Turkish Journal of Physiotherapy and Rehabilitation

Türk Fizyoterapi ve Rehabilitasyon Dergisi

www.dergipark.gov.tr/tjpr
Volume/Cilt 35, Number/Sayı 2, 2024

ISSN: 2651-4451 • e-ISSN: 2651-446X

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(On Behalf of Turkish Physiotherapy Association)
Tülin DÜGER

Editör ve Yazı İşleri Müdürü
(Editor in Chief and Managing Editor)
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TÜRKİYE FİZYOTERAPİSTLER DERNEĞİ'nin bilimsel yayın organı ve yaygın süreli yayınıdır.
(The official scientific journal of Turkish Physiotherapy Association)

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"Açık Erişim Dergi" yılda 3 kez (Nisan, Ağustos, Aralık) yayınlanır.
"Open Access Journal" published 3 times (April, August, December) a year.

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Dergi Basım Tarihi: 27.08.2024

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YAZARLARIN DİKKATİNE
Genel Bilgiler

Genel Bilgiler

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.

ETİK SORUMLULUK

Editör ve Alan Editörleri

Editör ve alan editörleri, açık erişim olarak Committee on Publication Ethics (COPE) tarafından yayımlanan "COPE Code of Conduct and Best Practice Guidelines for Journal Editors" ve "COPE Best Practice Guidelines for Journal Editors" rehberleri temelinde etik görev ve sorumluluklara sahiptirler. Editörler ve alan editörleri:

- Dergide yayımlanan her makalenin dergi yayın politikaları ve uluslararası standartlara uygun olarak yayımlanmasından,
- Derginin kalitesini, özgünlüğünü ile okunurluğunu geliştirmekten,
- Fikri mülkiyet hakları ile etik standartlardan taviz vermeden şeffaf bir şekilde iş süreçlerini yürütmekten,
- Makalelerin tarafsız ve bağımsız olarak değerlendirme süreçlerinin tamamlanması için yazarlar, hakemler ve üçüncü kişiler arasında oluşabilecek çıkar ilişkisi ve çatışmalarına karşı önlem almaktan sorumludurlar.

Editörler, çalışmaların önemi, özgün değeri, geçerliliği, anlatımın açıklığı ve derginin amaç ve hedeflerine dayanarak olumlu ya da olumsuz karar verirler. Dergi yayın politikalarında yer alan "Kör Hakemlik ve Değerlendirme Süreci" politikalarını uygulamaktadırlar. Bu bağlamda editörler her çalışmanın değerlendirme sürecinin çıkar çatışması olmadan, adil, tarafsız ve zamanında tamamlanmasını sağlarlar.

Derginin editör veya editör kurulu üyelerinin yazar oldukları makalelerin değerlendirme süreçlerinin yönetilmesi için dışarıdan bağımsız bir editör davet edilebilir.

Hakemler

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.

Yazarlar

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:

- *Makaleler;* 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.
- *Dergi ilavesinde yayımlanan çalışmalar;* 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.
- *Kitap;* Murtagh J. John Murtagh's general practice. 4th ed. Sydney: McGraw-Hill Australia Pty Ltd; 2007.
- *Kitap b*ölümü; 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.
- *Kongre Bildirisi;* 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 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.

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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.

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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.

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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.
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- *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.
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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.).

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

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- *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 Okurlarımız,

Türk Fizyoterapi ve Rehabilitasyon Dergisi'nin 2024 yılı Ağustos sayısını fizyoterapi ve rehabilitasyon bilim alanındaki güncel yaklaşımları geniş bir konu yelpazesinde ele alan 14 makale ile sizlere sunuyoruz. İkisi sistematik derleme olmak üzere kadınlar, yaşlılar, çocuklar ve sağlıklı bireyler üzerinde yürütülen araştırma sonuçlarını sunan makalelerinin yanı sıra ortopedik ve romatizmal hastalıklarda tele-rehabilitasyonun etkinliği, hayvanlarda fizyoterapi ve rehabilitasyon uygulamaları, ölçek güvenilirlik ve geçerliği, yapay zekâ ile soket önerme programı geliştirilmesi konularını içeren makalelerimizin birçok okuyucumuz için ufuk açıcı olacağını umuyoruz.

Bu sayıda sizinle paylaşmaktan mutluluk duyduğumuz diğer bir konu, Web of Science 2023 yılı Dergi Atıf Raporlarına göre dergimizin etki faktörünün (JCI: 0.12) ve çeyreklik dilimdeki yerinin (Q3) yükselmiş olmasıdır. Dergimizin Science Citation Index-Expanded kapsamında dizinlemesi adına umut vadeden bu gelişme için emeği geçen tüm Editör ve Bilim Kurullarımıza, hakemlerimize ve yazarlarımıza teşekkürlerimizi sunarız.

Son olarak, sizleri Yayın Kurulumuzda yapılan bazı değişiklikler hakkında bilgilendirmek isteriz. Kendi tercihleri doğrultusunda Yayın Kurulumuzdan ayrılan Prof. Dr. Mehtap Malkoç, Prof. Dr. Emine Handan Tüzün, Dr. Fzt. Pınar Van Der Veer ve Uz. Fzt. Uğur Verep'e bugüne kadarki desteklerinden ve özverili çalışmalarından dolayı teşekkürlerimizi sunar, yerlerine önerdikleri yeni Yayın Kurulu üyelerimiz olan Doç. Dr. Yasin Yurt, Dr. Öğr. Üyesi Nurel Ertürk, Uz. Fzt. Fulden Çakır ve Uz. Fzt. Nurhayat Korkmaz'a başarılar dileriz.

Yayın Kurulu adına,

Saygılarımla,

Prof. Dr. H Serap İNAL

Baş Editör

EDİTÖRDEN

Dear Readers,

We present you the August 2024 issue of the Turkish Journal of Physiotherapy and Rehabilitation with 14 articles covering current approaches in the field of physiotherapy and rehabilitation science on a wide range of topics. These articles include two systematic reviews, and in addition to research articles presenting the results of studies conducted on women, the elderly, children and healthy individuals, we hope that our articles on the effectiveness of tele-rehabilitation in orthopedic and rheumatic diseases, physiotherapy and rehabilitation practices in animals; scale reliability and validity, and the development of a socket recommendation program with artificial intelligence will be seminal and insightful for many of our readers.

Another issue that we are happy to share with you in this issue is that our journal's impact factor (JCI: 0.12) and its place in the quarter (Q3) have increased according to the Web of Science 2023 Journal Citation Reports. We would like to thank all our Editorial and Scientific Boards, referees and authors who contributed to this promising development for our journal to be indexed within the scope of Science Citation Index-Expanded.

Finally, we would like to inform you about some changes in our Editorial Board. We would like to thank Mehtap Malkoç, PT. Prof., Emine Handan Tüzün, PT. Prof., Pınar Van Der Veer, PT. PhD and Uğur Verep, PT. MSc. for their support and devoted work to date and wish success to the new Editorial Board members proposed by them (Yasin Yurt, Assoc. Prof., Nurel Ertürk, Assist. Prof., Fulden Çakır, PT. MSc. and Nurhayat Korkmaz, PT. MSc.).

On Behalf of the Editorial Board,

Kind Regards,

H. Serap İNAL, PT. Prof.

Editor-in-Chief

ISSN:2651-4451 • e-ISSN: 2651-446X

İÇİNDEKİLER

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)131-142

Emel METE, PT, MSc[1]
Zübeyir SARI, PT, PhD, Prof.[2]

TURKISH VALIDITY AND RELIABILITY OF THE POUND SATISFACTION SCALE IN STROKE PATIENTS UNDERGOING REHABILITATION

ORIGINAL ARTICLE

ABSTRACT

Purpose: This study aimed to evaluate the Turkish validity and reliability of the Pound Satisfaction Scale (PSS).

Methods: For the adaptation of the PSS to Turkish (PSS-Tr), the translation and back-translation process was carried out by following the international guidelines. Confirmatory factor analysis (CFA) was performed to measure structural validity. The relationship between PSS-Tr and the Patient Satisfaction Scale in Physiotherapy (PSSP) and the SF-36 was assessed for construct validity. Convergent validity was evaluated computing by the Average Variance Extracted (AVE). Cronbach's alpha coefficient and Composite reliability (CR) for internal consistency of the PSS-Tr and Bland-Altman plot and test-retest reliability analysis for temporal consistency were used.

Results: The study included 130 stroke patients. The fit index values of the CFA showed that the structural validity of the PSS-Tr was appropriate (*x2/sd*=1.779, RMSEA=0.075, GFI=0.911, AGFI=0.853, CFI=0.955, NFI=0.905). A high correlation was found between the PSS-Tr total score and the PSSP (p=0.001, r=0.672). A moderate correlation was found between the hospital satisfaction sub-dimension of PSS-Tr, and the sub-dimensions of SF-36 (p=0.001, r=0.484-0.609), while a low correlation was found between the home satisfaction sub-dimension of the PSS-Tr and the physical functioning (p=0.002, r=0.266) and physical role (p=0.035, r=0.180) sub-dimensions of SF-36. And also the PSS-Tr was found to have good internal (Cronbach alpha= 0.895, CR=0.94) and temporal consistency (ICC = 0.976).

Conclusion: The Turkish version of the Pound Satisfaction Scale (PSS-Tr) is reliable and valid. The PSS-Tr may be useful for clinicians and researchers in assessing satisfaction with rehabilitation in stroke patients.

Keywords: Patient Satisfaction, Rehabilitation, Stroke

REHABİLİTASYON HİZMETİ ALAN İNMELİ HASTALARDA POUND MEMNUNİYET ÖLÇEĞİ TÜRKÇE GEÇERLİLİK VE GÜVENİLİRLİĞİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmada Pound Memnuniyet Ölçeği (PMÖ)'nin Türkçe geçerlilik ve güvenilirliğini araştırmak amaçlanmıştır.

Yöntem: PMÖ'nün Türkçeye uyarlanması (PMÖ-Tr) için çeviri süreci uluslararası yönergelere göre yapıldı. Yapısal geçerlilik, doğrulayıcı faktör analizi (DFA) ile gerçekleştirildi. PMÖ ile Fizyoterapide Hasta Memnuniyet Ölçeği (FHMÖ) ve SF-36 ölçekleri arasındaki ilişki yapı geçerliliği açısından değerlendirildi. Yakınsak geçerlilik, Ortalama Açıklanan Varyans değerleri hesaplanarak değerlendirildi. PMÖ-Tr'nin iç tutarlılığı; Cronbach's alpha katsayısı, birleşik güvenilirlik ve Bland Altman grafiği ile değerlendirildi. Zamansal tutarlılık ise test-tekrar test yöntemi ile değerlendirildi.

Sonuçlar: Bu çalışmaya 130 inme hastası dâhil edildi. DFA kapsamındaki uyum değerlerine göre PMÖ-Tr'in yapı geçerliliği açısından uygun bulundu (x2/sd=1,779; RMSEA=0,075; GFI=0,911, AGFI=0,853; CFI=0,955; NFI=0,905). PMÖ-Tr toplam skoru ile FHMÖ arasında güçlü bir korelasyon saptandı (p=0,001; r=0,672). SF-36'un alt boyutları ile PMÖ-Tr'in hastane memnuniyeti arasında orta düzeyde bir korelasyon saptanırken (p=0,001; r=0,484-0,609), PMÖ-Tr'in ev memnuniyeti ile SF-36'un fiziksel fonksiyon (p=0,002; r=0,266) ve fiziksel rol güçlükleri (p=0,035; r=0,180) alt boyutları arasında zayıf bir korelasyon bulundu. Ayrıca PMÖ-Tr'nin iyi bir iç (Cronbach alpha= 0,895; CR=0,94) ve zamansal tutarlılığı (ICC= 0,976) olduğu belirlendi.

Tartışma: Pound Memnuniyet Ölçeği›nin Türkçe versiyonu (PMÖ-Tr) güvenilir ve geçerlidir. PMÖ-Tr, inmeli hastalarda rehabilitasyon ile ilgili memnuniyet düzeyinin değerlendirilmesinde klinisyenler ve araştırmacılar için yararlı olabilir.

Anahtar Kelimeler: Hasta Memnuniyeti, İnme, Rehabilitasyon

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***Received**: 07.11.2031 (Geliş Tarihi)*
***Accepted**: 30.01.2024 (Kabul Tarihi)*

INTRODUCTION

According to the Global Stroke Information Form, stroke is the second-most common cause of death and the third-most common cause of long-term disability in the world (1). In stroke rehabilitation, ICF is used to evaluate functionality, disability, and health together based on a biopsychosocial model. An important component of the ICF is that, in addition to health, it also evaluates environmental factors that influence performance during daily living activities. As part of this model, health is evaluated with a biopsychosocial approach, which considers health status and all factors that can influence health and functioning (2). In the context of the ICF, personal, medical, and environmental factors have been identified as affecting participation performance and satisfaction in stroke patients (3).

Satisfaction is a concept that is affected by a person's lifestyle and habits, sociodemographic characteristics, communication with other people, and social environment (4). In addition to these factors, satisfaction among stroke patients includes factors such as medical care and the rehabilitation process (5). In recent years, the importance of patient satisfaction in medical care has been emphasized. The level of satisfaction with healthcare services has been shown to positively affect patient compliance with treatment, alter patients' behavior, and lead to improved health outcomes. (4). In addition to affecting health outcomes, high patient satisfaction can also influence how health services are provided. Current concepts indicate that patient-reported outcomes, including patient satisfaction, play a crucial role in determining healthcare delivery and treatment effectiveness (6). In the USA, patient satisfaction reporting has been associated with reimbursement through appropriate care laws in a medical care center (6). According to a systematic review investigating the determinants of patient satisfaction, the importance of medical care services and providers has been very significant in patient satisfaction. Patient satisfaction is positively related to the quality of healthcare providers. Factors affecting the quality of healthcare providers can be listed as interpersonal communication, the physical environment of the facility, accessibility, continuity of care, and hospital characteristics (4). Healthcare providers should assess patient satisfaction to identify service factors that can be improved. It is also possible for healthcare providers to gain a better understanding of patients' needs to develop strategic plans and improve healthcare quality (7, 8).

As stroke causes long-term disability, it requires long-term treatment, including hospitalization and rehabilitation after discharge (1). In stroke rehabilitation, assessing patient satisfaction has been shown to have a significant impact on outcome measures. Patient satisfaction is related to quality of life measures and often depends on the individual's sense of interaction with the healthcare system. A stroke patient's rehabilitation process begins in the hospital and continues at home. Patient satisfaction with healthcare services, healthcare providers, and clinicians is an essential aspect of the rehabilitation process, both in terms of individual improvement and justifying continued participation (9). For these reasons, evaluating patient satisfaction may be an effective method for improving the quality of healthcare services and contributing to the rehabilitation process. The Pound Satisfaction Scale (PSS) was developed to evaluate patient satisfaction with the rehabilitation services provided to stroke patients both during hospitalization and after discharge (10). A scale that has Turkish validity and reliability and evaluates patient satisfaction in stroke patients has not been reported in the literature. The purpose of this study was to adapt the PSS to Turkish culture and determine whether it is a valid and reliable tool for assessing patient satisfaction.

METHODS

Participants

In this study, 130 stroke patients aged 18 to 80 years who had a Mini-Mental State Examination (MMSE) >24 and had received physiotherapy and rehabilitation services for two months with at least 16 sessions were included. Patients with an MMSE<24, other neurologic diseases (Such

as Multiple sclerosis and Parkinson), orthopaedic disorders (trauma or fractures), uncontrolled aritmia, visual and auditory deficits were excluded. Participants were recruited to the study among stroke patients who met the inclusion criteria and applied to the Physiotherapy and Rehabilitation Unit of a medical center called "Cadde Tıp Merkezi" in Istanbul, Turkey. Written and verbal consent was obtained from all subjects.

Evaluations

The PSS-Tr was applied face-to-face to patients who had received at least 16 rehabilitation sessions over 2 months at the medical center. At the same time, to test the discriminant validity, the SF-36 quality of life scale and the Patient Satisfaction Scale in Physiotherapy (PSSP) were applied to the patients. The PSS-Tr was repeated on the patients 2 weeks later for the test-retest reliability.

The Pound Satisfaction Scale (PSS): The PSS was developed to assess the satisfaction of stroke patients undergoing rehabilitation. It has 12 items and two summary components: Hospital satisfaction and Home satisfaction after-discharge. Hospital satisfaction consists of two parts: information on admission to the hospital (5 items) and the quantity and quality of the treatment (3 items). Home satisfaction consists of information and post-discharge support for the patients (4 items). The PSS is a Likert-type scale scored between 0 and 3. Higher scores indicate greater satisfaction with the service. (10).

The Patient Satisfaction Scale in Physiotherapy (PSSP): The PSSP is a reliable and valid scale that evaluates the satisfaction of patients after receiving physiotherapy treatments. It is a Likert-type scale scored between 1 (bad) and 4 (perfect) with 14 items. It was not developed specifically for a disease and generally measures satisfaction in patients receiving physiotherapy. A total score is calculated out of 100 (13).

SF-36 (Short Form): SF-36 is a reliable and valid scale to measure the quality of life. It has 8 sections: physical functioning (10 items), mental health (5 items), vitality (4 items), emotional role limitations (3 items), pain (2 items), social functioning (2 items), general health perceptions (5 items), physical role limitations (4 items), and a single item about health status over one year. Scores for each subscale are calculated separately, but the total score of the scale is not available. A score of 0 to 100 is assigned to each of the sub-dimensions of health-related quality of life. Higher scores indicate a higher level of quality of life (14).

Study protocol and Design

This is a cross-sectional research to assess the Turkish reliability and validity of the PSS in stroke patients. It was carried out between August 2020 and October 2022 and ethics approval was received from the ethics committee of Non-Invasive Research Ethics Committee of Marmara University (Date: 26.11.2020; Approval no: 66) in Istanbul, Turkey. This study was conducted following the Declaration of Helsinki and was registered with the US National Institutes of Health (ClinicalTrials.gov) #NCT NCT05509205.

Necessary permission was obtained from the developers of the PSS for this study. The translation process and cross-cultural adaptation of the PSS to Turkish were conducted according to international guidelines (11). As a first step, the original form of the scale was translated into Turkish by two translators who were proficient in English as well as native Turkish speakers. As part of the second stage, two Turkish translations of the scale were created, and these translations, along with the original text, were sent to other experts who knew English very well. After the comparison was completed by the experts, a translation synthesis was created by converting the scale into one translation in Turkish. The third stage is called back translation. The created Turkish synthesis was translated into English by two independent translators who were native Turkish speakers and speak Turkish fluently. One of the translators was a healthcare professional but had no experience with the original version of the scale, while the other translator specialized in the English language and literature. In the fourth stage, the conceptual equivalences between the Turkish translation and the original scale were evaluated by the committee of

experts and the preliminary final version of the scale was created. In the fifth stage, a pilot study was conducted with 15 stroke patients to determine possible difficulties in understanding the items of the Turkish translation of the scale. A final version of the scale was developed after the pilot study results were evaluated in detail by the committee.

Reliability was assessed by test-retest reliability, internal consistency, and composite reliability. Structural validity and convergent validity were conducted for the validity of the PSS-Tr. A hypothesis test was conducted to determine the strength of the relationship between PSS and PSSP and PSS and SF-36 (Short Form) to assess construct validity. The first of the hypotheses was that since similar constructs were assessed, there would be a positive correlation (correlation coefficient 0.60 or greater) between the PSS-Tr and the PSSP. The second hypothesis was that there would be a positive correlation (correlation coefficient between 0.40 and 0.60) between the "Hospital Satisfaction" sub-dimension of the PSS-Tr and the SF-36 sub-dimensions since related but dissimilar constructs were assessed. The third hypothesis was that there would be a positive correlation (correlation coefficient between 0.40 and 0.60) between the "Home Satisfaction" sub-dimension of the PSS-Tr and the SF-36 sub-dimensions since related but dissimilar constructs were assessed.

Sample Size Calculation

In scale adaptation, validity, and reliability studies, it is recommended to include 5 to 10 times as many participants as the number of items in the study (12). In this study, the number of participants was calculated to be at least 120 because PSS-Tr contains 12 items. Considering the possibility of data loss, the sample size was increased by 10% to 130 participants.

Statistical analysis

The data was analyzed using the IBM SPSS-26 version (Statistical Package for Social Sciences). It was accepted that the statistical significance level was $p<0.05$. The Kolmogorov-Smirnov test was used to evaluate the data's conformity to the normal distribution. Also, Skewness-Kurtosis Normality Test values between -2 and +2 were sought following a normal distribution.

Confirmatory factor analysis (CFA) was conducted to determine structural validity. CFA was conducted with the AMOS-26 Version (Analysis of Moment Structures) Package program using the fit index values (X2/df, GFI, AGFI, CFI, NFI, RMSEA). The structural validity of the PSS-Tr was determined by the cut-off values of the fit index (15). The Average Variance Extracted (AVE) was computed to assess convergent validity. AVE greater than 0.50 is considered adequate convergent validity (16). Construct validity was assessed by testing predefined hypotheses with correlation statistics (Spearman correlation coefficient). It is defined as low correlation when the correlation coefficient is less than 0.40, moderate correlation when the correlation coefficient is between 0.40 and 0.60, and high correlation when the correlation coefficient is greater than 0.60 (17).

The internal consistency reliability of PSS-Tr was evaluated by calculating Cronbach's alpha coefficient and composite reliability. A Cronbach's alpha coefficient of 0.70 or higher is considered to indicate acceptable internal consistency (18). Composite reliability (CR) is known as an alternative reliability index to Cronbach's alpha coefficient (19). The CR value should be above 0.70 in order to maintain internal consistency (20). The temporal stability of the PSS-Tr was examined by the test-retest method. A test-retest reliability assessment was conducted using the intraclass correlation coefficient ($ICC_{2.1}$). $ICC_{2.1}$ values below 0.50 indicate poor reliability, between 0.50 and 0.75 indicate moderate reliability, between 0.75 and 0.90 indicate good reliability, and above 0.90 indicate excellent reliability (21). Furthermore, the Bland-Altman plot was used in to compare the results between the test and the retest. The graphical method allows for the examination of concordance between repeated measurements. This plot displays the differences between the test and retest scores of each participant against the mean test and retest scores (22). It is necessary to establish whether the mean difference deviates significantly from zero

by calculating confidence intervals for the mean difference (23). Linear regression can be used to determine whether this difference is significant (24).

The floor and ceiling effects of the PSS-Tr were assessed. If the floor and ceiling scores for a scale do not exceed 15% of the participants, it is considered that there is no floor or ceiling effect on the scale (25).

RESULTS

A majority of the participants were male (62%), and the mean age was 62.53±9.72. The socio-demographic and clinical characteristics of the participants are shown in Table 1. A total of 130 participants were included in this study. The validity analyses were conducted on 130 participants (convergent validity, confirmatory factor analysis, correlations with all other scales), as well as reliability analyses (internal consistency, composite reliability). The test-retest method was completed by 77 participants (Figure 1).

Validity of the PSS-Tr

As a result of the CFA analysis, the fit index values were as follows: ΔX2 /df=1.684, RMSEA=0.073, GFI=0.909, AGFI=0.855, CFI=0.967, NFI=0.923 (Table 2). The path diagram of CFA is shown in Figure 2.

A high correlation was determined between both dimensions and total score of PSS-Tr and PSSP (r = 0.67, p = 0.001; Hypothesis 1). A moderate correlation was determined between the "hospital satisfaction" sub-dimension of the PSS-Tr and the sub-dimensions of the SF-36 (r = 0.48 to 0.60, p = 0.001; Hypothesis 2), while a low

Table 1. Demographic and Clinical Characteristics of the Participants

Gender N (%)	
Male	80 (62)
Female	50 (38)
Age *(years)*	
Mean ±SD	62.53±9.72
BMI *(kg/m²)*	
Mean ±SD	26.36±1.49
MMSE	
Mean ±SD	26.58±1.91
Time since stroke *(years)*	
Mean ±SD	4.5±3.46
Smoking N (%)	
Yes	40 (31)
No	90 (69)
Alcohol use N (%)	
Yes	10 (8)
No	120 (92)
Type of stroke N (%)	
Ischemic	126 (97)
Hemorrhagic	4 (3)
Education N (%)	
Elementary school	70 (54)
Secondary school	24 (18)
High school	30 (23)
University degree	6 (5)
Occupation N (%)	
Retired	74 (57)
Housewife	46 (35)
Not working	10 (8)
Antidepressant use N (%)	
Yes	9 (7)
No	121 (93)

SD: Standard deviation; N: Frequency.

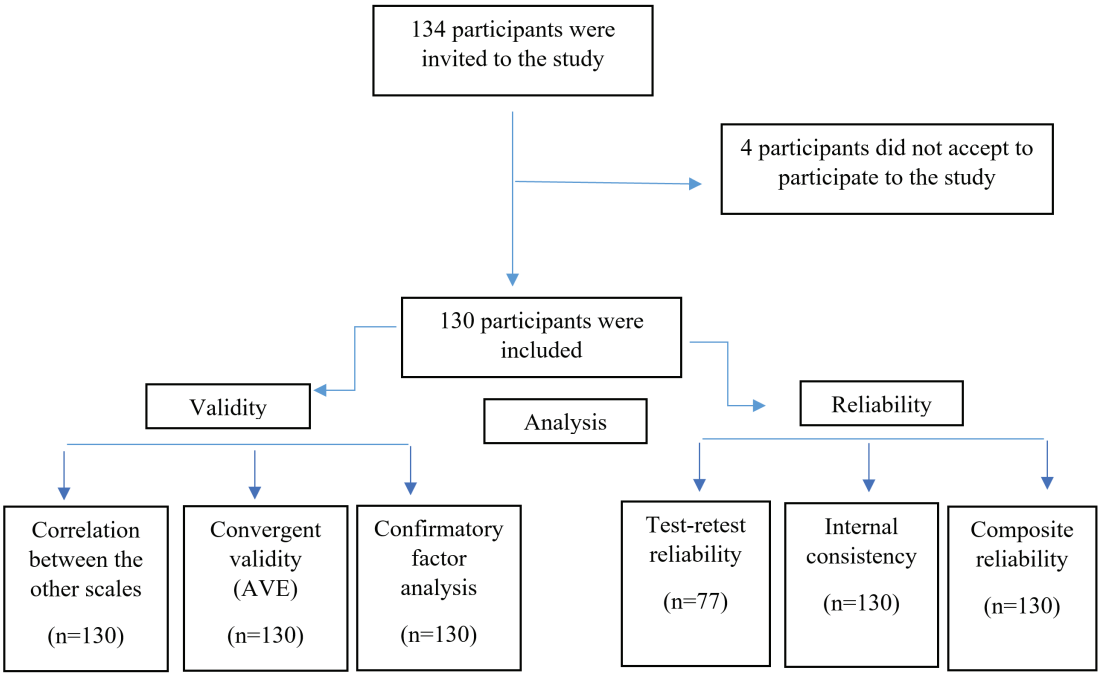

Figure 1. Flow chart of the study

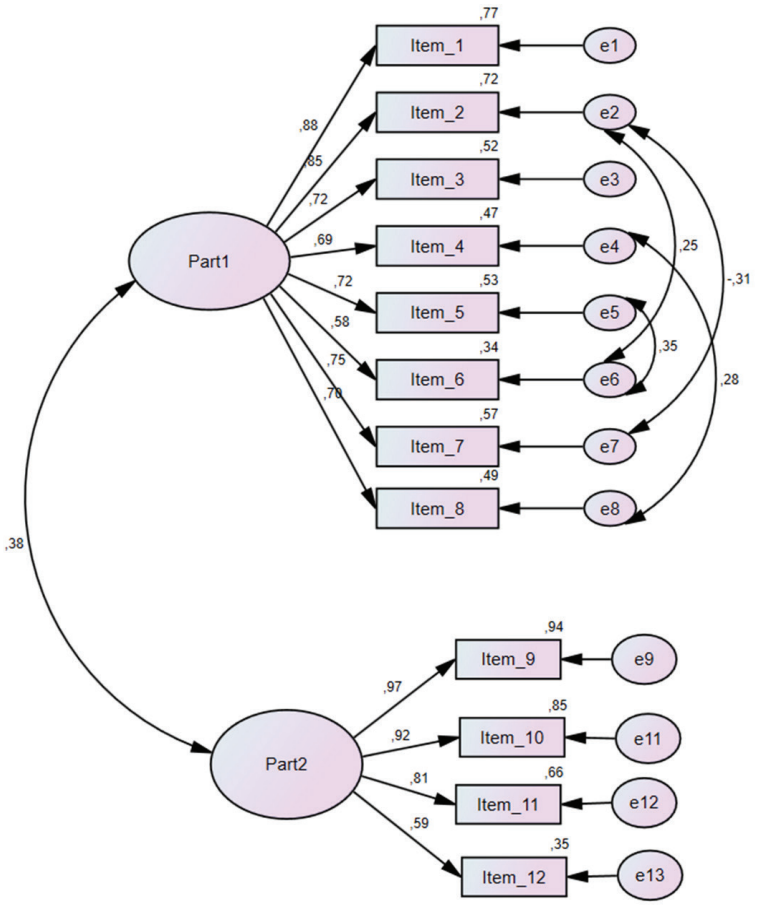

Figure 2. Path diagram of Confirmatory Factor Analysis

Table 2. The Model Fit Index Values for CFA

CFA Fit Index	Index Values	Good fit value	Acceptable Fit values
x2/df p	1.684 <0.001	0 <x2 /df ≤ 2	2<x2 /df ≤ 3
RMSEA	0.073	0 <RMSEA≤ 0.05	0.05 <RMSEA ≤ 0.08
GFI	0.909	0. 95 ≤ GFI <1.00	0. 90 ≤ GFI <0.95
AGFI	0.855	0.90 ≤ AGFI <1.00	0.85 ≤ AGFI <0.90
CFI	0.967	0.95 ≤ CFI < 1.00	0.95 ≤ CFI < 0.97
NFI	0.923	0.95 ≤ NFI < 1.00	0.90 ≤ NFI < 0.95

RMSEA: Root mean square error of approximation; GFI: Goodness of fit index; AGFI: Adjusted goodness of fit index; CFI: Comparative fit index; NFI: Normed fit index; x2/df: Chi-Square test/degrees of freedom; CFA: Confirmatory factor analysis.

Table 3. Spearman Correlation Coefficient between the PSS-Tr and the PSSP and the SF-36

	Hospital satisfaction		Home satisfaction		Total score of PSS-Tr	
	*P**	*r*	*P**	*r*	*P**	*r*
PSSP	0.001	0.641	0.001	0.614	0.001	0.672
SF-36						
Physical functioning	0.001	0.591	0.002	0.266	0.001	0.530
Physical role	0.001	0.484	0.035	0.180	0.001	0.443
Pain	0.001	0.583	0.001	0.354	0.001	0.544
General health perceptions	0.001	0.514	0.001	0.410	0.001	0.570
Vitality	0.001	0.552	0.001	0.358	0.001	0.518
Social functioning	0.001	0.609	0.001	0.418	0.001	0.603
Emotional role	0.001	0.545	0.001	0.380	0.001	0.579
Mental health	0.001	0.570	0.001	0.435	0.001	0.554

*: Spearman's correlation, r: correlation coefficient; PSSP: Patient Satisfaction Scale in Physiotherapy; PSS-Tr: Turkish adapted of Pound Satisfaction Scale.

correlation was found between the "home satisfaction" sub-dimension of the PSS-Tr and sub-dimensions of the SF-36 (r = 0.18 to 0.43, p = 0.035 to 0.001; Hypothesis 3) (Table 3). Seventy-five percent of the findings were in agreement with the hypotheses. Therefore, PSS-Tr was found to have good construct validity.

In both sub-dimensions as well as the total score of the PSS-Tr, AVE values were found to be above 0.50 (Table 4).

Reliability of the PSS-Tr

The Cronbach alpha coefficient of PSS-Tr was found to be 0.904, and the Cronbach alpha coefficient of the subdimensions of PSS-Tr was found to be between 0.868 and 0.906. PSS-Tr was also found to have a CR value above 0.70 (Table 4).

The PSS-Tr was retested on 77 stroke patients to determine temporal consistency. The intraclass correlation coefficient ($ICC_{2.1}$) of the

Table 4. Test-retest Reliability Analysis, Average variance extracted, Internal Consistency, and Composite Reliability of the PSS-Tr

	Test Mean±SD	Retest Mean±SD	$ICC_{2.1}$	95% CI for LoA	P*	AVE	CR	*Cronbach's α*
Hospital satisfaction	17.88±4.34	18.25±4.39	0.961	(-3.20) – (2.40)	0.719	0.54	0.90	0.906
Home satisfaction	5.06±2.01	4.9±1.78	0.906	(-1.07) – (1.41)	0.077	0.69	0.89	0.868
Total	22.95±5.57	23.15±5.71	0.963	(-4.70) – (4.30)	0.441	0.59	0.94	0.904

ICC: Intraclass Correlation Coefficient, CI: Confidence Interval, *: Linear regression, LoA: Limits of Agreement, AVE: Average Varience Extracted, CR: Composite reliability

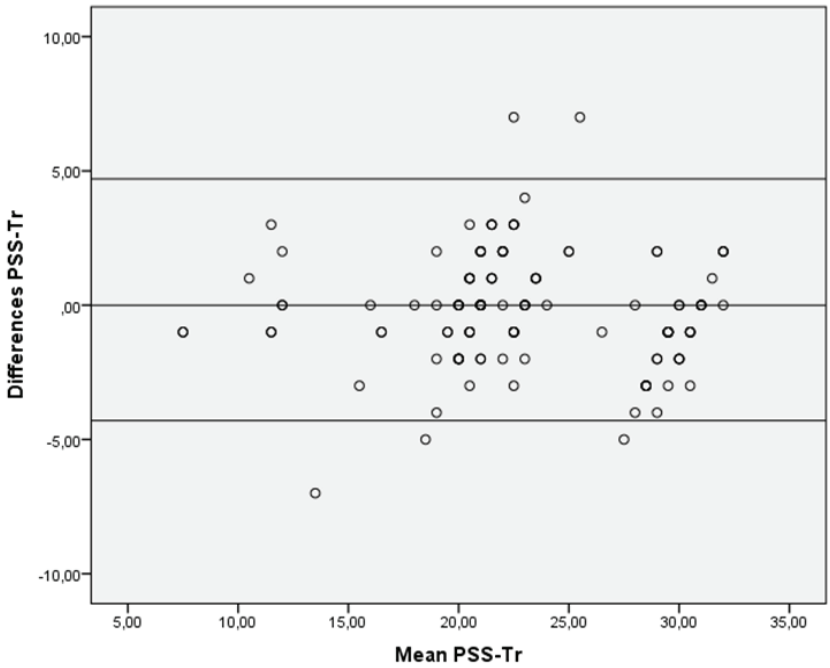

Figure 3. Bland Altman plot analysis graph for PSS-Tr test-retest reliability

PSS-Tr was found to be 0.963, and sub-dimensions ranged between 0.906 and 0.961 (Table 4).

In this study, Bland-Altman (Figure 3) and linear regression analyses indicated that there was no significant difference between the test-retest results and that the test reproducibility was acceptable (Table 4).

Results of the floor or ceiling effects showed that participants who received the lowest score of "0" comprised 0.76% (n = 1), while participants who received the highest score of "36 comprised 2.30% (n = 3). According to the results, the PSS-Tr had no floor or ceiling effects.

DISCUSSION

This study found that the PSS-Tr has been a reliable and valid tool to measure satisfaction with rehabilitation services among stroke patients. A Turkish scale evaluating patient satisfaction specific to stroke patients has not been reported in the literature. This study aimed to establish the Turkish validity and reliability of the Pound Satisfaction Scale (PSS) in stroke patients. Based on the results of this study, it was determined that the PSS-Tr has appropriate structural validity and sufficient convergent validity. As a result of reliability analysis, the PSS-TR has good composite reliability and internal consistency, as well as excellent temporal consistency. Similarly, the PSS also has Spanish validity and reliability (26).

The importance of patient satisfaction has been emphasized in recent years (27). And it is also known that patient satisfaction affects rehabilitation outcomes in stroke patients (9). In order to support patient-centered quality management, healthcare providers and clinicians should evaluate patient satisfaction to determine whether appropriate measures are being taken to meet patients' expectations and potential needs and improve patients' perceptions of actual service quality. High patient satisfaction also increases compliance with treatment and improves the competitiveness and impact of hospitals. In this way, both social and economic benefits can be achieved (6). The PSS-Tr may be helpful for the management of patient-centered quality because it contains items that measure the satisfaction of patients with rehabilitation services, physical environment, accessibility, therapists, and health care provided in the hospital and after discharge.

The PSS-Tr has two main parts: "hospital sat-

Tablo 5. Pound Memnuniyet Ölçeği

Lütfen her bir ifadeyi okuyun ve size en yakın olan yanıtı işaretleyin. Doğru ya da yanlış yanıt yoktur, önemli olan sizin görüşlerinizdir. Lütfen her soruyu cevaplayınız.

Hastane bakımı ve tedavi	**Kesinlikle katılıyorum**	**Katılıyorum**	**Katılmıyorum**	**Kesinlikle katılmıyorum**
Hastane personeli tarafından nezaketli ve saygı çerçevesi içerisinde tedavi edildim.				
Hastane personeli kişisel ihtiyaçlarımı iyi bir şekilde karşıladı. (Örneğin; isteğim vakit tuvalete gidebildim)				
Hastane personeli ile yaşadığım herhangi bir sorun hakkında konuşabileceğimi hissettim.				
Hastalığımın nedenleri ve tedavisi hakkında istediğim tüm bilgileri hastane personelinden edinebildim.				
Hekimler beni tedavi edebilmek için elinden geleni yaptılar.				
Hastalığımın başlangıcından beri kat ettiğim iyileşme miktarından memnunum.				
Terapistlerin beni tedavi etme biçimlerinden memnun kaldım.				
Yeterli tedavi süresi ve seansına sahip oldum.				
Taburculuk sonrası	**Kesinlikle katılıyorum**	**Katılıyorum**	**Katılmıyorum**	**Kesinlikle katılmıyorum**
Hastaneden taburcu edildikten sonra ihtiyacım olabilecek ödenekler veya hizmetler (evde bakım hizmeti gibi) hakkında ihtiyacım olan tüm bilgiler bana verildi.				
Eve dönüş için ilgili her şey (örneğin ihtiyacınız olduğunda kullanabileceğiniz tekerlekli sandalye gibi) güzel hazırlanmıştı.				
Evde bakım hizmetleri, evde hemşirelik hizmetleri gibi ihtiyacım olan hizmetleri taburculuk sonrası aldım.				
Hastane tarafından sağlanan taburculuk sonrası hizmetlerden memnun kaldım (kontrol muayene randevuları gibi).				

isfaction" and "home satisfaction". In the CFA, analyses were carried out on two factors based on these two main parts. According to the CFA results, the fit index scores were found to be at an acceptable level (15). In the Spanish validity of the PSS, fit index scores were found to be similar to those in this study (26). The PSS-Tr has a positive and high correlation with the PSSP. The PSSP is valid and reliable to evaluate patient satisfaction with physiotherapy and rehabilitation services for musculoskeletal problems (13). While the PSSP generally evaluates patient satisfaction with musculoskeletal problems (13), the PSS-Tr is specific to stroke patients (10). In addition, while the PSSP only evaluates satisfaction within the hospital, the PSS-Tr evaluates satisfaction with both in-hospital medical care and social support after discharge (10). Stroke is among the main causes of long-term disability and therefore includes a long-term treatment

period (28, 29, 30). Therefore, it becomes necessary to evaluate not only in-hospital medical services but also post-hospital medical services and environmental support for stroke patients to assess patient satisfaction. According to studies, patient satisfaction may be related to the quality of life (31, 32). In this study, the correlation of the PSS-Tr with SF-36 was examined, and a positive moderate correlation was found between "hospital satisfaction" sub-dimension of the PSS-Tr and SF-36. There was a low correlation between the physical function and physical role difficulties sub-dimensions of the SF-36 and the home satisfaction sub-dimension of the PSS-Tr, and a moderate correlation with the in-hospital satisfaction sub-dimension of the PSS-Tr. Similar results were found between SF-36 and the Spanish validity of the PSS (26). As part of the home satisfaction section of the PSS-Tr, questions were asked regarding outpatient services rather than physical role difficulties. Outpatient services included items related to environmental regulations as well as control examinations and appointments. The environmental regulations required that the patient's home and living area be ergonomically designed for the patient (for example, stair rails and ramps for wheelchairs). Research conducted in Turkey indicates that ergonomic environmental regulations are not sufficient to accommodate the needs of individuals with physical disability (33, 34). Despite this, there is evidence in the literature that ergonomic programs can contribute to the improvement of quality of life for people with disabilities (35). The Turkish health care system provides outpatient services under the title of home care services. Home care services in Turkey include physician examinations, nursing care, physiotherapy, patient transfers, and psychotherapy. A study conducted in Ankara, Turkey, found that only 30% of those receiving home care services were satisfied with home care services. Furthermore, these individuals had lower socioeconomic levels and expectations than others. A higher socioeconomic level is associated with lower levels of satisfaction. It has been reported that home care services can be improved to enhance quality of life by improving social support components (36). In this context, it may have been found that there is a low relationship between the physical function and physical role difficulties sub-dimensions of SF-36 and home satisfaction measured by PSS-Tr.

The Cronbach alpha coefficient of the PSS-Tr was found to be> 0.70 (16), which indicates that the PSS-Tr has a high internal consistency and is reliable. Any items (0%) were not excluded from the scale. According to test-retest reliability analysis, the PSS-Tr has excellent temporal consistency ($ICC_{2.1}$ = 0.976). Similarly, the temporal consistency was high in the Spanish version of the PSS (26).

While validity and reliability studies were conducted on 74 people in the Spanish version of the PSS (26), analyses were carried out on a larger sample group, such as 130 in this study, and the rate of 50% was exceeded in the test-retest analysis. Although this shows the strengths of this study, it also has some limitations. The time after stroke varied greatly among the patients, and the average was 4.50 years. The time since the stroke may have provided neurological and functional stability, but it can also lowen emotions and mask real satisfaction. Patients in acute, subacute, and chronic phases may have varying expectations regarding recovery, and patient satisfaction may be affected as a result. Additionally, a single center was used for this study. It is difficult to generalize data obtained from a single center. Consequently, we believe that future studies can be effective in determining the level of satisfaction through multicenter studies that ensure homogeneity so that minimal clinical significance can be determined.

This study showed that the Turkish adaptation of PSS is a reliable and valid to assess the satisfaction of patients with stroke. There is no scale with Turkish validity and reliability to evaluate patient satisfaction in stroke. It may be useful for clinicians and researchers to assess patient satisfaction as part of the stroke rehabilitation process to promote patient-centered quality management, meet patients' expectations, and identify potential needs.

Sources of Support: In this study, no specific grant was received from any public, commercial,

or not-for-profit funding agency.

Conflict of Interest: The authors report no conflicts of interest.

Author Contributions: Concept – EM, ZS; Design – EM, ZS; Supervision – ZS; Resources and Financial support– ZS, Materials- EM; Data Collection and/or Processing – EM, Analysis and/or Interpretation – EM, ZS; Literature Research- EM; Written Manuscript - EM, ZS; Critical Review – ZS

Explanations: None

Acknowledgement: None

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)143-151

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THE EFFECT OF TRUNK STABILITY TRAINING ON UPPER EXTREMITY ENDURANCE, STABILITY AND SHOULDER JOINT PROPRIOCEPTION IN POSTMENOPAUSAL WOMEN

ORIGINAL ARTICLE

ABSTRACT

Purpose: The incidence of shoulder pathologies is increasing in postmenopausal women. In this period, there is a need for protective approaches to be applied to prevent shoulder injuries. The aim of this study is to investigate the effects of clinical pilates exercises on upper extremity stability, endurance, function and shoulder joint proprioception in postmenopausal women.

Methods: 30 postmenopausal women between the ages of 40-60 were included in this study. Participants were given clinical pilates training for 6 weeks, 3 days a week, 60 minutes by a physiotherapist. Before and after pilates training, dynamic stability of the shoulder was evaluated with Closed Kinetic Chain Upper Extremity Stability Test (CKCUES Test) and Upper Quarter Y Balance Test (UQYBT). Upper extremity muscle endurance was evaluated with the modified push up test. Laser Pointer-Assisted Angle Reproduction Test (LP-ART) was used to evaluate shoulder joint position sense.

Results: A statistically significant difference was found in CKCUES Test (p=0.000, r=0.594), UQYBT (p=0.000, r=0.537), modified push up (p=0.000, r=0.594), LP-ART abduction (p=0.000, r= 0.491) and LP-ART flexion (p=0.000, r=0.484) at end of the training compared to the pre-training. The exercise program was found to be highly effective on all parameters.

Conclusion: It was concluded that clinical pilates training applied in postmenopausal women increased the dynamic stability of the shoulder, endurance and position sense. Trunk stabilization exercises may be beneficial as a preventive approach in the prevention of shoulder pathologies in postmenopausal women.

