın yayınlandığı derginin cilt ve sayfa sayısının hatalı yazılmasında kaynağın kullanıldığı yılın da anlamlı bir etken olduğu ortaya çıkmıştır (p<0,05).

**Tartışma:** DEF dergilerde hata oranlarının YEF dergilere göre daha düşük olduğu belirlendi. Yapılan çalışmaların sonuçları hata oranlarının azalmadığını ve bu konuda yeterli farkındalık yaratılamadığı göstermektedir. Yazarlar kaynak listesini oluştururken, atıf veri tabanları ise veri giriş sürecinde yaptıkları hatalar nedeniyle verilerin kullanılabilirliğini azaltmaktadır.

**Anahtar Kelimeler:** Alıntı, Doğruluk, Kaynak, Makale Künyesi

**S003 - Investigation of reference errors in physiotherapy and rehabilitation journals**

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**Purpose:** Reference errors are common in research papers. Purpose of the study was determining reference errors in low and high impact factor journals in the field of physiotherapy and rehabilitation.

**Methods:** European Journal of Physiotherapy, Physiotherapy Theory and Practice, Physical Therapy Reviews, Disability and Rehabilitation, Journal of Physiotherapy, Journal of Orthopaedic, Sports Physical Therapy were divided into two groups in terms of impact factors. References of research articles published in six physiotherapy and rehabilitation journals between January 2015 and December 2020 were included in the study. References were sequentially numbered starting from the first reference of the first published article. A total of 47407 (24374 references in low-impact factor (LIF) journals) were found. A total of 1500 (750 HIF) references were randomly selected among 47407 references. The title of the article, the names of the authors, the journal name, the publication date, the volume, and page numbers were compared with the original article's tag and checked.

**Results:** The error rate was higher in HIF journals (p<0.05). The publication year of the references were negatively affecting the reference error rates (p<0.05). It was found that the year in which the article was referred was also a significant factor in the incorrect writing of the volume and page number of the journal in which the reference was published (p<0.05).

**Conclusion:** It was determined that the error rates in LIF journals were lower than in HIF journals. Despite to the outcome of the previous studies, the error rates have not been declined and sufficient awareness could not be created on this issue.

**Keywords:** Accuracy, Citation, Journal, Reference Tag.

**S004 - Kuzey Kıbrıs'ta yaşayan yaşlılarda düşme sıklığı ve içsel risk faktörleri ile düşmeler arasındaki ilişki**

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**Amaç:** Düşmeler toplum içinde yaşayan yaşlılarda önemli bir sağlık sorunudur. Bu çalışmanın amacı, Kuzey Kıbrıs'ta toplum içinde yaşayan 65 yaş ve üstü nüfusta düşme prevalansını incelemek ve içsel risk faktörleri ile düşme arasındaki ilişkiyi değerlendirmektir.

**Yöntem:** Kesitsel ve yuvalandırılmış vaka-kontrol çalışması Değirmenlik Belediyesi'ne bağlı 16 köyde gerçekleştirilmiştir. Katılımcıların tanımlayıcı özellikleri, kapsamlı bir anket kullanılarak toplandı. Düşmeye etki eden faktörlere ilişkin tüm değerlendirmeler ABD Hastalık Kontrol ve Korunma Merkezinin (CDC) STEADI programının önerdiği şekilde yapıldı.

**Sonuçlar:** Çalışmaya katılım oranı %80,8 olarak gerçekleşti. Genel düşme prevalansı %40,7 olarak bulundu. Kadın (%40,4) ve erkeklerde (%41,0) düşme prevalansı değerlerin birbirine yakın olarak bulundu (p=0,896). Düşme korkusu olanlar ve kognitif bozuklukla ilişkili motor fonksiyon bozukluğu olanlar; polifarmasi; bozulmuş denge; dayanıklılık; ve güç; ortostatik hipotansiyon; yalnız yaşamak, depresif semptomlara sahip olmak ve ileri yaş, düşme olasılığının artmasıyla ilişkilidir.

**Tartışma:** Düşmeler Kuzey Kıbrıs'ta toplum içinde yaşayan yaşlılarda önemli bir sağlık sorunudur. Bu araştırmanın sonuçları, düşmeleri önlemek veya azaltmak için daha etkili müdahale stratejileri geliştirmede toplum, sağlık liderleri ve geriatri alanında çalışan sağlık uzmanlarına yardımcı olacaktır. Bireysel düzeyde risk faktörlerinin tanımlanması, uygun bir önleme stratejisi seçme olasılığını artırabilir.

**Anahtar Kelimeler:** Düşme, İçsel Faktörler, Prevalans, Yaşlı

**S004 - Fall prevalence among elderly people in Northern Cyprus and association between intrinsic risk factors and falls**

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**Purpose:** Falls are an important health problem in elderly community-dwelling people. This study examines the prevalence of falling among the 65-and-older population who lived in the community in Northern Cyprus and assess the association between intrinsic risk factors and falls.

**Methods:** This cross-sectional and nested case-control study was carried out in 16 villages belongs to Değirmenlik Municipality in Northern Cyprus. The descriptive characteristics of participants were collected using a standardized, semi-structured questionnaire. Guides and forms prepared by the STEADI program of the Centers for Disease Control and Prevention were used to evaluate the association between intrinsic risk factors and falls.

**Results:** The participation rate in the study was 80.8%. The overall prevalence of falls in the past year was 40.7%. The prevalence of falls was not significantly different among men (41.0%) and women (40.4%) (p=0.896). Those who have some level of fear of falling, and the impaired motor function associated with cognitive impairment; polypharmacy; impaired balance; endurance; and strength; orthostatic hypotension; living alone, having depressive symptoms, and older age are associated with an increased likelihood of falling.

**Conclusion:** Falls are an important health problem in elderly community-dwelling people in Northern Cyprus. The results of this research will assist community, health leaders and health care professionals who work on geriatrics in developing more efficacious intervention strategies to prevent or reduce falls. Identification of individual-level risk factors can increase the likelihood of selecting an appropriate prevention strategy.

**Key words:** Falling, Intrinsic Factor, Prevalance, Elderly

**S005 - Türk fizyoterapistlerinin elektrofiziksel ajanların kullanımı hakkında bilgi, tutum ve görüşleri**

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**Amaç:** Elektrofiziksel ajanlar (EFA), klinikte teşhis ve tedavi amacıyla kullanılmaktadır. Çalışmamızın amacı, Türkiye ve Kuzey Kıbrıs Türk Cumhuriyeti (KKTC)'nde ünitelerde bulunan ve kullanılan EFA profilini oluşturmak, ajan seçimindeki faktörleri belirlemektir.

**Yöntem:** Araştırmamıza Türkiye ve KKTC'de çalışan 350 mezun fizyoterapist, gönüllü katıldı. Veriler, güncel literatür temelinde oluşturulan bir anketle yüzyüze görüşme yöntemiyle toplandı.

**Sonuçlar:** Katılımcıların %81,1'i 21-39 yaş aralığında, %81,5'i lisans mezunu, %68'i 10 yıldan az çalışan bireylerden oluştu. Ajanlar ünitelerde bulunma sıklığına göre sıralandığında Transkutanöz Elektriksel Sinir Uyarımı (TENS) (%99,4), coldpack (%98,9) ve hotpack (%96,9) ilk üç sırada yer almakta ve üniteye başvuran hastaların yarısından fazlasında

yüksek oranda kullanılmaktaydı. Traksiyon cihazının ünitelerde bulunma oranı %49,3 iken %61,5 oranında hiç kullanılmıyordu. EFA seçimini en çok etkileyen üç faktör, ajanın ünitedeki mevcudiyeti (%71,5), olumlu geçmiş deneyim (%67,8), lisans eğitiminde yer alan dersler (%61,8) şeklindeyken etkisi en az olanın hastanın tercihleri (%44,7) olduğu bulundu. Katılımcıların %43'ü traksiyon cihazının kullanım güvenliği konusunda emin değilim görüşünü belirtti.

**Tartışma:** Elektrofiziksel modalitelerin etkinliği ve kullanım güvenliği konusunda daha fazla çalışmanın yapılması kanıta dayalı uygulamalara yol gösterici olabilir.

**Anahtar Kelimeler:** Deneyim, Fizik Tedavi Modaliteleri, Fizyoterapi

**S005 - Turkish physiotherapists on knowledge, attitudes and opinions about the use of electrophysical agents**

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**Purpose:** Electrophysical agents (EFA) are used clinically for diagnosis and treatment. The aim of our study is to create the EFA profile available and used in units in Turkey and Turkish Republic of Northern Cyprus (TRNC), and to determine the factors in agent selection.

**Methods:** 350 graduated physiotherapists and volunteers working in Turkey and TRNC participated in our research. Data were collected by face-to-face interview method with a questionnaire created on the basis of current literature.

**Results:** 81.1% of the participants were between the ages of 21-39, 81.5% were undergraduates, and 68% were individuals who worked less than 10 years. Agents in units Transcutaneous Electrical Nerve Stimulation (TENS) (99.4%), coldpack (98.9%) and hotpack (96.9%) were in the first three ranks when they were ranked according to the frequency of presence and were used at a high rate in more than half of the patients who applied to the unit. While the rate of presence of the traction device in the units was 49.3%, it was never used at the rate of 61.5%. The three factors that most affect the choice of EFA are the presence of the agent in the unit (71.5%), positive past experience (67.8%), courses in undergraduate education (61.8%), while the one with the least effect is the patient's preferences (44.7%) was found. 43% of the participants stated that they are not sure about the safety of using the traction device.

**Conclusion:** Further studies on the efficacy and safety of use of electrophysical modalities may guide evidence-based practices.

**Keywords:** Experience, Physical Therapy Modalities, Physiotherapy

**S006 - Türk fizyoterapistlerinin kanıta dayalı uygulama modeline bakışı**

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**Amaç:** Kanıta Dayalı Uygulama (KDU) modeli, en iyi kanıtın, sağlık profesyonelinin deneyimi ve hastanın tercihleriyle harmanlanarak tedavi programına karar vermeye rehberlik edecek biçimde kullanımıdır. Çalışmamızın amacı, Türk fizyoterapistlerin KDU modeli hakkında bilgi, tutum ve inançlarını incelemektir.

**Yöntem:** Araştırmamıza Türkiye ve Kuzey Kıbrıs Türk Cumhuriyeti (KKTC)'nde çalışan 358 mezun fizyoterapist, gönüllü katıldı. Veriler, güncel literatür temelinde oluşturulan bir anketle yüz yüze görüşme yöntemiyle toplandı.

**Sonuçlar:** Katılımcıların %81'i 21-39 yaş aralığında, %80,4'ü lisans mezunu, %67,3'ü 10 yıldan az çalışan, %54,5'i günlük ortalama 10 hastaya hizmet veren bireylerden oluşuyordu. 222 katılımcı, lisans ya da lisansüstü düzeyde KDU modeli hakkında eğitim aldıklarını ve 60 katılımcı temel biyoistatistik bilgi düzeyinin iyi olduğunu bildirdi. Literatürde kullanılan teknik terimleri anlama düzeyi sorgulandığında, hiç bilinmeyen terim PICO, en iyi bilinen, p değeri olarak bulundu. Katılımcıların %53,4'ü KDU'nun önemli bir klinik karar verme modeli olduğuna, %57'si Fizyoterapi alanında kullanımının gerekliliğine inanmaktaydı. KDU modeli hakkında eğitim almış katılımcıların modele karşı tutum ve inançları, eğitim almayanlara göre anlamlı düzeyde daha olumluydu. (z=-6,064 p=0,000).

**Tartışma:** KDU modeliyle tedavi planı oluşturmada becerilerin geliştirilmesi için mezuniyet sonrası eğitim programları önemli olacaktır.

**Anahtar Kelimeler:** Fizyoterapi, Kanıta Dayalı Uygulama, Klinik Karar Verme

**S006 - The view of Turkish physiotherapists on evidence-based practice model**

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**Purpose:** The Evidence-Based Practice (EBP) model is the use of the best evidence, blended with the healthcare professional's experience and patient preferences, to guide decision-making on the treatment program. The aim of our study is to examine the knowledge, attitudes and beliefs of Turkish physiotherapists about the EBP model.

**Methods:** 358 graduated physiotherapists and volunteers working in Turkey and Turkish Republic of Northern Cyprus participated in our research. Data were collected by face-to-face interview method with a questionnaire created on the basis of current literature.

**Results:** 81% of the participants were between the ages of 21-39, 80.4% had a bachelor's degree, 67.3% had worked less than 10 years, 54.5% consisted of individuals serving an average of 10 patients per day. 222 participants reported that they had received training on the EBP model at undergraduate or graduate level, and 60 participants reported that their basic biostatistics knowledge level was good. When the level of understanding of technic terms used in the literature was questioned, the unknown term PICO was found to be the best-known p-value. 53.4% of the participants believed that EBP is an important clinical decision-making model and 57% believed that it should be used in the field of physiotherapy. The attitudes and beliefs of the participants who received training on the EBP model were significantly more positive than those who did not receive training (z=-6.064 p=0.000).

**Conclusion:** Postgraduate education programs will be important to develop skills in creating a treatment plan with the EBP model.

**Keywords:** Physiotherapy, Evidence-Based Practice, Clinical Decision Making

**S007 - Renal replasman tedavisi alan kronik böbrek hastalarında yorgunluk şiddetinin karşılaştırılması**

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**Amaç:** Yorgunluk, kronik böbrek hastalarında hastalıkla ilişkili ilk semptomlardan birisidir. Yorgunluk, kronik böbrek hastalarını hem fiziksel hem de zihinsel olarak olumsuz etkilemektedir. Yorgunluk; fizyolojik faktörler, kişisel faktörler, psikolojik faktörler ve diyaliz ile ilişkili faktörlerden etkilenebilmektedir. Bu faktörler; üremi, anemi, uyku bozuklukları, kısıtlanmış aktivite, fiziksel fonksiyon ve psikolojik durum en önemli problemler olarak öne çıkmaktadır. Çalışmanın amacı Kıbrıs'ın kuzeyinde kronik böbrek yetmezliği nedeniyle hemodiyaliz ve periton diyalizi alan son dönem böbrek hastalarında yorgunluk şiddetini değerlendirmek ve karşılaştırmaktır.

**Yöntem:** Araştırmanın örneklemini, Dr. Burhan Nalbantoğlu Devlet Hastanesi Nefroloji kliniğinde, hemodiyaliz (HD) (n:35) ve periton diyalizi (PD) (n:11) alan ve dahil edilme kriterlerine uyan hastalar oluşturmaktaydı. Hastaların demografik bilgileri demografik bilgi anketi ile yorgunluk durumu da Yorgunluk Şiddet Ölçeği ile değerlendirildi.

**Sonuçlar:** Araştırmaya katılan hemodiyaliz ve periton diyalizi alan hastaların yorgunluk skorları sırasıyla 5,18±1,4 ve 4,5±2,06 olmakla birlikte, her iki grup arasında istatistiksel olarak anlamlı fark bulunmadı (p>0,05). Her iki grubun yorgunluk **şiddet** skorları yüksek ve bireyler **şiddetli** yorgundu.

**Tartışma**: Araştırmamıza dahil edilen kronik böbrek hastalarının yorgunluk şiddetleri yüksek olmakla birlikte, gruplar arası anlamlı bir farklılık bulunmadı. Bu durum; HD ve PD hastalarının hepsinin son

evre hastalar olması, inaktif ve düzenli fizyoterapi programına dahil olmayan hastalardan oluşması ile açıklanabilir. Bir diğer önemli konu ise literatürde kronik böbrek hastalarında yorgunluğu değerlendiren spesifik bir anket olmamasıdır. Yorgunlukla baş edebilmek için fizyoterapistler tarafından yapılandırılmış rehabilitasyon programları önemlidir.