Keywords: Postmenopause, Proprioception, Shoulder Joint

POSTMENOPOZAL KADINLARDA GÖVDE STABİLİTE EĞİTİMİNİN ÜST EKSTREMİTE ENDURANSI, STABİLİTESİ VE OMUZ EKLEM PROPRİOSEPSİYONUNA ETKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Postmenopozal dönemdeki kadınlarda omuz patolojilerinin görülme sıklığı artmaktadır. Bu dönemde omuz yaralanmalarını önleme amacıyla uygulanacak koruyucu yaklaşımlara ihtiyaç duyulmaktadır. Bu çalışma, postmenopozal dönemdeki kadınlarda klinik pilates egzersizlerinin omuz eklem propriosepsiyonu ile üst ekstremite stabilitesi ve enduransı üzerindeki etkileri araştırmak amacı ile tasarlanmıştır.

Yöntem: Çalışmaya 40-60 yaşları arasında değişmekte olan postmenopozal dönemdeki 30 gönüllü kadın dâhil edildi. Bireylere fizyoterapist eşliğinde haftada 3 gün, 6 hafta süreyle klinik pilates eğitimi verildi. Egzersiz programı öncesi ve sonrasında omuz eklem pozisyon hissi Lazer İmleç Yardımlı Açı Tekrarlama Testi (Lİ-ATT) ile, omzun dinamik stabilitesi Üst Ekstremite Y Denge Testi (ÜEYDT) ve kapalı kinetik zincir üst ekstremite stabilite testi (KKZÜEST) ile, üst ekstremite kas enduransı ise modifiye push up testi ile değerlendirildi.

Sonuçlar: Eğitim sonunda KKZÜEST (p=0,000, r=0,594), ÜEYDT (p=0,000, r=0,537), modifiye push up (p=0,000, r=0,594), Lİ-ATT abduksiyon (p=0,000, r=0,491) ve Lİ-ATT fleksiyon (p=0,000, r=0,484) ölçümleri üzerinde eğitim öncesine göre istatistiksel düzeyde anlamlı farklılık elde edildi ve egzersiz programı tüm parametreler üzerinde yüksek etkili bulundu.

Tartışma: Postmenopozal kadınlarda uygulanan klinik pilates eğitiminin omuz propriosepsiyonu, dinamik stabilitesi ve enduransını artırdığı sonucuna varıldı. Postmenopozal dönemdeki kadınlarda omuz patolojilerinin önlenmesinde koruyucu yaklaşım olarak gövde stabilizasyon egzersizleri yarar sağlayabilir.

Anahtar Kelimeler: Omuz Eklemi, Postmenopoz, Propriyosepsiyon

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Received: *21.08.2023 (Geliş Tarihi)*
Accepted: *02.02.2024 (Kabul Tarihi)*

INTRODUCTION

Postmenopause is defined as the period after menopause and begins after 12 months of amenorrhea (1). The incidence of shoulder injuries increases in the postmenopausal period (2,3). In a prevalence study investigating postmenopausal symptoms, it was reported that shoulder stiffness was the most common symptom in the postmenopausal period with a rate of 75.4% (2) Additionally, the prevalence of full-thickness rotator muscle tears in postmenopausal women (8.9%) was found to be significantly higher than the prevalence in premenopausal women (3.1%) (3).

Most of the studies in the literature involving postmenopausal women investigated the risk of falls and fractures. Studies mostly focused on lower extremity functions, balance and bone mineral density (4, 5). However, evaluation and rehabilitation of the upper extremity in postmenopausal women is at least as important as the lower extremity. Protective exercise approaches that improve strength, endurance and stability of the muscles around the shoulder can help to prevent shoulder pathologies that is more prevalent in postmenopausal period. Literatue suggests that the clinical pilates program applied in the postmenopausal period is effective in improving bone mineral density, physical fitness, balance and quality of life, and also reduces the risk of falling (5, 6).

Clinical pilates is a popular exercise programme today that focuses on stabilizing the 'core' area. The word 'core' refers to the area surrounded by M. Diaphragma, M. Transversus abdominis (TrA), M. Multifidus and pelvic floor muscles. The core area is the center of the functional kinetic chain that provides proximal stability for distal mobility and optimal function of the extremities (7). The kinetic chain refers to the connection of multiple parts of the body that allows the transfer of forces and movement. The core area provides a base of support for the transfer of force and energy to the upper and lower extremities. Breaks or deficits in the kinetic chain can lead to injury or decreased performance (7).

Recent studies have an increasing interest focusing on the relationship between trunk stability and distal segments. Studies in different populations have shown that pilates exercises increase knee joint proprioception (8) and lower extremity endurance (9). Evidence has reported that poor core stability is a potential risk factor for lower extremity injuries (10). In addition, a recent systematic review reported that injury prevention programs that included core stability exercises in athletes reduced knee injury rates by 56% (11).

In some studies, it has been reported that there is a kinetic relationship between the core region and shoulder movement (7,12). Futhermore, insufficient postural stability has been reported in patients with pathological shoulder pain (13). These study findings, which support the relationship between shoulder and core stability, suggest that good core stability may play an important role in pevention of shoulder injuries (12,13). However, to best of our knowledge, no studies have investigated whether clinical pilates that increase core stabilization would improve upper extremity stability, endurance and shoulder joint proprioception in postmenopausal women. The aim of this study is to investigate the effects of clinical pilates training on upper extremity stability, endurance and shoulder joint proprioception in postmenopausal women.

METHODS

Study Design and Patient Population

This study is a research with a single-group pre-test research design, conducted between October and January 2017. All procedures were carried out in compliance with the Helsinki Declaration. It has been approved by the decision of the ethics committee of the university that the authors are involved with. (Approval date: 19.12.2016, decision number: 2016/36-01). The GPower (G*Power, version 3.1.9.4 for Windows XP, Germany) program was used to determine the sample size. The initial sample size was calculated as n=25 under the assumptions of (d)= 0.6, α=0.05, β=0.20. Considering that there might be participants who leave the study, the

initial sample size was increased by 25% and the final sample size was determined as n=30 (14). Thirty postmenopausal women who lived in the Turkish Republic of Northern Cyprus (TRNC) Famagusta district and met the inclusion criteria were included in the study. The subjects were informed about the content of the study by the responsible physiotherapist. An informed consent form was signed by each participant.

Participants who had been in natural menopause for at least 6 months and were between the ages of 40 and 60 were included in the study. Participants with shoulder pain exceeding 3 centimeters (cm) on the visual analogue scale (VAS), any health problems that would contraindicate exercise, any diagnosed pathology or previous surgery on the shoulder, and participants receiving active hormone replacement therapy were excluded from the study.

Outcome Measurements

30 individuals participating in the study, in groups of 15, were included in the 6-week clinical pilates program. The sociodemographic information of the individuals were recorded before the exercise protocol. Shoulder joint position sense, dynamic shoulder stability and upper extremity muscle endurance were evaluated at pre-intervention and at the end of the 6 weeks exercise program. All measurements were performed by the same physiotherapist.

Shoulder Joint Position Sense

The assessment of shoulder position sense, which was the primary outcome measure of this study, was evaluated by using a Laser Pointer-Assisted Angle Reproduction Test (LP-ART). Measurements were repeated three times for 90° shoulder flexion and 90° shoulder abduction. The laser pointer was fixed 5 cm above the olecranon, in order to prevent angular deviations due to elbow and wrist movements. Measurements were taken from the dominant arm. The individual stood 1 meter away from a millimeter of paper fixed to the wall. During the test, the individual was asked to move their shoulder joint to 90° flexion position and the accuracy of the movement was evaluated by the physiotherapist using a digital goniometer (Baseline Absolute Axis Digital Goniometer). While maintaining 90º shoulder flexion, the projection of the laser pointer was marked on the millimetric paper as the target point. The individual was asked to keep the laser pointer light on that point for 10 seconds while the eyes were open. Then, the physiotherapist asked the individual to repeat the same movement by closing their eyes. When the 'OK' command was received, the coordinates of the position of the laser light which was on the paper were marked by the physiotherapist. The measurement was repeated thrice. Before each attempt, individuals opened their eyes and positioned the laser light on the target point. The test protocol for abduction movement was repeated at a 90° range of motion with the subject turned sideways against the wall. The angular deviation values obtained according to the x-y axis for the flexion and abduction positions were calculated by placing them in the formula $c=\sqrt{x^2 + y^2}$ in Microsoft Excel 2013 program. The average of the 3 values obtained in the abduction and flexion directions were used in the statistical analysis (15), (Figure 1).

Dynamic Shoulder Stability

Dynamic stability of the shoulder was evaluated using Closed Kinetic Chain Upper Extremity Stability (CKCUES) Test and Upper Quarter Y Balance Test (UQYBT).

The push-up position is commonly used in the CKCUES Test measurement, but in cases such as advanced age, the use of the modified version with the knees in flexion may be preferred (16). A modified version of this test was used in our study. Subjects took a push-up position with their hands placed 36 inches (91.44 centimeters) apart on 1.5 inches (3.81 centimeters) wide strips of tape attached to the floor. While one hand was fixed on the ground, the individual raised the other hand, touched the band under the fixed hand, and brought it back to the starting point. The same movement was repeated for the opposite side. The number of consecutive repetitions within 15 second timeframe was recorded. The test was repeated thrice with 45 sec resting periods in between. The average number

of successful repetitions obtained from the tests was used in the analysis (16), (Figure 1).

UQYBT is used to determine the risk of injury in musculoskeletal problems. It is also important because it is the only test in the literature that evaluates shoulder stabilization while also evaluating core stability (17). In our study, a wooden platform with three PVC pipes connected in the medial, inferolateral and superolateral directions, was used. This device was manufactured by taking the Y Balance Test Kit as an example. A tape measure was attached to the pipes in order to measure the reach in three directions. Prior to measurement, the subject assumes a modified push-up position with the upper extremity shoulder-width apart, the right hand on the stance plate, and the left hand on the access cursor. Maintaining the push-up position, participant advances the access cursor with the left hand in 3 directions, medial, inferolateral, and superolateral, respectively. The maximum distance reached in each direction was recorded. Three measurements were made on the right arm and on the left arm. A measuring tape was used to determine the length of the upper extremity, the distance between the acromion and the longest fingertip that will be used in scoring. The combined distance reached was calculated using the furthest distance reached for both extremities in that direction, using the formula [(maximum medial + maximal inferolateral + maximal superolateral) / (3 x upper extremity length)] x 100 in Microsoft Excel 2013 program and was used in the statistical analysis (17).

Upper Extremity Endurance

In our study, a modified push up test was used to evaluate upper extremity endurance. The push-up test was initially developed in order to evaluate upper extremity muscle endurance. The test may be performed in two different ways: whole body push-up or modified push-up. The modified push-up test is mostly preferred in women (18). In the study, the subject was asked to take the modified push-up position with knees flexed and elbows extended on a mat. Subjects were asked to bring their upper body closer to the ground by flexing their elbows without disturbing the flexion angle of their knees, and then to push their upper body back by extending their elbows. The number of successful repetitions performed in 30 seconds was recorded. Average of the three trials was recorded to be used in the analysis (18).

Exercise Protocol

Clinical pilates exercise training was applied for a total of 18 sessions, 3 days a week for 6 weeks. The exercises were performed in the indoor exercise room of the xxx University Faculty of Health Sciences. The exercises were performed by the same physiotherapist in two groups, with each group consisting of 15 people. The sessions lasted a total of one hour and each exercise was performed with 6-8 repetitions throughout the training.

The clinical pilates program included 10-minute warm-up exercises, 40-minute trunk stabilization exercises, followed by 10-minute cool-down exercises. During the first session, the main principles of clinical pilates exercises (concentration, control, centering, fluency, precision and breathing) were explained and subjects were asked to perform these exercises accordingly. During the exercises, it was checked by the physiotherapist whether the people could meet those principles. The difficulty of the exercise program was gradually increased with an interval of 2 weeks for 6 weeks. In addition, an elastic band was introduced in the exercise program during 2nd week and a pilates ball during 4th week. The exercise program was personalized by considering the clinical conditions and strain levels of some participants during the study (Table 1).

Statistical Analysis

The data obtained during the study was analyzed using the IBM SPSS 20.0 (IBM Crop. Released 2011. IBM Statistics for Windows, Version 20.0 Armonk, New York). Wilcoxon Sign Test was used to compare pre-training and post-training measurements.

Descriptive statistics for discrete and continuous variables in the study were expressed as percentage, mean ± standard deviation, and number. Significant difference value was accept-

ed as p < 0.05. P <0.001 was interpreted as a high level of significant difference. Mean values were given with 95% Confidence Interval (95% CI) lower and upper limit values. "P" values and "95% CI" values were used to interpret whether the pre-training and post-training measurements were significantly different from each other. The effect size was calculated to determine the clinical effectiveness of the training. Cohen's d coefficient was used to calculate the clinical effect size. Effect size was interpreted as small (d = 0.2), medium (d = 0.5), or large (d = 0.8), (19).

RESULTS

Thirty postmenopausal women with a mean age of 53.5 ± 4.7 years participated in the study. Of these people, of whom the first measurements were taken, 26 of them completed the study and 4 people left the study due to health problems, transportation problems and foreign travels.

The average age at menopause of the individuals was 49.5 ± 2.9 years, and the average menopause duration was 4.09 ± 3.4 years. The average body mass index (BMI) value of the individuals participating in the study was 29.3 ± 4.7 kg/cm². While 57.7% of the individuals were housewives, 15.4% were retirees, 19.2% were those who worked with more mental effort, and 7.7% were those who worked with physical effort.

After 6 weeks of clinical pilates exercise training, a statistically significant difference was detected in CKCUES Test scores compared to pre-training (p = 0.000) The mean CKCUES test

Table 1. Clinical Pilates Exercise Protocol

0-2 Week	2-4 Week	4-6 Week	Warm-up Phase	Cooling Phase
Hundreds1 Hundreds 2 One leg stretch 1 Shoulder bridge 1 Hip twist 1 Clam 1 Side kick 1 Arm openings 1 Swimming 1 Swimming 2 Single leg kicks One leg circle	Hundreds 3 One leg stretch 2 Double leg stretch 2 Shoulder bridge 2 Hip twist 3 Clam 2 Side kick 2 Side kick-small circles Abdominal prepation Swimming 3 Single leg kicks One leg circle 2	Hundreds in supine crook lying One leg stretch 2 Hells together-tools apart Hip twist Shoulder bridge Side kick in lying One leg kick Swimming 1 Swimming 2 Side kick beginner Double leg stretch Mermaid	Mini squat, Kleopatra, Toy soldier, Upper extremity PNF Swinging Chest stretch	The saw, Mermaid Cat stretch Toy soldier Swinging Chest stretch

Table 2. Comparison of Individuals' Pre- and Post-Training UQYBT, CKCUES Test, LP-ART and Modified Push Up Results.

Variables	Pre-Training	Post-Training	P *	d
UQYBT (cm)				
Right	90.75 ± 13.54 *(85.54— 95.95)*	101.07 ± 9.77 *(97.31 — 104.82)*	**<0.001***	**0.874**
Left	92.28 ± 12.34 *(87.54 — 97.02)*	102.28 ± 9.32 *(98.69 — 105.86)*	**<0.001***	**0,914**
CKCUES Test (repeat/15 sec)	8.48 ± 3.24 *(7.24 — 9.73)*	11.61 ± 2.49 *(10.66 — 12.57)*	**<0.001***	**1,083**
LP-ART (cm)				
Shoulder flexion	7.63 ± 2.64 *(6.61 — 8.65)*	5.23 ± 1.73 *(4.56 — 5.90)*	**<0.001***	**1,075**
Shoulder abduction	8.96 ± 3.85 *(7.48 — 10.44)*	6.35 ± 2.23 *(5.49 — 7.21)*	**<0.001***	**0,829**
Modified Push Up (repeat/30 sec)	5.19 ± 4.31 *(3.53 — 6.85)*	9.12 ± 4.80 *(7.27 — 10.97)*	**<0.001***	**0,861**

*: Wilcoxon Sign Test, UQYBT: Upper Quarter Y Balance Test, CKCUES Test: Closed Kinetic Chain Upper Extremity Stability Test, Laser Pointer Assisted Angle Reproduction Test (LP-ART)

Figure 1. (a) Closed Kinetic Chain Upper Extremity Stability Test, (b) Laser Pointer Assisted Repeat Test of Shoulder Flexion and Abduction

score increased from 8.5 ± 3.2 to 11.6 ± 2. A statistically significant decrease in both right extremity UQYBT (p=0.001) and left extremity UQYBT values (p=0.001) was observed post training compared to the beginning. Exercise was found to be large effect on right UQYBT, left UQYBT and CKCUES Test (d≥0.8)

When the pre-training and post-training Modified Push Up test values of the individuals were compared, a significant difference was observed (p=0.000). Although there was an overlap in the lower and upper limits of the 95% confidence interval, the difference between baseline and post-treatment mean values was considered significant because it did not include '0' (-6.44 — -1.36). When the effect size was examined, a clinically large effect was found for the Modified Push Up test (d=0,861). When shoulder position sense values were examined, joint position error values for both abduction movement (p = 0.000, d=0,829) and shoulder flexion movement (p=0.000, d=1,075) decreased significantly post-training compared to pre-training. It was determined that the exercise program had a large clinical effect on shoulder position sense (d≥0.8), (Table 2).

DISCUSSION

It was determined that there was an improvement in upper extremity dynamic stability, upper extremity endurance and shoulder joint position sense after a 6-week clinical pilates program in postmenopausal women.

Proprioception and neuromuscular control play an important role in the prevention of shoulder injuries (20). The main goal of clinical pilates exercises is to increase the strength and endurance of the core muscles responsible for the static and dynamic stabilization of the body (21). There is strong evidence that pilates exercises increase muscle endurance, reduce pain and improve quality of life in women (22). Core stability provides the transfer of torque and momentum between the lower and upper extremities, therefore it is considered to form the basis of the kinetic chain (7). There are various studies examining the relationship between core stability and distal segments (12,23). Joseph et al. hypothesize that the lumbopelvic (LP) region

and the GHJ were associated with myofascial suspension systems called posterior and anterior oblique slings and provide force transfer between the lower and upper extremities (12). Some electromyography (EMG) studies in the literature confirmed this hypothesis (23, 24).

Studies mostly examine the effects of pilates exercises and core stabilization exercises on trunk and lower extremity proprioception, and there are various evidences on this subject (8, 25-28). Kısacık et al. reported that the clinical pilates exercise program applied for 10 weeks in their study improved knee proprioception in patients with knee osteoarthritis (25). Alaa et al. reported that core stability training added to the standard rehabilitation protocol in patients who had undergone ACL reconstruction made a clinical difference in terms of improvement of knee proprioception (26). Mazloum and Rahnama reported that pilates training significantly increased knee joint proprioception in individuals with knee osteoarthritis (8). In the study of Kim et al. found that core stabilization-based exercise program increased trunk extension and flexion proprioception in women with chronic low back pain (27). Our study is the first to examine the effect of an exercise program on shoulder proprioception in postmenopausal women. Our study concluded that there was a significant increase in shoulder joint flexion and abduction position sense with clinical pilates exercises. These findings support other studies in the literatüre (8, 25-28). This increase was thought to be due to the fact that the load on the shoulder during closed kinetic chain exercises activates more mechanoreceptors in the shoulder joint. In addition, increased core stability with pilates exercise program may lead to the firing of more muscle spindles in the distal segments, resulting in an increase in upper extremity proprioception. However, authors suggest that further high quality studies are required on this subject.

In the evaluations made at the end of the clinical pilates exercise program, statistically significant impovements occurred in both shoulder stability and upper extremity endurance compared to pre-training. In our study, it is thought that myofascial force transmission realized between the LP region and the GHJ has contributed in the increase in shoulder stability and endurance with clinical pilates exercises. This can be explained by the transmission of the core stability and endurance increase provided by clinical pilates training to the upper extremity with myofascial suspension systems. The results obtained support the studies examining the relationship between core stability and upper extremity (12,23). Evidence-based studies examining the effect of core stability training on shoulder stability and endurance are insufficient. Micoogullari et al. reported that individuals who do regular pilates exercises for at least 6 months have significantly more scapular muscle strength than age and gender-matched sedentary individuals (29). In another study by Katayifçı et al., 35 healthy individuals were given pilates exercises 3 days a week for 8 weeks (30). A statistically significant increase was found at the end of the study, in the upper extremity muscle endurance, which was evaluated with the modified push-up (30). A previous study by Kloubec reported that Pilates training applied for 2 days a week for 12 weeks significantly increased shoulder endurance evaluated with the upper extremity push up test (31). In another study, it was found that there was an increase in tennis serve speed and abdominal muscle endurance in tennis players after pilates mat exercises applied twice a week for 6 weeks (32). However, to best of our knowledge, there is no study in the literature examining the relationship between core stability training and shoulder joint on postmenopausal women. Our study has found that there was an increase in shoulder stability and endurance with clinical pilates training applied in postmenopausal women. The results obtained from our study support previous study findings (29-31). In addition, the results obtained support the studies examining the kinetic relationship between core stabilization and upper extremity. In our study, it was thought that the increased core stability after clinical pilates training may have increased glenohumeral stability and endurance by providing torque and momentum to the upper extremity.

The limitation of our study is that the pilates exercise program was carried out within the lower

limit of 6 weeks. Another limitation of our study is that our sample was not selected from the population, so it cannot be generalized to the population. Additionally, due to the nature of the one group pre-post design, it is not possible to attribute changes over time to intervention components. The changes observed in this study may be due to nonspecific effects of the intervention, such as the attention paid by the therapist, the ritual of the exercise routine, or the natural improvement of symptoms over time, rather than the effect of the Pilates exercises. An additional untreated control group is therefore recommended in future studies.

This study shows that clinical pilates training significantly improves shoulder dynamic stability, endurance and position sense in postmenopausal women. Clinical pilates exercises can be an appropriate exercise choice for postmenopausal women, as increase shoulder stabilization, endurance and proprioception. Authors believe that clinical pilates exercises can be used as an appropriate, protective approach against shoulder injuries such as rotator cuff tears and shoulder impingement syndrome, which are seen in high incidence in the postmenopausal period.

Sources of Support: The authors declared that they did not receive any financial support for this study.

Conflict of Interest: The authors declare that there is no conflict of interest.

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

Explanations: None.

Acknowledgement: None.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)152-158

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Received: *16.08.2023 (Geliş Tarihi)*
Accepted: *28.02.2024 (Kabul Tarihi)*

UPPER EXTREMITY SELECTIVE VOLUNTARY MOTOR CONTROL IN CHILDREN WITH UNILATERAL CEREBRAL PALSY AND ITS ASSOCIATION WITH UPPER EXTREMITY FUNCTIONS

ORIGINAL ARTICLE

ABSTRACT

Purpose: The study aimed to define the upper extremity selective voluntary motor control (SVMC) in children with unilateral Cerebral Palsy (CP). It was also aimed to investigate the relationship between upper extremity SVMC and upper extremity functions.

Methods: Twenty-four children diagnosed with unilateral CP, aged between 6 and 18, were included in the study. The Quality of Upper Extremity Skills Test (QUEST) assessed the upper extremity functions. Manual dexterity was measured using the Jebsen-Taylor Hand Function Test (JTT) timed tasks. The SVMC of the upper extremity was measured using the Selective Control of Upper Extremity Scale (SCUES) using the videotape recording method.

Results: Statistically significant decreases in SCUES scores from shoulder to fingers were recorded using the Page statistical test for trend ($p<0.001$). There was a significant positive correlation between the SCUES total score and the QUEST total score (r: 0.796; $p<0.001$). Also, score on SCUES showed a significant negative correlation with JTT (r:- 0.875; $p<0.001$).

Conclusion: In children with unilateral CP, there was a relationship between upper extremity selective voluntary control and upper extremity functions. Deficiency in selective upper extremity movements disturbed functional manual skills, indicating these impairments' significance in assessing upper extremity functions and, potentially, rehabilitation.

Keywords: Cerebral Palsy, Motor Skills, Upper Extremity

UNİLATERAL SEREBRAL PALSİLİ ÇOCUKLARDA ÜST EKSTREMİTENİN İSTEMLİ SELEKTİF MOTOR KONTROLÜ VE ÜST EKSTREMİTE FONKSİYONLARI İLE İLİŞKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Çalışmada, unilateral Serebral Palsili (SP) çocuklarda üst ekstremite istemli selektif motor kontrolünü (SMK) tanımlamak ve SMK ile üst ekstremite fonksiyonları arasındaki ilişkiyi incelemek amaçlanmıştır.

Yöntemler: Çalışmaya yaşları 6 ile 18 arasında değişen 24 unilateral SP tanılı çocuk dahil edilmiştir. Üst ekstremite fonksiyonlarını değerlendirmek için Üst Ekstremite Beceri Kalitesi Testi (ÜEBKT) kullanıldı. El becerisi, Jebsen-Taylor El Fonksiyon Testinin (JTT) süreli görevleri kullanılarak ölçüldü. Üst ekstremitenin SMK, video kayıt yöntemi kullanılarak Üst Eksremite Selektif Kontrol Skalası (ÜESKS) ile ölçüldü.

Sonuç: Omuzdan parmaklara ÜESKS skorlarında istatistiksel olarak anlamlı düşüşler Page istatistiksel trend testi kullanılarak kaydedildi ($p<0,001$). ÜESKS toplam puanı ile ÜEBKT toplam puanı arasında anlamlı bir pozitif korelasyon vardı (r: 0,796; $p<0,001$). Ayrıca ÜESKS skoru, JTT ile anlamlı bir negatif korelasyon gösterdi (r: - 0,875; $p<0,001$).

Tartışma: Unilateral SP'li çocuklarda üst ekstremite SMK ile üst ekstremite fonksiyonları arasında ilişki bulundu. Selektif üst ekstremite hareketlerindeki eksikliğin, fonksiyonel el becerilerini etkilediği bulunmuştur. Bu nedenle üst ekstremite fonksiyonlarını değerlendirmede ve potansiyel olarak rehabilitasyonunda üst ekstremite SMK göz önünde bulundurulmalıdır.

Anahtar Kelimeler: Serebral Palsi, Motor Beceriler, Üst Ekstremite

INTRODUCTION

Cerebral palsy (CP) has been described as a group of disorders of the development of movement and posture in the developing fetal or infant brain (1). Children with CP can have many neurological deficits that interfere with motor function. These impairments include hypertonicity or hypotonicity with weakness, abnormal patterns of muscle activation, including excessive co-contractions, and absent or poor selective voluntary motor control (SVMC) (2).

Children with CP have damage to the corticospinal tract (CST) and ascending sensory tracts. With CST damage, isolated movements cannot be controlled, and SVMC is reduced (3). Reduced SVMC results in an impaired ability to isolate the activation of muscles in a selected pattern in response to the demands of a voluntary posture or movement (4). This results in decreased fluency, lack of movement, inability to change direction, reduced speed, and involuntary movement of other joints, including mirror movements (5).

Physical manifestations of reduced SVMC include mirrored movements, movement of other joints or trunk segments, mass pattern movements, and dynamic movement less than the available (passive) range of motion (4). In recent years, Selective Control of the Upper Extremity Scale (SCUES), which includes all the components of SVMC, has been developed to evaluate SVMC accurately. The SCUES allows for a more precise description of impaired selective movements (i.e., mirror movements, trunk movement, and other joints) (4).

Decreased SVMC in children with CP may prevent many daily bimanual activities that require independent control of both hands. The loss of SVMC may interfere with their overall level of functioning more so than some of the other impairments. Poor SVMC may limit the potential functional improvements in treating the other impairments (6). Therefore, SVMC evaluation is essential to determine its relationship with function to ensure possible improvement.

The literature has investigated the relationship between lower extremity SVMC and functional performance, such as gross motor function and walking, in children with CP (7-9). However, limited studies exist on the relationship between SVMC and upper extremity function. Therefore, this study aimed to describe the upper extremity SVMC in children with unilateral CP and its association with upper extremity function.

METHODS

Participants and Recruitment

This study was designed as a prospective study conducted between January 2018 and August 2018. Children with CP were evaluated in the Gazi University Faculty of Health Sciences pediatric rehabilitation unit. Each child's assessment took approximately one hour and was completed the same day. This study was approved by the Gazi University Ethical Committee (number: 77082166-302.08.01-). Volunteer approvals were received from each child and their parents to participate in the study. Inclusion criteria were: diagnosis of unilateral spastic CP, age between 6 and 18 years, and ability to follow simple instructions. The exclusion criteria were previous upper extremities surgery, botox injection of the upper extremities within the preceding six months, fixed deformities of the upper extremities, and visual or auditory problems. Twenty-four unilateral CPs who met the criteria were included in the study. One physiotherapist with expertise in the pediatric field performed the evaluations. To evaluate the child's SVMC, the review was first started with a video recording. Children's MACS level was recorded according to their daily performance. Then, the physiotherapist recorded the child's performances using JTT and QUEST.

Measurements

Selective Control of the Upper Extremity Scale (SCUES)

The scale evaluating the upper extremity selective control was developed by Wagner et al. (4). The SCUES considers movement at each joint level: the presence of mirror movements, movement of additional joints, the target or index joint, presence of trunk movement, and dynamic motion less than passive range of motion (ROM).

Upper extremity joints and trends are examined, including the shoulder (abduction/adduction), elbow (flexion/extension), forearm (supination/pronation), wrist (flexion/extension), and fingers/thumb (grasp/release). A video camera is placed in front of a participant sitting on a table. The examiner demonstrates the desired motion to the participant and then passively moves the participant's joint in the desired planes. The participant is then asked to perform the same movement—the examiner from the videotape grades this activity. The evaluation lasts less than 15 minutes. Motion at each of the five joint levels is graded on a four-point scale: no SVMC (0 points), moderately diminished SVMC (1 point), mildly reduced SVMC (2 points), and normal SVMC (3 points) (10). A third physiotherapist, blind to the child's clinical examination, scored the videos. The total score of the SCUES ranges between 0 and 15, and higher scores indicate better SVMC.

Jebsen Taylor Hand Function Test (JTT)

It is a standard test used to evaluate the general hand function of the person. Seven test subsets simulate hand function, including writing, simulated page turning, stacking checkers, simulated feeding and picking up small everyday objects, large light objects, and large, heavy objects, and in this study, eliminating the writing task and capping the maximum allowable time to complete each of the six timed items at 2 minutes modified the JTT. Thus, the whole time to complete all items was 720 seconds. A total score was calculated from the individual scores for each subtest (11).

Quality of Upper Extremity Skill Test (QUEST)

The QUEST evaluates the quality of the upper extremity in four areas: dissociated movement, grip, weight-bearing, and protective extension. A score of "yes" (1 point) or "no"(0 points) is given according to the completion of each movement or task. The four field scores are summed to achieve the total score. During evaluation, the child cannot use any device in the upper extremity. Both the right and left upper extremities of the child are scored. The total score is between 0 and 100; a child without a neurological problem can get 100 points. A higher score on the test indicates that the child has better upper extremity performance (12).

Manual Ability Classification System (MACS)

The MACS is a five-level system with a practical observation-based classification system for manual ability in children with CP. Level I represents the best manual ability, and level V indicates that the child does not use their hands for functional activity. It describes the children's handling of objects in daily activities (13).

Statistical analysis

Sample size for correlation analysis was determined using G*POWER statistical software. It was stated that the appropriate sample size for the current research was N = 24 (effect size = 0.5; β=0.2; α=0.05). Statistical analyses were performed using SPSS (IBM SPSS Statistics 22.0, IBM Ehningen, Germany). The variables were investigated using visual (histograms, probability plots) and analytical methods (Kolmogorov-Simirnov/Shapiro-Wilk's test) to determine whether or not they are typically distributed. Individual joint SCUES scores were compared using nonparametric repeated measures methods (Friedman procedure). Wilcoxon test with a Bonferroni correction was used to detect the significant differences within each limb. The corresponding test for trend was computed to analyze the relation among joints from shoulder to fingers. Spearman correlation coefficient (r) was used to describe associations between selective movement control and measures of upper extremity functions. Statistical significance was set at $p<0.05$.

RESULTS

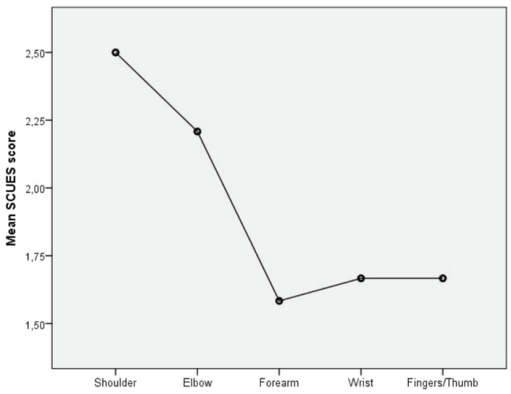
The mean age of the children participating in the study was 12.4 ± 3.4 years. The demographic characteristics and MACS levels of the participants are shown in Table 1.

Mean SCUES scores showed more significant SVMC impairment in distal than proximal joints bilaterally (Fig 1). A statistically significant decrease in SCUES scores from shoulder to fingers

Table 1. Demographic Features of the Participants

	Age (years)	
	Mean ± SD	**Range**
Child	12.40 ± 3.42	6-18
	n	**%**
Sex		
Male	11	45.80
Female	13	54.20
MACS Level		
Level 1	12	50
Level 2	6	25
Level 3	6	25

MACS: Manual Ability Classification System



SCUES: Selective Control of the Upper Extremity Scale

Figure 1. Mean Selective Control of the Upper Extremity Scale Scores by Joint for Affected Extremity

was found using the trend analysis (p<0.001). There was a substantial difference between all pairwise SCUES score comparisons involving shoulder and elbow joints. Comparisons between scores for fingers versus wrist, fingers versus forearm, and wrist versus forearm showed no difference. Table 2 presents p values for all pairwise comparisons using the Friedman test.

The median and IQR range of all variables are listed in Table 3. Correlations showed that all the variables of upper extremity function were associated with SCUES (Table 4). SCUES was negatively correlated with both the JTT and the MACS. Also, there was a positive correlation between QUEST and SCUES.

Table 2. Comparison between SCUES Scores for Five Joints

Joint Comparison	**p**
Shoulder vs Elbow	0.020
Shoulder vs Forearm	0.001
Shoulder vs. Wrist	0.001
Shoulder vs. Fingers/Thumb	0.001
Elbow vs. Forearm	0.001
Elbow vs. Wrist	0.002
Elbow vs. Fingers/Thumb	0.002
Forearm vs. Wrist	0.527
Forearm vs. Fingers/Thumb	0.527
Wrist vs. Fingers/Thumb	1.00

Significant at p<0.001, Individual p Values (Friedman Test) and Overall Trend

Table 3. Upper Extremity Function Results of the Participants

	Unilateral CP *n = 24*	
	Median	**IQR range**
SCUES		
Total Score	10.50	7 – 14
JTT		
Total Score	229.72	106.80 – 509.90
QUEST		
Dissociated Movement	96.80	82 – 99.65
Grasp	87.91	76.30 – 100
Weight Bearing	100	93 – 100
Protective Extension	100	91.60 – 100
Total Score	96.20	86.30 – 99.50

SCUES: Selective Control of the Upper Extremity Scale, JTT: Jebsen Taylor Hand Function Test, QUEST: Quality of Upper Extremity Skill Test

Table 4. Correlation between Upper Extremity Functions and Selective Motor Control

	SCUES	
	r	**p**
JTT Total Score	- 0.87	<0.001
QUEST		
Dissociated Movement	0.81	<0.001
Grasp	0.78	<0.001
Weight Bearing	0.67	<0.001
Protective Extension	0.68	<0.001
Total score	0.79	<0.001
MACS	-0.83	<0.001

SCUES: Selective Control of the Upper Extremity Scale, JTT: Jebsen Taylor Hand Function Test, QUEST: Quality of Upper Extremity Skill Test, MACS: Manual Ability Classification System, Spearman's Correlation Coefficients

DISCUSSION

This study aims to investigate the relationship between SVMC and upper extremity function in children with unilateral spastic CP; few studies examine this relationship between SVMC and upper extremity function in children with CP. This study found that the severity of SVMC impairment increased from proximal to distal joints. Also, in this study, we could demonstrate a relationship between upper extremity SVMC and upper extremity functions.

The upper extremity function impairment in children with unilateral CP is mainly associated with controlling the distal movement component of the affected side rather than the proximal one (14). Tedroff et al. evaluated the temporal sequence of muscle recruitment during maximal voluntary contractions in children with CP. They reported that inappropriate antagonist activation before agonists was more prevalent in the distal than the proximal muscular system in children with CP (15). These results are consistent with our findings of decreased ability to perform isolated joint motion in distal parts. In line with the study's results, the distribution of selective motor control impairment from proximal to distal in motor function development in young children with CP may be valuable for both treatment planning and prognosis evaluation.

Children with CP demonstrate mirror movements with uncontrolled simultaneous associated movements at contralateral joints. Mirror movements are simultaneous involuntary movements that accompany the voluntary movements of the muscles on the opposite side of the body (16). Mirror movements in the upper limbs and their

relationship with upper limb function have been studied in children with unilateral CP (16-18). Kuhtz-Buschbeck et al. found significant correlations between the number of mirror movements and the scores of bimanual function (16). Adler et al. concluded that mirror movements had a significant negative impact on the time to perform the bimanual activities and a negative effect on mirror movements on the bimanual hand function (18). The results show that mirror activity is associated with poor hand coordination, in line with our findings.

Although some studies have explored the relationship between mirror movements and bimanual performance while controlling for the capacity of the affected hand (17, 18), the relationship between total SVMC and upper extremity functions has never been studied directly. Also, these studies used only a subjective, ordinal rating scale for assessing mirror movements (17, 18). Further analysis using reliable and valid upper limb assessments is required better to understand the impact of SVMC on upper limb function. For this reason, SCUES, which was recently reported to have developed validity and reliability, has been used in this study (4). SCUES is a clinical tool designed to assess SVMC of the entire upper extremity by summing the scores for five joints (shoulder, elbow, forearm, wrist, and fingers/thumb). Thus, the mirror movements, other joints' movements, trunk direction, and available ROM motion were evaluated.

Hand motor skills involve both the activation of appropriate motor sequences and the prevention of involuntary, extraneous movements (16). The mirror movements during grasping can lead to inadequate grip force. Adler et al. found that children with unilateral CP could not adjust their grip forces due to mirror movements during bimanual activities (18). Kuhtz-Buschbeck et al. showed that, during a grip-lift task, hemiparetic children with mirror movement used a high grip force. This study had a relationship between SVMC and grasping skills (15). In another recent study, it was reported that there was a positive relationship between selective motor control and upper extremity function and hand grip strength in children with hemiparesis (19). Uncoordinated hand, finger, and arm movements make manipulating and grasping objects difficult. This study found a relationship between upper extremity SVMC and upper extremity functions, in line with the literature.

The small sample size limited the current study. Additionally, bimanual tasks have yet to be evaluated separately. A comprehensive evaluation of a larger sample size is recommended for future studies.

The present study aimed to define the upper extremity SVMC and found an increase in the severity of impairment from proximal to distal joints. Also, this study concludes that SVMC is generally associated with upper extremity impairments. Therefore, focusing on SVMC in physiotherapy and rehabilitation applications is essential to improve upper extremity performance.

Sources of Support: No external funding was secured for this study.

Conflict of Interest: Authors declare that there is no conflict of interest.

Author Contributions: Concept – AY and BE; Design - AY; Supervision – BE; Resources and Financial Support – BE and RY; Materials – RY and BE; Data Collection and Processing - RY, and AY; Analysis and Interpretation - AY; Literature Research - RY, and AY; Writing Manuscript - RY, and AY; Critical Review – BE.

Explanations: None.

Acknowledgments: The authors would like to thank the children and parents who participated in this study

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)159-169

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INVESTIGATION OF THE EFFECT OF AN ONLINE YOGA-BASED EXERCISE PROGRAM ON WOMEN WITH PRIMARY DYSMENORRHEA: A RANDOMIZED CONTROLLED TRIAL

ORIGINAL ARTICLE

ABSTRACT

Purpose: It was aimed to investigate the effects of telerehabilitation method and online yoga-based exercise program on pain, menstrual attitude, body awareness and quality of life in women with primary dysmenorrhea (PD).

Methods: This study is an experimental randomized controlled single-blind study. Fifty women (25 in the intervention group, and 25 in the control group) between the ages of 18-35 were included in the study. At the beginning of the study, both groups were given informational training on PD and treatment methods. In addition to informational training, an online yoga-based exercise program was applied individually to the intervention group, twice a week for 8 weeks, for a total of 16 sessions. Visual analog scale (VAS), menstrual attitude scale (MAS), body awareness questionnaire (BAQ), short form-36 (SF-36), and satisfaction questionnaire were used for data collection.

Results: The VAS score of the intervention group decreased from 6.76 to 3.76 points. VAS ($p<0.001$), MAS ($p<0.001$), BAQ ($p<0.001$), and SF-36 ($p<0.05$) questionnaire scores in the intervention group were found to be significant compared to the control group. While VAS scores increased significantly ($p<0.001$) in the control group, no change was observed in MAS ($p=0.791$) and BAQ ($p=0.174$) scores. In SF-36, improvement was observed only in social functionality ($p=0.050$), pain ($p=0.002$) and general health ($p=0.004$).

Conclusion: The results of this study showed that the online yoga-based exercise program had a positive effect on pain, menstrual attitude, body awareness and quality of life in PD.

Keywords: Dysmenorrhea, Exercise, Pain, Telerehabilitation, Yoga

ÇEVRİMİÇİ YOGA TEMELLİ EGZERSİZ PROGRAMININ PRİMER DİSMENORELİ KADINLARDA ETKİSİNİN ARAŞTIRILMASI: RANDOMİZE KONTROLLÜ ÇALIŞMA

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmada primer dismenoreli (PD) kadınlarda çevrimiçi yoga temelli egzersiz programının ağrı, menstrual tutum, beden farkındalığı ve yaşam kalitesi üzerine etkisinin araştırılması amaçlanmıştır.

Yöntem: Bu çalışma deneysel, randomize kontrollü, tek kör bir çalışmadır. Çalışmaya 18-35 yaş arası 50 kadın (müdahale grubunda 25, kontrol grubunda 25) dahil edildi. Çalışmanın başında her iki gruba da PD ve tedavi yöntemleri hakkında bilgilendirme eğitimi verildi. Müdahale grubuna bilgilendirme eğitimine ilave olarak, haftada iki kez, 8 hafta boyunca toplam 16 seans bireysel olarak çevrimiçi yoga temelli egzersiz programı uygulandı. Verilerin toplanmasında Görsel Analog Ölçeği (GAS), Menstruasyon Tutum Ölçeği (MTÖ), Vücut Farkındalığı Anketi (VFA), Kısa Form-36 (SF-36) Anketi ve Memnuniyet Anketi kullanıldı.

Sonuçlar: Müdahale grubunun GAS puanı 6,76›dan 3,76›ya düştü. Müdahale grubundaki GAS ($p<0,001$), MTÖ ($p<0,001$), VFA ($p<0,001$) ve SF-36 ($p<0,05$) anket puanları kontrol grubuna göre anlamlı bulundu. Kontrol grubunda GAS puanı anlamlı derecede artarken ($p<0,001$), MTÖ ($p=0,791$) ve VFA ($p=0,174$) puanlarında herhangi bir değişiklik gözlenmedi. SF-36'da ise sadece sosyal işlevsellik ($p=0,05$), ağrıda ($p=0,002$) ve genel sağlıkta ($p=0,004$) iyileşme gözlendi.

Tartışma: Bu çalışmanın sonuçları çevrimiçi yoga temelli egzersiz programının PD'de ağrı, menstrual tutum, vücut farkındalığı ve yaşam kalitesi üzerinde olumlu etkisinin olduğunu gösterdi.

Anahtar Kelimeler: Ağrı, Dismenore, Egzersiz, Telerehabilitasyon, Yoga

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Received: *19.09.2023 (Geliş Tarihi)*
Accepted: *01.03.2024 (Kabul Tarihi)*

INTRODUCTION

Primary dysmenorrhea (PD) is defined as painful cramps without any diagnosed pelvic pathology (1,2). This situation causes a serious decrease in women's quality of life and most of the women do not demand any health care services (3).

In the treatment of PD, individuals often prefer non-prescription pharmacological agents, and try various approaches such as physiotherapy, exercise, psychotherapy, and aromatherapy (4,5). Although PD is a common problem, it is perceived as normal by most women. It has been reported that the frequency of consulting a doctor due to dysmenorrhea varies between 7.1 and 32.6%, and the rate of over-the-counter drug use varies between 70-82%. However, drug therapy can also cause side effects such as headache, gastrointestinal problems, and heart attack (6,7).

Exercise is an important application that increases the secretion of beta-endorphin hormone, which has a natural pain reliever effect in the body, and reduces stress, pain and prostaglandin levels (8). Although the effectiveness of exercise practices in reducing the symptoms of PD has been proven, there is a need to improve its routine application in PD and other gynecological problems (9). Telerehabilitation is the ability to provide rehabilitation remotely using electronic information and communication technologies. Telerehabilitation facilitates access to both patients' rehabilitation services and researchers' access to individuals (10). A study investigating the effects of tele-yoga practice on chronic pain reported that the practice improved both physical and psychological aspects of individuals and reduced the stress load with its motivation-increasing feature (11). Due to the limited number of studies in the literature investigating exercise-oriented telerehabilitation in the treatment of PD, this study aimed to investigate the effect of an online yoga-based exercise program in women with PD.