**Anahtar kelimeler:** Fizyoterapi, Hemodiyaliz, Kronik Böbrek Yetmezliği, Periton Diyalizi, Yorgunluk

**S007 - A comparison of severity of fatigue in patients with chronic renal replacement treatment**

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**Purpose**: Fatigue is one of the first symptoms associated with the disease in patients with chronic kidney disease also negatively affect patients and ıt can be affected by physiological factors, personal factors, psychological factors and dialysis-related factors. These factors are; uremia, anemia, sleep disorders, limitation of movement, physical function and psychological state stand out. The aim of the study is to evaluate and compare the severity of fatigue in patients with end-stage renal disease receiving hemodialysis and peritoneal dialysis for chronic renal failure in North Cyprus.

**Methods**: The sample of the research was created in the Nephrology clinic in Dr. Burhan Nalbantoglu Hospital, which received hemodialysis (n:35) and peritoneal dialysis (n:11) and met the inclusion criteria. The demographic information of the patients was evaluated with the demographic information questionnaire and the fatigue was evaluated with the Fatigue Severity Scale.

**Results:** Although the fatigue scores of the patients who participated in the study and received hemodialysis and peritoneal dialysis were 5.18±1.4 and 4.5±2.06, respectively, there was no statistically significant difference between the two groups (p>0.05). Both groups had high fatigue severity scores and individuals were severely tired.

**Conclusion:** Although the severity of fatigue in patients was high, no significant difference was found between the groups. This can be explained by the fact that all of patients are end-stage and are inactive and not included in a regular physiotherapy program. Also there is no specific questionnaire evaluating fatigue in patients with chronic kidney disease in the literature. For cope with the fatigue the rehabilitation programs which structured by the physiotherapists is important.

**Keywords:** Physiotherapy, Hemodialysis, Chronic Renal Failure, Peritoneal Dialysis, Fatigue

**S008 - El-el bileği cerrahisi geçirmiş ve geçirmemiş hastalarda propriyoseptif duyunun karşılaştırılması**

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**Amaç**: El ve el bileğinin propriyosepsiyonunun sürdürülmesinde eklem mekanoreseptörleri ve innervasyondan sorumlu sinirler kritik rol oynamaktadır. Çeşitli üst ekstremite patolojileri propriyoseptif duyuyu etkileyen en yaygın faktörlerdendir. Çalışmamızın amacı el-el bileği cerrahisi geçirmiş hastalarda propriyoseptif duyunun cerrahi geçirmemiş hastalarla karşılaştırılmasıdır.

**Yöntem:** Araştırmaya el-el bileği cerrahisi geçirmiş 21 kişi ve hastalık tanısı olup cerrahi geçirmemiş 19 kişi olmak **üzere** toplamda 40 kişi dahil edilmiştir. Katılımcıların demografik bilgileri sosyodemografik veri formu ile değerlendirilmiştir. Propriyosepsiyon değerlendirmesi için kalınlığı 4mm ile 8mm arasında değişen ahşap **çubuklar** kullanılarak yapılan eklem pozisyon hissi testi ve 12 obje ile yapılan stereognozi testi kullanılmıştır.

**Sonuçlar:** Hastalar gruplara göre karşılaştırıldığında; cerrahi geçirmiş gruptaki yaş ortalaması 44,10±13,16, kontrol grubunda ise 38,68±15,45 olarak bulundu. Cerrahi geçirmiş gruptaki hastaların stereognozi testinde doğru obje ortalaması 10,33±1,42; kontrol grubunda ise 11,78±0,53 olduğu ve iki grup arasında istatistiksel olarak anlamlı fark olduğu bulundu (p=0,001). Eklem pozisyon hissi testinde cerrahi geçirmiş grupta doğru sayı ortalamasının 10,33±1,79; kontrol grubunda ise 12,47±1,95 olduğu ve iki grup arasında istatistiksel olarak anlamlı fark olduğu tespit edildi (p=0,002).

**Tartışma:** Yapılan **çalışmalarda** el ve el bileğinin propriyosepsiyon ve sensorimotor fonksiyonlarını bozan birçok durum olduğu belirtilmektedir. **Çalışmamızın** sonuçlarında el-el bileği cerrahisi geçirmiş hastalarda propriyoseptif duyunun olumsuz yönde etkilendiği görülmektedir. Bu bağlamda el-el bileği cerrahisi geçiren hastalarda rehabilitasyon programlarına proprioseptif egzersizlerin de eklenmesinin gerektiğini düşünmekteyiz.

**Anahtar Kelimeler:** Cerrahi, El-el bileği, Propriyosepsiyon, Stereognozi

**S008 - Comparison of proprioceptive sense in patients who had and who had not undergone hand-wrist surgery**

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**Purpose:** Joint mechanoreceptors and nerves responsible for innervation play a critical role in maintaining proprioception of the hand and wrist. Various upper extremity pathologies are the most common factors that affect proprioceptive sense. The aim of our study was to compare proprioceptive sense in patients who had undergone hand-wrist surgery with those who had not.

**Methods:** A total of 40 subjects were included in the study, 21 subjects who had undergone hand-wrist surgery and 19 subjects who had a disease of the hand-wrist region but did not undergo surgery. The demographic information were evaluated with the sociodemographic data form. For proprioception assessment; joint position sense test with wooden sticks ranging between 4mm and 8mm thickness and for stereognosis 12 objects were used.

**Results:** The mean age in the surgical group was 44.10±13.16 years, and was 38.68±15.45 years in the control group. The mean of the correctly identified in the stereognosis test in the surgical group was 10.33±1.42 and 11.78±0.53 in the control group. There was a significant difference between the two groups (p=0.001). In the joint position sense test, the mean of the correct number was 10.33±1.79 in the surgical group and 12.47±1.95 in the control group. There was a significant difference between the two groups (p=0.002).

**Conclusion:** The results of our study has shown that proprioceptive sense was negatively affected in patients who had undergone hand-wrist surgery. In this context, we think that proprioceptive exercises should be added to the rehabilitation programs of patients who will undergo hand-wrist surgery.

**Keywords:** Surgery, Hand-wrist, Proprioception, Stereognosis

**S009 - Kuzey Kıbrıs'ta yaşayan yaşlılarda fiziksel aktivite düzeyi ve ilişkili engeller/kolaylaştırıcıların belirlenmesi**

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**Amaç:** Çalışmada yaşlılarda fiziksel aktivite (FA) düzeylerinin yaş ve bölgelere göre araştırılması, engel ve kolaylaştırıcı faktörlerin FA düzeyi ile ilişkisinin incelenmesi amaçlanmıştır.

**Yöntem:** Bu çalışma kesitsel bir çalışmadır. Sosyodemografik bilgiler, engeller ve kolaylaştırıcı faktörler kaydedildi. FA düzeyi Yaşlılar İçin Fiziksel Aktivite Ölçeği (PASE), statik ve dinamik denge Tek Ayak Durma ve Fonksiyonel Uzanma Testi, alt ekstremite kuvveti ise 30 saniye kalk

otur testi ile değerlendirildi.