METHODS

Study design and participants

The protocol of the study was approved by Istanbul Medipol University Non-Interventional Clinical Research Ethics Committee (Meeting date: 22/10/2021, Decision No. 10840098-772.02-E.60605). This study was registered at the Clinical.Trials.gov Protocol Registration and Results System (Protocol ID Number NCT05081869).

This study was performed in line with the principles of the Declaration of Helsinki in participants' own settings and online between November 2020 and February 2021. An informative consent form and explanations that the participation was voluntary and they had the freedom to withdraw from the study were added to the online questionnaire for the participants. Written consent was obtained from all participants before the study.

Participants were informed that they would be evaluated on the first day of their menstrual cycle. Participants who met the inclusion criteria were randomized in a 1:1 ratio via closed-envelope method to receive either intervention or control groups. Evaluation (G.A.B.) and treatment (Y.S.) were performed by two different physiotherapists. The physiotherapist who made the evaluations was blind in knowing which group the patients belonged to.

In the current study included women who applied to us with the complaint of PD, had a regular menstrual cycle (28±7 days), aged 18-35, and had a menstrual visual analog scale score higher than 4 cm in the last 6 months (12). Those who had a history of birth or current pregnancy, had undergone pelvic surgery, had a history of secondary dysmenorrhea, used an intrauterine device, and used oral contraceptives or antidepressant derivatives at least 6 months before the study were excluded from the study (13). Individuals were followed over three menstrual cycles (9, 14, 15). In total, 58 people were evaluated. 2 people from the intervention group and 4 people from the control group were excluded from the study because they did not meet the inclusion criteria. Two people from the intervention group dropped out of the study because they refused to participate in the study. Fifty women who met the inclusion criteria and agreed to participate

in the study were divided into two groups as intervention (n=25) and control (n=25) (Figure 1).

Measurements

Participants' personal and menstrual period information "sociodemographic information form", pain intensity "visual analog scale (VAS)", menstruation attitudes "menstruation attitude scale (MAS)", body awareness "body awareness questionnaire (BAQ)", quality of life was evaluated with ''short form-36 (SF-36)'' and treatment satisfaction with ''satisfaction scale''. Evaluations were repeated by the same physiotherapist, blinded to group distribution, at the start of the study (based) and for two consecutive menstrual periods (first and second measurements), on the first day of the cycle. All assessments were administered individually online.

All participants filled out a sociodemographic information form in which information such as age, height, weight, educational status, medication use, family history, previous surgery, exercise habits, age at menarche, menstrual pattern, pain, treatment methods used, accompanying physical and mental symptoms, number of absenteeism at school or work (days) was questioned.

Visual analog scale (VAS) used to measure participants' pain levels. The level of pain was requested to be scored between 0-10 (0=No pain at all, 10=The most severe pain). It was developed by Bryant in 1993 and was adapted into Turkish by Aydin et al (16,17).

Menstruation attitude scale (MAS) is a scale consisting of 5 categories and 33 sub-items. Each item is scored between 1 (strongly disagree) and 5 (strongly agree). A high score on the scale indicates a "positive" attitude towards menstruation. MAS was developed by Brooks-Gunn and, Ruble in 1980 and was validated in Turkish by Kulakaç et al (18, 19).

Body awareness questionnaire (BAQ) consists of 18 questions in total. Each question is scored from 1 (Not at all true for me) to 7 (Totally true for me). A high score on the questionnaire means high body awareness. BAQ was developed by Shields et al. in 1989 and was validated in Turkish by Karaca (20, 21).

The Short Form-36 questionnaire (SF-36) was used to assess the participants' quality of life. The questionnaire has 36 questions and 8 subscales. The answers to the questions are scored between 0 (low) and 100 (high). SF-36 was developed by Ware and Sherbourne in 1992 and was validated in Turkish by Kocyigit et al (22, 23).

The treatment satisfaction of the participants in the intervention group was evaluated with 3 questions. Q1: Rate your satisfaction with the program on a scale of 1-10. Q2: Rate your level of recommending this treatment protocol to another woman with the same complaint as you, on a scale of 1-10. Q3: Which of the face-to-face and online treatment options do you prefer?"

Interventions

At the beginning of the study, both groups were given informational training on PD and treatment methods. Participants in the control group at the beginning of the study; 20-minute informational training including the female reproductive system organs, the structure of the pelvis, the position and functions of the pelvic floor muscles, the definition and physiology of menstruation, the types and risk factors of dysmenorrhea, the definition and symptoms of PD, the treatment methods for coping with the pain in PD, online given individually. This intervention was made once.

In addition to the information training, the intervention group implemented a 50-minute online yoga-based exercise program consisting of 5 categories (14, 15). The exercise program continued twice a week for a total of 8 weeks. The created online exercise program was implemented in the individuals' own environments, online and individually.

In the first category of the 5-category exercise program, yoga poses were performed to stretch the iliopsoas, hamstring, adductor group, tensor fascia lata and iliotibial band, piriformis, quadratus lumborum, quadriceps femoris, plantar fascia and gastrocnemius muscles associated with the pelvic region. Stretching for 20-30 seconds was

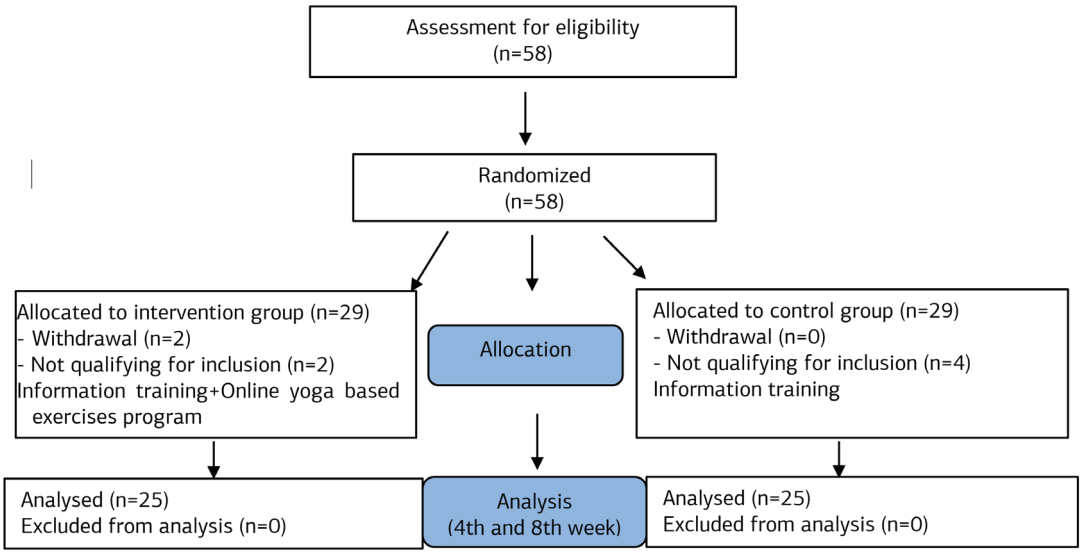

Figure 1. Flow Diagram of the Study

applied in each yoga pose. In the second category, stabilization and pelvic mobilization exercises for internal and external core muscles were applied. Each exercise was performed in 3 sets of 10 repetitions. In the third category, strengthening exercises were performed on the hip and surrounding muscle groups (gluteus maximus, gluteus medius), abdominal muscles (rectus abdominis, internal and external oblique muscles), erector spinae muscle group, quadriceps femoris and latissimus dorsi muscles. Each exercise was performed as 10 repetitions, 3 sets. In the fourth category, the correct activation pattern of the pelvic floor muscles was taught. Then, gradually supine, bridge, sitting position and standing kegel exercises were repeated 10 times in the form of fast and slow contractions (starting with 5 seconds and progressing according to the endurance of the person). The exercises were performed in 3 sets, with a rest period of 10 seconds between each set. In the fifth category, the participants performed two-minute diaphragmatic breathing in five different relaxation positions.

Statistical analysis

The G*Power (3.1 software) program was used to determine the number of participants. When the results of two studies similar to current study were evaluated in the literature review, it was found that the Effect size d value for the VAS score was between 0.17 and 2.06 and clustered around (15, 24). When effect size d=1, α=0.05, power (1-β)=0.90 (90%) were taken in the G power program, it was determined that the minimum sample size was 46 people, 23 in each group. Considering the possible data loss, it was decided to include a total of 50 people (25 people in each group) for the study.

Statistical analyses were performed using IBM SPSS Statistical Software (IBM Corporation, Armonk, New York) version 23. Compliance analyzes of numerical type variables (counted, measured) with normal distribution were evaluated using the Kolmogrow-Smirnov test. The relationships between categorical variables and groups were examined using the Chi-square test. In the conditions where parametric test assumptions were met, t-test was used to compare two independent groups, and ANOVA test was used for comparisons between groups. In the conditions where parametric test conditions were not met, Mann-Whitney U test was used for comparison of two independent groups, and Kruskal-Wallis analysis was used for comparisons between groups. The Mann-Whitney U test was used to compare the groups in the VAS scale, and the Friedman test was used to compare the periods. Test of variance was used for group and period comparisons in MAS, BAQ and SF-36 question-

Table 1. The Sociodemographic and Menstrual Period Characteristics of the Participants

		Intervention Group (n=25)		Control Group (n=25)		
		$\bar{x}$	SD	$\bar{x}$	SD	p*
Age (year)		23.9	2.3	24.2	2.9	0.906[a]
BMI (kg/ $m^{2)}$		21.04	2.61	22.02	3.75	0.287[b]
		n	%	n	%	p*
Education	High school	1	4.0	4	16.0	0.157[c]
	University	24	96.0	21	84.0	
Exercise routine	Yes	9	36.0	9	36.0	1.000[c]
	No	16	64.0	16	64.0	
Menarch age	≤13 year	7	28.0	10	40.0	0.370[c]
	>13 year	18	72.0	15	60.0	
Positive family history of PD in mother or sister	Yes	12	48.0	17	68.0	0.152[c]
	No	13	52.0	8	32.0	
Use of pain medication for the management of PD symptoms	Yes	9	36.0	13	52.0	0.254[c]
	No	16	64.0	12	48.0	
Number of absences from school or work due to PD	Yes	11	44.0	16	64.0	0.156[c]
	No	16	64.0	12	48.0	

*Statistical significance level p<0.05; $\bar{x}$: Arithmetic Mean; S.D: Standard Deviation; BMI: Body mass index; , PD: primary dysmenorrhea. a: Man Whitney U Test, b: T Test, c: Chi-square test

naires. P<0.05 was accepted as a statistical significance level.

RESULTS

Table 1 shows the sociodemographic characteristics of the participants. At the beginning, there was no difference between the sociodemographic and menstrual characteristics of the participants in the control and intervention groups (p>0.05).

There was no difference between groups in pretreatment pain severity scores (p=0.499). While the pain scores of the intervention group decreased significantly during the periods in the in-group comparison (p<0.001), an increase was observed in the within-group evaluation of the control group (p=0.001). In the first and second measurements after the treatment, the pain intensity of the intervention group was found to be significantly lower than the control group (p<0.001). In the comparison between groups; the program applied to the intervention group was found to be more effective in reducing the severity of pain compared to the control group (Table 2).

There was no difference between the groups in the pretreatment MAS scores (p=0.781). An increase was noted between the first and second measurement after the treatment in the within-group analysis scores of the intervention group (p=0.42). The scores of the intervention group were higher than the control group in the second period (p=0.030). It was found that the treatment applied in the intervention group had a positive effect on menstruation attitude and behavior compared to the control group (p=0.030) (Table 3).

There was no difference between groups in pretreatment BAQ (p=0.652). The increase in the within-group comparison scores of the intervention group, both between the baseline and the first measurement (p=0.009) and between the first and second measurement, was statistically significant (p=0.007). When the evaluation results in the intervention and, control groups

Table 2. The Variation of VAS Scores within and between Groups

	Intervention group		Control group		
	$\bar{x}$ (95% CI)	SD	$\bar{x}$ (95% CI)	SD	P** (ES)
VAS					
Based	6.76 (6.28-7.24)	1.165	6.52 (6.09-6.95)	1.046	0.499 (0.21)
P.T-1st	4.72 (4.30-5.14)	1.021	6.48 (5.89-7.07)	1.418	**<0.001** (1.42)
P.T-2nd	3.76 (3.21-4.31)	1.332	7.20 (6.63-7.77)	1.384	**<0.001** (2.56)
P*	**<0.001**		**0.001**		

Statistical significance level p<0.05; $\bar{x}$ Arithmetic Mean; S.D: Standard Deviation, VAS: Visual analog scale, ES: Effect size. Based: pretreatment measurement; P.T-1st: First measurement after treatment (4. week), P.T-2nd: Second measurement after treatment (8. week)

P*: Friedman test (In-group assessment), P**: Mann-Whitney U test (Assesment between groups)

were compared, it was found that the 8-week online exercise program had a positive effect on increasing the body awareness of the individuals from the first month (p<0.001), (Table 3).

Quality of life scores before treatment were similar in both groups (p>0.05). Eight sub-headings of the SF-36 questionnaire were analyzed separately. Significant improvements were de-

Table 3. The Time-Dependent Variation of MAS and BAQ Scores within and between Groups

	Intervention group		Control group		
	$\bar{x}$ (95% CI)	SD	$\bar{x}$ (95% CI)	SD	P** (ES)
MAS					
Based	92.48 (88.49-96.47)	9.67	93.28 (88.94-97.62)	10.52	0.781 (0.07)
P.T-1st	94.40 (90.32-98.48)	9.87	92.24 (88.25-96.23)	9.68	0.438 (0.22)
P.T-2nd	97.56 (94.35-100.77)	7.78	91.20 (86.29-96.11)	11.90	**0.030** (0.63)
$*P_{B-1}$	0.202		0.692		
$*P_{B-2}$	**<0.001**		0.225		
$*P_{1-2}$	**0.042**		0.791		
BAQ					
Based	90.36 (86.12-94.60)	10.27	92.12 (85.33-98.91)	16.45	0.652 (0.12)
P.T-1st	93.44 (89.57-97.31)	9.39	93.48 (87.43-99.53)	14.65	0.991 (0.003)
P.T-2nd	96.84 (92.64-101.04)	10.18	91.44 (85.54-97.34)	14.30	0.131 (0.43)
$*P_{B-1}$	**0.009**		0.433		
$*P_{B-2}$	**<0.001**		0.942		
$*P_{1-2}$	**0.007**		0.174		

Statistical significance level p<0.05; $\bar{x}$: Arithmetic Mean; S.D: Standard Deviation, ES: Effect size. MAS: Menstruation attitude scale, BAQ: Body awareness questionnaire. Based: pretreatment measurement, P.T-1st: First measurement after treatment (4. Week), P.T-2nd: Second measurement after treatment (8. Week), P_{B-1}: Based-First measurement (0-4 week), P_{1-2}: First and second measurement (4-8 week), P_{B-2}: Based and second measurement (0-8 week), P*: Repeated Measure ANOVA (In-group assessment), P**: T test (Assesment between groups)

Table 4. The Comparative Evaluation of the Effect of the Interventions on the SF-36 within and between Groups

Sub-titles of the SF-36 questionnaire	Intervention group		Control group		
	$\bar{x}$ (95% CI)	SD	$\bar{x}$ (95% CI)	SD	p** (ES)
Physical Function					
Based	83.40 (79.37-87.43)	9.76	81.40 (75.55-87.25)	14.18	0.564 (0.16)
P.T-1st	90.00 (87.27-92.73)	6.61	82.40 (76.23-88.57)	14.94	**0.024** (0.65)
P.T-2nd	90.80 (87.78-93.82)	7.31	80.40 (74.21-86.59)	14.99	**0.004** (0.88)
$*P_{B-1}$	**<0.001**		0.814		
$*P_{B-2}$	**<0.001**		0.827		
$*P_{1-2}$	0.842		0.192		
Physical Role Difficulties					
Based	51.00 (40.91-61.09)	24.45	48.00 (34.70-61.30)	32.21	0.712 (0.10)
P.T-1st	61.00 (49.82-72.18)	27.08	43.00 (29.18-56.82)	33.48	**0.042** (0.59)
P.T-2nd	78.00 (71.13-84.87)	16.65	45.00 (31.68-58.32)	32.27	**<0.001** (1.28)
$*P_{B-1}$	0.109		0.643		
$*P_{B-2}$	**<0.001**		0.851		
$*P_{1-2}$	**<0.001**		0.920		
Emotional Role Difficulties					
Based	33.30 (20.75-45.85)	30.41	46.65 (28.88-64.41)	43.03	0.211 (0.35)
P.T-1st	50.63 (37.99-63.25)	30.60	42.64 (27.51-57.77)	36.66	0.407 (0.23)
P.T-2nd	66.62 (56.11-77.13)	25.47	41.30 (27.39-55.21)	33.71	**0.004** (0.84)
$*P_{B-1}$	**0.011**		0.863		
$*P_{B-2}$	**<0.001**		0.798		
$*P_{1-2}$	**0.010**		0.992		
Energy					
Based	50.60 (43.80-57.40)	16.48	54.40 (46.62-62.18)	18.84	0.451 (0.21)
P.T-1st	59.80 (54.80-64.80)	12.12	54.80 (46.75-62.85)	19.50	0.282 (0.30)
P.T-2nd	66.00 (59.81-72.19)	15.00	48.80 (39.08-58.52)	23.55	**0.004** (0.87)
$*P_{B-1}$	**0.002**		0.998		
$*P_{B-2}$	**<0.001**		0.228		
$*P_{1-2}$	0.099		0.116		
Mental Health					
Based	61.76 (54.90-68.62)	16.62	63.92 (54.65-73.19)	22.47	0.701 (0.11)

P.T-1st	68.88 (63.43-74.33)	13.19	63.36 (56.01-70.71)	17.80	0.219 (0.35)
P.T-2nd	72.52 (67.71-77.33)	11.65	60.56 (53.24-67.88)	17.73	**0.007** (0.80)
*P_{B-1}	**0.016**		0.994		
*P_{B-2}	**<0.001**		0.456		
*P_{1-2}	0.267		0.490		
Social Functioning					
Based	58.50 (50.65-66.34)	19.01	65.90 (58.86-72.93)	17.05	0.154 (0.40)
P.T-1st t	66.80 (60.36-73.24)	15.59	57.10 (48.73-65.46)	20.27	0.064 (0.53)
P.T-2nd	78.20 (72.46-83.93)	13.89	59.80 (51.89-67.70)	19.15	**<0.001** (1.10)
*P_{B-1}	**<0.001**		**0.010**		
*P_{B-2}	**<0.001**		**0.050**		
*P_{1-2}	**<0.001**		0.491		
Pain					
Based	55.50 (48.85-62.14)	16.11	57.10 (49.42-64.77)	18.59	0.746 (0.09)
P.T-1st t	65.20 (59.03-71.37)	14.95	54.70 (47.69-61.70)	16.98	**0.025** (0.65)
P.T-2nd	76.50 (72.02-80.97)	10.85	48.00 (40.67-55.32)	17.74	**<0.001** (1.93)
*P_{B-1}	**<0.001**		0.373		
*P_{B-2}	**<0.001**		**0.002**		
*P_{1-2}	**<0.001**		**0.023**		
General Health					
Based	71.20 (63.56-78.84)	18.50	70.20 (62.92-77.48)	17.65	0.846 (0.05)
P.T-1st	76.40 (70.08-82.72)	15.31	67.00 (60.42-73.58)	15.94	**0.039** (0.60)
P.T-2nd	83.20 (76.90-89.50)	15.27	63.80 (57.13-70.47)	16.16	**<0.001** (1.23)
*P_{B-1}	**0.005**		0.131		
*P_{B-2}	**<0.001**		**0.004**		
*P_{1-2}	**<0.001**		0.081		

Statistical significance level p<0.05; $\bar{x}$: Arithmetic Mean; S.D: Standard Deviation, ES: Effect size, SF-36: Short form-36, Based: pretreatment measurement, P.T-1st: First measurement after treatment (4. Week), P.T-2nd: Second measurement after treatment (8. Week), P_{B-1}: Based-First measurement (0-4 week), P_{1-2}: First and second measurement (4-8 week), P_{B-2}: Based and second measurement (0-8 week), P*:Repeated Measure ANOVA (In-group assessment), P**: T test (Assesment between groups)

that they would choose the online exercise program, 40% stated that they would prefer face-to-face treatment (Table 5). During the study period, no negative situation was reported verbally from any of the participants.

DISCUSSION

In the study we aimed to investigate the effect of an online yoga-based exercise program on women with PD. Positive developments were obtained in the pain, menstrual attitude, body awareness and quality of life in PD.

Table 5. The Treatment Satisfaction Rates of the Intervention Group

Questions		Intervention Group $\bar{x}$ ±SD
OEP satisfaction (scoring 1-10)		9.04±0.98
Recommending the OEP to someone else (scoring 1-10)		9.24±1.09
Which of the face-to-face and online treatmentoptions do you prefer?"	Online	15 (%60,0)
	Facetoface	10 (%40.0)

$\bar{x}$: Arithmetic Mean; SD: Standard Deviation, OEP: Online Exercise Program

Bavil et al. increasing physical activity can reduce dysmenoric pain (25). Rakhshaee et al. found that three yoga poses were effective in reducing the severity of PD (24). Based on these results, it was concluded that a categorized and versatile exercise program was effective in reducing dysmenoric pain.

Sönmezer and Yosmaoğlu determined that there was a decrease in pain but no change in attitude towards menstruation in PD women who applied connective tissue massage and kinesio taping for 2 weeks (26). In a study in which progressive relaxation exercises were applied; it was concluded that the scores in the menstruation attitude scale's debilitating and disturbing case parameters decreased after the intervention, resulting in an increase in the ability of individuals to cope with pain and a decrease in kinesiophobia thanks to exercise (27). In the current study, while no significant change was observed in menstrual attitude in the first measurement after starting exercise therapy, significant differences were observed in the menstruation attitude scores of individuals at the end of 8 weeks. As a result, it was concluded that a 4-week exercise program may be insufficient to have an effect on menstruation attitude and behavior, and an exercise program of at least 8 weeks should be applied.

Yoga-based exercises improved body awareness in young women (28). Dogan et al. reported that 4-week lifestyle recommendations, relaxation exercises, and kinesio taping program were insufficient to improve body awareness in women with PD (13). In the current study, a significant increase was found in body awareness scores starting from the 4th week. Unlike the literature, it can be stated that interventions such as yoga have a positive effect on both pain and body awareness in achieving positive results in as little as 4 weeks. However, it is clear that the BAQ is not a specific questionnaire for dysmenorrhea, and since current study was conducted during the COVID-19 pandemic, where women were affected both physically and psychologically, a body awareness questionnaire specific to dysmenorrhea is needed.

In the current study, a statistically significant improvement was found in the subheadings of physical function, physical role difficulty, energy, and mental health of the quality of life questionnaire starting from the 4th week and this improvement was maintained until the end of the 8th week. Emotional role difficulty, social functionality, pain and general health scores of the quality of life questionnaire showed a statistically positive improvement from the beginning and this development continued increasingly until the end of the 8th week. In a study investigating the effects of 12-week yoga practice on the quality of life of women with PD without a sports background, statistically significant improvements were found in the intervention group in the areas of physical function, vitality, mental health, social functionality, and pain of the SF-36 questionnaire (15). It is known that the level of pain in PD directly affects the quality of life of individuals. It is thought that the significant decrease in VAS scores in the intervention group contributed to the improvement of the SF-36 questionnaire scores, which included both physical, emotional and daily life questions.

A significant reduction in pain has been achieved with the application of telerehabilitation in pel-

vic girdle pain associated with pregnancy (29). It has been reported that tele-yoga practice in chronic pain contributes to both physical and psychological recovery of individuals (11). In the current study, the satisfaction rate from the online yoga-based exercise program is quite high, and the fact that the selection rates between online and face-to-face treatment are close to each other means that the concept of telerehabilitation is still open to development. The limitations of the study include the fact that no face-to-face evaluation was made with the participants, the treatment period was limited to 8 weeks, and the lack of reliable communication over the internet at some points.

This study, it has been shown that the online yoga-based exercise program has positive effects on pain, menstrual attitude, body awareness in PD and increases the quality of life of women. In the treatment of PD, creating an exercise program based on methods that improve both physical and mental health, such as yoga, and delivering it to people by combining it with technological developments can be an effective and sustainable solution method in the long run. Future studies, with a longer follow-up period, need to focus on the limitations of telerehabilitation, increase alternative data collection methods, and improve the routine application of online exercise programs by physiotherapists in PD and other gynecological problems.

Source of Support: None

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

Author Contribution: YS: Conceptualization, Methodology, Investigation, Writing-Original draft preparation, Writing-Reviewing, and Editing. GAB: Conceptualization, Methodology, Investigation, Writing-Original draft preparation, Formal Analysis, Writing-Reviewing, and Editing.

Explanations: This study has not been presented or published on a scientific platform.

Acknowledgment: None

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)170-177

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FİZYOTERAPİ ÖĞRENCİLERİNİN MESLEĞE VE EĞİTİME YÖNELİK TUTUMLARININ UMUTSUZLUK DÜZEYİ VE MESLEKİ KAYGIYA ETKİSİ: AFYONKARAHİSAR SAĞLIK BİLİMLERİ ÜNİVERSİTESİ ÖRNEĞİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışma fizyoterapi öğrencilerinin mesleğine ve eğitimine yönelik tutumunun umutsuzluk ve mesleki kaygı düzeyine etkisinin incelenmesini amaçlamaktadır.

Yöntem: Kesitsel prospektif çalışmada çevrimiçi anket uygulandı. Fizyoterapi Öğrencilerinin Mesleğine ve Eğitimine Yönelik Tutum Anketi, Mesleki Kaygı Anketi ve Beck Umutsuzluk Ölçeği kullanıldı. Değişkenler arasındaki korelasyonu değerlendirmek için Pearson korelasyon analizi kullanıldı. Mesleğe ve eğitime yönelik tutumun mesleki kaygı ve umutsuzluk düzeyine etkisi basit doğrusal regresyon analizi ile incelendi.

Sonuçlar: Toplam 397 öğrenci katıldı. Katılımcıların yaş ortalaması 21,36±2,57 yıl, %32,20'si (n=128) üçüncü sınıf ve %58,40'ı (n=232) normal öğretimdi. Öğrencilerin %59,4'ü (n=236) mesleğine ve eğitimine karşı olumlu tutum içindeydi (toplam puan ortalaması=85,65±11,70). Mesleki kaygı düzeyi %10,8'nde (n=43) hafif, %68,0'inde (n=270) orta ve %20,9'unda (n=83) yüksekti. Öğrencilerin %35,3'ü (n=140) umutlu, %31,7'si (n=126) hafif umutsuz, %23,4'ü (n=93) orta seviyede umutsuz ve %9,6'sı (n=38) ileri derecede umutsuzdu. Tüm öğrencilerin ortalama mesleki kaygısı orta (58,07±12,13) ve umutsuzlukları hafif (6,65±5,01) düzeydeydi. Fizyoterapist öğrencilerin mesleğine ve eğitime yönelik tutumu ile mesleki kaygı (r=-0,552) ve umutsuzluk düzeyleri (r=-0,447) arasında negatif ve orta düzeyde bir ilişki vardı (p<0,001). Mesleğe ve eğitime yönelik tutumun mesleki kaygı (R^2=0,304) ve umutsuzluk düzeyine (R^2=0,200) etkisi vardı (p<0,001).

Tartışma: Mesleğe yönelik olumlu tutum, umutsuzluğu ve mesleki kaygıyı azalttığı için öğrencilerin olumlu tutumlarını etkileyen değişkenler araştırılmalıdır. Mesleki eğitimde bu değişkenlere odaklanılmalıdır.

Anahtar Kelimeler: Anksiyete, Fizyoterapi, Tutum, Umut

THE EFFECT OF PHYSIOTHERAPY STUDENTS' ATTITUDES TOWARDS THEIR PROFESSION AND EDUCATION ON HOPELESSNESS LEVELS AND PROFESSIONAL ANXIETY: THE CASE OF AFYONKARAHİSAR HEALTH SCIENCES UNIVERSITY

ORIGINAL ARTICLE

ABSTRACT

Purpose: This study aimed to examine the effect of physiotherapy students' attitudes toward their profession and education on hopelessness and professional anxiety.

Methods: An online questionnaire was applied in the cross-sectional prospective study. Physical therapy students' attitudes toward their profession and education, the professional anxiety questionnaire, and the Beck Hopelessness Scale were used. Pearson correlation analysis was used to evaluate the correlation between variables. The effect of attitude toward profession and education on professional anxiety and hopelessness level was analyzed by simple linear regression analysis.

Results: A total of 397 students participated. The mean age of the participants was 21.36±2.57 years; 32.20% (n=128) were in third grade, and 58.40% (n=232) in regular education. 59.4% (n=236) of the students had positive attitudes towards their profession and education (total mean score=85.65±11.70). The professional anxiety was mild in 10.8% (n=43), moderate in 68.0% (n=270) and high in 20.9% (n=83). Of the students, 35.3% (n=140) were hopeful, 31.7% (n=126) were mild hopelessness, 23.4% (n=93) were moderate hopelessness and 9.6% (n=38) were severe hopelessness. The professional anxiety was moderate (58.07±12.13), and hopelessness mild (6.65±5.01). There was a negative and moderate relationship between physiotherapist students' attitudes towards their profession and education and their professional anxiety (r=-0.552), and hopelessness levels (r=-0.447) (p<0.001). Attitudes towards profession and education had an effect on professional anxiety (R^2=0.304) and hopelessness level (R^2=0.200) (p<0.001).

Conclusion: Since positive attitudes towards the profession reduce hopelessness and professional anxiety, the variables affecting students' positive attitudes should be investigated. Professional education should focus on these variables.

Keywords: Anxiety, Physiotherapy, Attitude, Hope

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Received: *12.06.2023 (Geliş Tarihi)*
Accepted: *06.03.2024 (Kabul Tarihi)*

GİRİŞ

Fizyoterapistler, yaşamın belli bir döneminde vücut yapı ve fonksiyonunu etkileyebilecek hastalıklar, yaralanma, yaşlanma veya çevresel faktörlerin bireyde mobilite ve fonksiyonel kısıtlılıklara yol açtığı durumlarda, fizyoterapiye özgü değerlendirme yöntemleri ve tedavi yaklaşımlarını uygulayarak bireyin mobilite ve fonksiyonel yeteneklerini geliştiren, sürdüren veya eski haline getiren sağlık profesyonelleridir (1,2). Fizyoterapistler bireyin yaşam kalitesini ve fonksiyonel hareket kabiliyetini tanımlayarak en üst düzeye ulaştırmayı hedefler (2). Bu nedenle fizyoterapi öğrencileri, yeterli teorik bilgi ve klinik uygulama becerilerine ek olarak gelişmiş profesyonel davranışlara da sahip olmalıdır.

Mesleki tutum, kişilerin mesleklerine karşı geliştirdikleri bilişsel ve duyusal yönelimler ve davranışları kapsamaktadır (3). Bireyin mesleğine karşı olumlu ya da olumsuz tutumu mesleki davranışlarını etkilemektedir. Bir bireyin mesleğine karşı olumlu bir tutum içinde olması, meslekle ilgili en iyi çabayı göstereceğine işaret etmektedir ayrıca bireyin profesyonelliğini, mesleki doyumunu ve üretkenliğini artırmaktadır (4). May ve diğ., fizyoterapistlerin profesyonel niteliklerini belirleyen davranışlarını; etkin kişiler arası iletişim becerileri, yaşam boyu öğrenme, empati yapabilme, mesleki sorumluluk, zamanı ve kaynakları etkin kullanabilme, problem çözme, kritik düşünme ve stresle başa çıkabilme becerisi gibi özellikler olarak tanımlamıştır. Ayrıca bu davranışların öğrencilere eğitim hayatı boyunca kazandırılmasının öğrencilerin klinik başarısında etkili olduğunu vurgulamıştır (5).

Mesleki kaygı, çalışma koşulları ve işe yerleşme ile ilgili ben merkezli kaygılar ve mesleki yeterliliğe yönelik görev merkezli kaygı kaynakları şeklinde kategorize edilebilir (9). Ülkemizde eğitim veren Fizyoterapi ve Rehabilitasyon lisans programlarının sayı ve kontenjanlarının giderek artmasıyla birlikte bu bölümde eğitim gören öğrenciler için iş bulma sorunu ortaya çıkmaya başlamıştır (6). Fizyoterapi öğrencilerinde yapılan bir çalışmada, birinci sınıf öğrencilerinde mesleki yeterliliğe yönelik kaygıların; son sınıf öğrencilerinde ise bir kamu kuruluşuna atanma ve işsizlik gibi kaygıların ön planda olduğu vurgulanmıştır (7). Ayrıca fizyoterapi öğrencilerinin ikinci ve son sınıfta klinik uygulama becerilerinin geliştirilmesi için hastanede yer alan uygulamaya yönelik dersler mesleki yeterlilikle ilgili kaygılarını artırabilir (8).

Umutsuzluk, kişinin kendi içinde bulunduğu fiziksel, zihinsel veya toplumsal durumun düzelemeyeceğine ilişkin motivasyonel, duygusal ve bilişsel durumları içeren genel ruh halidir (9). Yapılan bir çalışmada, öğrencilerin eğitim aldıkları bölümden memnun olmamaları, mesleki saygınlık, mezun fizyoterapist sayısının artması ve iş bulma endişesi, fizyoterapi öğrencilerinin ikinci sınıftan itibaren umutsuzluk düzeylerini artırdığı vurgulanmıştır (10). Başka bir çalışmada ise üniversite öğrencilerinin yaşadıkları umutsuzluk düzeyinde akademik başarı durumu, iş bulma endişesi, okuduğu bölüm gibi faktörlerin etkili olduğu belirtilmiştir (11).

Fizyoterapi öğrencilerinin eğitimine ve mesleğine yönelik olumsuz tutumları onların iş bulma ile ilgili algılarını olumsuz etkileyebilir, klinik uygulamalarda başarı düzeyini düşürerek mesleki anlamda kendilerini yetersiz hissetmelerine ve mesleki doyumun azalmasına neden olabilir. Hemşirelik ve öğretmenlik alanlarında mesleki tutumun mesleki kaygı ve umutsuzluk düzeyi ile ilişkisini gösteren çalışmalar mevcuttur (12,13). Ancak fizyoterapi öğrencilerinin eğitimine ve mesleğine karşı tutumunun mesleki kaygı ve umutsuzluk düzeyine etkisini inceleyen bir çalışmaya rastlanılmamıştır. Öğrencilerin mesleğine ve eğitimine yönelik tutumlarının mesleki kaygı ve umutsuzluk düzeyine etkisinin araştırılması gelecekte öğrencilerin mesleki kaygı ve umutsuzluk düzeyinin azaltılmasına ilişkin çözümlerin geliştirilmesine katkı sağlayabilir. Tüm bu faktörler göz önünde bulundurulduğunda bireyin mesleğine ve eğitimine yönelik tutumunun mesleki kaygı ve umutsuzluk düzeyini etkileyebileceğini düşünüyoruz. Bu nedenle bu çalışmanın amacı fizyoterapi öğrencilerinin mesleğine ve eğitimine yönelik tutumunun mesleki kaygı ve umutsuzluk düzeyine etkisinin araştırılmasıdır.

YÖNTEM

Çalışmanın Tasarımı

Bu çalışma anket uygulamaları içeren prospektif kesitsel bir çalışmadır. Çalışmanın etik kurul onayı Afyonkarahisar Sağlık Bilimleri Üniversitesi Klinik Araştırmalar Etik Kurulu tarafından verildi (2023/2). Çalışma, Google Forms üzerinden çevrimiçi yürütüldü. Katılımcılara anketler, kartopu örnekleme yöntemiyle ulaştırıldı. Bireylere, anketin amacı ve yöntemine dair bilgiler ve gönüllü olur onayı çevrimiçi anket üzerinden ulaştırıldı. Anket soruları, bireyler araştırmaya katılmayı kabul ettikten sonra sistem tarafından otomatik olarak gönderildi. Araştırmaya katılmayı reddeden bireyler, anket sorularına erişemedi.

Katılımcılar için dahil edilme kriteri, öğrencilerin fizyoterapi ve rehabilitasyon lisans programında örgün eğitime devam ediyor olması; dışlama kriteri ise öğrencilerin mezun olmasıdır.

Bu çalışmada, fizyoterapi öğrencilerinin mesleğine ve eğitimine yönelik tutumunun mesleki kaygı ve umutsuzluk düzeylerine etkisi değerlendirildi. Çalışmada katılımcılara ait demografik veriler (yaş, cinsiyet, kaçıncı sınıf) kaydedildi. Çalışma 2022-2023 Akademik Eğitim-Öğretim yılının bahar döneminde Afyonkarahisar Sağlık Bilimleri Üniversitesi Sağlık Bilimleri Fakültesi Fizyoterapi ve Rehabilitasyon bölümünde öğrenim gören öğrenciler üzerinde gerçekleştirildi. Öğrencilerin mesleğine ve eğitimine yönelik tutumlarını değerlendirmek için Fizyoterapi Öğrencilerinin Mesleğine ve Eğitimine Yönelik Tutum Anketi (FÖMEYTA), mesleki kaygı durumlarını değerlendirmek için Mesleki Kaygı Anketi ve mesleki umutsuzluk düzeylerini değerlendirmek için Beck Umutsuzluk Ölçeği uygulandı.

FÖMEYTA: Fizyoterapi öğrencilerinin mesleğine ve eğitimine yönelik tutumunun değerlendirilmesi için tasarlanmış 25 sorudan oluşan bu anketin 5'li Likert ölçeğinden oluşan bir derecelendirme sistemi vardır. Anketten elde edilebilecek en yüksek puan 125'tir. Yüksek puanlar mesleğe ve eğitime yönelik olumlu tutumun göstergesidir. Anketin kesme puanı 83.5'tir. Bu puanın üzerinde alanların mesleğine ve eğitimine yönelik olumlu tutumları olduğu kabul edilir. Anket 4 farklı alt bölümden oluşmaktadır: Bölüm A= öğrenciler meslek/ders seçiminden memnun mu, Bölüm B=öğrencileri iyi bir gelecek bekliyor mu, Bölüm C=öğrencilerin iyi bir hasta deneyimi var mı ve Bölüm D=öğrenciler öğrendiklerinden memnun mu? Anketin orjinali Tedla (2017) tarafından geliştirilmiştir. İçerik geçerliği indeksi 0,71 ve Cronbach's alpha katsayısı 0,86 olarak bulunmuştur (3). Anketin Türkçe geçerlilik ve güvenirlik çalışması Taşvuran Horata ve diğ. tarafından yapılmıştır (14).

Mesleki Kaygı Anketi: Anket, çalışma ortam ve koşulları, iş bulma gibi ben merkezli kaygıya; mesleki yeterlilik ve memnuniyet gibi görev merkezli kaygıya neden olabilecek faktörlerle ilişkili, 18 adet beşli likert sorulardan oluşmaktadır. Anketten en fazla 90 puan alınmaktadır ve yüksek puanlar yüksek kaygı düzeyi olarak değerlendirilmektedir. Ayrıca 22-44 puan aralığı hafif, 45-67 orta ve 68-90 yüksek kaygı düzeyi olarak sınıflandırılmaktadır. Geçerli ve güvenilir olan bu anketin Cronbach alfa değeri 0,814 ve sınıf içi korelasyon katsayısı 0,799'dur (7).

Beck Umutsuzluk Ölçeği: Durak ve Palabıyıkoğlu tarafından Türkçe geçerlik çalışması yapılan ölçek, 20 sorudan oluşmaktadır. Her bir soru 0 veya 1 olarak puanlanmaktadır. Toplam puan 0-20 arasında değişmektedir. Elde edilen daha yüksek puan umutsuzluk düzeyinin daha yüksek olduğuna işaret etmektedir (15). Anketten alınan 0-3 puan umutlu, 4-8 hafif umutsuzluk, 9-14 orta seviyede umutsuzluk, 15-20 ileri derecede umutsuzluk varlığını ortaya koymaktadır.

Güç Analizi

Çalışmanın örneklem büyüklüğü G*Power 3.1.9.7 ile değerlendirildi. Fizyoterapi öğrencilerine yönelik mesleki tutumun mesleki kaygı ve umutsuzluk düzeyine etkisini değerlendiren örnek bir çalışmaya rastlanmadığı için küçük etki boyutuyla (f2=0,03) yapılan güç analizinde %95 güven düzeyi ve %80 güç elde etmek için minimum 325 katılımcının çalışmaya dahil edilmesi gerekmektedir (16).

İstatistiksel Analiz

Verilerin istatistiksel analizi IBM SPSS Statistics 26.0 (SPSS Inc, Chicago, IL, ABD) programı

Tablo 1. Katılımcıların Tanımlayıcı Özellikleri

Değişkenler	**Ortalama±Standart Sapma**
Yaş, (yıl),	21,36±2,57
Cinsiyet	**n (%)**
Kadın	305 (76,80)
Erkek	92 (23,20)
Sınıf	**n (%)**
Birinci sınıf	108 (27,20)
İkinci sınıf	79 (19,90)
Üçüncü sınıf	128 (32,20)
Dördüncü sınıf	82 (20,70)
Öğretim şekli	**n (%)**
Normal öğretim	232 (58,40)
İkinci öğretim	165 (41,60)
Bölüme yerleşme şekli	**n (%)**
ÖSYM	361 (90,90)
Yatay geçiş	7 (1,80)
Merkezi puanla yatay geçiş	24 (6,00)
Dikey geçiş	2 (5,00)
Özel/Misafir Öğrenci	3 (8,00)
Eğitime ve mesleğe yönelik tutum	**n (%)**
Olumlu	236 (59,4)
Olumsuz	161 (40,6)
Kaygı düzeyi	**n (%)**
Hafif	43 (10,8)
Orta	270 (68,0)
Yüksek	83 (20,9)
Umutsuzluk düzeyi	**n (%)**
Umutlu	140 (35,3)
Hafif	126 (31,7)
Orta	93 (23,4)
İleri	38 (9,6)

ile yapıldı. Değişkenlerin normal dağılım özelliği, çarpıklık ve basıklık değerlerine göre yorumlandı. Çarpıklık ve basıklık değerleri -2 ile +2 aralığında olan değişkenlerin normal dağılım gösterdikleri varsayıldı (17). Çalışmada tüm değişkenler normal dağılım özelliği gösterdi. Sonuçlar, sürekli verilerin ortalama ve standart sapma, kategorik verilerin ise sayı ve yüzde değerleri verilerek sunuldu. Değişkenler arasındaki ilişki Pearson korelasyon analiziyle değerlendirildi. Korelasyon katsayıları >0,50 olması güçlü, 0,30- 0,50 arasında orta ve 0,20-0,30 arasında zayıf ilişki düzeyi olarak kabul edildi (16). Bağımsız değişkenin (eğitime ve mesleğe yönelik tutum) bağımlı değişkenler (mesleki kaygı ve umutsuzluk düzeyi) üzerindeki etkisini değerlendirmek için basit doğrusal regresyon analizi yapıldı. Regresyon analizi sırasında 6 tane uç değer tespit edildi. Uç değerler, değer değiştirme yöntemiyle (diğer gözlemlerdeki en yüksek değerlerden yararlanılarak) düzenlendi (18). Kayıp veriler çalışmaya dahil edilmedi. İstatistiksel düzeyde bir anlamlılık $p<0,05$ olarak değerlendirildi (16).

SONUÇLAR

Çalışmada 401 bireye anket ulaştı. Dört kişi çalışmaya katılmayı reddetti. Sonuçta, 397 katılımcıyla çalışma tamamlandı. Çalışmaya katılan

Tablo 2. Fizyoterapi Öğrencilerinin Mesleğine ve Eğitimine Yönelik Tutumu, Mesleki Kaygı ve Umutsuzluk Düzeyi Arasındaki İlişki

Değişkenler	Tutum	Mesleki kaygı	Umutsuzluk düzeyi
Mesleki kaygı (n=397)	**-0,552***	-	
Umutsuzluk düzeyi (n=397)	**-0,447***	**0,433***	-
Puanlar, ortalama±SD (n=397)	85,65±11,70	58,07±12,13	6,65±5,01

*p<0,001

Tablo 3. Fizyoterapi Öğrencilerinin Mesleğine ve Eğitimine Yönelik Tutumunun Mesleki Kaygıya Etkisi

Bağımsız değişken	Standardize edilmemiş katsayılar		Standardize edilmiş katsayılar	t	p§	%95 Güven Aralığı
	B	SE	β			
(Sabit)	107,10	3,76		28,46	**<0,001***	99,70 -114,50
Tutum	-0,57	0,04	-0,55	-13,15	**<0,001***	(-0,66)-(-0,489)

*p < 0,001. §Basit doğrusal regresyon analizi. B:Standardize edilmemiş beta katsayısı, β:Standardize edilmiş beta katsayısı.

Modelin (Analizin) Özeti: F=172,85, p<0,001, R:0,552, R^2=0,304, SEE=10,13, Durbin-Watson=1,95.

öğrencilerin yaş ortalaması 21,36±2,57'di. Çalışmaya en fazla üçüncü sınıf (%32,20) ve normal öğretim (%58,40) öğrencileri katılım gösterdi. Öğrencilerin %59,4'ü (n=236) eğitimine ve mesleğine karşı olumlu tutum içindeydi. Mesleki kaygı düzeyi, öğrencilerin %10,8'inde (n=43) hafif, %68,0'inde (n=270) orta ve %20,9'unda (n=83) yüksekti. Öğrencilerin %35,3'ü (n=140) umutlu, %31,7'si (n=126) hafif umutsuz, %23,4'ü (n=93) orta seviyede umutsuz ve %9,6'sı (n=38) ileri derecede umutsuzdu. Çalışmada yer alan katılımcıların tanımlayıcı özellikleri Tablo 1'de sunuldu.

Fizyoterapi öğrencilerinin mesleğine ve eğitimine yönelik tutumu, mesleki kaygı ve umutsuzluk düzeyleri puanları ve aralarındaki ilişki Tablo 2'de verildi. Fizyoterapi öğrencilerinin mesleki kaygısı orta düzeydeydi (58,07) ve hafif düzeyde umutsuzlukları (6,65) vardı. Fizyoterapi öğrencilerinin mesleğine ve eğitimine yönelik tutumu ile mesleki kaygı (r=-0,552) ve umutsuzluk düzeyi (r=-0,447) arasında negatif yönlü ve orta düzeyde bir ilişki vardı (p<0,001). Mesleki kaygı ve umutsuzluk düzeyi arasında pozitif yönlü ve orta düzey bir ilişki tespit edildi (r=0,433, p<0,001). Fizyoterapi öğrencilerinin mesleğine ve eğitimine yönelik tutumu, mesleki kaygı ve umutsuzluk düzeyi arasındaki ilişki Tablo 2'de sunuldu.

Fizyoterapi öğrencilerinin mesleğine ve eğitimine yönelik tutumunun mesleki kaygıya etkisi Tablo 3'te sunuldu. Öğrencilerin mesleğine ve eğitimine yönelik tutumunun mesleki kaygıyı istatistiksel olarak anlamlı bir şekilde etkilediği bulundu (F=172,85, p<0,001).

Öğrencilerin mesleğine ve eğitimine yönelik tutumu, mesleki kaygıdaki varyansın %30'unu açıklamaktadır (R^2=0,304). Eğitime ve mesleğe yönelik tutumdaki bir puanlık artış mesleki kaygıda 0,57 birimlik azalmaya neden olmaktadır.

Tablo 4. Fizyoterapi Öğrencilerinin Mesleğine ve Eğitimine Yönelik Tutumunun Umutsuzluk Düzeyine Etkisi

Bağımsız değişken	Standardize edilmemiş katsayılar		Standardize edilmiş katsayılar	t	p§	%95 Güven Aralığı
	B	SE	β			
(Sabit)	23,07	1,67		13,84	**<0,001***	19,79-26,35
Tutum	-0,19	0,02	-0,45	-9,94	**<0,001***	(-0,23)-(-0,15)

*p < 0,001. §Basit doğrusal regresyon analizi. B:Standardize edilmemiş beta katsayısı, β:Standardize edilmiş beta katsayısı.

Modelin (Analizin) Özeti: F=98,75, p<0,001, R=0,447, R^2=0,200, SEE=4,49, Durbin-Watson=2,18.

Fizyoterapi öğrencilerinin mesleğine ve eğitimine yönelik tutumunun umutsuzluk düzeyine etkisi Tablo 4'te verildi. Umutsuzluk düzeyine, öğrencilerin mesleğine ve eğitimine yönelik tutumunun anlamlı düzeyde etkisi olduğu tespit edildi ($F=98,75$, $p<0,001$).

Öğrencilerin mesleğine ve eğitimine yönelik tutumu, umutsuzluk düzeyindeki varyansın %20'sini açıklamaktadır ($R^2=0,200$). Mesleğine ve eğitimine yönelik tutumdaki bir puanlık artış umutsuzluk düzeyinde 0,19 birimlik azalmaya neden olmaktadır.

TARTIŞMA

Bu çalışmada, fizyoterapi öğrencilerinin mesleğine ve eğitimine yönelik tutumlarının mesleki kaygı ve umutsuzluk düzeylerine etkisi değerlendirildi. Çalışmada öğrencilerin FÖMEYTA anketi puan ortalamaları dikkate alındığında mesleğine ve eğitimine yönelik olumlu bir tutum içinde oldukları bulundu. Öğrencilerin mesleki kaygı düzeylerinin orta düzeyde olduğu ve hafif umutsuz oldukları sonucuna ulaşıldı. Mesleğe ve eğitime yönelik tutum puanları ile mesleki kaygı ve umutsuzluk düzeyi arasında negatif bir korelasyon vardı. Ayrıca, fizyoterapi öğrencilerinin mesleğine ve eğitimine yönelik tutum puanlarının arttığında, mesleki kaygılarının ve umutsuzluk düzeylerinin azalacağı tespit edildi.

Özdinç ve diğ., çalışmalarında, fizyoterapi öğrencilerinde mesleki kaygıya neden olabilecek olası durumları ben merkezli ve görev merkezli kaygılar şeklinde ikiye ayırarak incelemiştir. Görev merkezli kaygılar, teorik bilginin ve pratik becerilerin klinik ortamda uygulanabilmesi gibi mesleki yeterliliğe yönelik kaygılarken; iş bulma, çalışma ortamı ve koşulları gibi kaygılar ben merkezli kaygıları oluşturmaktadır (7). Ben merkezli kaygılar, fizyoterapi öğrencileri için istihdamın artırılması ve mevcut çalışma koşullarının iyileştirilmesiyle azaltılabilir. Ancak görev merkezli kaygıların azaltılması, lisans eğitiminde öğrencilere gerekli teorik bilgilerin kazandırılması, pratik derslerde fizyoterapiye yönelik klinik becerilerin geliştirilmesi ve klinik uygulamalarda öğretim elemanları ve süpervizör fizyoterapistlerin klinik deneyimlerini öğrencilere aktarmasına bağlıdır (7). Çalışmamızda mesleğe ve eğitime yönelik tutumun geliştirilmesinin mesleki kaygıyı azaltacağı bulunmuştur. Mesleğe ve eğitime yönelik tutumun, lisans eğitimi aracılığıyla, mesleki kaygıyı (özellikle görev merkezli bileşenini) etkilediğini düşünüyoruz. Literatürde, bu düşüncemizi destekleyebilecek bazı çalışmalar mevcuttur. Tedla, fizyoterapi öğrencilerinin eğitimlerine ve mesleklerine yönelik tutumlarının, öğrencilerin lisans eğitimlerinin nasıl olduğunu, öğrendiklerinden memnun olup olmadıklarını, meslek seçimlerinden memnun olup olmadıklarını veya mesleğe bağlılıkları gibi konuları anlamak için önemli olduğunu vurgulamıştır. Aynı çalışmada, öğretim elemanının lisans eğitimini öğrencinin ihtiyaçlarına göre şekillendirmesi ve onları mesleki gelişimlerinden sorumlu tutmasının mesleğe yönelik olumlu bir tutum geliştirmeleri için olanak sağladığını belirtmiştir (3). Başka bir çalışmada ise, lisans eğitiminin öğrencilerin mesleğe ilgilerinin artmasında, mesleki bağlılığın kazandırılmasındaki etkin rolünün mesleki tutumun olumlu yönde gelişmesine katkı sağlayacağı, öğrencinin fizyoterapi alanında edindiği teorik ve pratik bilgilerle öz yeterliliğinin gelişeceği klinikte hastalara ilişkin problemlerin çözümünde etkin rol oynayacağı vurgulanmaktadır (19). Strohschein ve diğ., yeni mezun fizyoterapistlerin, kendi mesleki uygulamalarının yanı sıra mesleklerini inşa etmelerini sağlayacak tutum ve becerilerle güçlendirilmiş bir eğitim altyapısına ihtiyaç duyduklarını belirtmişlerdir. Bu tutum ve becerilerin, yaşam boyu öğrenme arzusu, fizyoterapi uygulamaları hakkında var olan temel teorileri ve algıları belirleme ve eleştirel bir şekilde değerlendirme becerisini içerdiğine inanılmaktadır. Ayrıca, öğrencilerin klinik uygulama bağlamında öğrenmeye dahil oldukları klinik eğitimin, bu tür becerilerin ve tutumların öğretilip iyileştirilebileceği en iyi alan olduğu sonucuna varmıştır (20).

Çalışmamızda öğrencilerin mesleğe ve eğitime yönelik tutumlarının olumlu olmasına rağmen mesleki kaygı düzeyinin orta seviyede olması, mesleğe ve eğitime karşı tutumun mesleki kaygıyı sadece %30 oranında etkilemesine bağlanabilir. Sonuç olarak, lisans eğitiminde kazandırılacak nitelikli teorik ve klinik uygulamaya yönelik bilgi ve becerilerin ve lisans eğitimiyle temelleri atılacak olan mesleki bağlılığın, mesleğe ve eği-

time yönelik tutuma olumlu yönde katkı sağlayarak, mesleki kaygıyı azaltabileceğine inanıyoruz. Bunun dışında çalışmamızın sonuçlarını karşılaştırabileceğimiz fizyoterapi ve rehabilitasyon öğrencilerinde mesleğe ve eğitime yönelik tutumun mesleki kaygı düzeyine etkisini araştıran başka bir çalışmaya rastlanılmamıştır. Bu nedenle bu alanda yapılacak çalışmalara ihtiyaç duyulmaktadır.

Kaya Mutlu ve diğ. fizyoterapi ve rehabilitasyon öğrencilerindeki umutsuzluk düzeyini incelemiştir. Çalışmalarında, benzer şekilde fizyoterapi öğrencilerinin mesleğe yönelik hafif umutsuzluk düzeylerinin olduğunu tespit etmiş ve umutsuzluk nedenlerinin cinsiyet, aile gelir düzeyi, artan mezun sayısı, iş bulma endişesi, mesleki saygınlık, aldığı eğitimden memnun olmama gibi birçok faktörle ilişkili olduğunu açıklamıştır (10). Çalışmamızda, eğitime ve mesleğe yönelik olumlu bir tutum geliştirmenin umutsuzluk düzeyini azaltacağına dair sonuçlar elde edildi. Ayrıca olumlu tutumun toplam varyans üzerindeki etkisi %20 'ydi. Mesleğe ve eğitime yönelik olumlu tutum geliştirmenin hemşirelik ve öğretmenlik alanlarında akademik başarıyı ve mesleki profesyonellik düzeyini artırabileceği önceki çalışmalarda gösterilmiştir (21,22). Bu nedenle, mesleğe ve eğitime yönelik tutumun olumlu yönde geliştirilmesinin mesleki öz-yeterlik gelişimine katkıda bulunabileceğini ve kişinin mezuniyet sonrası fizyoterapist olarak çalışma ortamında karşılaşacağı problemleri yönetebilme becerisini geliştirebileceğini varsayıyoruz. Bu durum dolaylı olarak mesleğe ve eğitime yönelik tutumun, öğrencilerin umut düzeyindeki etkisini açıklayabilir. Mesleğe ve eğitime yönelik tutumun fizyoterapi öğrencilerinin umut düzeyine etkisini araştıran herhangi bir çalışmaya rastlanılmamıştır. İlgili konuda ileri çalışmalara ihtiyaç vardır.

Çalışmamızda öğrencilerin mesleğine ve eğitimine yönelik olumlu tutumlarının olduğu dikkate alındığında, öğrencilerdeki umutsuzluk ve mesleki kaygıya neden olabilecek faktörlerin artan mezun sayısı, iş bulma endişesi ve mesleki saygınlık düzeyindeki azalmayla ilgili olabileceğini düşünüyoruz. Türkiye Cumhuriyeti Cumhurbaşkanlığı İnsan Kaynakları Ofisi üni-veri verilerine göre fizyoterapistlerin 6 ayda iş bulma oranı yaklaşık %70'tir (23). Karagözoğlu ve diğ. çalışmalarında 2012-2016 yılları arasındaki Türkiye'de fizyoterapistlerin iş bulma süreleri ve istihdam durumlarını incelemiştir. Çalışmada mezun olan fizyoterapistlerin ilk 6 ayda iş bulma oranı %80,18 olarak belirtilmiştir (24). İki çalışmanın mevcut sonuçları da göz önünde bulundurulduğunda fizyoterapistlerin iş bulma oranlarının azaldığı açıktır.

Bu çalışmanın bazı limitasyonları bulunmaktadır. Birincisi, anketin çevrimiçi doldurulması, örneklem seçiminde bir yanlılığa neden olmuş olabilir. Çalışmanın diğer limitasyonu ise örneklemin Türkiye'deki tek bir üniversitede gerçekleştirilmiş olması ve sonuçlarının genel olarak yorumlanamayacağıdır. İleride fizyoterapi ve rehabilitasyon lisans bölümü olan birçok üniversitenin dahil edildiği bir çalışma yapılarak çalışmanın genişletilmesi daha kapsamlı sonuçlara ulaşmamıza katkı sağlayabilir. Son olarak, çalışmamızda öğrencilerin gelir düzeyi veya sosyokültürel özellikleri değerlendirilmemiştir. Tüm bu faktörlerin de öğrencilerin umutsuzluk düzeyini etkileyebileceğini düşünüyoruz. O nedenle, araştırmacıların çalışma sonuçlarını yorumlarken dikkatli olmalarını tavsiye ederiz.

Sonuç olarak bu çalışma, araştırmacıların mevcut bilgisine göre, mesleğe ve eğitime yönelik tutumun mesleki kaygı ve umutsuzluk düzeyine etkisini araştıran ilk ve tek çalışmadır. Mesleki kaygı ve umutsuzluk düzeylerinin azaltılmasında, mesleğe ve eğitime yönelik tutumun etkili bir rolü vardır. Bu nedenle öğrencilerin umutsuzluk ve kaygı düzeylerinin azaltılması için mesleğe ve eğitime yönelik tutuma odaklanılması gerektiğini düşünüyoruz. Gelecekte mesleğe ve eğitime yönelik tutumu geliştirebilecek faktörlerin araştırılması, öğrencilerin umutsuzluk ve kaygı düzeylerinin azaltılması için faydalı olabilir.

Destekleyen Kuruluş: Yok

Çıkar Çatışması: Yok

Yazar Katkıları: ETH: fikir, tasarım, denetleme, kaynaklar, materyaller, veri toplama ve işleme, analiz ve veya yorumlama, literatür taraması, makale yazımı, eleştirel inceleme; GT: tasarım, kaynaklar, materyaller, veri toplama, literatür ta-

raması, makale yazımı, eleştirel inceleme

Açıklamalar: Yok

Teşekkür: Tüm katılımcılara katkılarından dolayı teşekkür ederiz.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)178-187

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Received: *4.08.2023 (Geliş Tarihi)*
Accepted: *6.04.2024 (Kabul Tarihi)*

EFFECT OF COVID-19 ON PAIN, FALL FREQUENCY, FEAR OF FALLING, AND PHYSICAL ACTIVITY LEVEL IN OLDER PEOPLE: A CROSS-SECTIONAL STUDY

ORIGINAL ARTICLE

ABSTRACT

Purpose: People who have recovered from COVID-19 may experience a range of symptoms. These symptoms are linked to negative changes in pain, falls, fear of falling, and physical activity. The current study aimed to investigate the effect of COVID-19 on pain, fall frequency, fear of falling, and physical activity level in older people, as well as identify associated factors with these variables.

Methods: Participants were divided into two groups for this cross-sectional study: COVID-19 (n=48) and healthy control (n=66). Pain, number of falls, fear of falling, and physical activity level of the participants were assessed. Multiple linear regression analysis was also used to identify factors associated with these variables. Participants were also asked about their demographics, illnesses, post-COVID-19 symptoms, smoking habits, who they lived with, how long they had been infected with COVID-19, hospitalization due to COVID-19, and the doses of the vaccine.

Results: Pain, fatigue, and cognitive impairment were found to be significantly more prevalent in the COVID-19 group (p=0.001, p=0.021, p=0.011, respectively). When compared to the control group, the COVID-19 group showed worse results in terms of pain intensity, the number of falls, fear of falling, and physical activity level (p=0.009, p=0.030, p=0.005, p<0.001, respectively). It was found that COVID-19 infection significantly predicted pain intensity and physical activity level (β=-0.273, p=0.007; β=0.416, p=0.003, respectively).

Conclusion: Older adults who have had COVID-19 experience more pain, falls, fear of falling, and reduced physical activity compared to their peers. COVID-19 affects pain severity and physical activity in older individuals after recovery. It is important to assess long-term symptoms, falls, and physical activity in older adults who have had COVID-19 and provide necessary treatments.

Keywords: Aging, COVID-19, Falling, Pain, Physical Activity

COVID-19'UN YAŞLILARDA AĞRI, DÜŞME SIKLIĞI, DÜŞME KORKUSU VE FİZİKSEL AKTİVİTE SEVİYESİ ÜZERİNE ETKİSİ: KESİTSEL BİR ÇALIŞMA

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: COVID-19'a yakalanmış kişiler hastalık sonrası çeşitli semptomlara sahip olabilirler. Bu semptomlar ağrı, düşme, düşme korkusu ve fiziksel aktivite seviyesindeki olumsuz değişiklikler ile ilişkilidir. Bu çalışmada COVID-19'un yaşlılarda ağrı, düşme sıklığı, düşme korkusu ve fiziksel aktivite seviyesi üzerine etkisini araştırmak ve bu değişkenlerle ilişkili faktörleri belirlenmek amaçlanmıştır.

Yöntem: Katılımcılar bu kesitsel çalışma için COVID-19 (n=48) ve sağlıklı kontrol (n=66) olmak üzere iki gruba ayrıldı. Katılımcıların ağrı, düşme sayısı, düşme korkusu ve fiziksel aktivite seviyeleri değerlendirildi. Bu faktörlerle ilişkili değişkenler çoklu lineer regresyon analizi kullanılarak belirlendi. Ayrıca katılımcıların demografik bilgileri, hastalık bilgileri, COVID-19 sonrası semptomları, sigara içme durumları, kimle birlikte yaşadıkları, COVID-19 hastalığına yakalandıktan sonra geçen süre, COVID-19 nedeniyle hastaneye yatış durumları ve COVID-19 aşı dozları sorgulandı.

Sonuçlar: Ağrı, yorgunluk ve bilişsel bozuklukların COVID-19 grubunda anlamlı şekilde daha yaygın olduğu görüldü (p=0,001, p=0,021, p=0,011, sırasıyla). COVID-19 grubu kontrol grubuyla karşılaştırıldığında ağrı şiddeti, düşme sayısı, düşme korkusu ve fiziksel aktivite seviyesinde daha kötü sonuçlar gösterdi (p=0,009, p=0,030, p=0,005, p<0,001, sırasıyla). COVID-19'un ağrı şiddeti ve fiziksel aktivite seviyesini önemli ölçüde etkileyen bir faktör olduğu tespit edildi (β=-0,273, p=0,007; β=0,416, p=0,003, sırasıyla).

Tartışma: COVID-19 geçirmiş yaşlı bireylerde ağrı, düşme sıklığı, düşme korkusu ve fiziksel aktivite seviyesi kendi yaş grubundaki kişilere göre daha kötüdür. Hastalık sonrası dönemde COVID-19, yaşlılarda ağrı şiddeti ve fiziksel aktivite seviyesini etkilemektedir. COVID-19'a yakalanan yaşlı bireylerin hastalık sonrası uzun süreli semptomlar, düşme ve fiziksel aktivite açısından değerlendirilmesi ve gerektiğinde uygun tedavinin uygulanması önemlidir.

Anahtar Kelimeler: Yaşlanma, COVID-19, Düşme, Ağrı, Fiziksel Aktivite

INTRODUCTION

The outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has become a global health problem, starting in the city of Wuhan, China, during the latter part of 2019 (1). The World Health Organization has named the outbreak COVID-19 and declared it a global pandemic as of March 2020 (2).

Following an infection with COVID-19, the majority of individuals encounter symptoms in the early stages, with these symptoms and their repercussions potentially persisting for an extended period (3). There are a variety of symptoms following COVID-19, including respiratory, cardiovascular, neurological, psychological, and musculoskeletal symptoms (4).

After the COVID-19 infection, pain has become one of the most common symptoms. Pain after COVID-19 can occur in various forms, such as chest pain, headaches, abdominal pain, and muscle and joint pain (5). The primary source of pain caused by COVID-19 is the inflammatory response. The inflammatory response causes an increase in pro-inflammatory cytokines by activating the immune system (6). However, it has been demonstrated that pain can persist even after the infection has ended (7).

Another condition caused by COVID-19 symptoms is a reduction in physical activity level (8). Individuals recovering from COVID-19 may encounter respiratory problems, loss of muscle mass, nerve damage, pain, fragility, or worsening of existing medical conditions due to persistent symptoms affecting systems such as the cardiovascular, respiratory, and musculoskeletal systems. Consequently, the occurrence of falls may increase during the post-COVID-19 period, posing a significant risk to the elderly. This leads to an elevated fear of falling and a decrease in physical activity levels (9). Elderly individuals who have previously experienced falls may suffer from various adverse health outcomes, including fractures and other morbidities (10). Research has shown that these fall-related health issues have long-term effects on physical condition and functioning (11). Approximately one-third of individuals aged 65 years or older living in the community experience at least one fall per year (4). Older adults may develop a fear of falling, which is one of the most significant effects of falls. The restriction of activity resulting from the fear of falling can lead to physical deconditioning, alterations in gait and balance, loss of muscle mass and strength, as well as the emergence of frailty and impairment (12). Additionally, it has been observed that fear of falling is linked to mortality and cognitive impairment (13). Fear of falling has also been identified as a significant risk factor associated with a decrease in physical activity levels (10,14,15) and fall risk (14). Tinetti et al. discovered that fifty percent of all individuals who experienced falls and expressed fear admitted to evading activities that were previously executed (16). Another study found that fear was linked to lower attendance at social events, which serves as a critical indicator of the functioning of older individuals in the community (17). Physical condition deteriorates with advancing age and can lead to disabilities. Furthermore, it has been discovered that decreased function is linked to a higher risk of falling and a higher fear of falling (10). The decline in physical activity levels has also been exacerbated by limitations on movement to prevent symptoms like pain, dyspnea, and fatigue (18).

At the beginning of the pandemic, the primary goal was to prevent deaths, and the older population faced a higher risk of death concerning COVID-19 (19). However, it is now known that people who survive COVID-19 confront an increased risk of experiencing various symptoms over a long period after the illness (4). Also, the older population is one of the groups with the highest risk for complications following COVID-19 (20). Understanding the long-term conditions that should be taken into account in older adults requires the identification of these effects and associations with COVID-19. Furthermore, comparing the symptoms observed after COVID-19 with those observed in the healthy population of the same age group can provide a clearer understanding of the adverse effects of the disease, as the general older population may also encounter such symptoms. The purpose of this

study was to examine how COVID-19 affected the pain, falls, fear of falling, and physical activity of older participants. Additionally, the associations between these parameters were investigated.

METHODS

Study Design

This cross-sectional study was conducted with a total of 114 people from March 2023 to May 2023, with people aged 65 or older who resided in Kırklareli province, Turkey. Before assessments, all participants in the trial signed an Informed Consent Form. This study was performed in line with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Kırklareli University Scientific Research and Publication Ethics Committee (Date: 23.01.2023/ No: E-35523585-302.99-75492). This study registered on 10.04.2023 with the number NCT05808348 to the ClinicalTrials.gov.

Participants

Depending on whether or not the individuals had contracted a COVID-19 infection within a one year, they were separated into two groups: the COVID-19 group and the control group.

To be included in the study, the following criteria needed to be met:

1. The participants had to be aged 65 or older.

2. The individuals needed to demonstrate cooperation by comprehending the questions posed and providing appropriate responses.

On the other hand, the following criteria were used to exclude individuals from the study:

1. Individuals with significant hearing impairments. 2. Individuals with substantial vision impairments.

Measurements

Participants were asked about their demographic characteristics, pain, frequency of falls, fear of falling, physical activity level, information about their illnesses, post-COVID-19 symptoms, smoking habits, who they lived with, the time they had been infected with COVID-19, hospitalization due to COVID-19, and the doses of the vaccine in the last year. Face-to-face interviews with participants were used for the assessments.

The Numerical Pain Rating Scale (NPRS) was used to evaluate participants' pain, the Falling Efficacy Scale-International (FES-I) to measure fear of falling, and the Baecke Physical Activity Questionnaire (BPAQ) to assess physical activity level. All questionnaires were used with the required permissions.

Pain measurement

The NPRS was used to assess the intensity of the pain (ICC = 0.67–0.96) (21,22). The participants were instructed to rate their level of pain from zero for the least painful experience to ten for the most painful experience (23). Participants were also recorded in the survey form by asking for the duration of their pain.

Fear of falling measurement

The FES-I was used to measure the fear of falling. Using a Likert-type scale with ratings from 1 to 4, the FES-I measures people's fears of falling during a total of 16 activities in daily life (24). The person's fear of falling increases as the overall score rises. The Turkish validity and reliability study was conducted by Ulus et al. (2012) and found a cut-off score of 24 for fear of falling (ICC: 0.97-0.99) (25).

Physical activity level measurement

The BPAQ was used to evaluate physical activity levels. In 2021, the Turkish validity and reliability study of the BPAQ was conducted by Yazıcı et al. (ICC:0.98-0.99) (26). The survey consists of three sections that evaluate work, sports, and leisure activities. Questions are answered by thinking about activities over the past 12 months. The scores of the three sections are determined by collecting and subtracting specified quantifiers (work and leisure time) or by splitting (sports) the scores obtained by dividing each section by the number of questions. Higher scores indicate higher physical activity levels (26,27).

Statistical analysis

The Statistical Package for Social Sciences (SPSS) version 22.0 (New York, 2013) statistical analysis program was used to analyze the data.

Table 1. Descriptive Characteristics of the Participants

Descriptive Characteristics	Total (n=114)	COVID-19 Group (n=48)	Control Group (n=66)	p (%95 CI)
Age (year) (X±SD)	71±5	70±4	71±5	0.536 (-2.49-1.30)[a]
Sex [n (%)]				0.984[b]
Female	45 (39.5)	19 (39.6)	26 (39.4)	
Male	69 (60.5)	29 (60.4)	40 (60.6)	
Height (cm) (X±SD)	166±8	167±8	166±8	0.484 (-1.99-4.18)[a]
Weight (kg) (X±SD)	76±16	74±15	77±16	0.356 (-8.68-3.14)[a]
BMI (kg/m²) (X±SD)	27.23±4.53	26.41±4.14	27.75±4.72	0.118 (-3.02-0.34)[a]
Illnesses [n (%)]				
Diabetes	21 (18.4)	10 (20.8)	11 (16.7)	0.571[b]
Hipertension	46 (40.4)	19 (39.6)	27 (40.9)	0.887[b]
Otoimmune Disease	21 (18.4)	10 (20.8)	11 (16.7)	0.571[b]
High Cholesterol	13 (11.4)	7 (14.6)	6 (9.1)	0.362[b]
Thyroid Disease	14 (12.3)	5 (10.4)	9 (13.6)	0.605[b]
Heart Disease	16 (14.0)	9 (18.8)	7 (10.6)	0.216[b]
Chronic Kidney Disease	10 (8.8)	6 (12.5)	4 (6.1)	0.230[b]
Chronic Pulmonary Disease	11 (9.6)	3 (6.3)	8 (12.1)	0.295[b]
Cerebrovascular disease	5 (4.4)	1 (2.1)	4 (6.1)	0.306[b]
Symptoms [n (%)]				
Pain	50 (43.9)	30 (62.5)	20 (30.3)	0.001**[, b]
Fatigue	43 (37.7)	24 (50)	19 (28.8)	0.021*[, b]
Dyspnea	37 (32.5)	20 (41.7)	17 (25.8)	0.073[b]
Cough	19 (16.7)	7 (14.6)	12 (18.2)	0.611[b]
Cognitive Disorder	19 (16.7)	13 (27.1)	6 (9.1)	0.011*[, b]
Smell and Taste Disorders	11 (9.6)	4 (8.3)	7 (10.6)	0.685[b]
Smoking [n (%)]				0.321[b]
Yes	48 (42.1)	19 (39.6)	29 (43.9)	
Former User	15 (13.2)	9 (18.8)	6 (9.1)	
No	51 (44.7)	20 (41.7)	31 (47.0)	
Living With Someone [n (%)]				0.940[b]
Child	11 (9.6)	5 (10.4)	6 (9.1)	
Spouse	78 (68.4)	32 (66.7)	46 (69.7)	
Alone	25 (21.9)	11 (22.9)	14 (21.2)	
Time Elapsed Since COVID-19 Disease (Month) (X±SD)		9±2	-	-
Hospitalization Due to COVID-19 [n (%)]				-
Yes		5 (10.4)	-	
No		42 (89.6)	-	
Number of COVID-19 Vaccine Doses [n (%)]				0.210[b]
0	10 (8.8)	6 (12.5)	4 (6.1)	
1	-	-	-	
2	25 (21.9)	9 (18.8)	16 (24.2)	
3 or higher	79 (69.3)	33 (68.7)	46 (69.7)	
VAS (X±SD)	4.81±1.70	5.31±1.63	4.05±1.68	0.009 (0.33-2.19)**[, a]
Pain Duration (Month) [n (%)]				0.615[b]
<12	23 (20.2)	13 (27.1)	10 (15.2)	
>12	30 (26.3)	19 (39.6)	11 (16.7)	
Number of Falls in One Year [n (%)]				0.030*[, b]
0	77 (67.5)	26 (54.2)	51 (77.3)	
1	24 (21.1)	15 (31.3)	9 (13.6)	
2 or higher	13 (11.4)	7 (14.6)	6 (9.1)	
FES-I (X±SD)	29.52±11.45	33.24±12.61	26.92±9.84	0.005 (2.00-10.71)**[, a]
BPAQ (X±SD)	5.50±1.54	4.88±1.34	5.95±1.53	<0.001 (-1.61-(-0.52))***[, a]

*p<0.05

**p<0.01

***p<0.001

n: number of participants, CI: confidence interval, X: mean, SD: standard deviation, %: per cent, BMI: body mass index, VAS: Visual Analogue Scale (range 0-10), FES-I: Falls Efficacy Scale-International (range 16-64), BPAQ: Baecke Physical Activity Questionnaire (range 3-15)

[a] Independent-samples t test

[b] x^2 test

Table 2. Multiple Linear Regression for Factors Associated with Pain Intensity

Predictor	B	SE	β	t	p	95% CI	
						LL	UL
COVID-19	-0.969	0.345	-0.273	-2.810	0.007**	-1.66	-0.27
Age	-0.016	0.034	-0.046	-0.472	0.639	-0.08	0.52
Sex	-0.397	0.306	-0.111	-1.296	0.202	-1.01	0.22
Living Alone	0.063	0.262	0.030	0.239	0.812	-0.46	0.59
Number of Falls	0.984	0.238	0.539	4.135	<0.001***	0.50	1.46
Fear of Falling	0.036	0.025	0.233	1.400	0.168	-0.01	0.08
Physical Activity Level	0.308	0.115	0.271	2.677	0.010*	0.07	0.54

*p<0.05

**p<0.01

***p<0.001

R=.824, R^2=.678

F(7, 45)=13.549, p<0.000

The normal distribution of the variables was assessed using kurtosis-skewness values. Percentage (%) for categorical variables and mean and standard deviation (X±SS) for numerical variables were used. Participants were divided into those who had COVID-19 disease and those who did not demonstrate potential effects of the condition. The Student t-test was used for numerical data, and the chi-square test was used for categorical data in the between-group comparisons. The results of the association between the variables were analyzed using the multiple linear regression analysis method. In regression analysis, the R^2 value was used to define the regression model. The R^2 value shows how much the model explains the variance in the dependent variable. In case of missing data, participants were excluded from the study. The statistical significance level was accepted as p<0.05.

RESULTS

Both the COVID-19 group (n=48) and the healthy control group (n=66) had a higher percentage of male participants than female participants. Hypertension was the most prevalent disease in both groups. Pain, fatigue, and cognitive impairment symptoms were found to be significantly higher in the COVID-19 group (p=0.001, p=0.021, and p=0.011, respectively). In the COVID-19 group, five (10.4%) people had previously been hospitalized due to the COVID-19 disease. Pain severity, number of falls, fear of falling, and physical activity level differed significantly, and the COVID-19 group showed worse results in all of these parameters than the control group (p=0.009, p=0.030, p=0.005, p<0.001, respectively). Notably, almost half of the COVID-19 group experienced at least one fall within a single year (45.8%) whereas this percentage was considerably lower among the older group who had not encountered COVID-19 (22.7%) (Table 1).

A statistically significant regression equation was discovered for the pain intensity (F(7, 45)=13.549, p<0.000), with an R^2 of 0.678. It was found that having caught COVID-19, the number of falls, and physical activity level significantly predicted pain intensity (β=-0.273, p=0.007; β=0.539, p<0.001; β=0.271, p=0.010, respectively) (Table 2).

The overall regression for the number of falls demonstrated statistical significance (F(7, 45)=14.663, p<0.000), R^2=0.695. Pain intensity and fear of falling were significant predictors of the number of falls (β=0.511, p<0.001; β=0.429, p=0.007, respectively) (Table 3).

The overall regression for the fear of falling was statistically significant (F(7, 45)=19.514, p<0.000), R^2=0.752. Living alone and the number of falls added statistically significantly to the prediction (β=0.407, p<0.000; β=0.349, p=0.007, respectively) (Table 4).

Table 3. Multiple Linear Regression for Factors Associated with Number of Falls

Predictor	B	SE	β	t	p	95% CI	
						LL	UL
COVID-19	0.292	0.195	0.151	1.501	0.140	-0.10	0.68
Age	-0.002	0.018	-0.012	-0.129	0.898	-0.03	0.03
Sex	-0.022	0.166	-0.011	-0.132	0.895	-0.35	0.31
Living Alone	-0.001	0.140	0.000	-0.004	0.099	-0.28	0.28
Pain Intensity	0.280	0.068	0.511	4.135	<0.001***	0.14	0.41
Fear of Falling	0.036	0.013	0.429	2.814	0.007**	0.01	0.06
Physical Activity Level	-0.090	0.065	-0.144	-1.390	0.171	-0.22	0.04

*p<0.05

**p<0.01

R=.834, R^2=.695

F(7, 45)=14.663, p<0.000

Table 4. Multiple Linear Regression for Factors Associated with Fear of Falling

Predictor	B	SE	β	t	p	95% CI	
						LL	UL
COVID-19	-2.347	2.119	-0.101	-1.107	0.274	-6.61	1.92
Age	0.296	0.190	0.130	1.562	0.125	-0.08	0.67
Sex	1.367	1.780	0.058	0.768	0.446	-2.21	4.95
Living Alone	5.611	1.253	0.407	4.479	<0.001***	3.08	8.13
Pain Intensity	1.173	0.838	0.179	1.400	0.168	-0.51	2.86
Number of Falling	4.167	1.481	0.349	2.814	0.007**	1.18	7.14
Physical Activity Level	-0.786	0.702	-0.106	-1.119	0.269	-2.19	0.62

**p<0.01

***p<0.001

R=.867. R^2=.752

F(7, 45)=19.514, p<0.000

A significant regression equation for the physical activity level was found (F(7,45)=4.242, p=0.001), with an R^2 of 0.398. The contraction of COVID-19, age, and pain intensity had an impact on physical activity level (β=0.416, p=0.003; β=-0.302, p=0.020; β=0.507, p=0.010, respectively) (Table 5).

DISCUSSION

This study examined how COVID-19 affected older persons' pain intensity, number of falls, fear of falling, and physical activity level. It also investigated how pain, number of falls, fear of falling, and physical activity level affect each other. The study revealed that the COVID-19 group experienced higher pain, fatigue, and cognitive impairment symptoms, as well as more pain intensity. Moreover, this group experienced more falls and had a greater fear of falling while engaging in less physical activity compared to the control group over the previous year.

The number of falls was identified as the most important variable in the explanation of the pain intensity. Contracting COVID-19 was identified as a prominent factor contributing to pain. Another factor that was shown to explain pain intensity was physical activity level. Pain intensity and fear of falling were the variables that specifically contributed to the explanation of the number of falls. The number of falls and living alone were significant explanatory variables for fear of falling. Lastly, contracting COVID-19, age, and pain

Table 5. Multiple Linear Regression for Factors Associated with Physical Activity Level

Predictor	B	SE	β	t	p	95% CI	
						LL	UL
COVID-19	1.295	0.406	0.416	3.186	0.003**	0.47	2.11
Age	-0.092	0.038	-0.302	-2.412	0.020*	-0.17	-0.01
Sex	0.098	0.375	0.031	-0.262	0.794	-0.65	0.85
Living Alone	0.099	0.315	0.054	0.316	0.754	-0.53	0.73
Pain Intensity	0.446	0.167	0.507	2.677	0.010*	0.11	0.78
Number of Falling	-0.458	0.329	-0.285	-1.390	0.171	-1.12	0.20
Fear of Falling	-0.034	0.031	-0.257	-1.119	0.269	-0.09	0.02

*p<0.05

**p<0.01

R=.631. R^2=.398

F(7, 45)=4.242, p=0.001

intensity were identified as unique variables that explained the level of physical activity.

Symptoms after COVID-19

Several symptoms may persist for a long time after COVID-19 infection, particularly among older people (28). However, the older population that has not had COVID-19 may also experience problems such as pain, fatigue, and dyspnea due to various diseases (29). According to a study, the three most common symptoms of COVID-19 infection in adults over 65 are pain, fatigue, and dyspnea (29). Similarly, these symptoms were the most common in our study. In the COVID-19 group, pain was present in more than half of the patients and fatigue in half of the patients. Although the COVID-19 group had significantly more frequent pain, fatigue, and cognitive impairment compared to the control group, there were no significant differences between the groups in terms of dyspnea. It was believed that decreased physical activity to ease the discomfort associated with dyspnea may have contributed to this condition. Even though people weren't reported to have dyspnea, they may have managed it by engaging in less physical activity. In comparison to the pain experienced during the infection, the level of pain tends to be lower during the long-term post-COVID-19 period (18,30). However, long-term and chronic pain can lead to serious issues for some people. In a study conducted by Korkut and Ülker with people who had experienced COVID-19, 37.1% of participants found that the pain continued, and the severity of the pain after COVID-19 was 3.81±3.00 (30). In the study of Bilgin et al., the participants had an average of 4.04±2.33 pain intensity (18). In our study, the pain intensity of COVID-19 subjects was 5.31±1.63. The mean age of the participants in the other studies was significantly lower than that of our study. Due to illnesses and other problems that worsen with age, the severity of pain may be higher in the older population. When considered in this context, it was thought that the reason for the heightened pain severity in our study compared to other studies was that only people aged 65 or older were included in our research. When pain intensity was compared between the groups, the COVID-19 group exhibited considerably higher pain intensity than the control group. The findings indicate that COVID-19 infection may have increased the prevalence of symptoms of pain, fatigue, and cognitive impairment over a long period after infection compared to the same age group.

Pain and fear of falling may lead to an increase in the number of falls after COVID-19 infection, particularly in the older population (10,14). Simsek et al. found that 35.4% of participants aged 80 years of age or older experienced a fall within the previous year (31). Upon examining the occurrence of falls, it was discovered that 22.7% of older adults in the control group had experienced at least one fall in the previous 12

months in our study. This ratio is similar when compared to the fall rate in healthy older people in the study conducted by Simsek et al. However, this rate has significantly increased to 45.9% for individuals aged 65 or over who have experienced COVID-19. As a result, it was thought that COVID-19 may increase the number of falls depending on the effect of pain and fear of falling on people aged 65 or over. Considering that falls are increasing and appear to be a more dangerous condition, particularly in advanced age, more attention should be paid to falls in elderly people who have been infected with COVID-19.

Regardless of the COVID-19 infection, fear of falling is a common condition among the older population. Fear of falling can increase the likelihood of falling, reduce a person's level of physical activity, and cause other serious health issues (10). Numerous studies have demonstrated that long-term symptoms of COVID-19 infection can also exacerbate the fear of falling (9,14). In our study, the mean FOF-I score was 26.91±9.80 in persons aged 65 or older who were not afflicted by COVID-19 infection whereas it was 33.27±12.65 among older adults who had contracted COVID-19. Given that the cut-off value for fear of falling in the Turkish FOF-I survey is 24, it would seem that both groups experience fear of falling (25). However, when the FOF-I scores were examined, it was determined that the COVID-19 group had a significantly higher fear of falling than the control group. As demonstrated by prior research, the persistence of symptoms following COVID-19 can contribute to a rise in falls by developing a fear of falling.

The physical condition frequently gets worse with age. The deterioration in function can lead to fear of falling and fall risk, but symptoms and increased pain after COVID-19 infection, frequency of falls, and fear of falling can also contribute to a further decrease in physical activity levels (10,14). In a study involving patients with severe COVID-19 infection, physical abilities like walking speed, balance, and endurance were significantly affected, and physical impairments persisted in a significant number of participants even after treatment (32). Based on the results of the physical activity level evaluated by the BPAQ in our study, the COVID-19 group had a mean score of 4.88±1.34, while the control group had a mean score of 5.95±1.53. The COVID-19 group had significantly lower levels of physical activity. It was believed that the differences in physical activity levels between the two groups could be attributed to a cumulative effect of the issues caused by COVID-19, particularly the worsened pain, increased number of falls, and heightened fear of falling experienced more by the COVID-19 group.

Associations among pain, number of falls, fear of falling, and physical activity level

According to the results of the multiple linear regression analysis, COVID-19 infection, number of falls, and physical activity level appeared as factors influencing pain intensity. Among these factors, the number of falls emerged as the most important parameter in explaining the intensity of pain.

A study involving community-dwelling older adults aged 80 and over revealed that age, gender, and fear of falling did not have any risk factors associated with falling (31). In another study involving older people, fear of falling was identified as a significant risk factor associated with falling (33). In a study conducted by Anezaki et al., living alone was found to be a risk factor for falling (34). Our investigation found that factors influencing the frequency of falls included pain intensity and fear of falling. According to the factor of living alone in the study by Anezaki et al., the reason our study is different is that the study conducted by Anezaki et al. was carried out during the pandemic period when factors like social isolation were more prominent. Additionally, there was no specific group of older people who had caught COVID-19 in their study, so the participants of the two studies were assumed to show different characteristics.

Tinetti et al., in their study involving community-dwelling older adults, identified age and living alone as factors that influenced fear of falling whereas gender and number of falls had no particular effect on fear of falling (10). In another study with community-dwelling older adults, while the female gender was a significant risk factor

associated with the fear of falling, it was determined that the fear of falling was not uniquely explained by age and number of falls (35). The findings of our study showed that fear of falling was not uniquely explained by COVID-19, age, gender, pain intensity, and physical activity level. However, it has been discovered that living alone and the rise in the number of falls are factors that increase fear of falling. Our study's results were similar to those of Tinetti et al. according to the living alone factor. Elderly adults who live alone may develop a fear of falling due to the belief that potential injuries resulting from falls will make it difficult for them to take care of themselves and carry out their everyday tasks. However, regarding the frequency of falls, our research differed from previous studies. This discrepancy was attributed to the inclusion of older individuals who had contracted COVID-19 in our study whereas prior research only encompassed community-dwelling older adults.

In the study conducted by Atıcı et al., the fear of falling was found to be a factor affecting the physical activity level (15). In our study, it was discovered that not having caught COVID-19 at, younger age, and heightened pain intensity resulted in a higher physical activity level. In this context, it was concluded that the contraction of a COVID-19 infection constituted a variable that reduced the level of physical activity in older persons. Consequently, assessing the amount of physical activity in older people infected with COVID-19 is crucial.

This study had some limitations. Firstly, the data was collected backward based on the statements of the participants. This can lead to recall bias and compromise the accuracy of some data. Also, the fact that study data was collected from only one region may limit the generalizability of study findings.

The results of this study showed that older people who had experienced COVID-19 had more pain, fatigue, and cognitive disorder symptoms; the intensity of pain, the number of falls, and the fear of falling were higher, and physical activity level was lower than that of those who did not have COVID-19. The pain intensity was significantly influenced by COVID-19, the number of falls, and physical activity level. Increased pain intensity and fear of falling were identified as two factors influencing the increase in the number of falls. The increased fear of falling was significantly associated with living alone and increased falls. It has been determined that having caught COVID-19, age, and pain intensity are key factors explaining physical activity level. Although COVID-19 did not specifically appear to be a factor influencing the number of falls and fear of falling, it was found to be a significant factor in increasing pain intensity. Considering that pain intensity affects the number of falls, having caught COVID-19 may indirectly contribute to an increase in the number of falls and fear of falling. It is therefore important that older people who have had COVID-19 are examined for the long-term symptoms, number of falls, fear of falling, and physical activity level, and that appropriate treatments are administered as needed.

Sources of Support: The authors did not receive support from any organization for the submitted work.

Conflict of Interest: No conflict of interest was declared by the authors.

Author Contributions: OG: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization; SB: Conceptualization, Methodology, Formal analysis, Writing - Review & Editing, Visualization, Supervision

Explanations: None.

Acknowledgement: None.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)188-197

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Received: *27.10.2022 (Geliş Tarihi)*
Accepted: *10.03.2024 (Kabul Tarihi)*

THE EFFECTS OF TELEREHABILITATION IN RHEUMATIC DISEASES DURING COVID-19 PANDEMIC

ORIGINAL ARTICLE

ABSTRACT

Purpose: This study was designed to investigate the effects of telerehabilitation on fatigue, depression, anxiety, disease activity, sleep quality and quality of life in patients with rheumatic diseases.