**Sonuçlar:** Çalışmaya 407 yaşlı (224 kadın/183 erkek, ortalama yaş:74,3±3,12) katıldı. Katılımcılar genç yaşlı (68,31±3,05) ve yaşlı (80,29±3,21) olarak gruplandırılmış olup, genç yaşlı grupta FA frekansı, statik/dinamik denge, alt ekstremite kas kuvveti ve PASE skoru daha yüksek bulunmuştur (p=0,00). Bölgelerarası FA puan ortalamaları yüksekten düşüğe Lefke 116,55±60,8; Lefkoşa 115,30±62,16; Güzelyurt 101,22±60,49; İskele 72,34±43,59; Girne 70,35±45,68; Gazimağusa 49,07±45,85 olarak belirlendi. FA düzeyi ile denge bozukluğu (r=0,272;p=0,00), düşme korkusu (r=0,250;p=0,00), yaralanma korkusu (r=0,265;p=0,00), komorbiditeler (r=0,278; p=0,00), nefes darlığı (r=0,252;p=0,00), kalp çarpıntısı (r=0,209; p=0,00), inkontinans (r=0,267;p=0,00), FA'nın faydalarını bilmemek (r=0,152;p=0,002), maddi sorunlar (r=0,133;p=0,007), araba kullanmamak (r=0,175;p=0,00) ve tek başına FA yapmak (r=-0.224;p=0.00) gibi engeller arasında ilişki bulundu. Kilo verme (r=-0,190;p=0,00), yürünebilir bir yerde yaşama (r=0,168;p=0,001), gruplarla arkadaşlık (r=-0,169;p=0,001), aktif olma (r=-0,187;p=0,00) enerjik hissetme (r=-0,219;p=0,00), mutlu olma (r=-0,233;p=0,00) ve güvende hissetme (r=-0,105;p=0,035) gibi kolaylaştırıcılar ile FA düzeyi arasında ilişki bulundu.

**Tartışma:** FA düzeyi yaşla birlikte azalmakta olup, fizyoterapistlerin uygun stratejilerle FA'nın korunmasına yönelik engelleri kaldırarak ve kolaylaştırıcıları kullanarak FA düzeyinin artırılması yönünde çalışmalar yapmasını öneriyoruz.

**Anahtar Kelimeler:** Engel, Fiziksel, Fizyoterapistler, Yaşlı.

### S009 - Determination of physical activity level and associated barriers/facilitators of elderly living in Northern Cyprus.

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**Purpose:** In this study, it was aimed to investigate physical activity (PA) levels in the elderly according to age and regions, and to examine the relationship between disability and facilitating factors and PA level.

**Methods:** This study is a cross-sectional study. Sociodemographic information, barriers and facilitators were recorded. PA level was evaluated with the PA Scale for the Elderly (PASE), static and dynamic balance was evaluated with the Single-Leg Stance Test (SLST) and Functional Reach Test (FRT), and lower extremity strength with the 30 Seconds Sit and Stand Test.

**Results:** 407 elderly (224women/183men, mean age: 74.3**±3.12) participated in the study. Participants were** grouped as young-aged (68.31±3.05 years) and elderly (80.29±3.21 years). PA frequency, static/dynamic balance, lower extremity muscle strength and PASE score were found to be higher in the young-aged group (p=0.00). Interregional PA score averages ranged from high to low in Lefka (116.55±60.8); Nicosia (115.30±62.16); Morphou (101.22±60.49); Trikomo (72.34±43.59); Kyrenia (70.35±45.68); Famagusta (49.07±45.85). A relationship was found between barriers and balance with PA level (r=0.272;p=0.00), fear of falling (r=0.250;p=0.00), fear of injury (r=0.265;p=0.00), comorbidities (r=0.278;p=0.00), breath shortness (r=0.252;p=0.00), heart palpitations (r=0.209;p=0.00), incontinence (r=0.267;p=0.00), not knowing the benefits of PA (r=0.152;p=0.002), financial problems (r=0.133;p=0.007), not driving (r=0.175;p=0.00), and doing PA alone (r=-0.224;p=0.00). A relationship was found between facilitators and PA level such as losing weight (r=-0.190;p=0.00), living in a walkable place(r=0.168;p=0.001), friendship with groups (r=-0.169;p=0.001), being active (r=-0.187;p=0.00), feeling energetic (r=-0.219. p=0.00), being happy (r=-0.233;p=0.00), and feeling safe (r=-0.105;p=0.035).

**Conclusion:** The level of PA decreases with age, and we recommend that physiotherapists work towards increasing the level of PA by removing the obstacles to the protection of PA with appropriate strategies and using facilitators.

**Keywords:** Disability, Physical, Physiotherapist, Elderly

### S010 - Üniversite öğrencilerinde premenstrüal sendrom semptomları ve ağrı alanlarının incelenmesi: ön çalışma

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**Amaç:** Premenstrual Sendrom (PMS) kadınlarda menstrual siklusun luteal fazında ortaya çıkıp, menstruasyonun başlamasıyla düzelen, üreme çağında yaygın görülen somatik, bilişsel, duygusal ve davranışsal semptomları tanımlamaktadır. Bu çalışma üniversite öğrencilerinde PMS durumlarını inceleyebilmek, prevalansını ve PMS'ne bağlı en sık görülen semptomları belirlemek amaçlanmıştır.

Y**öntem:** Çalışmaya 18-25 yaşları arasında, Kıbrıs'taki üniversitelerde öğrenci olan toplam 40 katılımcı (ortalama yaş: 20,87±0,21 yıl) dahil edildi. Veriler, kişisel bilgi formu ve 'Premenstrual Sendrom Ölçeği' kullanılarak toplandı.

**Sonuçlar:** Öğrenciler PMS ölçeğinden ortalama 112,72±6.41 puan aldı ve PMS prevalansı %57,5 olarak saptandı. PMS'li öğrencilerde ağrının en yaygın hissedildiği bölgeler sırasıyla bel (%40), alt karın (%32,5), üst karın (%20) olarak belirlendi. Öğrencilerin %57,5'inin düzenli egzersiz yapmadığı, adet öncesi dönemde %75'inin ağrı şikayeti olduğu, %67,5'inin şişkinlik hissi ve ruhsal duygulanım yaşadığı görülmüştür. Katılımcıların %72,5'inin ağrı kontrolü için dinlenme ve uyumayı ve %32,5'inin sıcak uygulama yapmayı tercih ettiği belirlendi.

**Tartışma:** PMS üniversite öğrencilerinde yaygın görülen bir sorundur. Ağrı varlığı emosyonel zorlanmalara neden olan, baş edilmesi gereken bir problemdir. Bu bağlamda premenstrual sendromu olan kadınlarda, bireylerin ağrıyı yönetimi temelli eğitim programlarına katılımlarını sağlamak ve fiziksel aktiviteye katılımı teşvik etmek ağrı ile baş etmede önem arz etmektedir.

**Anahtar Kelimeler:** Ağrı, Fiziksel Aktivite, Premenstrual Sendrom

### S010 - Examination of premenstrual syndrome symptoms and pain areas in university students: preliminary study

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**Purpose:** Premenstrual Syndrome (PMS) defines the common somatic, cognitive, emotional and behavioral symptoms in the reproductive age that occur in the luteal phase of the menstrual cycle in women and resolve with the onset of menstruation. In this study, it was aimed to examine the PMS status in university students, to determine its prevalence and the most common symptoms related to PMS.

**Methods:** A total of 40 participants (mean age: 20.87±0.21 years) between the ages of 18-25, who were students at universities in Cyprus, were included in the study. Data were collected using the personal information form and the 'Premenstrual Syndrome Scale'.

**Results:** The students scored an average of 112.72±6.41 on the PMS scale, and the prevalence of PMS was 57.5%. The most common areas of pain in students with PMS were the waist (40%), lower abdomen (32.5%), and upper abdomen (20%), respectively. It was observed that 57.5% of the students did not exercise regularly, 75% of them had pain complaints in the premenstrual period, 67.5% of them experienced a feeling of bloating and psychological affect. It was determined that 72.5% of the participants preferred rest and sleep for pain control and 32.5% preferred hot application.

**Conclusion:** PMS is a common problem among university students. The presence of pain is a problem that causes emotional difficulties and needs to be dealt with. In this context, it is important to ensure that individuals participate in pain management-based training programs

and to encourage participation in physical activity in women with premenstrual syndrome in coping with pain.