Methods: This study included 28 patients with rheumatic diseases. Patients were divided into two groups as intervention group (IG) (n=16) and control group (CG) (n=12). Both groups kept on their regular medical care and an IG group additionally had exercise program. An exercise program including strengthening, stretching, breathing, posture and relaxation exercises was practiced to the IG via video-conference method while no additional therapy was applied to the CG. Assessments were performed using SurveyMonkey to avoid face to face connection. Anxiety and depression were assessed with Hospital Anxiety and Depression Scale (HADS), fatigue was assessed with Fatigue Severity Scale (FSS), sleep quality was assessed with Pittsburg Sleep Quality Index (PSQI) and quality of life was assessed with Health Assessment Questionnaire (HAQ). Additionally, disease activity was evaluated with disease-specific measurements.

Results: Significant differences were found in anxiety (p=0.009), fatigue (p=0.003) and sleep quality (p=0.011) in group-by-time assessments in IG while no significant group-by-time difference were observed in any assessments in CG (p>0.05). No significant differences was observed in delta measurements of fatigue, quality of life, depression, anxiety and sleep quality within groups although patients in IG had better outcomes for all parameters compared to CG (p>0.05).

Conclusion: Telerehabilitation was found to be a safe and effective method for patients with rheumatic diseases.

Keywords: COVID-19, Depression, Fatigue, Rheumatic Diseases, Telerehabilitation

COVID-19 PANDEMİ SÜRECİNDE ROMATİZMAL HASTALIĞI OLAN BİREYLERDE TELEREHABİLİTASYONUN ETKİLERİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışma romatizmal hastalığı olan bireylerde telerehabilitasyonun yorgunluk, depresyon, anksiyete, hastalık aktivitesi, uyku kalitesi ve yaşam kalitesi üzerine etkilerini incelemek için tasarlandı.

Yöntem: Çalışmaya romatizmal hastalığı bulunan 28 hasta katıldı. Hastalar çalışma grubu (n=16) ve kontrol grubu (n=12) olmak üzere iki gruba ayrıldı. Çalışma grubuna video-konferans yöntemiyle germe, kuvvetlendirme, solunum, postür ve gevşeme egzersizlerini içeren bir egzersiz programı uygulanırken kontrol grubuna bir uygulama yapılmadı. Değerlendirmeler yüz yüze iletişimi engellemek için SurveyMonkey kullanılarak yapıldı. Anksiyete ve depresyon Hastane Anksiyete ve Depresyon Ölçeği, yorgunluk Yorgunluk Şiddet ölçeği, uyku kalitesi Pittsburg Uyku Kalitesi İndeksi ve yaşam kalitesi Sağlık Değerlendirme Anketi ile değerlendirildi. Hastalık aktivitesi ise hastalığa spesifik ölçümler kullanılarak değerlendirildi.

Sonuçlar: Çalışma grubunda tedavi sonrasında anksiyete (p=0.009), yorgunluk (p=0.003) ve uyku kalitesinde (p=0.011) anlamlı fark elde edilmişken, kontrol grubunda değerlendirilen parametrelerde anlamlı fark gözlenmemiştir (p>0.05). Bununla birlikte, çalışma grubunun değerleri daha iyi olmasına rağmen, yorgunluk, yaşam kalitesi, depresyon, anksiyete ve uyku kalitesi değerlendirmelerindeki değişimlerde gruplar arası anlamlı fark bulunamamıştır (p>0,05).

Tartışma: Romatolojik hastalıklarda telerehabilitasyonun güvenilir ve etkili bir yöntem olduğu görüldü.

Anahtar kelimeler: COVID-19, Depresyon, Romatizmal Hastalıklar, Telerehabilitasyon, Yorgunluk

INTRODUCTION

Telerehabilitation (TR) aims to decrease barriers such as distance, time and cost by using technology to patients and clinicians. It provides to obtain rehabilitation for patients who cannot go to a medical center due to physical, environmental or economic inadequacies (1,2). It is also applied as a complementary method to the traditional treatment. Studies showed that most patients do not continue home exercises after treatment at medical centers (3). In addition, there is a need to update the treatment program with the improvement of functional status of patients. Therefore, TR may be an opportunity to bridge the gap. It has also become popular recently due to the coronavirus disease 2019 (COVID-19) pandemic, which is risky to go to a rehabilitation center and be together with other people (4).

TR has become more popular during the pandemic worldwide. It was found to be a safe, viable, effective and satisfying approach in some chronic diseases like obesity, stroke, osteoarthritis and diabetes mellitus (5, 6). In addition, physiotherapists explained that TR had made patients more self-disciplined in practicing exercises at home and patients' satisfaction was high according to a recent study investigating patients' attitudes and physical therapists' experiences in TR (7). However, there are limited studies investigating the effects of TR in rheumatic diseases. Hand dysfunction were found to be satisfied with TR (8). Ji et al. (9) investigated smartphone management system applications and found the app as providing important data for clinicians, cost-effective and self-management in patients with AS. Therefore, we investigated the effects of TR on disease-related symptoms in rheumatic patients. No adverse events were encountered in patients during exercise sessions.

COVID-19 is a contagious respiratory disease that is caused Severe Acute Respiratory Syndrome causing Coronavirus-2 (SARS-CoV-2) (10). World Health Organization (WHO) was declared COVID-19 as a pandemic in March 2020 (11). Curfew except necessity was applied in some countries and time of curfew varied by country. Social isolation and curfew triggered physical inactivity and an increased sitting time (12). It is important to be active and maintain an exercise routine to preserve mental and physical health. WHO periodically repeats its calls on this issue (13,14).

One hundred and fifty minutes of moderate-intensity exercise or seventy five minutes of intensity exercise are recommended to be continued physical and mental health in general population by the American College of Sports Medicine and WHO (15). Physical inactivity is found to be the fourth reason of mortality. Moreover, physical inactivity and sedentary behavior cause muscle atrophy, muscle weakness, decreased physical capacity, chronic fatigue, obesity, decreased insulin resistance, dyslipidemia and increased the revelation of negative emotions (16,17). 38-72% of patients with rheumatic diseases are known to have physical inactivity, which is higher than general population, according to studies before the COVID-19 pandemic (16).

Patients with rheumatic diseases are at higher risk of infections because of disease activity and immunosuppression (17). In addition, old age and having concomitant chronic disease are among risk factors for coronavirus. Therefore, national health services recommend patients to practice self-isolation and self-quarantine. However, social isolation was concluded with more increased physical inactivity and sedentary lifestyle (18). Physical inactivity and disuse are proven to cause joint destruction, decreased aerobic capacity and muscle atrophy in patients with rheumatic diseases. Increased physical inactivity and sedentary lifestyle are anticipated to lead to worsened disease activity, poor quality of life, decreased functionality and aerobic capacity, poor cardiovascular risk profile and increased mental distress in these patients (16,18). Additionally, exercise has many benefits on musculoskeletal, cardiovascular and immune system and mental health in rheumatic diseases (19). Home-based exercises or TR are more suitable in the context of the pandemic to prevent face-to-face connection. However, supervised exercise program is superior to home-based exercise owing to regu-

larity (20).

The importance and requirement for TR were observed better during the COVID-19 pandemic (21). There are limited studies investigating the effects of TR in rheumatic diseases. Pani et al (8) concluded patients with hand dysfunction due to rheumatic diseases were satisfied with home TR. Ji et al (9) investigated disease management and cost-effectiveness of smartphone management system applications in patients with Ankylosing Spondylitis (AS). Researchers found the app as providing important data for clinicians, cost-effective and self-management for AS patients. Srikesavan et al (22) found uncertainty in pain, function, physical activity and quality of life in patients with RA due to the very low quality of evidence mostly from small single studies. Therefore, aim of this study was to investigate the effects of TR on fatigue, depression, anxiety, sleep quality, disease activity and quality of life in patients with rheumatic diseases.

METHOD

Subjects

This prospective and pretest and posttest design study was carried out in accordance with Declaration of Helsinki and approved from the relevant ethics committee (Fırat University Clinical Research Ethics Committee, 05.11.2020, 2020/15-16). An informed consent form was sent patients by e-mail and asked to sign and resent by e-mail.

Patients who were aged between 18-65 years, followed-up in Fırat University Rheumatology Department, having minimal smartphone or computer usage knowledge or an acquaintance with this information who can help in this regard, having a computer and active internet connection at home and volunteer to participate the study were included in the study. We excluded patients who had changes of medical treatments in the last three months, had malignancy, pregnancy, had more than one rheumatic disease, had dysfunction that limited physical activity such as immobility, had psychiatric disease, being uncooperative, severe neurological involvement.

Study design

Priory sample size calculation section of G*Power 3.1.9.2 program (Software, concept and design of the University of Kiel, Germany, free Windows software by Franz) was used to determine minimum patient number. To calculate the minimum required number of the participants, an effect size was calculated based on the results of Sari et al (25). The effect size was calculated as 1.468. In the power analysis, a one tailed test, an alpha level of 0.05, and a power of 95% was used. As a result, the minimum required sample size was determined as 22, 11 in each groups. Eighty patients with rheumatic diseases were invited to this study between December 2020 and February 2021. Thirty-six of 80 patients were eligible for inclusion in the study. The study included questionnaires as assessment. The questionnaires were administered online using SurveyMonkey to avoid face-to-face contact and prevent virus transmission. Patients were invited to the survey via a web link and QR code. Participants were asked to fill out the forms by using their smartphones, computers, or tablet devices, etc. The mean time of completing the forms was 20 minutes. Demographics (age, gender, length, weight and disease duration) anxiety, depression, fatigue, sleep quality, disease activity and quality of life were evaluated by using the survey forms. After evaluation, patients were divided into groups as intervention group (IG) and control group (CG). Patients without access to the internet were included in the control group, while patients who could adapt to TR were included in the intervention group. TR was applied to the IG via the video-conference method (Zoom™ - Zoom cloud meeting, Zoom video communication, San Jose, CA, USA). A portable computer was used for TR and meetings created via Zoom for each session. The built-in camera (720p FaceTime HD camera) was used for the video and the standard headset microphone was used for the sound. Standard broadband internet connection (download speed at least 3 Mbps) was used for the connection. Patients were requested to be ready in time to participate the meeting. The IG was performed exercise program including stretching, strengthening, posture and relaxation exercises by an

experienced physiotherapist for 3 times a week for 8 weeks. No additional therapy was performed to the CG and they were suggested to continue their usual physical activity. The study was explained to the CG; they were informed that they could not be included in the exercise group because they did not have access to the internet. During this period, they were informed that they would be called weekly and asked if there was any change in their condition. At the end of the treatment, they were told that the same exercises would be applied to them after the pandemic period if they accepted according to the results of the exercise treatment. These people were contacted with the end of the pandemic period, and treatment was started for 8 patients with their own consent at the end of the study. The assessments were repeated after 8 weeks for all participants.

Intervention

An exercise program was performed on the IG for 3 times a week for 8 weeks. The importance of exercise was told to the patients in the first session. All sessions began with warm-up and finished with cool-down exercises. Warm-up and cool-down exercises contained relaxation, stretching and flexibility exercises. The program included stretching, strengthening, breathing, posture, proprioceptive, relaxation exercises and segmental extremity movements. Hamstring muscles, lumbar extensor muscles, servical rotation and extension muscles and pectoralis major and minor were applied stretching exercises. Muscle strengthening exercises were performed to back and lumbar extensors, abdominal muscles, shoulder and hip muscles. Each exercise was performed 10 times in a session for the first 4 weeks and 15 times for the last 4 weeks. Exercises were performed progressively on the patients. Feedback about status of patients was received during the sessions. Each session was completed in about 40 minutes (26).

Outcomes

Anxiety and depression were assessed with the Turkish version of the Hospital Anxiety and Depression Scale (HADS) which was developed by Zigmond and Snaith (1983). It consists of 14 questions that which 7 of them evaluate depression and 7 of them evaluate anxiety. Each question is scored from 0 to 3 and high scores indicate severe anxiety and depression (23).

Fatigue was evaluated with the Fatigue Severity Scale (FSS)- Turkish version which consists of 9 questions. Each question is scored from 1 to 7 and high score indicates more severe fatigue (24).

Sleep quality was assessed using the Turkish version of the Pittsburg Sleep Quality Index (PSQI). It assesses sleep quality and disturbances over a month's time interval and consists of 19 self-rated items and five questions. Higher scores indicate worse sleep quality (25).

Health Assessment Questionnaire (HAQ) was used to evaluate quality of life. The questionnaire consists of 20 questions and each question is scored from 0 to 3. It was firstly developed to evaluate patients with arthritis in 1980 and was used for many chronic diseases. The questions of HAQ are about dressing and grooming, arising, eating, walking, hygiene, reach, grip, and activity. Higher scores indicate worse quality of life (26).

Disease-specific measurements were used to assess function and disease activity. Disease activity was assessed with clinical disease activity index (CDAI) for Rheumatoid Arthritis (RA), Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) (31) for Ankylosing Spondylitis (AS) (cutoff value is 40) and Systemic Lupus Erythematosus (SLE) patient's global assessment SLE. Function was evaluated with Fibromyalgia Impact Questionnaire (FIQ) (32) for Fibromyalgia Syndrome (FMS) (33) (cutoff value is 66.25) and Bath Ankylosing Spondylitis Function Index (BASFI) for AS.

Statistical Analysis

Data analysis was performed using Statistical Package for the Social Sciences (SPSS Inc. Version 21; IBM, Raleigh, NC, USA) for Windows program. The variables were investigated using histograms, probability plots and Shapiro-Wilk Test to determine if they were normally distributed. Continuous data were expressed as mean,

standard deviation (SD). The p values were deemed significant at <0.05. Paired samples t-test was used if the data were normally distributed to calculate in group differences before and after the treatment. Wilcoxon signed ranks test and Mann-Whitney U test were used to analyze in group differences. Delta values (Δ) were calculated as subtracting the first values from the last values.

RESULTS

Participants

This study was completed with 28 patients with rheumatic diseases (16 patients in IG, 12 patients in CG) (Figure 1). Two patients from IG and 6 patients from CG were excluded from the study due to lack of attendance and lack of follow-up, respectively. Number of patients with diagnosis was presented in the Figure 2.

The comparisons of baseline parameters

Baseline characteristics and baseline measurements of intervention and control groups were summarized in the Table 1. The results showed that most participants were female in both groups. No significant differences were found either in age, length, weight and disease duration (p>0.05 for all), or in baseline measurements of depression, anxiety, sleep quality, fatigue, quality of life and disease specific measurements (p>0.05 for all).

The effects of TR on psychosocial status

Significant differences were found in HADS-anxiety (p= 0.009), FSS (p= 0.003) and PSQI (p= 0.011) in group-by-time assessments in IG (p<0.05 for all) while no significant differences were found in these parameters in CG (p>0.05 for all) (Table 2). Other assessments including HADS-depression, HAQ, BASFI and FIQ showed no significant group-by-time differences in both groups (p>0.05) (Table 2). ΔValues was obtained by subtracting the values obtained after treatment from the baseline values. ΔHADS- anxiety, ΔHADS-depression, ΔFSS and ΔHAQ were more prominent in IG, but could not reach statistical significance (p>0.05 for all) (Table 2).

Improvement ratio was 81.3% in IG and 50% in

Table 1. Comparisons of Baseline Characteristics and Baseline Measurement Results of Study and Control Groups

	IG (n: 16) Mean ± SD (min-max)	CG (n: 12) Mean ± SD (min-max)	p
Age (year)	40.25±10.89 (23-54)	39.25±13.93 (20-59)	0.882
Gender-Females (n)	14 (88%)	10 (83%)	0.268
Length (m)	1.63±0.07 (1.5-1.7)	1.64±0.06 (1.54-1.74)	0.900
Weight (kg)	69.93±1.87 (42-89)	65.25±11.77 (48-82)	0.285
Disease Duration (year)	6.25±5.24 (1-20)	6.08±5.26 (1-16)	0.726
HADS (anxiety)	11.87±5.28 (4-20)	8.50±4.25 (3-16)	0.073
HADS (depression)	8.81±5.29 (0-21)	6.50±5.86 (0-18)	0.247
FSS	46.56±14.04 (18-63)	38.16±15.53 (8-57)	0.113
HAQ	0.97±1.11 (0-3,2)	0.41±0.42 (0-1.30)	0.249
PSQI	7.93±4.56 (1-15)	6.50±3.28 (2-13)	0.545
FIQ	62.67±11.67 (45.7-72.1)	46.92±15.46 (28.6-64.6)	0.837
CDAI	11.5±3.9 (2-19)	9.7±3.2 (6-16)	-
BASFI	5.13±1.00 (4.2-6.2)	5.50±1.13 (4.70-6.3)	-
BASDAI	7.70±2.25 (5.1-9)	2.50±3.53 (0-5)	-
Patient's global assessment for SLE	4.5±3.1 (1-8)	4±1.4 (3-5)	-

SD: Standard Deviation, IG: intervention group, CG: control group, cm: centimeters, kg: kilograms, m: meters, HADS: Hospital Anxiety and Depression Score, FSS: Fatigue Severity Scale, HAQ: Health Assessment Questionnaire, PSQI: Pittsburg Sleep Quality Index, FIQ: Fibromyalgia Impact Questionnaire, CDAI: clinical disease activity index BASFI: Bath Ankylosing Spondylitis Function Index, BASDAI: Bath Ankylosing Spondylitis Disease Activity Index. Mann - Whitney U test
* p < 0.05, **p < 0.005.

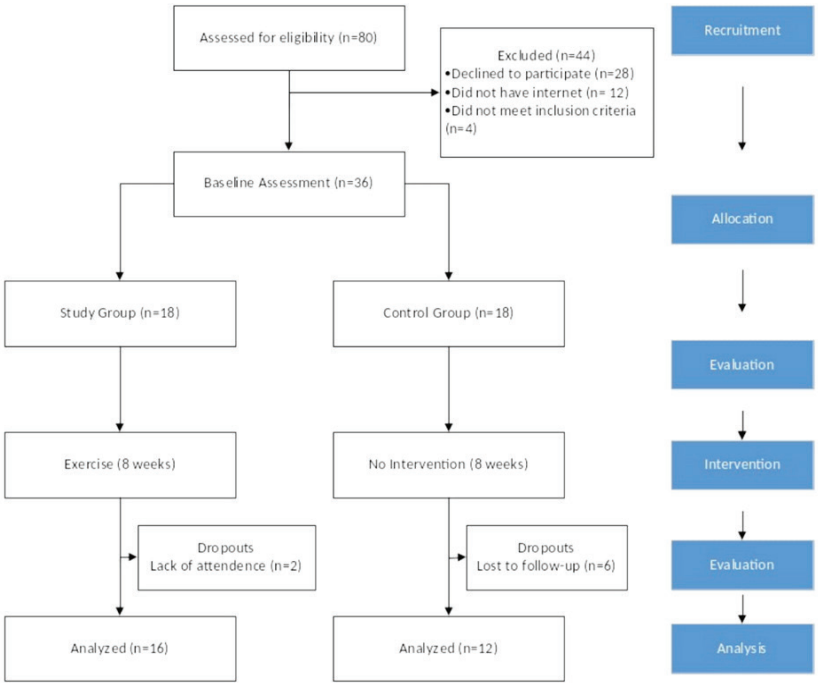


Figure 1: Study Flow Chart

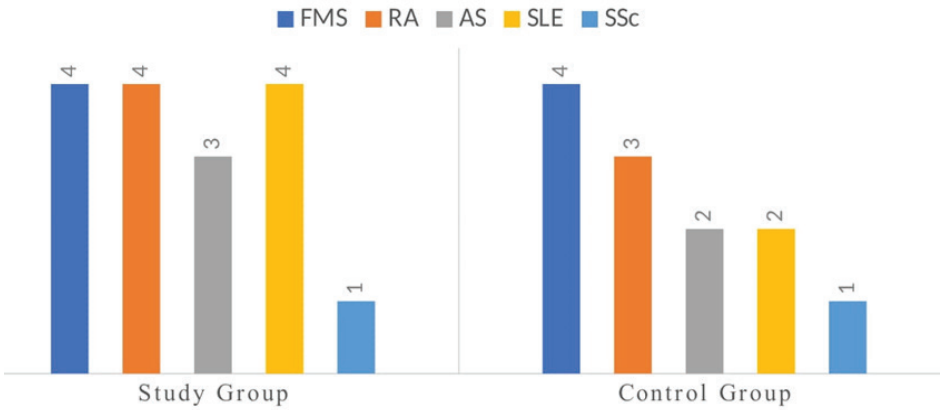
CG (OR:2.1, 95% CI: 0.94-4.7, p=0.080) for HADS-anxiety and 62.5% in IG and 50% in CG (OR: 1.3, 95% CI: 0.57-3.1, p=0.508) for HADS-depression. Similarly, improvement rates of fatigue (81.3% in IG vs. 66.7% in CG) and HAQ (50% in IG and 33.3% in CG) was higher in IG than CG, but it was not statistically significant (p>0.05 for both). Improvement rate of FIQ was 50% in IG while all patients in CG had improvements in FIQ scores (p=0.102).

Table 2: Differences Before and After the Treatment Within Groups

	IG (n=16) Mean ± SD (min-max)				CG (n=12) Mean ± SD (min-max)				P** for ΔValues
	Baseline	**After Treatment**	**P***	ΔValues	**Baseline**	**After Treatment**	**P***	ΔValues	
HADS (anxiety)	11.87±5.28 (4-20)	9.06±6.02 (2-19)	**0.009**	-2.81±4.33 (-14-7)	8.50±4.25 (3-16)	7.83±3.37 (3-14)	0.656	-0.66±4.97 (-10-6)	0.223
HADS (depression)	8.81±5.29 (0-21)	7.56±6.22 (1-21)	0.349	-1.25±6.800 (-19-12)	6.50±5.86 (0-18)	6.16±3.43 (1-12)	0.682	-0.33±4.00 (-9-8)	0.423
FSS	46.56±14.04 (18-63)	43.12±15.36 (13-63)	**0.003**	-3.43±3.42 (-11-4)	38.16±15.53 (8-57)	38.58±12.92 (5-50)	0.479	0.41±11.34 (-13-26)	0.725
HAQ	0.97±1.11 (0-3,2)	0.64±0.79 (0-2,9)	0.146	-0.32±0.78 (-2-0,7)	0.41±0.42 (0-1,30)	0.50±0.41 (0-1,25)	0.878	0.83±0.47 (-0.50-1.20)	0.272
PSQI	7.93±4.56 (1-15)	6.43±4.64 (1-14)	**0.011**	-1.50±2.06 (-7-2)	6.50±3.28 (2-13)	4.66±2.49 (2-10)	0.056	-1.83±3.15 (-10-2)	0.981
FIQ	62.67±11.67 (45,7-72,1)	57.37±22.11 (26-73)	-	-5.2±10.9 (-19.7-5.6	46.92±15.46 (64.7- 28.6)	34.80±6.10 (27.8-42.7)	-	-12.1±12.3 (-22 - 5.6)	-
BASFI	5.13±1.00 (4.2-6.2)	4.30±0.88 (3.30-5)	-	-0.8±0.4 (-1.2 - -0.4)	5.50±1.13 (4.70-6.3)	6.10±0.42 (5.8-6.4)	-	0.6±1.6 (-0.5-1.7)	-
BASDAI	7.70±2.25 (5.1-9)	6.57±2.87 (3.40-9)	-	-1.1±0.9 (-1.7 - 0)	2.50±3.53 (0-5)	6.20±5.84 (5.6-6.8)	-	3.7±4.4 (0.6-6.8)	-
CDAI	11.5±3.9 (2-19)	8.5±2.1 (4-12)	-	-3.0±3.9 (-7 - 2)	9.7±3.2 (6-16)	2.1±3.6 (4-11)	-	-2.7±2.5 (-5.0-0))	-
Patient's global assessment for SLE	4.5±3.1 (1-8)	3.5±3.7 (1-9)	-	-1.0±2.8 (-5 - 1)	4±1.4 (3-5)	6±0 (6-6)	-	2.0±1.4 (1-3)	-

SD: Standard Deviation, IG: intervention group, CG: control group, HADS: Hospital Anxiety and Depression Score, FSS: Fatigue Severity Scale, HAQ: Health Assessment Questionnaire, PSQI: Pittsburg Sleep Quality Index, FIQ: Fibromyalgia Impact Questionnaire, CDAI: clinical disease activity index, BASFI, Bath Ankylosing Spondylitis Function Index, BASDAI: Bath Ankylosing Spondylitis Disease Activity Index.

*Wilcoxon Signed Rank Test P values and **Mann - Whitney U test P value



Abbreviations: FMS: Fibromyalgia Syndrome, RA: Rheumatoid Arthritis, AS: Ankylosing Spondylitis, SLE: Systemic Lupus Erythematosus, SSc: Scleroderma

Figure 2: Number of Patients in Study and Control Groups

The effects of TR on disease activities

Improvements in BASDAI score was 66.7% in IG while no improvement was observed in CG. Improvement rate of CDAI was 75% in IG and 66.7% in CG. All patients were seen improvements in SLE patient's global assessment in IG while 50% of improvement rate was observed in CG. Improvements in FIQ score was 50% in IG while 75% in CG.

DISCUSSION

This study was aimed to investigate the effects of TR on fatigue, anxiety, depression, sleep quality, disease activity and quality of life in patients with rheumatic diseases during the COVID-19 pandemic period. The results of the study demonstrated significant improvements on fatigue, anxiety and sleep quality in the intervention group while no significant differences were found in the control group. Although, there was no significant difference in ΔMeasurements between-group analysis, changes for measurements in IG was greater than changes in CG. TR was found to may be an applicable, safe, and effective method in patients with rheumatic diseases according to our study.

Patients with rheumatic diseases are known to have low level of physical activity. It was reported increased smoking, weight gain, alcohol consumption and reduced physical activity in a study including 1707 patients with rheumatic musculoskeletal disorders during the COVID-19 pandemic. Patients also revealed inability to continue exercise programs (27). Supervised exercise is key and cornerstone of nonpharmacologic treatment of rheumatic diseases. There is extensive evidence in literature to emphasize that regular physical activity and exercise are effective at decreasing symptoms including fatigue, depression, sleep quality, pain and quality of life in these patients (28). Recent evidence suggests telehealth and remote data collection to avoid face-to-face connection during the pandemic (29). Additionally, patients with rheumatic diseases are at high risk to infections (17) and avoiding coronavirus is crucial for them.

Significant differences were found in fatigue, anxiety and sleep quality in IG while no significant differences were found in CG. Regular physical activity and exercise are known to modify the levels of hypothalamic-pituitary function and neurotransmitters. This modification results in improvements of pain, depression, anxiety and stress (30). Patients have biological, psychological and social features and disease-related symptoms could influence each other. Improvements in a symptom may cause improvements in other related symptoms (31). In addition, regular exercise has anti-inflammatory effects, and our results may have resulted from these effects. It is

well known that supervised exercise is one of the most effective methods on disease-related symptoms in rheumatic diseases in literature (32). However, there are few studies investigating effects of TR in rheumatic diseases. Hernando-Garijo et al was found significant improvements on pain intensity and psychological distress in FMS patients practicing TR program based on aerobic exercise while no significant improvements in control group with no additional intervention (21). Van den Berg et al (33) concluded increased physical activity level in patients with RA who performed home-based physical activity intervention with individually tailored supervision using internet technology. Srikesevan et al. reviewed effects of web-based rehabilitation interventions on quality of life, pain, self-efficacy, RA knowledge and physical activity in RA patients. Estimates of the effects for all assessments were reported to be uncertain due to low quality of evidence (22). In addition, TR was preferred due to cost effectiveness in many disorders. It can be preferred in patients with rheumatic diseases considering that cost effectiveness and improvements symptoms (41). These studies are in parallel with our study.

No significant differences were found in depression and quality of life in both groups in this study. However, improvements in depression and quality of life were seen in patients, but this difference was not statistically significant. Therefore, significant differences can be reached with larger number of patients in subgroups. In addition, baseline HAQ scores of the patients were low which demonstrates high quality of life for patients. This finding could be related with leaving little room for improvement. Van den Berg et al. (33) investigated the effects of 2 internet-based physical activity interventions in patients with RA. Individualized physical activity program was practiced to intervention group, while general information on exercise and physical activity was practiced to control group for 12 months. Significant improvement was found in physical activity level while no significant improvement was found in functional ability and quality of life, which was interpreted a result of low sample size. Studies comparing TR with in-person therapy were not found significant different outcomes (depression and quality of life), suggesting that TR was not inferior in patients with stroke (42). Therefore, further studies should involve larger number of patients or longer exercise duration.

Exercise is known as a valid and safe method for rheumatic diseases (32). In this study, no significant difference was found in disease activity in both groups. Participants of our study had low levels of disease activity at baseline and no adverse event was seen during sessions. Additionally, patients completed the sessions with low disease activity score. Therefore, it could be interpreted tele-exercise as safe method for patients with rheumatic patients. However, it should be supported with studies including high number of patients and long-lasting studies. No significant differences were found between-group comparisons of Δmeasurements in this study. Although improvements of measurements in the intervention group were more than control group, it was not significant statistically possibly stem from low number of patients.

This study has some limitations. The low number of subgroups made it difficult to achieve significant differences especially in between-group analyses. Second, applying questionnaires as assessment was given subjective information in the study. However, avoiding face-to-face connection was survival in the COVID-19 pandemic and it was not possible to have objective data.

In conclusion, this study demonstrates that TR could be a safe, effective, and valid method for patients with rheumatic diseases in improving fatigue, anxiety and sleep quality. It is used as a mandatory method during pandemic outbreak, but considering the advantages of TR, it can be practiced for rheumatic diseases in the post-pandemic period. Further studies should include comparison of TR with face-to-face supervised exercise methods and investigation of effects of TR on arthritis and inflammation in patients with rheumatic diseases.

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: The authors declare that they have no conflict of interest

Authors Contributions: Study conception and design: Songül Bağlan Yentür; data collection: Songül Bağlan Yentür, Furkan Bilek, Zübeyde Ercan, Gülnihal Deniz; analysis and interpretation of results: Songül Bağlan Yentür, Furkan Bilek; draft manuscript preparation: Songül Bağlan Yentür. All authors reviewed the results and approved the final version of the manuscript.

Acknowledgements: None.

Explanation: None.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)198-205

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Received: *19.07.2023 (Geliş Tarihi)*
Accepted: *21.03.2024 (Kabul Tarihi)*

PHYSIOTHERAPY IN DOGS WITH HIP OSTEOARTHRITIS – EFFECTS ON PAIN, MUSCLE AND LAMENESS: A RANDOMISED CONTROLLED TRIAL

ORIGINAL ARTICLE

ABSTRACT

Purpose: The aim of this study was to investigate the effectiveness of a physiotherapy programme in dogs with hip osteoarthritis (OA).

Methods: 20 dogs with hip OA were included in the four-weeks study. The dogs were randomly divided into two groups as physiotherapy group (PTG) and control group (CG). Hyaluronic acid (HA) was injected into the hip joint of dogs in PTG and CG. The physiotherapy programme in PTG consisted of massage, electrophysical modalities and exercises. Primer assessments were pain intensity, muscle mass and lameness scores. Pain assessment was performed with Simple Pain Rating Score (0-4). Muscle mass was measured by thigh circumference measurement and lameness was measured by scoring system (0-5).

Results: At the end of the study, pain intensity (p=0.006) and lameness scores (p=0.005, p=0.006) were decreased and muscle mass was increased in the PTG (p=0.012). In addition, between group comparisons showed that all changes were statistically improved in the PTG compared to the CG (p=0.042, p=0.010, p=0.028, p=0.015).

Conclusion: We think that the "HA + physiotherapy" programme used in our study is more effective than "HA alone" in reducing pain and increasing muscle mass. Therefore, we can say that physiotherapy programmes are beneficial and safe in the treatment of dogs with OA. Physiotherapy programmes can be used to prevent the development of muscle atrophy and lameness, especially from the early stages of the disease.

Keywords: Animal Physiotherapy, Dog, Muscle, Osteoarthritis, Pain

KALÇA OSTEOARTRİTLİ KÖPEKLERDE FİZYOTERAPİ-AĞRI, KAS VE TOPALLIK ÜZERİNE ETKİLER: RANDOMİZE KONTROLLÜ BİR ÇALIŞMA

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Çalışmamızın amacı kalça osteoartriti (OA) olan köpeklerde fizyoterapi programının etkinliğini incelemekti.

Yöntem: Kalça OA'sı olan 20 köpek dört haftalık çalışmaya dahil edildi. Köpekler rastgele olarak fizyoterapi grubu (PTG) ve kontrol grubu (CG) olarak iki gruba ayrıldı. PTG ve CG'deki köpeklerin kalça eklemine hyaluronik asit (HA) enjekte edildi. PTG'deki fizyoterapi programı masaj, elektrofiziksel modaliteler ve egzersizlerden oluşturuldu. Primer değerlendirmeler ağrı yoğunluğu, kas kütlesi ve topallama skorlarıydı. Ağrı değerlendirmesi Basit Ağrı Derecelendirme Skoru (0-4) ile yapıldı. Kas kütlesi uyluk çevresi ölçümleri kullanılarak, topallama ise özel bir skorlama sistemi (0-5) kullanılarak ölçüldü.

Sonuçlar: Çalışmanın sonunda, PTG'de ağrı (p=0,006) ve topallık skorları (p=0,005, p=0,006) azalmış ve kas kütlesi artmıştı (p=0,012). Ayrıca, gruplar arası karşılaştırmalar, tüm değişikliklerin CG'ye kıyasla PTG'de istatistiksel olarak daha fazla iyileştiğini göstermiştir (p=0,042, p=0,010, p=0,028, p=0,015).

Tartışma: Çalışmamızda kullanılan «HA + fizyoterapi» programının ağrıyı azaltmada ve kas kütlesini artırmada «tek başına HA"ya göre daha etkili olduğunu düşünüyoruz. Bu nedenle, fizyoterapi programlarının OA'lı köpeklerin tedavisinde faydalı ve güvenli olduğunu söyleyebiliriz. Fizyoterapi programları, özellikle hastalığın erken evrelerinden itibaren kas atrofisi ve topallık gelişimini önlemek için kullanılabilir.

Anahtar Kelimeler: Ağrı, Hayvanlarda Fizyoterapi, Kas, Köpek, Osteoartrit

INTRODUCTION

Osteoarthritis (OA) is a common disease that can significantly affect the welfare of dogs (1). Clinical manifestations of OA in dogs include reduced painless range of motion (ROM) in the affected synovial joints, decreased muscle flexibility, altered weight bearing of the affected limb when standing or moving, reduced performance in daily activities such as running, walking, jumping and climbing. Behavioural and reactionary changes are also seen in dogs with this disease. OA occurs most commonly in the hip, knee and elbow joints in dogs (2).

Pain and disability may not be associated with structural joint changes (such as joint space narrowing, osteophyte formation, bone sclerosis) that can be seen on radiography (3). Pain in OA may be caused by a variety of mechanisms. For example, mechanical stress with movement may cause pain in an OA joint. Recent studies suggest that neuroinflammation in the peripheral and central nervous systems plays a key role in chronic pain (4). OA is recognised as one of the leading causes of chronic pain in dogs, therefore it is a threat to health-related quality of life and animal welfare. Pain in dogs is defined as a subjective, unpleasant sensory and emotional experience. However, the inability of dogs to express their experiences in words makes it difficult to use scales to directly assess pain (5).

It is difficult for dog owners to report pain levels on a visual analogue scale (VAS). Pain associated with OA can manifest as behavioural changes in the dog. One of the most commonly used methods of assessing pain in dogs is gait analysis. In addition, visual assessment of movement and determination of the lameness degree may be used (6-7).

Another parameter closely related to pain is muscle mass and therefore muscle strength. A dog with hip pain cannot be expected to functionally use the affected area. This immobilisation will lead to loss of muscle mass and weakness over time. One study (8) in humans with hip OA analysed muscle strength and found strong evidence of generalised muscle weakness in the affected leg rather than localised hip muscle weakness. These differences in muscle strength and muscle mass may also occur because people with hip OA increase the load on the asymptomatic side to reduce the load on the symptomatic side. Cross-sectional studies have shown that generalised muscle weakness in the affected leg is present even in the early stages of OA (9), and that muscle strength and power are very important parameters in the diagnosis of OA. Based on the results of studies, it is hypothesised that an increase in muscle mass will lead to an increase in muscle strength, and stronger muscles will lead to improved functional performance (10). Therefore, exercise may be started early to prevent muscle weakness in patients with OA.

One of the methods used for pain management in the treatment of OA is HA application. It is thought that HA applied intra-articularly increases joint lubrication and leads to more painless movement (11).

Studies on the effectiveness of physiotherapy in the treatment of osteoarthritis in dogs are available in the literature (1). Physiotherapy methods are used in the treatment of OA in dogs, however, there is still no established protocol on this subject. Therefore, we aimed to investigate the effect of physiotherapy in OA dogs with this study.

We hypothesize that physiotherapy is effective in increasing muscle mass and reducing pain, and improvements in these parameters will lead to further improvements in functional performance. The aim of our study was to show that physiotherapy combined with HA provides more improvement than HA alone in dogs with OA.

METHODS

Design

The report follows the CONSORT guidelines for randomised trials of treatments.

Our study was conducted at the Near East University Animal Hospital between 2018-2020. This study was completed with two groups of dogs with OA randomly assigned (basic computer method) to receive four weeks of physiothe-

rapy or not. The person who did the randomization and the people who performed the evaluation and treatments were different. The applications were performed by a physiotherapist with a certificate in animal physiotherapy. In the 20-subject study, pain intensity, muscle mass and lameness of dogs were evaluated at baseline and after 4 weeks. Since exercise programs in animals are generally revised at the end of 4 weeks in clinical practice, the program was planned for 4 weeks. The flow chart is given in Figure 1. Approval for this study was obtained from the Near East University Animal Experiments Local Ethics Committee (dated 26/09/2018 and decision number 2018/24-52). Written informed consent was obtained from the dog owners.

Participants

The severity of joint damage was evaluated by the veterinarian using the Kellgren-Lawrence scoring system (12). All dogs included were stage 2 or 3. The inclusion criteria for the study were diagnosis of hip OA on X-Ray by a veterinary surgeon, being older than 1 year and consent given by the volunteer dog owner.

Exclusion criteria; developed an acute health problem during the study, had undergone orthopaedic surgery in the previous 3 months and failed to comply with study/commands.

Clinical assessment

Pain severity was calculated using the Millis and Levine Simple Pain Rating Score (13). According to this scale (0-4), dogs were scored as follows: "0- no pain when the affected limb is palpated", "4- the affected limb cannot be palpated, the dog does not allow movement or physical touch".

Muscle mass was measured using an inflexible tape measure according to anthropometric protocols. The reference point (13) taken was ¼ of the proximal distance between the greater trochanter and the patella.

Lameness was scored using Millis and Levine's (0-5) scoring system. In the scoring system, '0' represents normal ambulation and '5' represents ambulation with any weight on the limb (13).

Interventions

The dogs were divided into physiotherapy group PTG (n=10) and control group CG (n=10). Dogs in the CG were injected with HA (Ostenil Plus 20 mg/ml) under sedation by the veterinarian on the first day. A dose of 5 mg was used in dogs weighing 10 kg or less, and a dose of 10 mg was used once in dogs weighing 11 kg or more. The dogs in the PTG in addition to the intra-articular application of HA, received a physiotherapy programme.

The physiotherapy programme consisted of massage, electrophysical modalities and exercises. At the beginning of the treatment, all dogs received 5 min of massage (stroking and kneading). Ultrasound (US) was applied for 5 min at an intensity of 1 watt/cm^2 and a frequency of 3.3 mHz, with the patient in the lateral recumbent position. After US, 70 Hz, 300 μsec, 20 min NMES and 15 min TENS at 100 Hz, 100 μsec duration were applied. All electrophysical applications were performed using Intelect® Vet Chattanooga.

After massage and electrical stimulation, exercises were performed by the physiotherapist (Table 1). Dogs in the PTG were treated 3 days a week for 4 weeks.

Statistical analysis and data reduction

The power analysis (G-power 3.1) was based on a similar study (14). It is based on the estimation that the study performed on 20 dogs with OA (10 dogs per group) will work at 95% confidence level and reach 85% power. Data were analysed with SPSS-21 package programme. Continuous variables were expressed as mean ± standard deviation and categorical variables were expressed as number and percentage. The independent samples t-test was used to compare two sample means, and Chi-square test was used for testing relationships on categorical variables. Mann Whitney U test was used for intergroup comparison of variables determined by counting. Wilcoxon test was used to compare independent group differences. In all analyses, $p<0.05$ was considered statistically significant.

Table 1. Exercise Program

Exercise	Procedure	0-2 weeks	2-4 weeks
ROM exercises	Hip joint, stifle joint, 10 reps	X	
Standing exercises	With 4 limbs, 3 min	X	
Weight-bearing	Dancing, three-leg standing, 3 min	X	X
Foam mattress walk	10 reps	X	X
Sit to stand exercises	20 reps		X
Exercise ball, wobble board	5 min		X
Gait training	Leash walking, 5 min		X
Stair activities	5 min		X

Table 2. Comparison of Demographic and Clinical Findings at the Beginning of Treatment

Variable	Physiotherapy Group	Control Group	p-value
Age (X±SD)	8.90±4.15	8.40±2.67	0.752^{+}
BCS (X)	6	5	0.695^{++}
Sex (%)	30 F 70 M	50 F 50 M	0.650^{+++}

$^{+}$Independent Sample T-Test, $^{++}$Mann Whitney U testi, $^{+++}$Chi Square test, BCS: body condition score, X:mean, SD: standart deviation, p<0.05

RESULTS

Initially, 23 dogs were screened to identify 20 dogs for randomisation. Based on owner consent, all 10 dogs in the PTG received physiotherapy for 4 weeks and all assessments were completed on the first and last day of treatment. All dogs were fully compliant with the protocol and therefore data from all 20 dogs were included in the analysis.

The 10 dogs in the CG consisted of 5 females and 5 males. The dogs were aged between 5 and 13 years (median 8.40±2.67 years) and body condition scores (BCS) median was 5. The 10 dogs in PTG consisted of 3 females and 7 males. The dogs were aged between 2 and 14 years (median 8.90±4.15) and BCS median was 6 (Table 2).

Change in pain severity score

A comparison of the change in pain scores between the post-treatment groups is shown in Table-3.

According to this table, although the pain scores of both the PTG and CG decreased compared to baseline (p=0.006, p=0.083), the decrease in pain scores of the PTG compared to the CG was found to be statistically more significant in the between-group comparison (p=0.042).

Change in muscle mass

The comparison of the change in thigh circumference measurement between the groups after the programme is shown in Table 4. According to this table, the thigh circumference measurement increased in the PTG compared to the baseline

Table 3. Changes in the Pain Scores of the Groups

Pain (0-4)	Physiotherapy group				Control group				Mann Whitney U Test	
	Baseline	4 weeks	Wilcoxon test		Baseline	4 weeks	Wilcoxon test			
	Median (min-max)	Median (min-max)	Z	p	Median (min-max)	Median (min-max)	Z	p	Z	p
Pain	3 (1-3)	1 (1-2)	-2.739	0.006*	2 (1-3)	2 (1-3)	-1.732	0.083	-2.032	0.042*

Min: minimum, max: maximum, X: mean, SD: standard deviation, p<0.05: statistical error level, *Significant differences

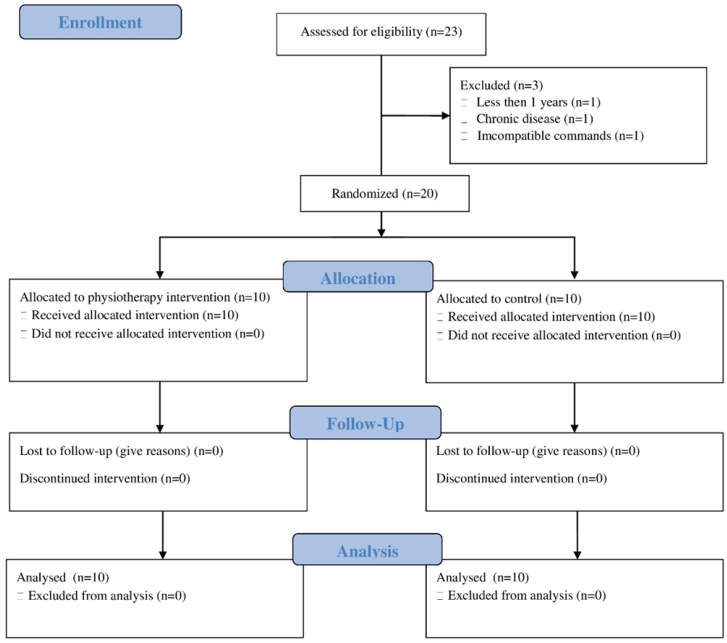

Figure 1. Flow Chart of the Study

results (p=0.012), whereas no change was observed in the CG (p=0.102). When comparing the groups, the thigh circumference measurements of the PTG were found to be statistically more significant than those of the CG (p=0.015).