**Keywords:** Pain, Physical Activity, Premenstrual Syndrome

**S011 - Genç yetişkinlerde fiziksel performans düzeyinin, dengenin ve core stabilizasyonun ikili görev yeteneği ile ilişkilerinin değerlendirilmesi**

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**Amaç:** Bu çalışmanın amacı; genç yetişkinlerde fiziksel performans düzeylerinin, dengenin ve core stabilizasyonun değerlendirilip, bu parametrelerle ikili görev yeteneği arasındaki ilişkinin araştırılmasıdır.

**Yöntem:** Araştırmamızın değerlendirmeleri Kuzey Kıbrıs Türk Cumhuriyeti (KKTC)'nde ikamet eden ve Uluslararası Kıbrıs Üniversitesi 2018-2019 Akademik Dönemde aktif kayıtlı olan 19-26 yaş öğrencilerle gerçekleştirildi. Bireylere çalışma başında Montreal Kognitif Değerlendirme Testi yapılarak skorlarına göre çalışmaya dâhil edildiler. Hastaların statik ve dinamik denge değerlendirmeleri 3 farklı test ile değerlendirildi. Statik denge için Tek Ayak Üzerinde Durma Testi, dinamik denge değerlendirmesi için Fonksiyonel Öne Uzanma ve 4 Adım Kare Testi kullanıldı. Bireylerin fiziksel performans düzeyleri alt ekstremite kuvvetini ölçen 4 farklı testle değerlendirildi (Dikey Sıçrama, Koşu Temelli Anaerobik Sprint Testleri, Zamanlanmış 6 Metre Sıçrama ve Üçlü Sıçrama Testi). Core kaslarının stabilizasyon kabiliyeti hakkında bilgi almak adına core endurans testleri uygulandı.

**Sonuçlar:** Çalışmanın sonunda; ikili görev performansı ile dinamik denge testleri arasında anlamlı bir ilişki olduğu ($p<0,050$), ikili görev motor-motor performans ile Anaerobik Sprint Testi ve Üçlü Sıçrama Testleri arasında anlamlı bir ilişki olduğu ($p<0,050$), core stabilizasyon Lateral Kasların Dayanıklılık Testleri ile kognitif-motor ikili görev performansı arasında anlamlı bir ilişki olduğu ($p<0,050$) sonucuna ulaşılmıştır.

**Tartışma: Çalışmadan** elde ettiğimiz sonuçlar açısından ikili görev **üzerinde** dengenin etkinliği **öne çıkmaktadır**. Dengenin korunması ve geliştirilmesi fonksiyonellik açısından **önem** arz ettiği saptanmıştır. Tedavi ve egzersiz programları içerisinde dengeyi geliştirmek adına fiziksel aktivite düzeyinin arttırılması ve core stabilizasyon egzersizlerinin verilmesi **önerilebilir**.

**Anahtar kelimeler:** Core Stabilizasyon, Denge, Fiziksel Performans, Genç Yetişkin, **İkili** Görev

**S011 - Evaluation of the relationship between physical performance level, balance, and core stabilization with dual task ability in young adults**

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**Purpose:** Evaluating physical performance levels, balance and core stabilization in young adults and investigating the relationship between parameters and dual task ability.

**Methods:** The study were carried out with students aged 19-26 who reside in Turkish Republic of Northern Cyprus (TRNC) and are actively enrolled in Cyprus International University in the 2018-2019 Academic Term. Individuals were included in study according to their scores by Montreal Cognitive Assessment Test. Static and dynamic balance assesment evaluated with 3 tests. One-Legged Standing Test was used for static; Functional Forward Reach and 4-Step Square Test for dynamic balance assessment. Individuals' physical performance levels were evaluated with 4 tests measuring lower extremity strength (Vertical Jump, Running-Based Anaerobic Sprint Tests, Timed 6-meter Jump and Triple Jump Test). Core endurance tests were applied to obtain information about stabilization ability of the core muscles.

**Results:** It was determined that; there was a significant relationship between dual task performance and dynamic balance tests ($p<0.05$), dual-task motor-motor performance and Anaerobic Sprint Test and Triple Jump Tests ($p<0.05$) and core stabilization Lateral Muscles Endurance Tests and cognitive-motor dual task performance ($p<0.05$).

**Conclusion:** In terms of the results we obtained, the effectiveness of the balance on the dual task comes to the fore. It has been determined that the protection and development of balance is important in terms of functionality. In order to improve the balance within the treatment and exercise programs, it may be recommended to increase the level of physical activity and core stabilization.

**Keywords:** Core Stabilization, Balance, Physical Performance, Young Adult, Dual Task

**S012 - Yaşlı bireylerde telerehabilitasyonun uyku** üzerine **etkisi**

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**Amaç:** Yaşlı bireylerde yapılandırılmış ev tabanlı interaktif telerehabilitasyon programının uyku üzerindeki etkisini araştırmaktır.

**Yöntem:** Çalışmaya 65 yaş üzeri toplam 23 katılımcı (ortalama yaş:72,47±5,58 yıl, 15 kadın) dahil edildi. Katılımcılara 8 hafta boyunca haftada üç kez telerehabilitasyon ile egzersiz yaptırıldı. Çalışmaya başlamadan önce ve 8 haftalık egzersiz programının bitiminden sonra katılımcılarda Sensewear Armband ile uyku değerlendirilmesi yapıldı. Ayrıca, subjektif uyku süreçlerini değerlendirmek için Pittsburgh Uyku Kalite İndeksi (PUKİ) ve Epworth Uyku Skalası kullanıldı.

**Sonuçlar:** Katılımcıların egzersiz öncesi ve egzersiz sonrası uyku verileri karşılaştırılmıştır. Sensewear armband verilerinden uyku süresinde artış olduğu saptanmıştır ($p=0,033$). PUKİ alt bileşenlerinden uyku latansında ve gündüz uykululuk durumunda anlamlı iyileşmeler gözlemlenmiştir. Epworth Uyku Skalası sonuçları incelendiğinde ise egzersiz sonrası katılımcıların gün içi uykululuk durumlarının istatistiksel olarak anlamlı azaldığı görülmüştür. ($p=0,013$)

**Tartışma:** Çalışmamız telerehabilitasyon ile yapılan egzersiz programının yaşlı yetişkinlerde sağlıklı yaşlanma sürecini destekleyerek uyku kalitesini artırmak için etkili bir yöntem olduğunu göstermektedir.

**Anahtar Kelimeler:** Telerehabilitasyon, Uyku Kalitesi, Yaşlılık,

**S012 - The effect of telerehabilitation on sleep in the elderly**

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**Purpose:** To investigate the effect of a structured home-based interactive telerehabilitation program on sleep in elderly individuals.

**Methods:** A total of 23 participants (mean age: 72.47±5.58 years, 15 women) over 65 years of age were included in the study. Participants exercised with telerehabilitation three times a week for 8 weeks. Before starting the study and after the end of the 8-week exercise program, the participants were evaluated for sleep with the Sensewear Armband. In addition, Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleep Scale were used to evaluate subjective sleep processes.

**Results:** Participants' pre-exercise and post-exercise sleep data were compared. An increase in sleep duration was determined from the Sensewear armband data ($p=0.033$). Significant improvements were observed in sleep latency and daytime sleepiness, which are sub-components of PSQI. When the Epworth Sleep Scale results were examined, it was observed that the daytime sleepiness of the participants decreased statistically significantly after exercise ($p=0.013$).

**Conclusion:** Our study shows that the exercise program with telerehabilitation is an effective method to increase sleep quality by supporting the healthy aging process in older adults.

**Keywords:** Telerehabilitation, Sleep Quality, Aging

**S013 - Covid-19 karantinası sırasında ve sonrasında Kıbrıs'ın**

**kuzeyindeki bireylerin haftalık fiziksel aktivite durumlarının incelenmesi**

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**Amaç:** Kıbrıs'ın kuzeyinde sokağa **çıkma** yasağının fiziksel aktivite (FA) **üzerindeki** etkilerini belirlemeyi amaçlanmıştır.

**Yöntem:** Çalışmaya, ilk tam kapanma sürecini Kuzey Kıbrıs'ta geçiren, yetişkin toplam 307 (215 kadın, 92 erkek) katılımcı dahil edilmiştir. Katılımcılara genel bilgileri ve fiziksel aktivite davranışları ile ilgili sorular sorulmuştur. Karantinanın etkilerini değerlendirmek için her soru katılımcılara hem karantina süresince hem de sonrasında olmak üzere toplam iki kere yöneltilmiştir.

**Sonuçlar:** Kapanmada video izleyerek egzersiz yapanların (n:133;%43,3), %24,1'inin kapanma sonrası alışkanlığını sürdürdüğü, %19,5'inin ise karantina sonrasında spor salonuna başladığı, görülmüştür. Hem kapanmada hem de kapanma sonrası video eşliğinde egzersiz yapanların oranı, kapanmada video eşliğinde egzersiz yapmayıp, sonrasında egzersiz yapmaya başlayan bireylerin **üzerindedir** (p< 0,001). Katılımcıların tam kapanma sürecinde evde orta şiddetli FA yapma (n:148;%48,2) sıklıkları haftada ortalama 2,54±1,36 kez iken, kapanma sonrasında evde veya spor salonunda olmak üzere bu sıklık 2,75±1,34 olarak bulunmuştur (p=0,034). Aynı zamanda, kapanmada orta şiddetli fiziksel aktivite yapan bireylerin % 65,5'i bu davranışı sürdürmüşlerdir. Hem kapanmada hem de kapanma sonrası orta **şiddette** fiziksel aktivite (FA) yapanların oranı, kapanmada bu davranışı göstermeyip, kapanma sonrasında bu aktiviteyi yapmaya başlayanların oldukça (%25,8) üzerindedir (p<0,001).

**Tartışma:** Karantinada fiziksel aktivite yapan bireylerin bir kısmının bu alışkanlığı karantina sonrasında da sürdürdüğü, karantina sürecinin tamamlanması ile sokağa **çıkma** yasağının kaldırılması, spor merkezlerinin yeniden kullanıma açılması vb. sebeplerle egzersiz yapma sıklığında artış olduğu görülmüştür.

**Anahtar Kelimeler:** Covid-19, Fiziksel Aktivite, Karantina

**S013 - Examination of participants' weekly physical activity frequencies during and after the Covid-19-related lockdown in the northern side of Cyprus**

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**Purpose:** This study aimed to determine the effects of the national lockdown on the participants' physical activity (PA) behaviors.

**Methods:** Totally 307 people (215 female, 92 male) participated in this study. Background information and physical activity (PA) related questions were asked. Each question was asked twice both during and after the national lockdown to determine the effects of quarantine.

**Results:** 24.1 % of participants, who did exercise via online videos during the lockdown (n:133;43.3%), continued this behavior after the lock down while 19.5% begin to do exercise in gym. The rate of those who did exercise via videos both during and after lockdown was higher than those who did not do exercise during lockdown and then started to do exercise after (p<0.001). Moderate-intensity PA frequency of participants (n:148;48.2%) was 2.54±1.36 times/week at home during the lockdown while it increased to 2.75±1.34 times/week (p=0.034) (either at home or in gym) after the lock down. It was found that 65.5% of these participants continued this behavior after the lockdown. The rate of those who did moderate PA both during and after lockdown was significantly higher (25.8%) than those who did not do exercise during lockdown and began to do it after (p< 0.001).

**Conclusion**: It was observed that most of the participants who did regular physical activity during lockdown adopted this behavior after and with the end of the curfew and reopening of the fitness centers there was a significant increase in exercise frequency.

**Keywords:** Covid-19, Physical activity, Quarantine

**S014 - Ağrısı olan esnek pes planuslu bireylerde ağrı, ayak bileği kas kuvveti ve fiziksel aktivite seviyesi arasındaki ilişkinin incelenmesi**

Cansu KOLTAK[1], Yasin YURT[1]

[1]Doğu Akdeniz Üniversitesi, Sağlık Bilimleri Fakültesi, Fizyoterapi ve Rehabilitasyon Bölümü, Gazimağusa, KKTC

**Amaç:** Ayak ağrısının önemli nedenlerinden biri olan esnek pes planus deformitesi sıklıkla azalmış ayak bileği kas kuvveti ile birliktedir. Disabilite ile sonuçlanan ağrılı pes planus deformitesi fiziksel aktivite seviyesini olumsuz etkileyebilmektedir. Amacımız ağrılı esnek pes planuslu bireylerde ağrı şiddeti, ayak bileği kas kuvveti ve fiziksel aktivite arasındaki ilişkiyi incelemekti.

**Yöntem:** Ağrılı esnek pes planus deformitesi olan 52 (30 kadın- 22 erkek) birey çalışmaya dahil edildi. Bireylerin ağrı şiddeti görsel analog skalası kullanılarak, fiziksel aktivite düzeyleri ise Uluslararası Fiziksel Aktivite Anketinin kısa formuyla değerlendirildi. İnvertör ve evertör kas kuvveti değerlendirmek için 180°/sn ve 240°/sn açısal hızda eksentrik ve konsantrik olarak izokinetik dinamometre kullanıldı.

**Sonuçlar**: Bireylerin yaş ortalaması 25,62±7,87 yıl, beden kütle indeksi ortalaması 25,68±4,74 kg/m² olarak hesaplandı. 180□ eksentrik invertör - evertör kas kuvvetleri ile fiziksel aktivite düzeyi arasında pozitif yönde zayıf bir ilişki bulundu (p<0,05, r=0,328, r=0,344). 240□ eksentrik kas kuvvetinde sadece evertör kas grubu ile pozitif yönde orta bir ilişki saptandı (p<0,05, r= 0,445). Ağrı şiddeti ile kas kuvveti ve fiziksel aktivite seviyeleri arasında ilişki yoktu (p>0,05)

**Tartışma:** Ağrılı pes planus deformitesi olan bireylerde fiziksel aktivite seviyesi arttıkça ayak bileği eksentrik kas kuvveti de artmaktadır. Ayak bileği kaslarının kuvvetlendirilmesini içeren konservatif tedavi kapsamında bireylerin fiziksel aktivite seviyelerini arttırmak da hedeflenmelidir.

**Anahtar kelimeler: Ayak Bileği, Fiziksel Aktivite, Kas Kuvveti, Pes Planus**

**S014 - Investigation of the relationship between pain, ankle muscle strength and physical activity level in subjects with flexible pes planus with pain.**

Cansu KOLTAK[1], Yasin YURT[1]

[1]Eastern Mediterranean University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Famagusta, TRNC

**Purpose:** Flexible pes planus deformity, which is one of the important causes of foot pain, is often associated with decreased ankle muscle strength.Painful pes planus deformity resulting in disability can negatively affect the level of physical activity. Our aim was to examine the relationship between pain intensity, ankle muscle strength and physical activity in subjects with painful flexible pes planus.

**Methods:** Fifty-two subjects with painful flexible pes planus deformity were included in the study. Subjects pain intensity was evaluated using the Visual Analog Scale, and their physical activity levels were evaluated with the short form of the International Physical Activity Questionnaire. Eccentric and concentric isokinetic dynamometers were used to evaluate the inverter and evertor muscle strength at an angular speed of 180°/sec and 240°/sec.

**Results:** The mean age of the subjects was 25.62±7.87 years, and the mean body mass index was calculated as 25.68±4.74 kg/m². A weak positive correlation was found between 180□eccentric inverter-evertor muscle strength and physical activity level (p<0.05, r= 0.328, r=0.344). In 240□-eccentric muscle strength, a moderate positive correlation was found only with the evertor muscle group (p<0.05, r= 0.445). No correlation was found between concentric inverter-evertor muscle strength and physical activity.