Change in lameness scores

The comparison of the change in lameness score between the groups after the programme is shown in Table 5. According to this table, lameness decreased in the PTG compared to baseline

Table 4. Changes in Thigh Circumference Measurement of the Groups

Circumference measurement	Physiotherapy group				Control group				Mann Whitney U Test	
	Baseline	4 weeks	Wilcoxon test		Baseline	4 weeks	Wilcoxon test			
	X ±SD	X ±SD	Z	p	X ±SD	X ±SD	Z	p	Z	p
Thigh circumference (cm)	29.70±9.38	32.73±9.74	-2.510	0.012*	27.70±6.20	28.10±6.38	-1.633	0.102	-2.327	0.015*

Wilcoxon test, Mann Whitney U test, min: minimum, max: maximum, X: mean, SD: standard deviation, p<0.05: statistical error level, *Significant differences

Table 5. Comparison of Group Lameness Scores within and between Groups

Lamenes (0-5)	Physiotherapy group				Control group				Mann Whitney U Test	
	Baseline	4 weeks	Wilcoxon test		Baseline	4 weeks	Wilcoxon test			
	Median (min-max)	Median (min-max)	Z	p	Median (min-max)	Median (min-max)	Z	p	Z	p
Walk	3 (2-4)	2 (1-3)	-2.810	0.005*	3 (1-4)	2 (1-4)	-1.732	0.083	-2.646	0.010*
Trot	3 (3-4)	2 (1-3)	-2.739	0.006*	3 (2-4)	3 (2-4)	-1.732	0.083	-2.202	0.028*

Wilcoxon test, Mann Whitney U test, min: minimum, max: maximum, X: mean, SD: standard deviation, p<0.05: statistical error level, *Significant differences

(p=0.005, p=0.006), whereas no change was observed in the control group (p=0.083, p=0.083). When comparing the groups, the lameness scores of the treatment group were statistically more significant than those of the CG (p=0.010, p=0.028).

DISCUSSION

Several studies have shown that intra-articular administration of HA is effective in modulating pain in dogs with OA (14-15). The general aim of physiotherapy in dogs with OA is to reduce pain, increase joint ROM and muscle strength to aid recovery. The aim of our study was to demonstrate the efficacy of physiotherapy combined with HA. And this trial showed that dogs with OA who received physiotherapy had greater reductions in pain and lameness and greater increases in muscle mass.

In our study, the average pain in dogs in the PTG was 3/4 at baseline, but decreased to 1/4 at the end of treatment. OA is the most common cause of chronic pain in dogs. The goal of pain management in OA is to provide adequate analgesia so that dogs can use their affected joints normally (16). This will minimise stiffness and muscle loss in the arthritic joint. In our study, in addition to HA, massage, TENS and US were used in the PTG to reduce pain. We hypothesise that the reduction in physical activity due to pain in dogs in the PTG was blocked by the analgesic effect of US therapy and TENS. Thus, US contributed to the reduction of pain in the dogs and thus to an increase in muscle mass.

Many studies in the literature emphasise the need to use exercise programmes to develop pain modulation and functional skills (17-18). A recent review (19) on the pain-relieving mechanism of exercise examined exercises of different duration, type, frequency and intensity. Researchers suggest that exercise regulates electrophysiological responses in the spinal cord, macrophage levels in the painful area and reduces pain by increasing anti-inflammatory cytokine synthesis (19). We believe that the exercises used in our treatment programme contribute to the modulation of pain. The exercises used reduced pain in the dogs both by regulating physiological responses and by increasing the dogs' physical activity and well-being. Vaz et al. (20) found in their study of patients with OA that NMES increased the thickness of the vastus lateralis muscle and the length of the fascicle, resulting in improved functional status. Electrical stimulation helps to increase muscle strength by inducing beneficial changes in muscle fibres and the capillary system. In this way, it allows the recovery of muscular atrophy due to inactivity. Melo Mde et al. (21) found that NMES statistically increased muscle fibre thickness and pennation angle values more than low-level laser treatment in patients with OA. Therefore, more force is released as a result of muscle contraction. The results of the study confirm that NMES administration is an effective strategy for improving OA-related muscle wasting. Increasing muscle mass and thus muscle strength will improve the functionality of the dogs.

According to the results of our study, we can say that the reduction in lameness scores is related to the reduction in pain and the increase in muscle strength achieved through exercise. The reduction in pain has an effect on the dog's gait and activity level.

There are articles showing that pain may be directly related to lameness (22). In his study, Brown et al. (23) showed that pain and lameness were directly related. Although there was no correlation between pain and lameness in the correlation analysis of our study (p>0.05), we believe that the reduction of pain is a parameter that will secondarily reduce lameness. Pain caused by stimulation of nociceptors (24) causes lameness. In a clinical setting, it is clear that most dogs with lameness experience pain. A study by Drygas et al. (25) showed that pain, lameness, swelling and joint restriction were all reduced within 24 hours in dogs treated with ice after TPLO surgery.

Similarly, the increase in muscle mass-strength will increase proprioception and receptor activity in affected limb. Therefore, it can be said that the amount of time the dog presses on the limb will increase and therefore the amount of lameness will decrease. Pellegrino et al. (26) investigated the effect of the 30 minutes of treadmill

exercise on physical fitness and found that the dogs' thigh circumference measurements increased significantly at the end of 12 weeks. Thigh circumference measurements have a high correlation with muscle mass and have been used in studies to indirectly measure muscle mass (27). In our study, we found that there was a statistically significant increase in thigh circumference measurements in the PTG compared to the CG as a result of four weeks of NMES application and exercise training. No increase in thigh muscle mass was observed in the CG.

In the hip joint, all the stabilisers work to maintain joint kinematics. We know that stability is not normal kinematics and that kinematics is the key to normal joint health and function. While failure of any one stabiliser can lead to loss of normal kinematics and joint organ failure, failure of one stabiliser can be compensated for by others so that functional kinematics can be maintained (28). Muscle atrophy can be used as a clinical indicator to measure limb use. As the dog begins to use the limb normally, the strength of the thigh muscles increases (29,30). In their study, Fischer et al. (31), who investigated the relationship between muscle activity and gait, stated that kinetic and kinematic analyses that muscle activity produces more tissue response and joint loading increases muscle activity, joint stabilisation and muscle co-contraction.

The limitations of the study are that gait analysis could not be performed with objective methods and long-term effects of the treatment were not presented. We assume that the difference in the breeds of dogs does not affect the results of the study. Because all dogs were compatible with the exercises. However, in order to say anything clearly on this issue, the same study needs to be conducted on a single breed of dogs.

We think that the "HA + physiotherapy" programme used in our study was more effective than "HA alone" in reducing pain and increasing muscle mass. Therefore, we can say that physiotherapy programmes are beneficial and safe in the treatment of dogs with hip OA. Physiotherapy programmes can be used to prevent the development of muscle atrophy and lameness, especially from the early stages of the disease.

The results of this study are in line with other studies in the literature. And has shown that animal physiotherapy is an open and multidisciplinary field of science for clinicians and academicians working in both physiotherapy and veterinary medicine.

Sources of Support: None

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

Author Contributions: Concept – NA, EK; Design – NA, EK; Supervision – EK, FEÖ; Materials – NA; Data Collection and/or Processing – NA, SÇ; Analysis and/or Interpretation – NA, EK, FEÖ, SÇ; Literature Research – NA, EK; Writing Manuscript – NA, EK; Critical Review – EK, FEÖ.

Acknowledgements: None.

Explanation: None.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)206-213

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ARTIFICIAL INTELLIGENCE–BASED AUTONOMOUS SOCKET PROPOSAL PROGRAM: A PRELIMINARY STUDY FOR CLINICAL DECISION SUPPORT SYSTEM

ORIGINAL ARTICLE

ABSTRACT

Purpose: The aim of this study is to develop artificial intelligence-based interfaces that can be used by professionals (clinicians and/or academics) working with disabled individuals who need prosthetics and to create a sample data set for professionals working in this field.

Methods: 101 patients who had undergone amputation were enrolled. The residual limbs of all patients were scanned using a three-dimensional (3D) scanner and saved on the computer. The prosthetic sockets, fabricated using traditional methods, were also scanned with the same scanner and saved as a 3D model. Residual limb–prosthetic socket matches were obtained using data points and a deep neural network (DNN)-based decision support system was developed.

Results: Simulation studies conducted with the point cloud data sets of 101 patients yielded a training success rate of 86%. The DNN model exhibited a generalization success rate of 78%.

Conclusion: The artificial intelligence–based software interface has potential and could assist professionals by suggesting a suitable 3D socket model for patients in need of a prosthesis. Further studies will benefit from additional sample data to enhance the accuracy of the model.

Keywords: Amputation, Artificial Intelligence, Decision Support System.

YAPAY ZEKA TABANLI OTONOM SOKET ÖNERME PROGRAMI: KLİNİK KARAR DESTEK SİSTEMİ İÇİN ÖN ÇALIŞMA

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı, protez ihtiyacı olan engelli bireylerle çalışan profesyonellerin (klinisyenler ve/veya akademisyenler) kullanabileceği yapay zeka tabanlı arayüzler geliştirmek ve bu alanda çalışan profesyoneller için örnek bir veri seti oluşturmaktır.

Yöntem: Amputasyon cerrahisi geçiren toplam 101 hasta çalışmaya dahil edildi. Tüm hastaların güdükleri üç boyutlu tarayıcı kullanılarak tarandı ve bilgisayara kaydedildi. Çalışmaya dahil edilen hastaların geleneksel yöntemlerle üretilen protez soketleri de aynı tarayıcıyla taranarak elde edilen üç boyutlu modelleri de bilgisayara kaydedildi. Üç boyutlu tarayıcılarla elde edilen nokta bulutu verileri kullanılarak güdük-protez soket eşleşmeleri elde edildi ve derin sinir ağı (DNN) tabanlı bir karar destek sistemi geliştirildi.

Sonuçlar: 101 hastaya ait nokta bulutu veri setleri ile yapılan simülasyon çalışmalarında %86 oranında eğitim başarı oranı elde edildi. DNN modeli %78'lik bir genelleme başarı oranı sergiledi.

Tartışma: Bu çalışma ile geliştirilen yapay zeka tabanlı otonom soket önerme ara yüzü protez ihtiyacı olan hastalar için uygun 3 boyutlu soket modeli önererek profesyonellere yardımcı olabilir. Daha sonraki çalışmalarda modelin doğruluğunu artırmak için daha fazla hastanın verilerinin kullanılması planlanmaktadır.

Anahtar Kelimeler: Amputasyon, Yapay Zeka, Karar Destek Sistemi

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Received: *17.01.2024 (Geliş Tarihi)*
Accepted: *29.03.2024 (Kabul Tarihi)*

INTRODUCTION

Prosthetic rehabilitation is the most effective method for increasing the functional levels of patients who have undergone amputation of their extremities. Traditional methods for socket fabrication can be expensive, particularly in developing countries with poor accessibility to materials, such as epoxy resins, fiberglass, or carbon fiber. According to the World Health Organization, only 5%–15% of patients who have undergone amputation in low-income countries have received an appropriate prosthesis (1-4). This can be attributed to high costs, difficulty accessing prosthetic materials, a lack of trained personnel, a lack of information regarding prostheses, and difficulty accessing well-equipped hospitals or health centers (1-4).

Advancements in the industrial sector have positively influenced prosthesis manufacturing processes. Recently, the use of three-dimensional (3D) scanners and printer systems for prosthesis fabrication and related studies has grown in popularity. With the rapid development of 3D systems (scanner and printer), prosthesis fabrication has become simpler and more accessible (4,5). The 3D printing systems shorten the prosthesis manufacturing processes and allow for the fabrication of patient-specific socket and prosthetic components at lower costs (4,5). However, appropriate software and computer systems utilizing 3D technology are required to fabricate prostheses suitable for each patient. Although 3D systems seem a viable option for prosthesis fabrication in developing countries, the lack of access to appropriate software and computer systems is a roadblock. Even though they are more efficient in terms of time and cost effectiveness compared to traditional methods, research in developing countries is insufficient to apply 3D technology in prosthesis fabrication as a long-term solution (4,5).

It is considered that the development of an artificial intelligence-based software can help to overcome some of these shortcomings. Thus, intelligent approaches can make significant contributions to healthcare professionals by helping them the creating socket process.

The primary objective of the study was to utilize artificial intelligence to create a recommendation program for the fabrication of prosthetic sockets. This program will be based on data points derived from the residual limbs and socket shapes of previous patients. Furthermore, another aim of the study was to generate a sample set for the clinical decision support system.

METHODS

From January 2020 to June 2021, eligible patients who had undergone amputation at the Faculty of Health Sciences, Department of Physiotherapy and Rehabilitatio, Hasan Kalyoncu University and expressed willingness were enrolled in this study. The inclusion criteria were as follows: 1) age > 18 years; 2) no intellectual disability; 3) have a transfemoral or transtibial amputation and used the prosthesis for at least a year. The exclusion criteria were as follows: 1) severe visual or perceptual impairment; 2) postoperative functional sequelae in the extremities; 3) pain that would prevent the study procedures from being performed; and 4) neurological diseases, e.g., stroke and multiple sclerosis.

Ethical approval was obtained from the Faculty of Health Sciences Research Ethics Committee, Hasan Kalyoncu University (Clinical Trial Registration Number: NCT05341674). Written informed consent was obtained from all participants. Patients were made aware of their right to withdraw from the study at any time.

Data collection

Participants' residual limbs, while wearing the silicone liner, were scanned in a sitting position above the stool (Figure 1) and recorded on a computer using the Artec Eva Lite (Artec Group 2013, Luxembourg) 3D scanner with 0.1-mm sensitivity, 0.2-mm resolution, and a 16-frames/s frame rate (6,7). In the literature, it is stated that the Artec Eva 3D scanner is a reliable device capable of capturing even the smallest details of the human body with point cloud data, and therefore, it has been decided to use this device in this study (6,7). While the patients held their residual limbs in this position, scans were taken 5 times and

from different angles to minimize the effect of gravity. All scanning procedures were completed within 3 minutes to avoid fatigue in the patients. All these scanning operations were saved on the computer. After completing the residual limb scanning procedures, we used the same scanner to scan the prosthetic sockets that patients had used for at least 1 year without any complaints. During the scanning procedures, the prosthesis was placed on a stable surface (Figure 1) (8). The residual limb 3D models of all patients were matched with the 3D model of the prosthetic socket of the same patient and saved to the computer.

Developing an artificial intelligence model

Artificial intelligence is the ability of computers to replicate the working structure of human intelligence and perform tasks that require logic, such as drawing conclusions, finding solutions, making generalizations, understanding problems, and learning by using past experiences (9). It aims to replicate or imitate human intelligence within a computer system, encompassing the subfield of machine learning.

Deep learning is a machine learning technique recognized by artificial neural networks based on the working principle of brain neurons. In recent years, it has been widely used in both research and industry. DNN, a basic architecture in deep learning, was used in this study.

The interface obtained using the data in the study (using DNN) is a preliminary study for a clinical decision support system. In this study, in which the deep learning model was developed, a classical statistical analysis was not performed, but artificial intelligence was used to determine the accuracy of the desired interface.

We processed the data through various stages before developing the artificial intelligence model. Scanned residual limb and socket models were converted into solid models by a professional computer engineer through the Artec studio program (Artec Group 2013, Luxembourg) (6,7) and were saved to the computer (Figure 2). Along with the residual limb and socket images converted into a solid model, information about the patients such as age, gender, amputation level, amputation side and dominant limb were recorded on the computer.

The artificial intelligence model was developed on the Anaconda data science platform using the Python (Python 3.0,2020, Python Software Foundation License, designed by Guido van Rossum) programming language and the TensorFlow deep learning library. The point cloud dataset was divided into training and test sets at a ratio of 9:1 to create the best DNN model. The most appropriate DNN model was determined based on the trials to create the most accurate decision support system. Seven layers were used in the obtained model, with the first being the input layer and the last being the output layer. The "ReLu" function served as the activation function for the input and intermediate layers, while the "linear" function served as the activation

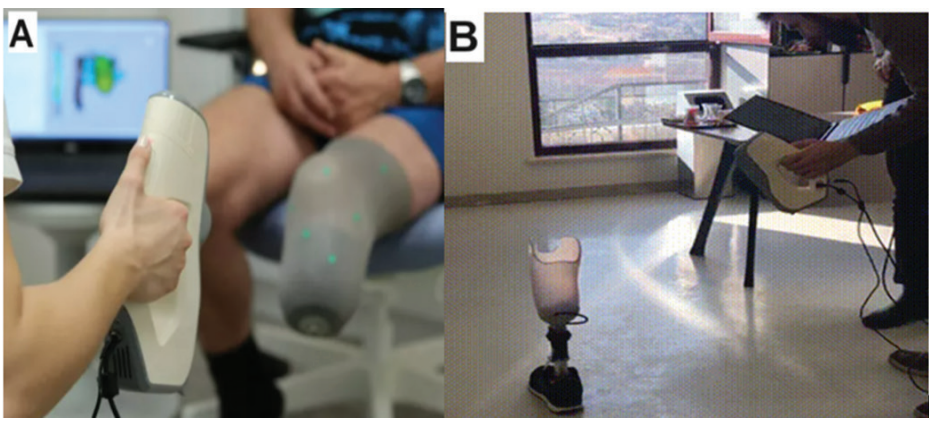

Figure 1. Scanning processes with 3D scanner. A: Scanning residual limb (8), B: scanning prosthetic socket (permission was taken from the patient for the image)

Table 1. The Values of Hyperparameters Used in the Proposed Network

Hyperparameter	Value
Optimizer	Adam
Learning rate	0.001
Batch size	64
Drop-out	0.25
Number of epochs	500

function for the output layer. As the optimizer, "Adam" was chosen as the most successful algorithm for model training. Within the scope of the study, a new interface was designed using the Python (Python 3.0,2020, Python Software Foundation License, designed by Guido van Rossum).

programming language to develop the program that would run the decision support system. The most suitable DNN models and weights were obtained and integrated into the newly developed decision support system. The software that recommended the most suitable prosthetic socket for the end user was utilized.

RESULTS

101 patients who fulfilled the eligibility criteria, including 68 men and 33 women were enrolled. Using point cloud data consisting of residual limb and socket matches of these participants, a preliminary study of an artificial intelligence model that can recommend autonomous sockets was completed.

The "batch size" of the model trained with a total of 500 "epochs" was determined to be 64. Table 1 summarizes the hyperparameter values. 90% of the point cloud dataset is reserved for training and 10% for testing. The training performance of the DNN model was 86%. Testing the model with the point cloud test data yielded a success rate of 78%.

Figure 3 shows a 3D model of the prosthetic socket suggested by the artificial intelligence–based DNN model. This 3D socket model was prepared using Plotly's This 3D socket model was prepared using Plotly's Python (Python 3.0,2020, Python Software Foundation License, designed by Guido van Rossum) graphics library and found to be able to use as a decision support system.

DISCUSSION

In this study, a recommendation program for prosthetic socket production was created using artificial intelligence. The sample set obtained from our study may contribute to the development of a clinical decision support system for prosthesis production with 3D systems (3D printer and scanner) in future studies.

Point cloud; It is a data type that allows representing the geometry of objects and/or anatomical structures with a large number of points

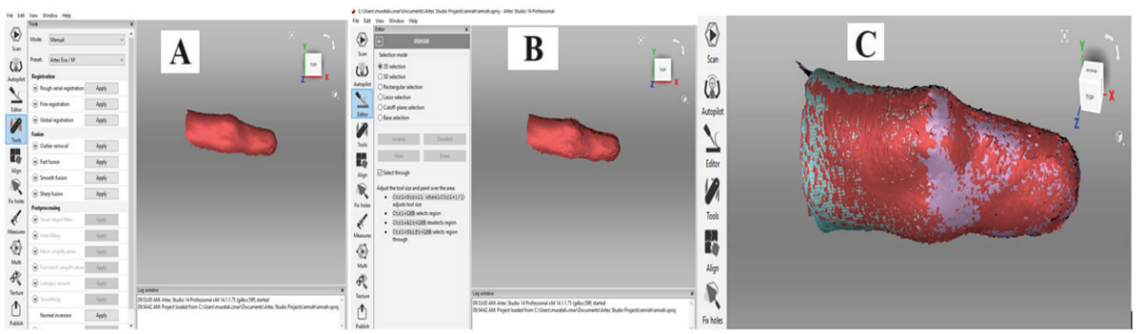

Figure 2. Example images of the process of converting 3D models into solid models with the Artec eva studio program (Artec Group 2013, Luxembourg). A: Three-dimensional scanning raw image, B: Cleaning of artifacts from the raw image, C: Final image of the solid model after all operations

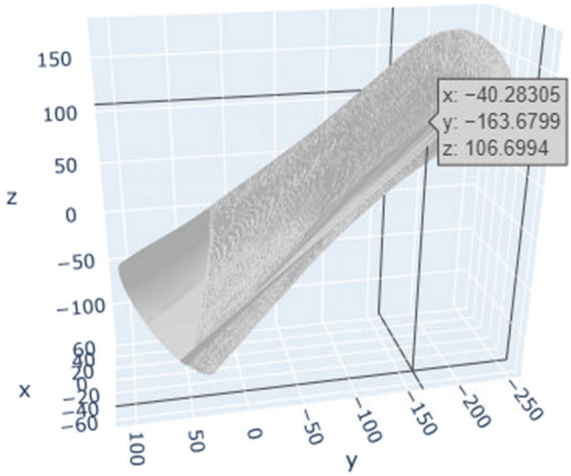

Figure 3. Example of a 3D model of the prosthetic socket suggested by the proposed deep neural network model for a patient with transtibial amputation.

sampled on their external surfaces, and is used for 3D modeling in healthcare fields (10-12). In the literature, studies in which point cloud data are obtained by scanning the residual limbs of amputees are quite limited (13,14). In our study, point cloud data was obtained by scanning the residual limbs of the patients with a 3D scanner and these point cloud data were used in the developed program. This study, which includes the use of point cloud data obtained from amputees, can serve as an example for future studies. Studies on processing and analyzing point cloud data with the help of artificial intelligence are limited in the literature (15). In this study, point cloud data obtained from amputee patients were processed and analyzed with the help of artificial intelligence. It is believed that these results obtained from our study will make significant contributions and guide researchers working in the field.

Three-dimensional modeling methods provide a better understanding of anatomy beyond traditional imaging (16). When studies are examined, it can be seen that computerized tomography (CT) and magnetic resonance imaging (MRI) systems are generally used to visualize the anatomical structure of an organ or tissue in detail in a non-invasive manner (12,17). These are software available in the literature that use these MRI or CT images to make three-dimensional modeling of organs or any anatomical part (17). The most widely used one of these software is the software called MIMICS (The Materialize Group, Leuven, Belgium) (17). MIMICS can make three-dimensional modeling with CT images of patients in DICOM format (17). Organ modeling is generally done with this software, and the images obtained contain only the point cloud data of that organ (18-20). It is not a software that recommends any prosthesis or similar device suitable for the resulting three-dimensional model. The software obtained from our study recommends a socket that may be suitable for the patient using the residual limb point cloud data scanned with any 3D scanner. Healthcare professionals using this software can make the necessary changes via this recommended socket (3D model). This feature of the software may facilitate the work of healthcare professionals who want to design sockets suitable for amputees applying to the clinic.

Sockets in lower extremity prostheses are one of the most important prosthetic components when evaluated in terms of mobility (21). Sockets are generally handmade according to the morphology of the patient's anatomical region (21). However, there are also software in the literature that produces sockets with computer-aided systems (21). Software such as The Canfit™ computer-aided design (CAD) software

application and rodin4d can be given as examples (21). These are known as software that helps design prostheses and orthoses that work with CAD/CAM technology (21). While designing prostheses or orthoses (such as scoliosis orthoses) with this software, the point cloud data obtained from the patients are matched with the patient's x-ray images. In order to design prosthesis with this software, the professional using the software must be experienced and be able to use his/her own skills for the resulting models. Therefore, design in this way, it is important that the person using the software is as knowledgeable and skilled as an engineer. In the software we obtained in our study, when the point cloud data of the amputee patient is entered into the system, a sample socket is suggested by the software. The healthcare professional can make the necessary changes on this recommended socket. With this feature, the software obtained from the study may be easier to use than software such as The Canfit™ computer-aided design (CAD) software application rodin4d.

In order to produce a prototype of any product with three-dimensional printers, a three-dimensional model of that product must first be designed/drawn. Programs such as Solidworks and Meshmixer are frequently used for these designs or drawings (7,22-26). It requires advanced software and engineering knowledge to make such designs or drawings. The drawings/designs made depend on the abilities of the person using the software. The software obtained in our study provides both drawing/design opportunities to professionals who want to produce sockets and suggests a socket model according to the shape of the patient's stump (according to point cloud data). This model (3D socket model) recommended by the system can be printed with three-dimensional printers if desired. If it is thought that the proposed socket is not suitable for the patient, drawings can be made based on the proposed model and the model can be revised. It is believed that this software obtained from our study is easier to use than other software (Solidworks, Meshmixer) due to this feature. In addition, since this software uses the deep learning method within artificial intelligence models, the software continues to learn and increase its socket recommendation success (deep learning). As a healthcare professional who uses the software in our study in his own clinic uploads the three-dimensional models (point cloud data) of the residual limbs of the patients coming to his clinic to this software system and continues to produce sockets suitable for that patient, the software will be able to increase its success by continuing to learn from these processes. In this aspect of the study, it can make significant contributions to the literature.

According to the World Health Organization, patients in low-income countries cannot easily access prostheses due to high costs and lack of equipped personnel and institutions (1-4). It has been emphasized that prosthesis production using 3D technologies may be a good option for patients in low-income countries (4,5). It is stated in the literature that for production with 3D systems to be successful, appropriate software must be available (4,5,7). Studies have shown that the lack of adequately suitable software is a problem (4,5,7). The software in our study is a recommendation program that can produce sockets with the help of artificial intelligence. Thanks to this feature, it can help produce sockets that are more compatible with patients and make faster designs.

This software obtained as a result of our study was created with data obtained from real patients, and the success of the software was tested in a computer environment. It has not been tested on a real patient. Our work continues to test it on patients.

With this work we have done, an artificial intelligence-supported software has been developed with a success rate of more than 80%. It is believed that this artificial intelligence-based autonomous socket recommendation program may be preferred by healthcare professionals interested in prosthetic manufacturing processes compared to other 3D modeling software. The sample data set obtained from this study also enabled the development of a clinical decision support system that can be used in prosthesis production processes with 3D systems. We think that these results support the literature.

Furthermore, the AI-supported interface developed in this study can provide significant contributions by assisting physiotherapists, prosthetists and prosthetic orthosis technicians in the socket creation process. The point cloud data used in this study will offer valuable contributions to the effective clinical implementation of this interface. The resulting software has only been tested and verified in a virtual environment. One of the limitations of the research is that it has not been tested on patients. Future studies should focus on developing additional software to enhance the accuracy of the model and validate it using a larger sample of patients.

Sources of Support: This study was supported by The Scientific and Technological Research Council of Türkiye (TÜBITAK) (BIGG 1512- Project number: 2180990)

Conflicting Interests: The authors declare that they have no conflicts of interest

Author Contributions: Concept- MAÇ, KB; Design – MAÇ; Supervision – MAÇ, BH; Materials – MAÇ; Data Collection and/or Processing –MAÇ, BH, KB; Analysis and/or Interpretation – MAÇ, BH, KB; Literature Research – MAÇ, BH, KB; Writing Manuscript – MAÇ; Critical Review – MAÇ, BH, KB;

Explanations: None.

Acknowledgments: None.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)214-223

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Received: *06.10.2023 (Geliş Tarihi)*
Accepted: *02.04.2024 (Kabul Tarihi)*

YENİDEN DÜZENLENMİŞ KİSTİK FİBROZİS ANKETİNİN İŞLEVSELLİK YETİYİTİMİ VE SAĞLIĞIN ULUSLARARASI SINIFLANDIRMASI KAPSAMINDA İLİŞKİLENDİRME SÜRECİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Sağlık sonuç ölçümleri, "ilişkilendirme kuralları" olarak adlandırılan bir yöntem kullanılarak standart bir şekilde İşlevsellik, Yetiyitimi ve Sağlığın Uluslararası Sınıflandırması (ICF) ile ilişkilendirilmektedir. Bu çalışmanın amacı kistik fibroziste yaşam kalitesini değerlendirme amacı ile en sık kullanılan anket olan Yeniden Düzenlenmiş Kistik Fibrozis Anketi'nin (CFQ-R) çocuk (CFQ-R_{6-11}, CFQ-R_{12-13}), adölesan/erişkin (CFQ-R_{14+}) ve ebeveyn (CFQ-$R_{ebeveyn}$) formlarının ICF kapsamında ilişkilendirilmesidir.

Yöntem: CFQ-R çocuk (6-11 yaş ve 12-13 yaş), adölesan/erişkin (14+) ve ebeveyn formlarının her bir maddesi üç bağımsız araştırmacı tarafından Cieze'nin kurallarına göre ICF ile ilişkilendirildi. Araştırmacıların anlaşma derecesi kappa katsayısı kullanılarak hesaplandı.

Sonuçlar: CFQ-$R_{ebeveyn}$ formunun vücut işlevlerini %46 (n=26), etkinlikler ve katılımı %34 (n=19) ve çevresel faktörleri %11 (n=6) oranında içerdiği bulundu. CFQ-R_{6-11} formunun vücut işlevlerini %40 (n=19), etkinlikler ve katılımı %34 (n=16) ve çevresel faktörleri %19 (n=9) oranında içerdiği bulundu. CFQ-R_{12-13} formunun vücut işlevlerini %40 (n=19), etkinlikler ve katılımı %34 (n=16) ve çevresel faktörleri %19 (n=9) oranında içerdiği bulundu. CFQ-R_{14+} formunun vücut işlevlerini %43 (n=29), etkinlikler ve katılımı %37 (n=25) ve çevresel faktörleri %7 (n=5) oranında içerdiği bulundu. Anketlerde CFQ-$R_{ebeveyn}$ için %9 (n=5), CFQ-R_{6-11} için %6 (n=3), CFQ-R_{12-13} için %6 (n=3) ve CFQ-R_{14+} için %12 (n=8) oranında madde ICF kapsamında tanımlanamadı.

Tartışma: CFQ-R çocuk, adölesan/yetişkin ve ebeveyn formlarında vücut işlevleri, ICF ile en çok ilişkili kategoridir. Çevresel faktörler anketler kapsamında yetersiz bir şekilde tanımlanmaktadır. Bu içerik karşılaştırması her bir anketin içeriğini ve doğasını göstererek kişinin fonksiyonelliğinin kapsamı hakkında bilgi edinmeyi sağlar. Ayrıca, KF'yi bütüncül değerlendirmek için çevresel faktörlerin değerlendirildiği ölçütlere ihtiyaç olduğu söylenebilir.

Anahtar Kelimeler: ICF, İlişkilendirme Kuralları, Kistik Fibrozis, Yaşam Kalitesi

LINKING PROCESS OF THE REVISED CYSTIC FIBROSIS QUESTIONNAIRE WITHIN THE SCOPE OF THE INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH

ORIGINAL ARTICLE

ABSTRACT

Purpose: Health outcome measures are standardly linked with the International Classification of Functioning, Disability, and Health (ICF) using a method called "linking rules". This study aims to evaluate the Cystic Fibrosis Questionnaire-Revised (CFQ-R), which is the most commonly used questionnaire to evaluate the quality of life in cystic fibrosis, for children (CFQ-R_{6-11}, CFQ-R_{12-13}), adolescent/adult (CFQ-R_{14+}) and parent (CFQ-R_{parent}) questionnaires are linked within the scope of ICF.

Methods: Each items of the CFO-R child (6-11,12-13), adolescent/adults (14+) and parents forms was linked with the ICF by three independent researchers according to Cieze's rules. The researchers' degree of agreement was calculated using the kappa coefficient.

Results: The CFQ-R_{parent} form was found to include body functions 46% (n=26), activities and participation 34% (n=19), and environmental factors 11% (n=6). The CFQ-R_{6-11} form was found to include body functions in 40% (n=19), activities and participation in 34% (n=16), and environmental factors in 19% (n=9). It was found that the CFQ-R_{12-13} form included body functions in 40% (n=19), activities and participation in 34% (n=16), and environmental factors in 19% (n=9). The CFQ-R_{14+} form was found to include body functions 43% (n=29), activities and participation 37% (n=25) and environmental factors 7% (n=5).

Conclusion: In the CFQ-R child, adolescent/adult, and parent forms, body functions are the category most associated with the ICF. Environmental factors were inadequately identified within the questionnaires. This content comparison showed the content and nature of each questionnaire, providing insight into the scope of the individual's functionality. Additionally, it can be said that criteria that evaluate environmental factors are needed to evaluate CF holistically.

Keywords: ICF, Linking Rules, Cystic Fibrosis, Quality Of Life

GİRİŞ

Kistik fibrozis (KF) kronik, ilerleyici ve çoklu sistem etkilenimi içeren, genelde pankreas yetmezliği ve kronik havayolu enfeksiyonu sonucu pulmoner değişimlere sebep olan bir hastalıktır. Bu çoklu sistem etkilenimi sonucu artan tedavi yükü KF tanılı bireylerin yaşam kalitesini olumsuz yönde etkilemektedir (1).

Son yıllarda hastalığın bireylerin sağlıkla ilişkili yaşam kalitesine etkisini ölçmeye yönelik anketler geliştirilmeye başlanmıştır. Sağlıkla ilişkili yaşam kalitesini değerlendiren anketler kişinin fiziksel, emosyonel durumunu, sosyal yaşantısını ve çevresel etmenleri sorgulayan yapılar içerebilir (2). Geliştirilen anketlerin yaşam kalitesini değerlendirme kapsamı ve ele alış şekli değişkenlik göstermektedir. Bu nedenle anketlerin doğru yorumlanması adına kapsamlarını analiz etmek önem arz etmektedir (3).

ICF, insanın işlevselliği ve kısıtlılıklarla ilgili durumları tanımlar ve bu bilginin düzenlenmesi için bir çerçeve oluşturur. ICF, bilgiyi iki bölüm halinde düzenler. Birinci bölüm 'İşlevler ve Yetiyitimini', ikinci bölüm ise 'Bağlamsal Etmenleri' kapsar. 'İşlevler ve Yetiyitiminin' vücut bileşeni, vücut sistemlerinin işlevleri ve vücut yapıları olmak üzere iki sınıflandırmadan meydana gelir. 'Etkinlikler ve Katılım' bileşeni ise bireysel ve toplumsal bakış açısından işlevsellik anlamına gelecek bütün alanları kapsar. Bağlamsal Etmenlerin çevresel etmenler bileşeni işlevler ve yetiyitiminin bütün bileşenleri üzerinde etkisi vardır ve kişinin yakın çevresinden başlayıp, genel çevresine doğru giden bir çerçeveyi incelemektedir. Kişisel Etmenler bileşeni ise geniş çaplı sosyal ve kültürel farklılıklar olduğundan ICF'de sınıflandırılmamışlardır (4). Örneğin İşlevler ve Yetiyitiminin bileşenleri bir yandan problemleri belirtmek için kullanılabilirler öte yandan, yine geniş bir yelpazeyi kapsayan işlev terimiyle, sağlık ve sağlıkla ilgili durumlarda bir sorun olmadığı koşulu (doğal) belirtebilirler. Sağlık durum ölçümlerini ICF ile ilişkilendirmek için sistematik ve standart bir yaklaşım sağlamak amacıyla Cieze ve ark. tarafından 10 adet ilişkilendirme kuralı tanımlanmıştır (5).

Son zamanlarda yaşam kalitesi anketlerinin klinisyenlere kapsamlı ve doğru çıktı vermesini sağlamak amacıyla ICF kapsamında ilişkilendirme çalışmalarının sayısı artış göstermektedir (6-8). Kistik Fibrozis özelinde bu çalışmalar sınırlı sayıdadır (9). Bu alanda çalışan klinisyenlerin, kapsamlı değerlendirme yapabilmeleri ve sonuçların doğru yorumlanması amacıyla kistik fibrozis tanılı bireylerin sağlıkla ilişkili yaşam kalitesi değerlendirmesinde kullanılan anketlerin ICF ile ilişkilendirilmesinin yapılması önemlidir.

Bu çalışmanın amacı kistik fibroziste yaşam kalitesini değerlendirme amacı ile en sık kullanılan anket olan Yeniden Düzenlenmiş Kistik Fibrozis Anketinin (CFQ-R), çocuk (CFQ-R_{6-11}, CFQ-R_{12-13}) adölesan/erişkin (CFQ-R_{14+}) ve ebeveyn (CFQ-$R_{e-beveyn}$) formlarının ICF kapsamında ilişkilendirilmesidir.

YÖNTEM

Anketlerin içeriğinin ilişkilendirme süreci, Cieza ve ark. tarafından önerilen ilişkilendirme kurallarının uygulanması yoluyla gerçekleşti (5). CFQ-R_{6-11}, CFQ-R_{12-13} ve CFQ-R_{14+}, CFQ-$R_{ebeveyn}$ formlarındaki anketlerin her bir maddesi ICF içerisinden uygun olan bir veya birden fazla madde ile 3 bağımsız araştırmacı (SNK, TD, İD) tarafından ilişkilendirildi. Fikir birliğinin sağlanamadığı durumlarda ICF deneyimine sahip dördünce kıdemli bir kişiye (SB) danışıldı. Bağımsız araştırmacılar 8 yıllık klinik/akademik deneyime sahip olan uzman fizyoterapistlerdi. SB Kardiyopulmoner Rehabilitasyonda lisansüstü programlarda 8 yıldır danışmanlık yapmakta ve 15 yıldır lisansüstü düzeyde ICF ile ilgili ders vermektedir. Ayrıca ICF ile ilgili kanıta dayalı değerlendirme başlığı altında dersler verip kurslara katılmaktadır. Son aldığı kurs "ICF- StARS- An introduction to the standardized assessment and reporting of functioning by using the International Classification of Functioning Disabilty, and Health (ICF)" idi.

Öncelikle metodolojik kılavuza (5) göre, anketlerin her bir maddesinde yer alan ilişkilendirme yapılacak anlamlı kavramlar belirlendi. Üç bağımsız araştırmacı anketlerde yer alan her bir madde için bağlamı, ifadeleri ve yanıt seçeneklerini dikkate alarak anlamlı kavramları belirledi. Daha sonra fikir birliğine varmak için

anlamlı kavramlar karşılaştırıldı. Her anlamlı kavram en kesin ve spesifik ICF kategorisine bağlandı.

ICF kategorisiyle ilişkilendirmek için yeterli bilgi sağlamayan anlamlı kavramlar "tanımlanamaz" olarak ilişkilendirildi. ICF kategorisi seçimi için yeterli bilgi sağlamayan fiziksel sağlık, zihinsel sağlık, genel sağlık, genel engellilik, işlevsellik ve çocuğun gelişimi ile ilgili anlamlı kavramlar tanımlanamaz olarak sınıflandırıldı ve "tanımlanamaz-fiziksel sağlık", "tanımlanamaz-zihinsel sağlık", "tanımlanamaz-genel sağlık", "tanımlanamaz-genel engellilik", "tanımlanamaz-işlevsellik" ve "tanımlanamaz-çocuğun gelişimi" olarak atandı. Anlamlı bir kavram kişisel bir faktör olarak tanımlandığında "kişisel faktör" olarak ilişkilendirildi. Anlamlı kavram, ICF' in kapsamına girmiyorsa "ICF tarafından kapsanmıyor" olarak kaydedildi.

İçerik ilişkilendirme süreci Microsoft Office 365 Word kelime işlemcisinde düzenlendi. Üç bağımsız araştırmacı tarafından ilişkilendirilen kavramlara ilişkin uyum derecesi kappa istatistiği kullanılarak hesaplandı.

Yeniden Düzenlenmiş Kistik Fibrozis Anketi (CFQ-R) Çocuk ($CFQ\text{-}R_{6\text{-}11}$, $CFQ\text{-}R_{12\text{-}13}$), Adölesan/Erişkin ($CFQ\text{-}R_{14+}$) ve Ebeveyn ($CFQ\text{-}R_{ebeveyn}$) Formları

Miami Üniversitesi Psikoloji bölümünden Dr. Alexandra Quittner tarafından geliştirilen ölçeğin 6-11, 12-13, 14+ yaş ve ebeveyn formları mevcuttur (10). Anketlerin Türkçe geçerlilik ve güvenilirliği Yüksel ve ark. tarafından yapılmıştır (11). CFQ-R anketi bireylerin son iki haftadaki durumunu baz alır. Anket 100 puan üzerinden hesaplanır ve puan yükseldikçe daha iyi sağlıkla ilişkili yaşam kalitesi temsil edilir. Yaş aralığına göre 35–50 arasında değişen sorudan oluşur.

CFQ-R Yeniden Düzenlenmiş Kistik Fibrozis Anketi 6-11 yaşlarındaki çocuklar (Görüşmecinin uygulayacağı form): 4 puanlık Likert skalasıyla cevaplanan 35 sorudan oluşmaktadır. Verilen talimatlar ışığında görüşmeci hastaya uygular. Fiziksel işlevsellik (1-6), duygusal işlevsellik (7-14), yemek yeme (15. 17. 19), sosyal işlevsellik-(20-26), vücut imajı (27-29), tedavi yükü (16. 18. 30.), solunum (31-34) ve sindirim (35.) parametrelerini değerlendirmektedir. Soruların bir kısmı çok doğru/çoğunlukla doğru/biraz doğru/hiç doğru değil şeklinde, bir kısmı ise her zaman/ sıklıkla/ bazen/ hiç şeklinde seçenekler sunmaktadır.

CFQ-R Yeniden Düzenlenmiş Kistik Fibrozis Anketi 12-13 yaşlarındaki çocuklar (Hastanın Kendi Kendine Uygulayacağı Form): 6-11 yaş formu ile büyük ölçüde benzer olan 35 soru içerir. Soruları hastanın biliş durumuna göre kendisi ya da uygulayıcı işaretler. Fiziksel işlevsellik (1-6), duygusal işlevsellik (7-14), yemek yeme (15. 17. 19), sosyal işlevsellik-(20-26), vücut imajı (27-29), tedavi yükü (16. 18. 30.), solunum (31-34) ve sindirim (35.) parametrelerini değerlendirmektedir.

CFQ-R Yeniden Düzenlenmiş Kistik Fibrozis Anketi Adölesan ve Yetişkinler (14 yaş ve üzeri hastalar için): Anketin içeriğini; demografik, yaşam kalitesi, okul iş ve günlük aktiviteler olmak üzere 3 bölümden toplam 50 soru oluşturur. Fiziksel işlevsellik (1-5.,13,19,20.), canlılık (6,9,10,11) duygusal işlevsellik (7,8, 12, 31 33), yemek yeme (14,21,50), sosyal işlevsellik-(22-23, 27-30)), vücut imajı (24-26), tedavi yükü (15-17), rol (35-38), kilo (39.) solunum (40-42, 44-46) ve sindirim (47-49.) parametrelerini değerlendirmektedir.

CFQ-R Yeniden Düzenlenmiş Kistik Fibrozis Anketi Ebeveyn\Bakıcılar (6-13 yaşlarındaki çocukların ebeveyn ve bakıcılarına): Anketin içeriğini; demografik, yaşam kalitesi, yakınmalarla ilgili zorlukları olmak üzere 3 bölümden toplam 44 soru oluşturur. Anketi 6-13 yaşlarındaki hastaların ebeveyn ya da bakım verenleri doldurur.