**Conclusion**: In subjects with painful pes planus deformity, as the level of physical activity increases, eccentric ankle muscle strength also increases. Within the scope of conservative treatment, which includes strengthening the ankle muscles, it should also be aimed to increase the

physical activity levels of subjects.

**Keywords:** Ankle, Physical Activity, Muscle Strength, Pes Planus

**S015 - Fizyoterapi** öğrencilerinde **akıllı telefon bağımlılığının baş-boyun postürü ve akademik başarıya etkileri**

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**Amaç**: Dünyada telefon çeşitliliğinin artması ve nispeten ucuzlaması akıllı telefon kullanımının popülerliğine ve sonuçta akıllı telefon bağımlılığının artmasına yol açmaktadır. Bu durum kullanıcıların psikolojik ve fiziksel sağlık problemlerine neden olabilmektedir. Bu çalışma, Doğu Akdeniz Üniversitesi, Fizyoterapi ve Rehabilitasyon bölümündeki öğrencilerde akıllı telefon bağımlılığı ile baş-boyun postürü ve akademik başarı arasındaki ilişkinin incelenmesi amacıyla yapıldı.

**Yöntem**: Çalışmamız Doğu Akdeniz Üniversitesi, Sağlık Bilimleri Fakültesi, Fizyoterapi ve Rehabilitasyon Bölümü'ndeki 2,3 ve 4.sınıf öğrencilerinde gerçekleştirildi. Yaşları 19-28 yıl arasında olan 177 öğrenci çalışmaya katıldı. Bireylerin demografik bilgileri ve akıllı telefon kullanım süresi kaydedildi. Akıllı telefon bağımlılığı Akıllı Telefon Bağımlılığı Ölçeği-Kısa Versiyonu (ATBÖ-KV) ile, akademik başarıları dönemlik ve genel not ortalamalarıyla, baş-boyun postürleri fotoğraflama yöntemiyle değerlendirildi. ATBÖ-KV puanı > 29,5 olan bireyler bağımlı olarak tanımlandı.

**Sonuçlar**: Katılımcıların yaş ortalaması 21,56 ± 1,77 yıl, ATBÖ-KV puan ortalamaları 33,32±l1,18'di. Çalışmaya katılan öğrencilerin 86'sı (%49,4) akıllı telefon bağımlısıydı. Katılımcıların akıllı telefon kullanma süreleri ortalama 6,97±2,06 yıldı. Bağımlı olduğu belirlenen katılımcılarda Akıllı Telefon Bağımlılık Ölçeği puanları ile incelenen hiçbir değişken arasında istatistiksel olarak anlamlı bir ilişki bulunmadı (p>0,05).

**Tartışma:** Fizyoterapi ve Rehabilitasyon Bölümü'nde eğitim alan öğrencilerin yaklaşık yarısı akıllı telefon bağımlısı olup, bağımlılık düzeyi yüksektir. Akıllı telefon bağımlılığı ile baş boyun postürü ve akademik başarı arasında ilişki bulunmamaktadır. Akıllı telefonların segmentlerine göre değişen performans ve özellikleri bağımlılık düzeyini etkileyebilir. Katılımcıların genç oluşları ve akıllı telefon kullanım sürelerinin kısa olması sonuçlar üzerinde etkili olmuş olabilir. Gelecek çalışmaların bu faktörle birlikte farklı yaş gruplarında daha geniş örneklem üzerinde yapılması önerilir.

**Anahtar Kelimeler:** Akademik Başarı, Akıllı Telefon, Öğrenciler, Postür

**S015 - The effects of smartphone addiction on head and neck posture and academic achievement in physiotherapy students**

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**Purpose:** Increasing phone variety and affordable prices cause an increase in smartphone addiction. This can cause psychological and physical problems. The aim of this study is to examine the relationship between smartphone addiction, head-neck posture and academic achievement in Eastern Mediterranean University (EMU), Physiotherapy and Rehabilitation students.

**Methods:** Our study was carried out on 2nd, 3rd and 4th grade students in EMU, Department of Physiotherapy and Rehabilitation. 177 students aged between 19-28 years participated. Their demographic information and smartphone usage duration were recorded. Smartphone addiction was evaulated with the Smartphone Addiction Scale-Short Version (SAS-SV).These addicts'academic achievements were evaulated with their semester and grade averages. Their head-neck postures were eveulated with photographing method. SAS-SV score>29.5 were defined as addicted.

**Results:** The mean age of the participants was 21.56 ± 1.77 years, the mean SAS-SV score was 33.32±1.18. Eighty-six (49.4%) of the students participating in the study were smartphone addicts. The average duration of using smartphones of the participants was 6.97±2.06 years. There was no statistically significant relationship between the SAS-SV scores and the variables in the participants who were determined to be addicted (p>0.05).

**Conclusion:** About half of the participant students are addicted to smartphones and have a high level addiction. There's no relationship between smartphone addiction and head-neck posture also academic achievement. The smartphones' performance varies according to their segments which may affect addiction. Short smartphone usage time may have affected the results. Studies with larger samples and different age groups are recommended.

**Keywords:** Academic Success, Smartphone, Students, Posture

**S016 - Diz osteoartritli köpeklerde kinezyo bantlamanın ağrı ve yürüyüş üzerine etkisi: iki olgunun sunumu**

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**Amaç:** Diz osteoartriti olan köpeklerde tedavi programını olgu raporu olarak sunmaktır.

**Yöntem:** Diz osteoartriti olan ve ağrı ve topallama şikayeti ile başvuran iki olgu değerlendirildi. 10 yaşındaki birinci olgunun, ilk değerlendirmesinde ağrı skoru Helsinki Kronik Ağrı İndeksine (HCPI) göre 25/44, 12 yaşındaki ikinci olgunun 29/44 idi. Yürüyüş değerlendirmesi için 12 m yürüme testi kullanıldı. Ağrıyı azaltmak ve yürüyüşü düzeltmek amacıyla her iki olguya kinezyo bantlama ve egzersiz tedavisi planlandı. Kinezyo bantlamada hayvanlar için Kinesio® Canine Tape marka bant kullanıldı. Kinezyo bantlama patellar mekanik koreksiyon tekniği ile birlikte Kuadriseps kas fasilitasyonu tekniği kullanılarak %20 gerimle yapıldı. Dans egzersizleri, ağırlık aktarmalar, basamak egzersizleri ve engel üzerinden atlama egzersizleri her seans kinezyo bantlama ile birlikte yaptırıldı. Tedaviler haftada 3 seans, toplam 4 haftalık programlandı.

**Sonuçlar:** Birinci olguda ağrı skoru tedavi sonrası 15'e, yürüme süresi 10,34 saniyeden 9,91'e, adım sayısı 33'ten 30'a düştü. İkinci olguda ağrı skoru tedavi sonrası 16'ya inerken, yürüme süresi 12,44 saniyeden 9,47 saniyeye, adım sayısı 38'den 33'e düştü.

**Tartışma:** Köpeklerde diz osteoartritinde kinezyo bantlama ve egzersizler ile ağrıda azalma elde edildi. Yürüyüş parametrelerinde ise artış gözlendi. Egzersizlerin kinezyo bant ile yaptırılması, diz ekleminde stabilizasyonu, kas fasilitasyonunu ve propriyosepsiyonu arttırıcı etki göstermiştir. Kinezyo bantlama ile mekanoreseptörler uyarılır ve merkezi sinir sistemine afferent girdi artar. Böylelikle köpeklerin daha az ağrı ile egzersizleri yaptığını ve kinezyo bantlamanın egzersiz tedavisinin etkinliğini arttırdığını düşünmekteyiz.