İstatistiksel analiz

İstatistiksel analizin tanımlanmasında mutlak ve bağıl frekanslar kullanıldı. ICF ile anketlerdeki parametreleri ilişkilendiren üç bağımsız araştırmacı arasındaki kappa katsayısı hesaplandı. Hesaplanan değerlerden 0'dan küçük olanlar zayıf, 0-0.2 arası hafif, 0.21-0.4 arası uygun, 0.41-0.6 arası ılımlı, 0.61-0.8 önemli, 0.81-1.0 arası neredeyse mükemmel olarak değerlendirildi. Analizin tamamında Sosyal Bilimler İstatistik Programı

Tablo 1. Anketlerde Tanımlanan ICF'in Bölüm ve Bileşenleri

	CFQ-R$_{ebeveyn}$	CFQ-R$_{6-11}$	CFQ-R$_{12-13}$	CFQ-R$_{14+}$
Vücut İşlevleri (b)				
(b1) Zihinsel işlevler	b134-uyku b140-dikkat işlevleri b1528-duygu durum b1268- mizaç ve kişilik b1300-enerji düzeyi b1302-iştah işlevleri, diğer belirtilmiş b1801- beden imajı	b1302-iştah b134-uyku işlevleri b1341 uykuya dalma b1344 uyku döngüsü içindeki işlevler b1522 duygudurum aralığı b1528 duygudurum işlevleri, diğer belirtilmiş b1801- beden imajı	b1302-iştah b134-uyku b1341 uykuya dalma b1344-uyku döngüsü içindeki işlevler b1528- duygudurum işlevleri, diğer belirtilmiş b1801- beden imajı	b1300- enerji düzeyi b1302-iştah b134-uyku b1528 duygudurum işlevleri, diğer belirtilmiş b1801-beden imajı
(b2) Duyusal işlevler ve ağrı	b28012- mide veya karın ağrısı	b28012- mide veya karın ağrısı	b28012- mide veya karın ağrısı	b28012- mide veya karın ağrısı
(b4)Kardiovasküler, hematolojik, immünolojik ve solunum sistemi işlevleri	b440 solunum işlevleri b455-egzersiz b4552-yorgunluk toleransı b450- ek solunum işlevleri b460- solunum sistemi işlevleri b469-kardiyovasküler ve solunum sistemi ek işlevleri	b440 solunum işlevleri b450- ek solunum işlevleri b4552-yorgunluk b469-kardiyovasküler ve solunum sistemi ek işlevleri	b440- solunum işlevleri b450- ek solunum işlevleri b4552-yorgunluk b469- Kardiovasküler ve solunum sistemi ek işlevleri	b440- solunum işlevleri b450- ek solunum işlevleri b455-egzersiz toleransı işlevleri b4552-yorgunluk b460 Kardiovasküler ve solunum işlevleriyle ilişkili belirtiler b469-kardiyovasküler ve solunum sistemi ek işlevleri
b5) Sindirim, metabolik ve endokrin sistem işlevleri	b510- yeme işlevleri b5251-feçesin kıvamı b5254-gazkıvamı işlevleri b530- kiloyu koruma			b5251-feçesin kıvamı b5254-gaz b530 kiloyu koruma işlevleri
Etkinlikler ve Katılım (d)				
(d2) Genel görevler ve talepler	d230- günlük rutinleri yerine getirme			d2102 tek bir görevi bağımsız olarak üstlenme d230 günlük rutinleri yerine getirme
(d4) Yer değiştirme	d430-nesneleri kaldırma d450- yürüme d4551- tırmanma d4552-koşma	d430-nesenleri kaldırma ve taşıma d450- yürüme d4551- tırmanma d4552 koşma d4553 atlama d4554 yüzme	d430-nesenleri kaldırma ve taşıma d450-yürüme d45541-tırmanma d4552 koşma d4553 atlama d4554 yüzme	d430-nesenleri kaldırma ve taşıma d450-yürüme d4551-tırmanma(merdiven) d4552-koşma
(d5) Kendine bakım	d550- yeme	d550- yeme d5702 kişinin sağlığını koruması	d550- yeme d5702 kişinin sağlığını koruması	d550 yeme
(d6) Ev yaşamı (d7) Kişilerarası genel etkileşimler	d7504-akranlarla gayri resmi ilişkiler	d7500-arkadaşlarla gayrı resmi ilişkiler	d7500 arkadaşlarla gayrı resmi ilişkiler	d6200 alış veriş yapma d750 gayrı resmi sosyal ilişkiler d7701 karı koca ilişkiler
(d8) Temel yaşam alanları	d820-okul eğitimi			d820 okul eğitimi d830-yüksek eğitim d839 eğitim, diğer belirtilmiş ve belirtilmemiş d845 iş bulma, sürdürme ve son verme d8451 işi sürdürme d860 basit ekonomik işlemler
(d9) Toplum hayatı, sosyal hayat ve yurttaşlık	d9201- spor d920-eğlence ve boş zaman	d920- eğlence ve boş zaman d9201-spor d9205-sosyalleşme d9209- eğlence ve boş zaman, belirtilmemiş	d920- eğlence ve boş zaman d9201- spor d9205-sosyalleşme d9209 eğlence ve boş zaman, belirtilmemiş	d9201-spor d9205-sosyalleşme d9208 eğlence ve boş zaman, diğer belirtilmiş

Çevresel Etmenler (e)				
(e1) Ürünler ve teknoloji	e1101-İlaçlar			e1001-ilaçlar
(e3) Destek ve ilişkiler	e325- tanıdıklar, akranlar, iş arkadaşları, komşular ve topluluk üyeleri			
(e4) Tutumlar		e420 arkadaşların bireysel tutumlar e425-tanıdıklar, akranlar, iş arkadaşları, komşular ve topluluk üyelerinin bireysel tutumları e430 yetkili konumundaki insanların bireysel tutumları e498 tutumlar, diğer belirtilmiş e499 tutumlar, belirtilmemiş	e420 arkadaşların bireysel tutumlar e425-tanıdıklar, akranlar, iş arkadaşları, komşular ve topluluk üyelerinin bireysel tutumları e430 yetkili konumundaki insanların bireysel tutumları e498-tutumlar, diğer belirtilmiş e499 tutumlar, belirtilmemiş	e498 tutumlar, diğer belirtilmiş
(e5) Hizmetler, sistemler ve politikalar	e5800-sağlık hizmetleri	e5800-sağlık hizmetle	e5800-sağlık hizmetleri	e5800-sağlık hizmetleri

(SPSS) sürüm 26.0 ve %95 güven aralığı kullanılmıştır.

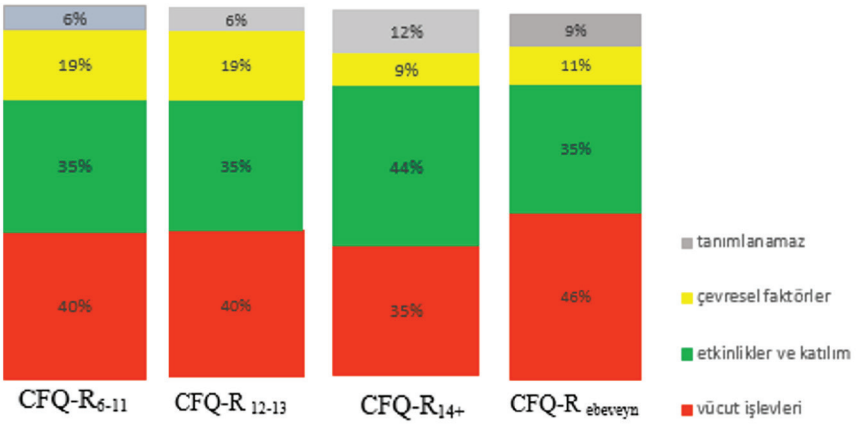
SONUÇLAR

Toplamda 164 madde, 76 farklı ICF kategorisi ile ilişkilendirildi (CFQ-R_{6-11} k=0.786, CFQ-R_{12-13} k=0.803, CFQ-R_{14+} k=0.821 ve CFQ-$R_{ebeveyn}$ k=0.801).

CFQ-R_{6-11} formu 48 kod ile ilişkilendirildi. CFQ-R_{6-11} formunun vücut işlevlerini %40 (n=19), etkinlikler ve katılımı %35 (n=17) ve çevresel faktörleri %19 (n=9) oranında içerdiği bulundu (şekil 1, şekil 2, tablo 1). %6 (n=3) oranında madde ICF kapsamında tanımlanamadı. Anketin 4 maddesi için "diğer belirtilmiş" kullanıldı. Örneğin: Endişeli hissettin. *b1528 duygudurum* işlevleri, diğer belirtilmiş (endişe). 10 madde birden fazla kod ile tanımlandı. Örneğin: İstediğin gibi koşabildin, atlayabildin ve tırmanabildin. *d4552 koşma, d4553 atlama, d4551 tırmanma.* Anketteki bazı maddeler kodların tanımlanması için yeterince açık değildi, bu nedenle 3 maddede "tanımlanamaz" kullanıldı. *Örneğin; Evde istediğinden çok kaldın.* 1 madde için belirtilmemiş kullanıldı. *Örneğin; Sevdiğin sporlara katılabildin. (*örn*: yüzme futbol, dans etme ve diğerleri). d9209 eğlence ve boş zaman, belirtilmemiş (dans).*

CFQ-R_{12-13} formu 48 kod ile ilişkilendirildi. CFQ-R_{12-13} formunun vücut işlevlerini %40 (n=19), etkinlikler ve katılımı %35 (n=17) ve çevresel faktörleri %19 (n=9) oranında içerdiği bulundu. %6 (n=3) oranında madde ICF kapsamında tanımlanamadı. Anketin 4 maddesi için "diğer belirtilmiş" kullanıldı. *Örneğin; öfkeli hissettin. b1528 duygudurum* işlevleri, diğer belirtilmiş (öfke). 9 madde birden fazla kod ile tanımlandı. *Örneğin; gece öksürük nedeni ile uyandın. b450 ek solunum işlevleri, b134 Uyku işlevleri (gece).* Anketteki bazı maddeler kodların tanımlanması için yeterince açık değildi, bu nedenle 3 madde için "tanımlanamaz" kullanıldı. *Örneğin; Kendini iyi hissettin.* 2 madde için "belirtilmemiş" kullanıldı. Örneğin; Sevdiğin sporlara katılabildin. (örn*: yüzme futbol, dans etme vs.) d9209 eğlence ve boş zaman, belirtilmemiş(dans).*

CFQ-R_{14+} formu 68 kod ile ilişkilendirildi. CFQ-R_{14+} formunun vücut işlevlerini %35 (n=24), etkinlikler ve katılımı %44 (n=30) ve çevresel faktörleri %9 (n=6) oranında içerdiği bulundu. %12 (n=8) oranında madde ICF kapsamında tanımlanamadı. Anketin 6 maddesi için "diğer belirtilmiş" kullanıldı. Örneğin*; Gece dışarı* çıkarken *kendimi rahat hissediyorum. d9208 Eğlence ve boş zaman, diğer belirtilmiş (gece dışarı* çıkmak*).*12 madde birden fazla kod ile tanımlandı. Örneğin*: Yemek yemek için kendimi zorlamam gerekiyor. d550 yeme, b1302 iştah.* Anketteki bazı maddeler kodların tanımlanması için yeterince açık değildi, bu nedenle 8 maddede "tanımlanamaz" maddesi kullanıldı. Örneğin*; Kendimi sıklıkla yalnız hissediyorum.* 3 madde için "belirtilmemiş" kullanıldı. Örneğin*;*



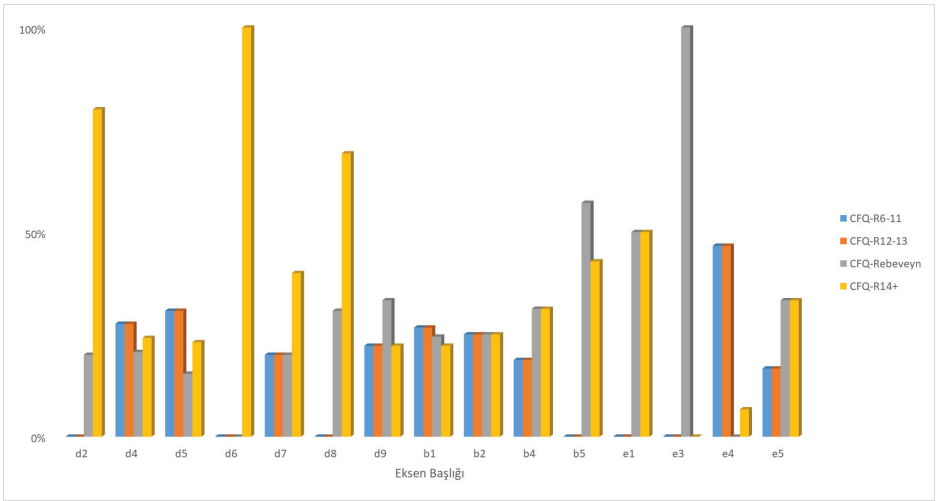
Şekil 1. 1. 6-11, 12-13, Ebeveyn, 14+ Yaş Anketlerinin ICF Bileşenleri

Balgamın genelde nasıl oldu? b469 Kardiovasküler ve solunum sistemlerinin ek işlevleri ve belirtileri, diğer belirtilmiş ve belirtilmemiş (balgam).

CFQ-R ebeveyn formu 57 kod ile ilişkilendirildi. CFQ-R$_{ebeveyn}$ formunun vücut işlevlerini %46 (n=26), etkinlikler ve katılımı %35 (n=20) ve çevresel faktörleri %11 (n=6) oranında içerdiği bulundu. %9 (n=5) oranında madde ICF kapsamında tanımlanamadı. Anketin 9 maddesi için "diğer belirtilmiş" kullanıldı. Örneğin; Endişeli göründü. *b1528 Duygu durum işlevleri, diğer belirtilmiş, endişe.* 11 madde birden fazla kod ile tanımlandı. *Örneğin: Çocuğunuz için her gün tedavilerini (ilaçlar dâhil) yapmak ne kadar zor? e1101 ilaçlar, e5800 Sağlık hizmetleri.* Anketteki bazı maddeler kodların tanımlanması için yeterince açık değildi, bu nedenle 5 maddede "tanımlanamaz" kullanıldı. *Örneğin; Sizce çocuğunuzun sağlığı şimdi nasıl?* 3 madde için "belirtilmemiş" kullanıldı. *Örneğin; Çocuğum balgam çıkarmak zorunda kaldı. b469 kardiovasküler ve solunum sistemlerinin ek işlevleri ve belirtileri, diğer belirtilmiş ve belirtilmemiş (balgam).*

TARTIŞMA

Sağlıkla ilişkili yaşam kalitesini değerlendirmek amacıyla geliştirilen anketlerin kapsamı değişkenlik göstermektedir. Geliştirilen çeşitli anketleri ICF kapsamında ilişkilendirmek ve içerik karşılaştırması yapmak her bir anketin doğasını ve içeriğini göstererek kişinin fonksiyonelliğinin kapsamı hakkında bilgi edinmeyi mümkün kılabilir (12). Yayınlanan çeşitli çalışmalarda mevcut anketlerin, ICF'in genellikle vücut işlevleri ve aktivite katılım bileşenlerinin temsil edildiği göste-



Şekil 2. CFQ-R$_{6-11}$ CFQ-R$_{12-13,}$ CFQ-R $_{ebeveyn}$ ve CFQ-R$_{14+}$ *için ICF Bileşenlerinin Birinci Basamak Alanlarını Yüzdelik İçerme Oranları*

rilmiştir (13, 14). Literatüre benzer şekilde çalışmamızda da ICF kapsamında ilişkilendirmesini sunduğumuz CFQ-R_{6-11} CFQ-$R_{12-13,}$ CFQ-$R_{ebeveyn}$ ve CFQ-R_{14+} için vücut işlevleri (b) ve etkinlikler katılım (d) bileşenleri, ICF ile en çok ilişkili kategoriydi. Çevresel faktörler (e) anket kapsamında yetersiz bir şekilde tanımlanırken, vücut yapıları (s) bileşeni hiç temsil edilmemişti. Anketlerde en sık tekrar eden kategori b1801 beden imajı oldu (12 kere). Mutlu, üzgün, endişeli gibi his ve duyguları içeren b1528 Duygu durum işlevleri, diğer belirtilmiş kategorisi de sık tekrarlanan bir diğer kategoriydi (11 kere).

Çalışmamızda CFQ-R_{6-11} CFQ-$R_{12-13,}$ CFQ-$R_{ebeveyn}$ ve CFQ-R_{14+} içindeki maddelerin ICF'te vücut işlevlerinin (b); zihinsel işlevler (b1), duyusal işlevler (b2) ve kardiovasküler, hematolojik, immünolojik ve solunum sistemi işlevleri (b4) bölümleri ile ilişkilendirildiği görüldü. Fakat her 4 anket için ICF'teki ses ve konuşma işlevleri (b3) bölümünün temsil edilmediği görüldü. Kistik Fibrozis hastalarında sıklıkla kullanılan, mukolitik özellikteki dornaz alfa tedavisinin ses değişikliğine yol açtığı bilinmektedir. Hastaların karşılaştığı diğer zorlukların yanında önemsiz gibi görünse de bu bölümün anketlerde bulunması kapsamlı değerlendirme açısından önemlidir (15) . Çalışmamızda ICF'teki sindirim, metabolik ve endokrin sistem işlevleri (b5) bölümünün CFQ-R_{6-11} ve CFQ-R_{12-13} anketlerindeki maddeler ile ilişkilendirilmediği görüldü. KF'li bireylerde uzayan yaşam süresiyle birlikte akciğer hasarı ve bozulmuş beslenmeye ek diyabet, kemik hastalıkları ve reflü gibi hastalıklarda yaygın görülmektedir (16). Ayrıca Avrupa Kistik Fibrozis Vakfı'nın 2020'de yayınladığı veride 10 yaşın altında %0,8 ve 10-19 yaş arasında %9,7 oranında KF bağlantılı diyabet görüldüğü kaydedilmiştir (17) . Buna istinaden b5 bölümüne CFQ-R_{6-11} ve CFQ-R_{12-13} anketlerinde yer verilmesi önemlidir. KF multisistemik bir hastalık olduğundan, hastalarda çok sık rastlanan genitoüriner ve üreme işlevleri (b6), nöromüsküloskeletal ve hareketle ilgili işlevler (b7) ve deri ve ilişkili yapıların işlevleri (b8) bölümleri hiçbir anket maddesiyle ilişkilendirilmedi. Literatürü incelediğimizde bu bölümlerle ilgili birçok çalışma görülmektedir. Örneğin KF'li çocuklarda postüral bozuklukların sayısının yaşla arttığı ve diğer sağlık parametrelerini de etkilediği görülmüştür (18). Çeşitli yaş aralıklarındaki KF'li bireylerde yapılan bir çalışmada üriner inkontinansın endişe ve utanç duygusuna sebep olduğu ve sosyal yaşantılarını etkilediği belirtilmiştir (19). Ayrıca KF 'li bireylerde sıklıkla görülen ve hastalığın seyriyle bağlantılı olan çomak parmak, kişide dış görünüşüyle alakalı huzursuzluk yaratabilir (20). KF'nin multisistemik yapısı nedeniyle yaşam kalitesini değerlendiren anketlerin vücut işlevleri kapsamında çok sayıda yönü ele alması gerektiğini düşünmekteyiz. Çalışmamızda incelenen CFQ-R anketinin bütün formlarının vücut işlevlerini diğer bileşenlere oranla daha fazla içerdiği görülmekle birlikte literatürün de desteklediği üzere bu hastalığa özgü incelenmeyen değişkenlerin de olduğuna dikkat çekmek gerekebilir.

Çalışmamızda anketleri aktivite ve katılım açısından ICF kapsamında incelediğimizde, d1 (öğrenme ve bilgiyi uygulama) ve d3 (iletişim) bölümleri haricinde tüm bölümlerle ilgili soru mevcuttu. KF hastalarında multisistemik etkilenim olduğunu bilmekle beraber öğrenme, iletişim, bilgiyi uygulama özelinde etkilenim olması çok da beklenen ya da diğer etkilenimlere kıyasla çok da önemli bir durum olmadığını düşünebiliriz. Fakat hastalığın bireye özgü seyrettiği göz önüne alındığında ve bu bileşenlerin bireylerin yaşam kalitesini etkileyeceği açık olduğundan, anket içerisinde sorgulanmaları anket kapsayıcılığı açısından önem arz etmektedir.

Kistik fibrozisin multisistemik doğası sebebiyle, diğer bileşenlere kıyasla anketlerin aktivite ve katılım bölümlerini yüksek oranda içermesi aktivite ve katılımı kapsamlı değerlendirmeye olanak sağlamaktadır. Fakat CFQ-R_{6-11} ve CFQ-R_{12-13} anketlerinde d2 (temel görevler ve talepler) ve d8 (temel yaşam alanları) bölümüne ilişkin soru bulunmaması göze çarpmaktadır. İlgili literatür incelendiğinde KF'li bireylerde bu bölümlerin yaşam kalitesi etkisi üzerine yapılan bir çalışmada KF'li bireyler, semptomların artması veya tekrarlanması korkusuyla şiddetli aktivitelerden kaçınmaktadır ve bu bireylerde fiziksel işlevlerle ilişkili rollerde yaşam kalitesinin sağlıklı bireylere kıyasla daha düşük olduğu belirtilmiştir (21). Bu sonuçlara göre CFQ-R_{6-11} ve CFQ-R_{12-13} anketlerinde günlük rutinleri yerine getirmeyi

sorgulayan soru içermemesi anketlerin limitasyonu olarak görülmektedir. Ayrıca KF'ye farklı perspektiflerden yaklaşılan çalışmalarda, bireylerin okul yaşantısının hastalık sebebiyle olumsuz etkilendiği saptanmıştır (22-24). Gathercole ve ark. tarafından bu yaş gruplarındaki KF' li bireylerin yoğun tedaviye ihtiyaç duyduğu dönemlerde okuldan geri kaldıklarını belirtilmiştir (22). Buna ek olarak bireylerin, tedavilerini okul ortamında yapmasının tıbbi durumuna dikkat çekeceği, akranlarından farklı görüleceği endişesi taşıdığı görülmüştür. Mevcut çalışmalar da dikkate alınarak, bu yaş grubundaki bireylerin yaşam kalitesi üzerine okul yaşantısının etkisi göz ardı edilemeyeceğinden CFQ-R_{6-11} ve CFQ-R_{12-13} anketleri için bu bölüme yer verilmemesi bir başka limitasyon olarak görülmektedir. Son olarak d6 (ev yaşantısı) bölümüne CFQ-R_{14+} anketi haricinde diğer anketlerde yer verilmemiştir. Diğer bölümlere kıyasla bu bölümün göz ardı edilmesinin büyük bir eksikliğe yol açacağı düşünülmese de hastalığın bireye özgü seyrettiği unutulmamalıdır.

Çevresel faktörlerin belirlenmesi bu bireylerin günlük yaşamını kolaylaştırıcı ve zorlaştırıcı faktörleri saptamakta önemlidir. Çalışmamızda CFQ-R_{6-11} CFQ-$R_{12-13,}$ CFQ-$R_{ebeveyn}$ ve CFQ-R_{14+} anketlerin tümünün ICF'in hizmetler, sistemler ve politikalar (e5) bölümünü kapsadığı görüldü. KF tanılı bireyler yaşam boyu devam eden tedaviler sebebiyle hastane ziyaretleri sık ve düzenli yapmaktadır. Bu sebeple sağlık politikaları kişilerin tedavi yükünü büyük ölçüde etkilemektedir. Bu bölümün tüm anketlerde bulunması yaşam kalitesini kapsamlı bir şekilde değerlendirmek adına önemli olduğu düşünülmektedir. CFQ-R_{6-11} ve CFQ-R_{12-13} anketlerinde, e1 (ürünler ve teknoloji) bölümünden KF tanılı bireyler için kritik bir öneme sahip olan ilaçlar (e1101) kategorisinin bulunmadığını gördük. Multisistemik doğasından kaynaklanan çoklu organ etkilenimi sebebiyle pek çok ilaç kullanmak durumunda kalan KF hastalarının yaşam kalitesi değerlendirmesinde bu bölümün ilgili anketlerde yer almaması büyük bir boşluk oluşturmaktadır (25) . CFQ-R_{6-11} CFQ-$R_{12-13,}$ CFQ-$R_{ebeveyn}$ ve CFQ-R_{14+} anketlerinin tümü doğal çevre ve çevrede insan yapımı değişiklikler (e2) bölümünü içermemekteydi. Yaşanılan coğrafya ve ona bağlı faktörlerin bireylerin hastalık progresyonunu etkilemesi kaçınılmazdır. Szczesniak ve ark. hava kirleticilerine yıllık maruz kalmanın KF hastalarında alevlenme sıklığındaki artışla ilişkili olduğunu bildirmektedir (26). Diğer bir çalışmada ise 287 KF hastası üzerinde yapılan analiz sonuçları, hastalığın alevlenme riskinin hava kirleticilerin varlığıyla önemli ölçüde arttığını göstermiştir (27). Bunlara ek KF tanılı bireylerde ortam sıcaklığının psödomanas aeruginosa prevalansı ve akciğer fonksiyonu ile ilişkili olduğu görülmüştür (28). Bu anlamda e2 bölümünün eksikliğinin bu anketlerle değerlendirme yaparken sorun oluşturacağı açıktır.

Kistik fibrozis hastalarıyla çalışan farklı disiplinler, KF'li bireylerde yaşam kalitesi değerlendirirken, CFQ-R anketi için belirtilen bu eksiklikleri göz önünde bulundurarak hastalara ICF'in her bileşenini kapsayıcı şekilde değerlendirmek adına oluşturulan spesifik sorular yöneltebilirler (29). Örneğin çevresel faktörlerin daha iyi sorgulanması için "Çevrenizi ve yaşam koşullarınızı düşündüğünüzde, neyi faydalı veya destekleyici buluyorsunuz?" ya da "Çevrenizi ve yaşam koşullarınızı düşündüğünüzde, hangi engellerle karşılaşıyorsunuz? Çevresel faktörler bileşeninin yanı sıra ICF'in diğer bileşenleri için de spesifik sorular belirlenmiştir. Vücut işlevleri bileşeni için "Bedeniniz ve zihniniz hakkında düşünürseniz...olması gerektiği gibi çalışmıyor mu?", vücut yapıları için "Vücudunuzu düşünürseniz, hangi kısımlarda sorunlar mevcut?", aktivite ve katılım için "Günlük hayatınızı düşünürseniz, sizin için sorunlar neler?". ICF bileşenlerine yönelik oluşturulan bu soruların anketin mevcut bileşenlerdeki eksikliklerini azaltmak adına yararlı olacağını düşünüyoruz (30, 31).

Çalışmamızın sonuçları yaşam kalitesini değerlendirmek için kullanılan CFQ-R anketinin içeriğinin doğası ve kapsayıcılığı hakkında ayrıntılı bilgi ortaya koymaktadır. CFQ-$R_{6-11,}$ CFQ-$R_{12-13,}$ CFQ-$R_{ebeveyn}$ anketlerinin çoğunlukla vücut işlevleri bölümü ile, CFQ-R_{14+} anketinin ise büyük ölçüde etkinlik katılım bölümü ile ilişkili olduğunu gördük. Çevresel faktörler bileşeninin her bir ankette daha az temsil edildiğini söyleyebiliriz. Çalışmamızda sunduğumuz CFQ-R_{6-11} CFQ-$R_{12-13,}$ ve CFQ-R_{14+}, CFQ-$R_{ebeveyn}$ formları için belirtilen eksikliklerin ortaya konması bu alanda çalışan

klinisyenlerin değerlendirmede sorgulanmayan ICF bileşenlerine yönelik spesifik soru kalıplarının kullanılması açısından önemlidir. Ayrıca bu alanda çalışan klinisyenlerin yanı sıra KF'de yeni ölçekler geliştirmeyi hedefleyen araştırmacılar için araçların ICF ile uyumlu hale getirilmesi adına ortaya koyduğumuz bulgular yol gösterici olacaktır.

Destekleyen kuruluş: Yoktur.

Çıkar çatışması: Yoktur.

Yazar katkıları: Fikir/Kavram: SB, NA; Tasarım: SB, NA; Denetleme/Danışmanlık: SB; Veri Toplama ve/veya Veri İşleme: SB, NA, SNK, TD, İD; Analiz ve/veya Yorumlama: SB, NA, SNK, TD, İD, BÖ; Literatür Tarama: NA; Makale Yazımı: NA; Eleştirel İnceleme: SB

Açıklamalar: Yoktur.

Teşekkür: Yoktur.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)224-235

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EXAMINING THE CORRELATION BETWEEN HIP ADDUCTOR MUSCLE STRENGTH, CORE STABILIZATION, AND LOWER EXTREMITY PERFORMANCE IN HEALTHY INDIVIDUALS

ORIGINAL ARTICLE

ABSTRACT

Purpose: This study aimed to investigate the correlation between hip adductor muscle strength and endurance, core stabilization, and lower extremity performance.

Methods: One hundred thirty-three healthy individuals were included in the study. Bilateral hip adductor muscle strength was evaluated with a compression test by using a sphygmomanometer, and endurance was evaluated by the number of hip adduction repetitions for each extremity performed in the side-lying position in one minute. Core stabilization was evaluated by the endurance of the trunk muscles (the time of maintaining the flexion of the trunk 60 degrees, the lateral bridge position, and the trunk extension against gravity). Lower extremity dynamic balance (Y balance test) and performance (single-leg and triple-crossover hop test) were also evaluated.

Results: A positive and moderate correlation was found between hip adductor muscle strength and endurance of nondominant (r=0.529, p<0.001) and dominant (r=0.355, p<0.001) trunk lateral flexors on the lower extremity side, dominant single-leg hop test (r=0.314, p<0.001), and dominant (r=0.362, p<0.001) and nondominant (r=0.331, p<0.001) triple-crossover hop test. A negative and low level of correlation was found between hip adductor muscle strength and dominant (r=-0.235, p=0.007) and nondominant (r=-0.244, p=0.005) Y balance test total scores, and dominant (r=-0.167, p=0.055) and nondominant (r=-0.186, p=0.032) Y balance test posteromedial scores.

Conclusion: Hip adductor muscle strength and endurance were significantly correlated with core stabilization, lower extremity dynamic balance and performance, and hip adductor muscle strength, balance, and performance test scores were affected by gender.

Keywords: Core Stability, Muscle Strength, Physical Functional Performance

SAĞLIKLI BİREYLERDE KALÇA ADDUKTÖR KAS KUVVETİNİN, KOR STABİLİZASYONU VE ALT EKSTREMİTE PERFORMANSI İLE İLİŞKİSİNİN İNCELENMESİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı, kalça adduktör kas kuvveti ve enduransı ile kor stabilizasyonu ve alt ekstremite performansı arasındaki ilişkiyi araştırmaktı.

Yöntem: Çalışmaya 133 sağlıklı birey dahil edildi. Bilateral kalça adduktör kas kuvveti sfigmomanometre kullanılarak sıkıştırma testi ile, endurans ise her bir ekstremite için yan yatış pozisyonunda bir dakika içinde yapılan kalça adduksiyon tekrar sayısı ile değerlendirildi. Kor stabilizasyon, gövde kaslarının enduransı (gövdenin 60 derece fleksiyonunu, lateral köprü pozisyonunu ve yerçekimine karşı gövde ekstansiyonunu sürdürme süresi) ile değerlendirildi. Alt ekstremite dinamik dengesi (Y denge testi) ve performans (tek ayak ve üç adım çapraz sıçrama testi) değerlendirildi.

Sonuçlar: Kalça adduktör kas kuvveti ile nondominat (r=0,529, p<0,001) ve dominant (r=0,355, p<0,001) alt eksremite tarafındaki gövde lateral fleksörleri enduransları, dominant tek ayak sıçrama testi (r=0,314, p<0,001), dominant (r=0,362, p<0,001) ve nondominant (r=0.331, p<0,001) üç adım çapraz sıçrama testi skorları arasında pozitif yön ve orta düzeyde ilişki bulundu. Kalça adduktör kas kuvveti ile dominant (r=-0.235, p=0.007) ve nondominant (r=-0.244, p=0.005) Y denge testi toplam skorları ve dominant (r=-0.167, p=0.055) ve nondominant (r=-0.186, p=0.032) Y denge testi posteromedial skorları ile negatif yön ve düşük düzeyde ilişki bulundu.

Tartışma: Kalça adduktör kas kuvveti ve enduransı ile core stabilizasyon, alt ekstremite dinamik denge ve performansı arasında anlamlı ilişki bulunmuştur ve kalça adduktör kas kuvveti, denge ve performans test skorları cinsiyetten etkilenmektedir.

Anahtar Kelimeler: Kor Stabilite, Kas Kuvveti, Fiziksel Fonksiyonel Performans

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Received: *05.07.2023 (Geliş Tarihi)*
Accepted: *25.04.2024 (Kabul Tarihi)*

INTRODUCTION

Today, participation in sporting activities has expanded not only to athletes but also to too many participants, with the increase in participants' interest and recreational resources (1). The hip adductors account for approximately 25% of the lower limb muscle volume of healthy adults. Since the proportion of muscle volume is closely related to muscle strength, the muscle strength of the hip adductors is higher than that of other hip muscles. Due to sudden changes in the direction of sports activities and explosive power hip adductor muscles are injured more frequently, and this causes pain (2,3). Apart from sports activities, hip adductor muscles are among the muscles that should be avoided from injuries due to their contribution to lowering extremity stabilization and spine stabilization and their effects on knee biomechanics. Determining the factors associated with the strength of the hip adductor muscles is deemed significant for the prevention of injuries and the planning of rehabilitation programs (4).

Core muscles are the main stabilizer muscles. The endurance and balance of these muscles are related to the entire spine biomechanics. Besides, abnormal pelvic mechanics that can lead to injuries can be prevented by maintaining the strength balance of the lower extremity and core muscles (5). The contractions of the hip adductors are responsible for the adduction movement of the lower limb and are also involved in the control of pelvic movements when body weight is supported by only one lower limb. Furthermore, contractions of the hip adductors facilitate coordination between the pelvic and abdominal muscles. The striated muscles of the urethral wall also contract during contraction of the hip adductor muscles along with the pelvic floor muscles. Contraction of the adductor muscles facilitates synergistic intrapelvic muscle contraction. Considering the correlation between hip adductor muscles and trunk muscles, internal and external obliques work together with hip adductor muscles to provide not only functional movement but also stabilization by connecting to each other in the anterior oblique sling system (6). Although we have already had this information, there are no studies present in the literature, as far as we could review, examining the correlation between hip adductor muscle strength and core stabilization in healthy young individuals.

Evaluating lower extremity performance provides information about the ability to perform advanced activities and sports aptitude (7). Extremity strength and endurance are important components that determine performance power and post-performance injury risk (8). In the research examining the correlation between muscle strength around the hips and functional performance tests, the strongest correlation has been found between performance test scores and hip adductor strength. However, it has been reported that more research is needed on this issue (9).

The hypotheses of this study are as follows;

H1: There is a relationship between hip adductor muscle strength and core stabilization in healthy individuals.

H2: There is a relationship between hip adductor muscle strength and lower extremity performance in healthy individuals.

Based on all these, we aimed to examine the correlation between hip adductor muscle strength and endurance, core stabilization, and lower extremity performance in healthy individuals.

METHODS

Ethics committee approval of this study was obtained from Pamukkale University Non-Interventional Clinical Research Ethics Committee with the committee decision dated 24.12.2019 and numbered 22, and necessary changes were made with the committee decision dated 08.12.2020 and numbered 23. The research was carried out at Burdur Mehmet Akif Ersoy University Burdur Vocational School of Health Services University. The students at the university in the 2019-2020 and 2020-2021 academic years were informed about the research through the school information system and were invited to participate in the research. Informed consent forms were ob-

tained from the participants according to the Declaration of Helsinki, and information was given about the evaluations.

The sample size of our research was determined by the G*Power (3.1.9.2) program. It was planned to include at least 111 participants in our research to achieve 90% power with r=0.27 (10) α=0.05 type I error, β=0.10 type II error.

Inclusion criteria: individuals who are between 18 and 25 years of age; volunteers; who can understand and apply the relevant instructions; and individuals who can speak and understand Turkish were included in the study. Exclusion criteria: subjects with spine and lower extremity injuries or surgery in the last 6 months; individuals who have chronic pain in the spine and lower extremities; individuals who have systemic and chronic diseases; recreational or professional athletes; individuals who have muscle shortness in the lower extremities that affects performance were not included in the study. Individuals who wanted to leave the study voluntarily and individuals who could not complete the assessment content for any reason were excluded from the study. The sampling flow chart of the research is presented in Figure 1.

In the evaluation, the demographic information and dominant lower extremity information of the participants were recorded through a prepared form. Lower extremity dominance was determined by examining the dominant foot while kicking the ball (11). The strength and endurance of hip adductor muscles were evaluated. Static endurance measurements of trunk flexors, extensors, and lateral flexors were performed in evaluating core stabilization. Since it would affect performance, dynamic balance evaluation was performed, and lower extremity performance tests were applied. All the assessments of one participant were made by the same person on the same day. Muscle strength, endurance, dynamic balance, and performance were evaluated with appropriate rest intervals.

Muscle strength

Hip adductor muscles strength measurement: The strength of the hip adductor muscles was evaluated by using a sphygmomanometer. Before initiating the evaluation, a pre-test was applied to 45 individuals in order to determine the validity of the sphygmomanometer. Then the measurement for the research was initiated. The sphygmomanometer was fixed at 10 millimeters of mercury (mmHg) while the participant's hips were flexed to approximately 45 degrees, and the soles of the feet were lying on their back on the bed. The cuff of the sphygmomanometer was placed between both knees. The participant compressed the cuff. After the compression, the closest pressure value up to 5 mmHg was measured as the isometric force (12). Each measurement was performed three times, and the mean score of the three measurements was recorded as the score. Hip adductor muscle strength measurement is presented in Figure 2.

Hip adductor muscles endurance measurement: In order to measure the dynamic endurance of the adductor muscles, a 20-degree arc with normal hip adduction value was drawn on the wall. The participant was positioned in the side-lying position so that the hip, knee, and ankle joints were in the same line. The participant was asked to perform as many hip adductions as possible within 60 seconds, with the participant's foot on the spring drawn on the wall. The number of adductions performed correctly (reaching the reference line) was recorded for both legs (The clinical test applied for the dynamic endurance measurement of the hip abductor muscles was designed so that it was appropriate for the dynamic endurance measurement of the hip adductor muscles.) (13).

Core stabilization

Trunk flexor muscles endurance assessment: The participant's trunk was positioned in 60° flexion, knees in 90° flexion, with feet fixed on the bed and arms crossed in front. The participant was asked to try to maintain trunk flexion. While continuing the position, the participant was told to breathe without holding their breath (14).

Trunk extensor muscles endurance assessment: The participant was positioned in the prone position so that the pelvis and lower ex-

tremities remained on the bed, and the torso hanging from the bed from the anterior superior of the spine iliac. The lower extremity weight was stabilized with the help of the researchers. The participant was instructed to cross their arms forward and lift their torso backward. The participant was also asked to try to maintain trunk extension (14).

Trunk lateral flexor muscles endurance assessment: The participant was positioned on the left side for the right side and on the right side for the left side with the forearm parallel to the bed. When ready, the participant was asked to do a side bridge with support from the elbows and feet.

The tests were terminated as soon as the participant was not able to maintain the test position or when the body oscillations were observed. The time obtained with the stopwatch was recorded in seconds (14).

Lower extremity performance

Dynamic balance measurement (Y balance test): The participant was asked to place their feet in the very center of the test setup. The participant was told to lie down with the other foot in the anterior, posterolateral, and posteromedial directions while standing in balance on one leg. Three trials were performed before initiating the test. The participant was then asked to lie down three times in each direction. The largest distance lying down by the participant was recorded in centimeters. For the total score calculation, the participant's leg length was measured for both extremities. The distance lengths in three directions were summed up. The test score was obtained by dividing the total value by 3 times the leg length of the same side and multiplying it by 100. It is accepted that the higher the score, the better the balance is (15).

Lower extremity performance tests: Performance evaluations were carried out with single-leg hop and triple-crossover hop tests. For both tests, a track with a long vertical line passing through the middle of a horizontal line was used. In the single-leg hop test, the participant jumped on the vertical line with the finger line behind the horizontal line (16). The distance between the heel and the horizontal line was measured. In the triple-crossover hop test, the participant on one foot made triple crossover jumps, crossing the vertical line, on the right or left side of the vertical line, with the finger level behind the horizontal line. The distance between the heel and the horizontal line was measured. Scores were recorded for both legs. It is accepted that the higher the score, the better the performance of the individual is (17).

Statistical Analysis

Statistical analyses were performed with SPSS 24.0 (IBM SPSS Statistics 24, Armonk, NY: IBM Corp.) package program. Continuous variables were expressed as mean ± standard deviation and categorical variables were expressed as numbers and percentages. The Kolmogorov-Smirnov test was used for the normal distribution of the variables examined. The Mann-Whitney U Test was used to compare independent group differences. The Spearman Correlation analysis was used to examine the correlations between continuous variables. $p<0.05$ was considered statistically significant. The correlation coefficient between 0.1-0.29 was considered low, while the correlation coefficient between 0.30-0.49 was considered moderate, the correlation coefficient between 0.50-0.69 was considered high, and the correlation coefficient between 0.70 and above was considered very high (18).

Table 1. Mean Age, Height, Weight, and BMI of the Participants

	Min-Max	X±SD
Age (year)	18-25	20.03±1.15
Height (m)	1.40-1.89	1.67±0.09
Weight (kg)	42-95	61.83±11.94
BMI (kg/m^2)	16.94-32.03	22.09±3.14

Data presented as X ± SD, min: minimum, max: maximum, m: meter, kg: kilogram, kg/m^2: kilogram/ square meters, BMI: body mass index

Table 2. Values of the Continuous Variables of the Participants

Variables	Min-Max	X±SD
Hip adductor muscles strength (mmHg)	93.33-300	167.47 ± 40
Dominant hip adductors endurance (repetitions)	20-120	52.55 ± 17.59
Nondominant hip adductors endurance (repetitions)	18-112	49.99 ± 16.4
Trunk flexors endurance (sec)	12-600	125.41 ± 109.85
Trunk extensors endurance (sec)	7-156	46.26 ± 27.41
Trunk lateral flexor endurance on the dominant lower extremity side (sec)	2-109	37.63 ± 24.4
Trunk lateral flexor endurance on the nondominant lower extremity side (sec)	2-115	39.43 ± 26.32
Y balance test- dominant anterior (cm)	43-100	60.94 ± 10.47
Y balance test- dominant posteromedial (cm)	13-97	47.97 ± 16.16
Y balance test- dominant posterolateral (cm)	31-100	57.2 ± 12.84
Y balance test- dominant total (cm)	41.92-108.79	64.6 ± 13.92
Y balance test- nondominant anterior (cm)	39-87	60.66 ± 10.69
Y balance test- nondominant posteromedial (cm)	21-97	49.03 ± 16.4
Y balance test- nondominant posterolateral (cm)	34-113	59.29 ± 12.57
Y balance test- nondominant total (cm)	40.56-108.79	65.68 ± 13.68
Dominant single-leg hop test score (cm)	28-134	72.92 ± 22.79
Nondominant single-leg hop test score (cm)	6-148	69.74 ± 23.83
Dominant triple-crossover hop test score (cm)	109-454	228.11 ± 64.13
Nondominant triple-crossover hop test score (cm)	115-453	225.14 ± 63.45

Data presented as X±SD, min: minimum, max: maximum, mmHg: millimeters of mercury, sec: second, cm: centimeter

RESULTS

The mean age of the participants was 20.03±1.15 (18-25) years, and their mean body mass index (BMI) was 22.09±3.14 (16.94-32.03) kg/m2. The number of female participants was 94 (70.7%), whereas the number of male participants was 39 (29.3%). The dominant lower extremity of 121 (91%) participants was right, while the dominant lower extremity of 12 (9%) participants was left (Table 1). The values of the continuous variables of the participants are presented in Table 2.

A positive and moderate level correlation was found between hip adductor muscle strength and dominant (r=0.355, p<0.001) and nondominant (r=0.529, p<0.001) trunk lateral flexor endurance, dominant single leg hop test (r=0.314, p<0.001), and dominant (r=0.362, p<0.001) and nondominant (r=0.331, p<0.001) triple-crossover hop test scores. A positive and low-level correlation was found between hip adductor muscle strength and the nondominant single-leg hop test (r=0.288, p=0.001). Besides, negative and low-level correlations were found between hip adductor muscle strength and dominant Y balance test total score (r=-0.235, p=0.007) and posteromedial score (r=-0.167, p=0.050), nondominant Y balance test total score (r=-0.244, p=0.005) and posteromedial score (r=-0.186, p=0.032), and the difference in the endurance of the trunk lateral flexors between the dominant and nondominant sides (r=-0.247, p=0.004) (Table 3).

A positive moderate-level correlation was found between dominant hip adductor endurance and trunk flexor endurance (r=0.306, p<0.001). Positive and low-level correlations were found between dominant hip adductor endurance and trunk extensor endurance (r=0.189, p=0.029), dominant trunk lateral flexors endurance (r=0.177, p=0.041), and dominant Y balance test posteromedial score (r=0.173, p=0.046). A positive and low-level correlation was found between nondominant hip adductor endurance and trunk flexor endurance (r=0.228, p=0.008), trunk

Table 3. The Correlation between Participants' Hip Adductor Muscle Strength and Core Stabilization, Lower Extremity Balance and Performance

	Hip adductor muscle strength	
Variables	**r**	**p**
BMI	0.174	0.045*
Hip adductor endurance		
Dominant extremity	0.147	0.091
Nondominant extremity	0.157	0.071
Core stabilization		
Endurance of trunk flexors	0.149	0.087
Endurance of trunk extensors	0.036	0.679
Endurance of trunk lateral flexor on the dominant lower extremity side	0.355	0.000*
Endurance of trunk lateral flexor on the nondominant lower extremity side	0.529	0.000*
Dominant Y balance test		
Anterior	-0.131	0.132
Posteromedial	-0.167	0.050*
Posterolateral	-0.088	0.313
Total score	-0.235	0.007*
Nondominant Y balance test		
Anterior	-0.162	0.062
Posteromedial	-0.186	0.032*
Posterolateral	-0.081	0.353
Total score	-0.244	0.005*
Lower Extremity Performance		
Dominant single-leg hop test	0.314	0.000*
Nondominant single-leg hop test	0.288	0.001*
Dominant triple-crossover hop test	0.362	0.000*
Nondominant triple-crossover hop test	0.331	0.000*
Dominant vs. Nondominant Differences		
Endurance difference of trunk lateral flexors	-0.247	0.004*

Spearman correlation analysis r= correlation coefficient, p= significance value, *p<0.05 statistically significant difference, BMI: body mass index

extensor endurance (r=0.185, p=0.033), and dominant (r=0.218, p=0.012) and nondominant (r=0.199, p=0.022) trunk lateral flexor endurance (Table 4). The comparisons of hip adductor muscle strength, lower extremity balance, and performance scores according to gender are shown in Table 5.