**Anahtar kelimeler:** Hayvanlarda Fizyoterapi, Kinezyo Bantlama, Köpek

**S016 - The effect of kinesio taping on pain and gait in dogs with knee osteoarthritis: report of two cases**

Neyran Altınkaya[1], Nihan Özünlü Pekyavaş[2]

[1]Final International University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Girne, TRNC

[2]Başkent University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Turkey

**Purpose:** To present the treatment program in dogs with knee osteoarthritis as a case report.

**Methods:** Two dogs with knee osteoarthritis, pain and lameness were evaluated. The pain score of the first 10-year-old dog was 25/44 according to the Helsinki Chronic Pain Index (HCPI), and 29/44 in the second 12-year-old dog. The 12 m walking test was used for gait assessment. Kinesiotaping and exercise therapy were planned in order to reduce pain and improve gait. Kinesio® Canine Tape was used for applications. Kinesiotaping was performed using patellar mechanical correction technique and Quadriceps muscle facilitation technique with 20% tension. Dance exercises, weight transfers, step exercises and obstacle exercises were performed with kinesiotaping in each session. Treatments were scheduled for 3 sessions per 4 weeks.

**Results:** In the first case, pain score decreased to 15, walking time decreased from 10.34 seconds to 9.91, and number of steps decreased from 33 to 30. In the second case, pain score decreased to 16, walking time decreased from 12.44 seconds to 9.47 seconds, and number of steps decreased from 38 to 33.

**Conclusion:** In dogs with knee osteoarthritis with kinesiotaping and exercises decreased pain and increased gait parameters. Performing the exercises with kinesiotape has shown an increasing effect on stabilization, muscle facilitation and proprioception in knee joint. Kinesiotaping increases mechanoreceptors stimulation and afferent inputs in the central nervous system. We think with kinesiotaping dogs can do exercises with less pain and it increases the effectiveness of exercises.

**Key words:** Animal Physiotherapy, Kinesio Taping, Dog

**S017 - Köpeklerde akupunktur uygulamaları ile ilgili yapılmış çalışmaların incelenmesi**

Neyran Altınkaya[1], Caniz Tonyalı[1], İpek Ergür[1]

[1]Uluslararası Final Üniversitesi, Sağlık Bilimleri Fakültesi, Fizyoterapi ve Rehabilitasyon Bölümü, Girne, KKTC

**Amaç:** Bu çalışmanın amacı köpeklerde akupunktur ile ilgili makalelerin sayısal oranını belirlemek ve kullanılan yöntemleri incelemektir.

**Yöntem:** Son 5 yılda "canine acupuncture" ile ilişkili yayınlar PUBMED veritabanında incelenmiştir. İncelenen 33 makalenin 29 (%87) tanesi konu ile ilişkili bulunmuştur. Makaleler, derleme, randomize çalışmalar ve diğerleri olmak üzere 3 bölüme ayrılarak incelenmiştir. Konularına göre ise nörolojik, ortopedik ve diğerleri olmak üzere 3 bölüme ayrılmıştır.

**Sonuçlar:** Akupunktur ile ilgili makalelerin %27,50'i derleme, %37,90'u randomize kontrollü çalışma, %34,40'ü diğer bilimsel yayınlardı. İncelenen yayınların %51'i ağrı ile ilişkiliydi. Makaleler konularına göre incelendiğinde %34,40'ünün nörolojik vakalar, %6,80'inin ortopedik vakalar, %58,60'sının diğer klinik vakalar üzerinde yapıldığı gözlenmiştir.

**Tartışma:** Bu yayın inceleme araştırmasının sonuçlarına göre köpeklerde yapılan akupunktur çalışmalarında en çok kullanılan değerlendirme parametresinin ağrı olduğu, en çok tedavi edilen hasta grubunun nörolojik hastalar olduğu, kullanılan bilimsel metotlar arasında en çok tercih edilen yöntemin randomize çalışmalar olduğu belirlenmiştir.

**Anahtar kelimeler:** Akupunktur, Köpek, Literatür, Nörolojik

**S017 - Examination of studies on acupuncture applications in dogs**

Neyran Altınkaya[1], Caniz Tonyalı[1], İpek Ergür[1]

[1]Final International University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Girne, TRNC

**Purpose:** This study aims to determine the numerical ratio of articles on acupuncture in dogs and to examine the methods used by the studies.

**Methods:** Publications related to "canine acupuncture" in the last 5 years were reviewed in the PUBMED database. Out of a total of 33 articles, 29 (87%) were related to the subject. The articles were analyzed by dividing them into 3 sections: review, randomized studies, and others. According to their subjects, it is divided into 3 sections neurological, orthopedic, and others.

**Results:** 27.50% of the articles on acupuncture were reviewed, 37.90% were randomized controlled trials, and 34.40% were other scientific publications. 51% of the reviewed publications were associated with pain. When the articles were examined according to their subjects, it was observed that 34.40% were made on neurological cases, 6.80% on orthopedic cases, and 58.60% on other clinical cases.

**Discussion:** According to the results of this publication review study, it was determined that the most used evaluation parameter in acupuncture studies in canines was pain, the most treated patient group was neurological patients, and the most preferred method among the scientific methods used was randomized studies.

**Keywords:** Acupuncture, Canine, Literature, Neurological

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**(LÜTFEN BÜTÜN YAZARLARIN İSİMLERİNİ MAKALEDEKİ İSİM SIRALAMASINA GÖRE YAZINIZ. YAZARLARIN TAMAMININ İMZASI GEREKMEKTEDİR.)**

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Authors of this study report no financial interests or connections that might raise the question of bias in the work reported or the conclusions, implications, or opinions stated including pertinent commercial or other sources of funding. *(P.S.: If a conflict of interest exists, it should also be reported.)*

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Başlık: .....

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| KATKI TÜRÜ | AÇIKLAMA | KATKIDA BULUNANLAR |
|---|---|---|
| FİKİR/KAVRAM | Araştırma hipotezini veya fikrini oluşturmak | |
| TASARIM | Sonuçlara ulaşılmasını sağlayacak yöntemi tasarlamak | |
| DENETLEME/DANIŞMANLIK | Araştırmanın yürütülmesini organize etmek, ilerlemesini gözetmek ve sorumluluğunu almak | |
| KAYNAKLAR VE FON SAĞLAMA | Çalışma için gerekli personel, mekan, finansal kaynak ve araç-gereçleri sağlamak | |
| MATERYALLER | Materyaller ile ilgili sorumluluk almak | |
| VERİ TOPLAMA VE/VEYA VERİ İŞLEME | Verilerin toplanması, düzenlenmesi ve raporlanması için sorumluluk almak | |
| ANALİZ VE/VEYA YORUMLAMA | Bulguların değerlendirilerek sonuçlandırılmasında sorumluluk almak | |
| LİTERATÜR TARAMASI | Çalışma için gerekli literatür taramasında sorumluluk almak | |
| MAKALE YAZIMI | Çalışmanın tamamının veya önemli bölümlerinin yazılmasında sorumluluk almak | |
| ELEŞTİREL İNCELEME | Çalışmanın raporlanmasından sonra, dil ve yazınsal düzeltmelerden bağımsız olarak bilimsel anlamda çalışmayı yeniden değerlendirmek | |

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| CONCEPT | Formulating the research hypothesis or idea | |
| DESIGN | Designing the method to achieve the results | |
| SUPERVISION | Organizing the conduct of the research, overseeing its progress, and taking responsibility | |
| RESOURCES AND FINANCIAL SUPPORT | Providing necessary staff, space, financial resources, and equipment for the study | |
| MATERIALS | Taking responsibility for the materials | |
| DATA COLLECTION AND/OR PROCESSING | Taking responsibility for collecting, organizing, and reporting data | |
| ANALYSIS AND/OR INTERPRETATION | Taking responsibility in evaluating and finalizing the findings | |
| LITERATURE SEARCH | Taking responsibility in the literature review required for the study | |
| WRITING MANUSCRIPT | Taking responsibility for the writing of all important parts of the study | |
| CRITICAL REVIEW | After the report of the study, re-evaluating the study in a scientific sense regardless of language and literary corrections | |