DISCUSSION

In our research, in which we aimed to examine the correlation between hip adductor muscle strength, core stabilization, lower extremity dynamic balance, and performance in healthy individuals, a correlation was found between trunk lateral flexor endurance and hip adductor muscle strength and endurance. Besides, a correlation was observed between trunk flexor and extensor endurance and hip adductor endurance. Correlations were also revealed between posteromedial and total score of dynamic balance and hip adductor strength and endurance and between lower extremity performance and hip adductor muscle strength.

Many studies have included the relationship between BMI and lower extremity muscle strength. Although there was a negative relationship between BMI and lower extremity muscle strength in studies that included obese and normal BMI

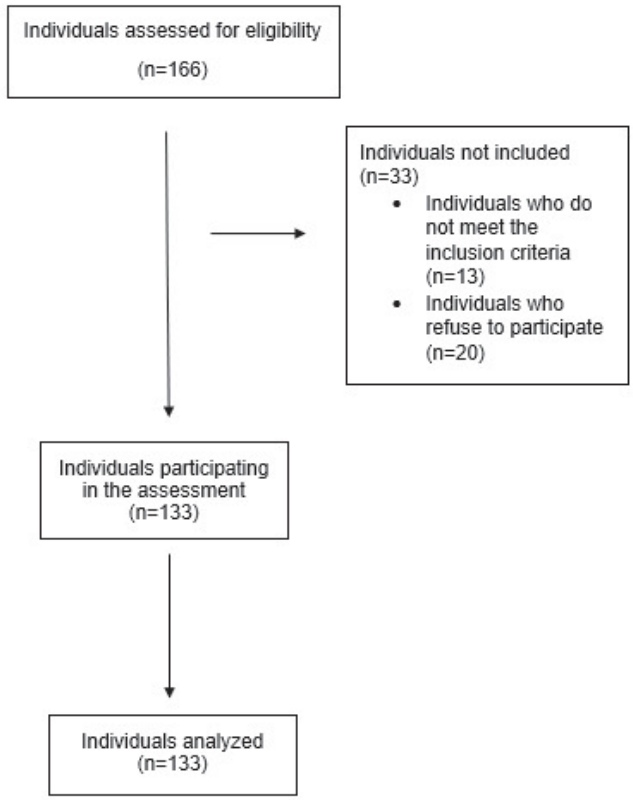

Figure 1. The Sampling Flow Chart of the Research

individuals and examined the relationship between BMI and lower extremity muscle strength, in a study that included young and healthy participants with a BMI of 35 and below and a positive correlation was found between BMI and lower extremity muscle strength. (19,20,21). Our study was also performed with a young and similar population with a mean BMI of 22.09±3.14 kg/m^2, and a positive correlation was found between hip adductor muscle strength and BMI. Similar to the results of the study mentioned above, the fact that our population had normal BMI values may have caused this conclusion.

Hip adduction increases oblique muscle activity and isometric contraction of adductor muscles facilitates contralateral oblique muscle function through the muscle sling system (22). Probably because of this, in our research, we observed a correlation between trunk lateral flexor endurance and hip adductor muscle strength and endurance. Hip adductor muscle strength and endurance may have a significant role in the lateral stabilization of the trunk. Therefore, hip adductor strength and endurance should also be considered in cases associated with a lack of lateral stabilization and thus, should be included in the rehabilitation program.

It has been reported that imbalances and deficits in core muscles will cause increased fatigue, decreased lower extremity endurance, and increased risk of injury (23). Our research found a negative correlation between the dominant and nondominant difference in trunk lateral flexor endurance and hip adductor muscle strength. Although this correlation is low it suggests that hip adductor muscle strength may be adversely affected as the difference between the dominant and nondominant sides increases, that is to say, as an imbalance occurs in the trunk muscles.

It has been shown that the contraction of hip adductor muscles during different exercises such as bridge and sling exercises increases the activation of muscles such as transversus abdominus, multifidus, and erector spina in healthy young individuals (24). We found a correlation

Table 4. The Correlation between the Participants' Dominant and Nondominant Hip Adductor Endurance and Core Stabilization, Lower Extremity Balance and Performance

	Dominant hip adductor endurance		Nondominant hip adductor endurance	
Variables	**r**	**p**	**r**	**p**
Core stabilization				
Endurance of trunk flexors	0.306	0.000*	0.228	0.008*
Endurance of trunk extensors	0.189	0.029*	0.185	0.033*
Endurance of trunk lateral flexor on the dominant lower extremity side	0.177	0.041*	0.218	0.012*
Endurance of trunk lateral flexor on the nondominant lower extremity side	0.155	0.074	0.199	0.022*
Dominant Y balance test				
Anterior	0.044	0.613	0.021	0.811
Posteromedial	0.173	0.046*	0.107	0.221
Posterolateral	0.141	0.105	0.089	0.311
Total score	0.112	0.198	0.067	0.442
Nondominant Y balance test				
Anterior	0.121	0.165	0.070	0.422
Posteromedial	0.156	0.072	0.104	0.206
Posterolateral	0.125	0.151	0.024	0.781
Total score	0.130	0.136	0.067	0.445
Lower Extremity Performance				
Dominant single-leg hop test	0.133	0.127	0.158	0.068
Nondominant single-leg hop test	0.059	0.502	0.099	0.256
Dominant triple-crossover hop test	0.094	0.280	0.060	0.496
Nondominant triple-crossover hop test	0.019	0.826	-0.006	0.949

Spearman correlation analysis r= correlation coefficient, p= significance value, *p<0.05 statistically significant difference

between dominant and nondominant hip adductor endurance and trunk extensor endurance in our research. In this case, hip adduction exercises performed simultaneously with trunk extension exercises may facilitate the function of trunk extensors. It may be beneficial for them to take part in exercise programs together.

The plank exercise with unilateral and bilateral hip adduction increases the activation of the rectus abdominis and oblique abdominals (25). Besides, another study mentions a synergy connecting the muscles of the internal oblique, transversus abdominis, rectus femoris, and hip adductors. It has been stated that this synergy deteriorates after an intervention that causes fatigue, such as taking a sidestep, and accordingly, a decrease in hip control function may occur (26). In our research, we found a correlation between dominant and nondominant hip adductor endurance and trunk flexor endurance. Adding hip adduction activity to exercises focusing on improving core stabilization such as plank may increase the effectiveness of the exercise. Also, improving hip adductor endurance can increase the effectiveness of the exercise.

Balanced lower extremity motor activities are associated with lower extremity performance (27). Y balance test, one of the dynamic balance tests, imitates the functional activities of daily life quite well. It also provides a better analysis of bilateral postural control asymmetry, injury risk, or post-injury damage (28). In the research examining the correlation between lower extremity strength and dynamic balance in patients who had had an operated ankle fracture six months before; a correlation was reported between hip adductor muscle strength and anterior, posteromedial, and posterolateral balance in the intact

Table 5. Muscle Strength, Lower Extremity Balance, and Performance Comparisons by Gender

Variables	Min-Max	X±SD	p
Hip adductor muscle strength (mmHg)			
Female	93.33-216.66	154.15±27.21	0.000*
Male	106.66-300	199.57±47.43	
Dominant hip adductor muscle endurance (repetitions)			
Female	20-88	51.58±14.41	0.329
Male	23-120	54.87±23.64	
Nondominant hip adductor muscle endurance (repetitions)			
Female	20-91	49.97±14.52	0.929
Male	18-112	49.79±20.34	
Dominant Y balance test score (cm)			
Female anterior score	43-84	60.15±10.44	0.177
Male anterior score	47-100	62.85±10.43	
Female posteromedial score	13-88	47.09±16.20	0.335
Male posteromedial score	20-97	50.08±16.08	
Female posterolateral score	33-89	56.07±12.08	0.131
Male posterolateral score	31-100	59.90±14.30	
Female total score	42.57-97.86	65.94±13.68	0.741
Male total score	41.92-108.79	65.07±13.86	
Nondominant Y balance test score (cm)			
Female anterior score	39-87	60.09±11.03	0.131
Male anterior score	45-87	62.02±9.83	
Female posteromedial score	21-94	48.08±16.37	0.304
Male posteromedial score	28-97	51.31±16.46	
Female posterolateral score	34-90	57.52±11.70	0.011*
Male posterolateral score	45-113	63.54±13.69	
Female total score	40.56-97.78	65.01±13.85	0.598
Male total score	45.98-108.79	63.61±14.22	
Dominant single-leg hop test score (cm)			
Female	28-130	66.91±20.15	0.000*
Male	40-134	87.41±22.50	
Nondominant single-leg hop test score (cm)			
Female	6-123	62.89±19.42	0.000*
Male	32-148	86.26±25.58	
Dominant triple-crossover hop test score (cm)			
Female	109-373	207.45±48.59	0.000*
Male	155-454	277.90±70.06	
Nondominant triple-crossover hop test score (cm)			
Female	115-366	203.76±48.71	0.000*
Male	127-453	276.69±65.71	

The Mann-Whitney U Test analyzed, data presented as X ± SD, min: minimum, max: maximum, mmHg: millimeters of mercury, cm: centimeter, p= significance value, *p<0.05 statistically significant difference

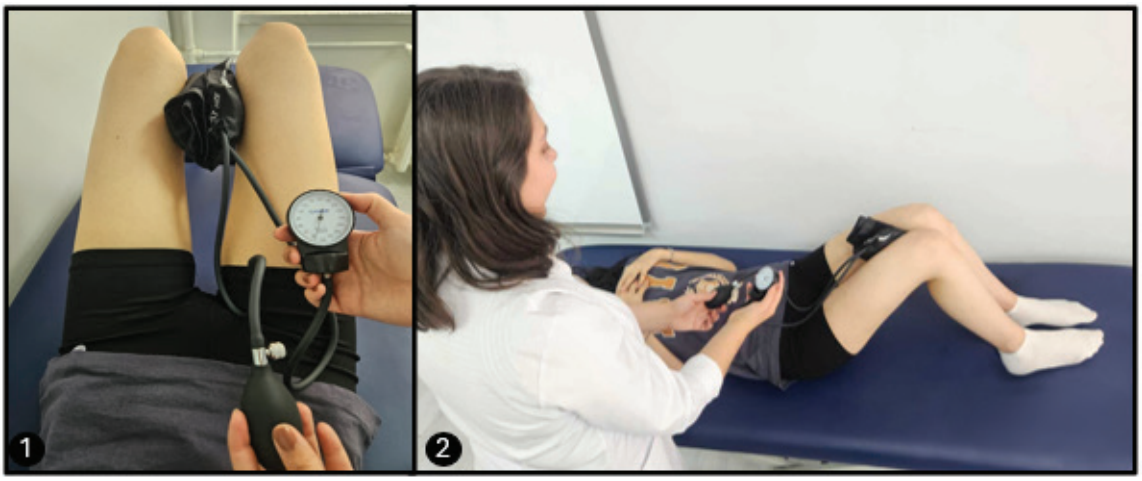

Figure 2. Strength Measurement of the Hip Adductor Muscles.

1) Starting position 2) Compression moment

extremity. It has been stated that this may be due to the involvement of hip adductor muscles in hip flexion and extension movements (29). In our research, we observed a negative correlation between posteromedial and total balance scores and hip adductor strength and endurance. This negative correlation has not been previously reported in the literature. This situation may be caused by other components (such as height, leg length, and the flexibility of the contractile and non-contractile structures of the lower extremities and trunk) on which the dynamic balance is affected. Just as in our research, low correlations were reported between balance and lower extremity muscle strength in children, adolescents, young, middle-aged, and old adults in a review and meta-analysis (30). In our study, we found a significant difference between the dominant and nondominant sides in the Y balance test posterolateral, posteromedial, and total scores. This is thought to support the literature (31,32) stating that balance is affected by dominance. The fact that the total score of the dominant side is higher than that of the nondominant side may also indicate that the ability.

Functionality is a term that is widely used in the clinic and that includes reaching a goal as a result of movement but does not have a standard form for this reason there is no standard for evaluating functionality. But functional performance is evaluated with the help of tests to embody physical abilities and to identify activity-specific disorders. (33,34). In the research examining the correlation between the strength of the muscles around the hip and functional performance tests, the strongest correlation was found between the triple-crossover hop test and the hip adductor peak strength (9). In our research, we found a correlation between hip adductor muscle strength and hop test scores. In this case, we suggest that hip adductor strength should not be ignored in exercise programs designed for functional performance improvement in athletes or when returning to normal function after an injury.

Differences in lower extremity strength and kinematics between genders have been the subject of many studies (35,36). Among the results reported in studies are that especially sagittal plane movements are affected by gender differences (37), males show better aerobic and musculoskeletal system performance than females, and females have lower hip abductor and external rotator muscle strength than males (35). In our study, hip adductor muscle strength and lower extremity performances were found to be higher in males than in females by the literature. The higher muscle strength of males may have caused them to be more skillful in performance tests, to generate more explosive power required for jumping, and to elicit balance reaction responses more easily.

The strengths of our study are that it is one of the few studies investigating the correlation between hip adductor muscle strength, core stabilization, and lower extremity performance in healthy individuals. In our study, all assessments were performed by the same researcher in an environment where the assessments were prepared. In our research, all the evaluations were made by the same researcher in an environment prepared by the evaluations.

The limitation of our research; was the distribution of the students in Burdur Mehmet Akif Ersoy University Burdur Vocational School of Health Services, which is the population of our research, was not equal by gender, and the female population was higher. In other words, while the number of female participants in our research was 94, the number of male participants was 39. This situation is thought to have created several inequalities according to gender in our research.

There is no research on the parameters related to hip adductor muscle strength in the young and healthy population (except for athletes). In this research, we aimed to reveal the correlation between hip adductor strength, core stabilization, and lower extremity performance in this population. Hip adductor muscle strengthening exercises may be included in the exercise programs applied to improve core stabilization and lower extremity performance in healthy individuals. Besides, there is a need to examine the correlation between hip adductor muscle strength and core stabilization in different musculoskeletal system problems. Hip adductor strengthening exercises can contribute to increasing the stabilization of individuals with stabilization problems more effectively. In addition to the performance tests used in the evaluation of athletes, including hip adductor muscle strength to the evaluations may also reveal the correlation between adductor muscle strength and performance in athletes. It may also be beneficial in terms of the efficiency of sports performance, and the prevention of lower extremity injuries can contribute to the planning of post-injury rehabilitation and reinjury prevention programs.

Sources of Support: There is no source of support.

Conflict of Interest: There is no conflict of interest.

Author Contributions: Concept and design Nevriye UNAL-SUZER, Nihal BUKER and Akın SUZER; supervision Nihal BUKER; data collection Nevriye UNAL-SUZER and Akın SUZER; analysis Nihal BUKER; literature review and article writing Nevriye UNAL-SUZER; critical review Nihal BUKER.

Explanations: It is a publication produced from the Master's thesis prepared by Nevriye UNAL-SUZER under the supervision of Nihal BUKER within the scope of the Pamukkale University Health Sciences Institute Physiotherapy and Rehabilitation Master's Program. No paper presentation was made.

Acknowledgment: We would like to thank Burdur Mehmet Akif Ersoy University Burdur Vocational School of Health Services for the technical opportunities they provide

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)236-245

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Received: *21.06.2023 (Geliş Tarihi)*
Accepted: *03.06.2024 (Kabul Tarihi)*

TOTAL DİZ PROTEZİ CERRAHİSİ SONRASI TELE-REHABİLİTASYON PROGRAMININ ETKİLERİNİN ARAŞTIRILMASI: RANDOMİZE KONTROLLÜ ÇALIŞMA

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Çalışmamızın amacı; total diz protezi (TDP) cerrahisi sonrası tele-rehabilitasyon programı (TR-FTR) ve yüz yüze fizik tedavi ve rehabilitasyon programı (YY-FTR) alan bireylerde uygulanan protokolleri fiziksel ve fonksiyonel parametreler açısından karşılaştırmak ve tele-rehabilitasyon (TR) hizmeti alanların bu hizmetten memnuniyetlerini değerlendirmekti.

Yöntem: TDP cerrahisi geçirmiş 37 birey randomize olarak TR-FTR ve YY-FTR grubu olacak şekilde ikiye ayrıldı. Çalışmaya dahil olan bireylerin diz eklem hareket açıklığı (D-EHA) universal gonyometre ile; fiziksel performansları "Zamanlı Kalk ve Yürü Testi", "6 Dakika Yürüme Testi", "5 Tekrarlı Otur-Kalk Testi" ile; fonksiyonellikleri "Western Ontario ve McMaster Üniversiteleri Osteoartrit İndeksi" (WOMAC) ile, egzersiz programına uyumu ise "Egzersize Uyum Derecelendirme Ölçeği" ile değerlendirildi. TR-FTR'ye katılanlara "Tele-Sağlık Kullanılabilirlik Anketi" ve "Tele-Tıp Memnuniyet Anketi" uygulandı. Her iki gruba uygulanan testler ve anketler yüz yüze olarak yapıldı.

Sonuçlar: Her iki grubun da tedavi sonrası D-EHA aktif ve pasif ölçümlerinde (pasif diz ekstansiyonu hariç) ($p<0,05$), fiziksel performans değerlendirmelerinde ve fonksiyonelliklerinde anlamlı gelişmeler bulundu ($p<0,05$). Bu parametrelerdeki değişimlerin gruplar arasında benzer olduğu ve egzersize uyum açısından da anlamlı fark olmadığı bulundu ($p>0,05$).

Tartışma: TDP cerrahisi sonrası TR-FTR ve YY-FTR bireylerin fiziksel ve fonksiyonel parametrelerinin geliştirilmesi açısından etkilidir. TR hizmetlerinin ortopedik problemi olan bireylerde YY-FTR'ye benzer sonuçlar vermesinden dolayı kullanılmasını önermekteyiz.

Anahtar Kelimeler: Diz Protezi, Memnuniyet, Osteoartrit, Telerehabilitasyon

INVESTIGATION OF THE EFFECTS OF THE TELE-REHABILITATION PROGRAM AFTER TOTAL KNEE PROSTHESIS SURGERY: A RANDOMIZED CONTROLLED TRIAL

ORIGINAL ARTICLE

ABSTRACT

Purpose: This study aimed to compare the protocols applied in individuals who received tele-rehabilitation (TR-PTR) and face-to-face physical therapy and rehabilitation (FF-PTR) program after total knee prosthesis (TKP) surgery in terms of physical and functional parameters and to evaluate the satisfaction of tele-rehabilitation (TR) service recipients.

Methods: Thirty-seven individuals who underwent TKP surgery were randomly divided into two groups: TR-PTR and FF-PTR program. The knee joint range of motion (K-ROM) of the individuals included in the study was determined by universal goniometer; physical performances were evaluated with the "Timed Get-Up-and-Walk Test", "6-Minute Walk Test", and "5 Times Sit-to-Stand Test", their functionality was evaluated with the "Western Ontario and McMaster Universities Osteoarthritis Index" (WOMAC), and their compliance with the exercise program was evaluated with the "Exercise Adherence Rating Scale". "Tele-Health Usability Questionnaire" and "Tele-Medicine Satisfaction Questionnaire" were administered to the TR-PTR group. Assessments and evaluations in both groups were conducted face to face.

Results: Significant improvements were found in active and passive measurements of K-ROM (except passive knee extension) ($p<0.05$), physical performance evaluations and functionality of both groups after treatment ($p<0.05$). It was found that the changes in these parameters were similar between the groups and there was no significant difference in terms of exercise adherence ($p>0.05$).

Conclusion: TR-PTR and FF-PTR programs are effective in improving the physical and functional parameters of individuals after TKA surgery. We recommend the use of TR services in individuals with orthopedic problems because it gives similar results to the FF-FTR program.

Keywords: Knee Prosthesis, Satisfaction, Osteoarthritis, Telerehabilitation

GİRİŞ

Total diz protezi (TDP); eklem kıkırdaklarında bozulma, yıpranma ve aşınmaya sebep olan diz osteoartriti (OA) problemleri olan bireylere sıklıkla uygulanan cerrahi bir yöntemdir. Bu yöntemle bireylerin eklem ağrısını hafifletmek, fonksiyonel kapasitelerini geliştirmek, mobilite ve yaşam kalitelerini artırmak hedeflenmektedir (1, 2).

TDP cerrahisi sonrası fizik tedavi ve rehabilitasyon protokolleri; cerrahinin klinik ve sosyal faydalarını artırmak, cerrahi sonrası oluşabilecek komplikasyonları azaltmak, fonksiyonel sonuçları iyileştirmek ve günlük yaşam aktivitelerine dönüşü sağlamak için yaygın olarak uygulanmaktadır (3, 4). Rehabilitasyon yaklaşımları; cerrahi için spesifik endikasyona, cerrahi prosedürlere ve hastanın özelliklerine (yaş, genel zihinsel ve fiziksel sağlık ve ameliyat öncesi durum vb.) göre değişiklik gösterebilmektedir (5). Eklem hareket açıklığı (EHA), germe, kuvvetlendirme, yürüme, endurans, denge egzersizleri vb. fizyoterapi modalitelerinin uygulanması TDP cerrahisi sonrası hastaların tam iyileşmeye ulaşılmasına yardımcı olur (4, 6).

TDP cerrahisi sonrası egzersiz tedavisi terapötik stratejinin önemli bir parçasıdır fakat postoperatif egzersiz tedavisinin sürdürülebilirliğini arttırmak için daha esnek ve bireyselleştirilmiş tedavi seçeneklerine ihtiyaç duyulmaktadır (7). Bu nedenle, hastalara uygun ve erişilebilir bakım hizmeti sağlamak için yeni ve etkili yaklaşımlar sunulmaktadır. Bu yaklaşımlar içinde son yıllarda tele-rehabilitasyon (TR) hizmetleri de önemli yer tutmaktadır (8).

TR yaklaşımı, bilgi ve iletişim araçları kullanılarak rehabilitasyon hizmetlerinin bireylere ulaştırılmasına ve takibine olanak tanır. TR yaklaşımları ile değerlendirme, müdahale etme, kontrol etme, eğitim ve danışma hizmetleri de sağlanabilmektedir (9). Sağlık hizmetine erişmede zorluk yaşayanlar için bir çözüm olarak benimsenmekte ve uzak bölgelerde yaşayan, çevresel imkanları uygun olmayan veya kısıtlamalar nedeniyle (pandemiler gibi) yerel sağlık hizmetlerine ulaşamayan kişilere rehabilitasyon hizmetlerine erişme konusunda adil bir fırsat sunmaktadır (9, 10).

Yapılan çalışmalarda, TDP cerrahisi sonrası TR programlarının, yüz yüze programlarla kıyaslandığında, etkilerinin daha geride kalmadığı gösterilmiştir (11, 12). Bu bilgiler ışığında, bu çalışmadaki primer amacımız, TDP cerrahisi sonrası, hastalara sunulan tele-rehabilitasyon programı (TR-FTR) ve klinikte sunulan yüz yüze fizyoterapi ve rehabilitasyon programının (YY-FTR), değerlendirilen fiziksel ve fonksiyonel parametreler açısından sonuçlarını karşılaştırmak, sekonder amacımız ise TR hizmeti alan hastaların bu hizmetten memnuniyetini değerlendirmekti. Çalışmamızda öngörülen hipotez, TDP cerrahisi sonrası TR-FTR ve YY-FTR grupları arasındaki sonuçların fiziksel performans, fonksiyonellik, hasta uyumu ve memnuniyet açısından benzer olduğu yönündeydi.

YÖNTEM

Bu randomize kontrollü çalışma Haziran 2022 ve Mart 2023 arasında yapıldı. Çalışma öncesi Lokman Hekim Üniversitesi Etik Kurulu'ndan 31 Mayıs 2022 tarihli ve 2022/9 sayılı izni alındı. Çalışma Helsinki Bildirgesinde tanımlanan ilkelere uygun şekilde yürütüldü.

Bireyler

Çalışmaya, Haziran 2022 ve Mart 2023 tarihleri arasında sementli TDP ameliyatı geçirmiş olan, çalışmaya katılmayı gönüllü olarak kabul eden, verilen sözel, görsel ve yazılı bilgileri anlayabilen, 50-75 yaş arası bireyler dahil edildi. Revizyon TDP ameliyatı olanlar, romatoid artrit, diyabetus mellitus, kanser gibi sistemik rahatsızlığı olanlar, TR hizmetlerini takip etmede uyum ve zorluk yaşayanlar, fonksiyonel yetersizliğe neden olan nörolojik hastalığı olanlar, morbid obez olanlar (vücut kütle indeksi [VKİ] > 40 kg/m^2) ve kalp pili olan bireyler çalışma dışı bırakıldı. Tüm katılımcıların sementli TDP cerrahileri aynı cerrah tarafından ve aynı protokol uygulanarak gerçekleştirildi ve tüm katılımcılardan yazılı aydınlatılmış onamları alındı. Veriler, tedavi amacıyla Prof. Dr. Murat Bozkurt Muayenehanesi'ne başvuran hastalardan toplandı.

Örneklem büyüklüğünün hesaplanabilmesi için, TR-FTR ve YY-FTR olmak üzere, iki grubun tek-

rarlı anket ölçüm düzeyleri arasında istatistiksel olarak anlamlı bir fark saptanabilmesi için Karma Desenli Varyans Analizi (Mixed Design ANOVA) kullanılarak, 0,80 etki büyüklüğünde %80 güç ve α=0,05 yanılma düzeyinde TR-FTR grubu 20 birey ve YY-FTR grubu 20 birey olacak şekilde (toplam 40 birey) olarak hesaplandı. Dahil edilme kriterlerini karşılayan bireyler zarf yöntemi kullanılarak basit randomizasyon tekniği ile 2 gruba ayrıldı ve sıralı olarak numaralandırıldı: TR-FTR grubu "1" ve YY-FTR grubu "2" olarak gösterildi.

Uygulanan Değerlendirmeler

Veri toplanmasında kullanılacak tüm testler, anketler ve değerlendirmeler klinikte yüz yüze yapıldı. Değerlendirmeler öncesi, hastaların yaş, boy uzunluğu, vücut ağırlığı, VKİ, eşlik eden hastalıklar, meslek, öğrenim durumu, çalışma durumu, alt ekstremite dominantlığı, etkilenen diz eklemi gibi demografik özellikleri kaydedildi. Bireylerin alt ekstremite dominantlığı, ayakta duruşta 50 cm mesafede önlerine iki ayak arasına konulan topa üç kez vurmaları istenerek belirlendi, topa vurmayı tercih ettikleri bacak dominant alt ekstremite olarak kaydedildi (13). Bireylerin, diz eklem hareket açıklıkları (D-EHA) üniversal gonyometre kullanılarak aktif/ pasif fleksiyon ve ekstansiyon olarak ölçüldü.

Bireyler, randomize olarak klinikte YY-FTR ve TR-FTR olmak üzere iki gruba ayrıldı. Her iki grupta yer alan olguların fiziksel ve fonksiyonel parametrelerini ortaya koyabilmek amacıyla değerlendirme yöntemleri, cerrahi öncesinde ve cerrahiden 6 hafta sonrasında yüz yüzeolmak üzere iki kez uygulandı.

Bireylerin, fiziksel performansı değerlendirmek için kullanılan Zamanlı Kalk ve Yürü Testi (ZKYT) kullanıldı. Test standart prosedürle üç tekrarlı uygulandı ve ortalama değer alınarak kaydedildi (14, 15).

Bireylerin fiziksel performansları ek olarak, 5 Tekrarlı Otur-Kalk Testi (5TOKT) ve 6 Dakika Yürüme Testi (6DYT) kullanılarak değerlendirildi (16-18).

Fonksiyonelliğin değerlendirilmesi için Western Ontario ve McMaster Üniversiteleri Osteoartrit İndeksi'nin (WOMAC) Tüzün ve diğ. tarafından yapılan Türkçe geçerlilik ve güvenirlik çalışması kullanıldı. WOMAC toplam skoru maksimum 96 puandır. Yüksek puanlar semptomların kötü veya fazla olduğunu ve sağlık durumunun kötü olduğunu ifade etmektedir. Çalışmamızda likert formu (Yok/ Hafif/ Orta Şiddette/ Şiddetli/ Çok Şiddetli) kullanıldı (19).

Bireylerin egzersiz programına uyumunu derecelendirmek için Newman ve diğ. tarafından geliştirilen Egzersize Uyum Derecelendirme Ölçeği (EUDÖ) kullanıldı. Kronik hastalığı olan hastalara önerilen ev egzersizine uyumu, uyumlu olma ve olmama sebeplerini değerlendirmek için geliştirilmiş ölçektir. EUDÖ A, B ve C olmak üzere 3 bölümden oluşmaktadır. Bölüm A; kişisel ihtiyaçlara göre adapte edilebilen, ölçek puanlamasına dahil edilmeyen 6 maddeden oluşmaktadır. Bölüm B; EUDÖ'nin kişisel ihtiyaçlara göre adapte edilemeyen, önerilen ev egzersizinin nasıl yapıldığının tanımlandığı bölümüdür. Bölüm C; önerilen ev egzersizine uyumun olmasının veya uyumun olmamasının nedenini değerlendiren bir bölümdür. Anket sonuç skoru B ve C bölümlerinden alınan skorların toplamı ile 0 ile 64 arasında yer almaktadır ve yüksek puan egzersize daha fazla uyumu gösterir. (20). Korkmaz ve diğ. tarafından Türkçe geçerlik ve güvenirliği yüksek lisans tezi kapsamında yapılmıştır fakat henüz yayınlanmamıştır.

TR-FTR grubundaki bireylere ayrıca memnuniyet düzeylerini belirlemek için Tele-Sağlık Kullanılabilirlik Anketi (TKA) ve Tele-Tıp Memnuniyet Anketi (TMA) uygulandı. TKA, yazılım ve sistem aracılığıyla uzaktan verilen rehabilitasyon hizmetini değerlendiren 21 maddeden oluşmaktadır. 7'li likert tipi bir ölçektir (1 = katılmıyorum ve 7 = katılıyorum). Toplam puan 21 maddenin toplanmasıyla hesaplanır. Anketten alınacak en yüksek puan 147 puandır ve yüksek puanlar kişi tarafından tele-sağlık hizmetinin kullanılabilir olduğunu gösterir. TMA TR hizmeti alan hastaların memnuniyet seviyesini değerlendiren 14 maddeden oluşmaktadır. 5'li likert tipi bir ölçektir (1 = kesinlikle katılmıyorum ve 5 = kesinlikle katılıyorum). Toplam puan 14 ile 70 arasında değişmektedir ve yüksek puanlar tele-tıp hizmetlerinden memnuniyeti gösterir. Her iki anketin Türkçe geçerlik ve güvenirliği Özden F. ve diğ. tarafından yapılmıştır (21).

Tüm değerlendirmeler, YY-FTR ve TR-FTR grubuna dahil olanlara, tedavi öncesinde ve tedavi sonrasında (6 hafta sonra) birinci değerlendirmeye kör farklı bir değerlendirici tarafından tekrar edildi.

Protokol

Çalışmaya dahil olan tüm bireylere (TR-FTR ve YY-FTR) post-operatif 1. günden taburcu oldukları güne kadar (post-operatif 3. gün) aynı fizyoterapi ve rehabilitasyon protokolü yüz yüze olacak şekilde uygulandı.

Bireyler taburcu olduktan hemen sonra post-operatif 4.-7. gün arasında, YY-FTR grubundaki hastalara klinikte egzersiz programı, nöromüsküler elektrik stimülasyonu (NMES) ve soğuk uygulama uygulandı. Daha sonra YY-FTR grubuna taburcu oldukları güne kadar egzersiz programı ve NMES uygulanmasına devam edildi.

TR-FTR grubundaki hastaların post-operatif dönemde egzersiz programı YY-FTR grubundaki protokoller ile aynı olacak şekilde *Youtube* kanalı üzerinden video tabanlı olarak gönderildi. Altı hafta boyunca haftada 3 gün olacak şekilde *Whatsapp* üzerinden görüntülü aranıp egzersizleri fizyoterapist gözetiminde ve kontrollü bir şekilde uygulandı.

Her iki çalışma grubuna yapılan uygulamalar Tablo 1'de gösterilmiştir.

İstatistiksel analiz

İstatistiksel analizler IBM SPSS Statistics 26,0 (SPSS Inc, Chicago, IL, ABD) paket programı kullanılarak yapıldı. Tanımlayıcı istatistikler; nominal ve ordinal değişkenler için frekans ve yüzde değerleri ile numerik değişkenler için ortalama, standart sapma, medyan ve persantil değerleri ile verildi. Görsel (histogram ve olasılık grafikleri) ve analitik yöntemler (Shapiro–Wilk testi, çarpıklık ve basıklık değerleri, varyasyon katsayısı) kullanılarak numerik değişkenlerin normal dağılıma uygunluğu incelendi. Bağımsız iki nominal değişkenin kıyaslanmasında Ki-Kare Testi kullanılırken, gözlerdeki beklenen değerlerin durumuna göre Pearson Ki-Kare ya da Fisher'in Kesin Test istatistiklerinden birinin kullanımı tercih edildi. Gruplar arası numerik değişkenlerin karşılaştırılmasında non-parametrik test olarak 'Mann-Whitney U Testi', parametrik test olarak ise 'Bağımsız Gruplar T Testi' kullanıldı. Grup içi numerik değişkenlerin karşılaştırılmasında ise non-parametrik test olarak 'Wilcoxon İşaretli Sıralar Testi', parametrik test olarak 'Bağımlı Gruplar T Testi' kullanıldı. Tip 1 hata düzeyinin %5'in altında olduğu durumlar istatistiksel olarak anlamlı kabul edildi.

SONUÇLAR

Dahil edilme kriterlerini sağlayan 40 birey çalışmaya dahil edildi. Değerlendirmeler esnasında TR-FTR grubundaki 3 birey TR programını takip etmede zorluk yaşadığı için (internet bağlantısı sorunu, refakatçi sorunu vb.) çalışmadan ayrılmak zorunda kaldı. Çalışma toplam 37 birey ile tamamlandı (Şekil 1).

İki grubun sosyo-demografik özellikleri cinsiyet bakımından kıyaslandığında, TR-FTR grubunda 16 kişi (%94,1); YY-FTR grubunda da 19 kişi (%95,0) kadındı. Bireylerin yaş ortalaması TR-FTR grubunda 66,71±7,22 yıl iken YY-FTR grubunda 69,80±4,55 yıl idi. VKİ TR-FTR ve YY-FTR grubunda sırasıyla 31,33±3,10 kg/m² ve 32,19±3,86 kg/m² olarak bulundu. Etkilenen diz eklemi TR-FTR grubunda %64,7 (n=11) sağ; YY-FTR grubunda %70 (n=14) sağ olarak bulundu. Alt ekstremite dominantlığı ise TR-FTR grubunda %76,5 sağ; YY-FTR'de %85 sağ olarak bulundu (Tablo 2a. ve 2b.).

Her iki grupta da diz ekstansiyonu EHA pasif ölçümlerinde tedavi öncesine kıyasla tedavi sonrasında istatistiksel olarak anlamlı bir fark bulunmamasına karşın ($p>0,05$); ölçülen diğer D-EHA değerlerinde tedavi öncesine kıyasla tedavi sonrasında anlamlı fark bulundu. ($p<0,05$). D-EHA'daki gelişmeler açısından iki grup arasında ise istatistiksel olarak anlamlı fark olmadığı görüldü ($p>0,05$) (Tablo 3).

TR-FTR ve YY-FTR olmak üzere her 2 grupta da fiziksel performans ölçümlerinin (ZKYT, 6DYT, 5TOKT) tedavi öncesine kıyasla anlamlı iyileşme sağladığı bulundu ($p<0,05$). Fiziksel performans parametreleri gruplar arası kıyaslandığında ise bu artışların benzer olduğu, aralarındaki farkın istatistiksel olarak anlamlı olmadığı belirlendi ($p>0,05$) (Tablo 4).

Her iki grubun WOMAC alt skorları ve toplam

skorlarında tedavi öncesine kıyasla tedavi sonrasında gelişme bulundu (p<0,05). Gruplar arası kıyaslandığında ise WOMAC fiziksel fonksiyon ve toplam skorlarında istatistiksel olarak anlamlı fark bulundu (p<0,05) (Tablo 5).

Her iki grubun tedavi sonrasında egzersize uyumu değerlendirildiğinde gruplar arasında anlamlı fark olmadığı bulundu (p>0,05). 0-64 puan üzerinden değerlendirilen EUDÖ anketi TR-FTR grubunda 34,71±5,77; YY-FTR grubunda ise 30,35±7,82 puan olarak hesaplandı.

TR-FTR grubuna 6. haftalık program sonrası uygulanan TKA toplam puanı 147 puan üzerinden 120±28,52 ve TMA toplam puanı ise 70 üzerinden 64,65±4,08 olarak bulundu.

TARTIŞMA

Ağrılı, kronik dejeneratif semptomları olan ve yaş almış, özellikle de cerrahi sonrası mobilite korkuları ve endişeleri olan bireylerin kliniklerde uygulanan yüz yüze yoğun fizyoterapi programlarına ulaşması, katılımı ve sürdürebilirliği kısıtlıdır. Gelişmiş popülasyonlarda, yaşın artmasıyla beraber, ortopedik fizyoterapi ve rehabilitasyon hizmetlerine talep artmaktadır ve artan talebe

Tablo 1. Her İki Gruba Uygulanan Tedavi Protokolleri

<table>
<tr><th></th><th>TR-FTR</th><th>YY-FTR</th></tr>
<tr><td>Post-op
0-3 gün</td><td colspan="2">1.Ayak bileği aktif EHA egzersizleri
2.Alt ekstremite izometrik egzersizleri (kuariseps ve gluteal kaslara yönelik)
3.Düz bacak kaldırma egzersizi
4. Bireyin tolere edebilidiği şekilde topuk kaydırma egzersizi
5. Ameliyat olmayan tarafa aktif alt ekstremite EHA egzersizleri
6. Yürüteç ile ambulasyon
7. Soğuk uygulama (15-20 dakika, günde 3-4 kez)
Tüm egzersizlerin günde 2 kez ve 10 tekrar olacak şekilde yapılması sağlandı.</td></tr>
<tr><td></td><td>TR-FTR</td><td>YY-FTR</td></tr>
<tr><td>Post-op
4-7. gün</td><td rowspan="2">NMES hariç aynı tedavi programı Youtube kanalı üzerinden video tabanlı olarak gönderildi.
Egzersizler, haftanın 3 günü boyunca toplam 6 hafta olmak üzere WhatsApp üzerinden görüntülü aranıp fizyoterapist gözetiminde ve kontrollü bir şekilde uygulandı. Egzersizler yapılırken bireyin yanında mutlaka refakatçisinin olmasına (egzersizlere yardım ve görüntülü aramada destek olması için) özen gösterildi.
Egzersiz programından sonra hastalardan ameliyatlı dizine günde 3-4 kez 15-20 dk soğuk uygulama yapılması (post-op 7. güne kadar) istenildi.
Her bir TR seansında egzersiz uygulaması ortalama 35-45 dakika sürdü.</td><td>1. Aktif ayak/ayak bileği EHA egzersizleri
2.Alt ekstremiteye yönelik izometrik egzersizler (Kuadriseps Femoris, addüktor, abdüktör ve gluteal kaslara yönelik)
3. Düz bacak kaldırma egzersizi
4. Aktif kalça abdüksiyon ve abdüksiyon egzersizi
5. 0-90 derece arası aktif/ asistif diz fleksiyonu
6. Bazı durumlarda diz ekstansiyonu yönünde germe egzersizi
7. Oturma pozisyonunda aktif/asistif diz fleksiyonu ve ekstansiyonu
8. Ameliyat olmayan taraf alt ekstremite EHA egzersizleri
9. Kuadriseps Femoris kasına yönelik 15 dk NMES uygulaması (35 Hz, 250µS, 5 sn çalışma, 5 sn dinlenme)
10. Soğuk uygulama (günde 3-4 kez 15-20 dakika, post-op 7. güne kadar)</td></tr>
<tr><td>Post-op
2-6 hafta</td><td>1. Oturma pozisyonunda aktif diz fleksiyonu ve ekstansiyonu
2. Sırtüstü yatış pozisyonunda diz fleksiyon açısını 120 dereceye kadar kademeli bir şekilde artırma
3. Terminal diz ekstansiyonu
4. Farklı açılarda (90-60-45 derece) açık kinetik zincir egzersizleri
5. Köprü kurma egzersizi
6. Yan yatış pozisyonunda kalça fleksiyon, ekstansiyon, abdüksiyon ve adduksiyonu
7. Yüzükoyun diz fleksiyonu
8. Kademeli bir şekilde alt ekstremiteye yönelik kuvvetlendirme egzersizleri (kum torbası ve egzersiz lastikleri ile)
9. Kuadriseps Femoris kasına yönelik 15 dk NMES uygulaması (35 Hz, 250µS, 5 sn çalışma, 5 sn dinlenme)
10. Yürüme eğitimi
11. Denge eğitimi
12. Merdiven eğitimi</td></tr>
<tr><td colspan="3">Bireylere bu egzersizleri ev egzersiz programı şeklinde (günde 2 kez 10 tekrar) yapmaları önerildi.
Programın tekrar ve set sayısı hastanın ağrı durumuna, toleransına ve ihtiyacına göre planlandı.</td></tr>
</table>

TR-FTR: Tele-rehabilitasyon Grubu; YY-FTR: Yüz yüze Fizyoterapi ve Rehabilitasyon Grubu; Post-op:Post-operatif; dk:dakika; sn:saniye NMES: Nöromüsküler elektrik stimülasyonu

Tablo 2.a. Grupların Sosyodemografik Özellikleri ve Kıyaslanması

n		TR-FTR (n=17)		YY-FTR (n=20)		p
		%	n	%		
Cinsiyet	**Kadın**	16	94,10	19	95,00	1
	Erkek	1	5,90	1	5,00	
Öğrenim Durumu	İlkokul	4	23,50	8	40,00	0,538
	Ortaokul	4	23,50	3	15,00	
	Lise	9	52,90	9	45,00	
Medeni durum	**Bekar**	3	17,60	6	30,00	0,462
	Evli	14	82,40	14	70,00	
Meslek	**Emekli**	4	23,50	10	50,00	0,098
	Ev Hanımı	13	76,50	10	50,00	
Dominant Taraf	**Sağ**	13	76,50	17	85,00	0,680
	Sol	4	23,50	3	15,00	
Etkilenen Diz Eklemi	**Sağ**	11	64,70	14	70,00	0,732
	Sol	6	35,30	6	30,00	
Egzersiz Alışkanlığı	**Yok**	14	82,40	16	80,00	1
	Var	3	17,60	4	20,00	
Kronik Hastalık	**Yok**	3	17,60	2	10,00	0,644
	Var	14	82,40	18	90,00	
Sigara	**Yok**	14	82,40	14	70,00	0,462
	Var	3	17,60	6	30,00	
Alkol	**Yok**	17	100,00	19	95,00	1
	Var	0	0,00	1	5,00	

TR-FTR: Telerehabilitasyon Grubu; YY-FTR: Yüzyüze Fizyoterapi ve Rehabilitasyon Grubu; Ki-kare ya da Fisher kesin ki-kare testi, *p<0,05.

Tablo 2.b. Grupların Sosyodemografik Özellikleri ve Kıyaslanması

	TR-FTR (n=17)		YY-FTR (n=20)		p
	Ortalama±SD	**Medyan (25./75. yüzdelik dilim)**	**Ortalama±SD**	**Medyan (25./75. Yüzdelik dilim)**	
Yaş	66,71±7,22	68,00 (61,00/72,00)	69,80±4,55	70,50 (67,50/73,00)	0,221
VKİ (kg/m²)	31,33±3,10	30,10 (29,20/33,50)	32,19±3,86	32,95 (30,56/35,15)	0,223
Şikâyet Süresi (yıl)	8,65±4,37	8,00 (7,00/10,00)	8,80±5,46	7,00 (5,00/15,00)	0,794

VKİ: Vücut kütle indeksi, kg/m²: kilogram/metrekare, SD: Standart deviasyon, TR-FTR: Telerehabilitasyon Grubu, YY-FTR: Yüzyüze Fizyoterapi ve Rehabilitasyon Grubu, Mann-Whitney U test, Değerler medyan (25. / 75. yüzdelik dilim) olarak verildi. *p<0,05.

karşılık alternatif rehabilitasyon hizmetleri gündeme gelmektedir. Ortopedik rehabilitasyon hizmetlerinin arasında TR uygulamaları da son yıllarda güncel olarak tercih edilmektedir (22).

Bu çalışma, TDP cerrahisi sonrası TR-FTR ve YY-FTR gruplarında fizyoterapist gözetiminde uygulanan rehabilitasyon programını değerlendirilen fiziksel ve fonksiyonel parametreler açısından karşılaştırmak, gruplarının egzersize uyumunu ve TR-FTR grubunun TR hizmetinden memnuniyetini değerlendirmek amacıyla planlandı.

Çalışmamızın sonucunda TDP cerrahisini takiben her iki grupta da post-operatif 6. haftada D-EHA ölçümlerinde, ZKYT, 5TOKT, 6DYT ve WOMAC skorlarında önemli gelişmeler bulundu. TR-FTR grubu ile YY-FTR grubunun egzersize uyumunun benzer olduğu bulundu. TR-FTR grubuna uygulanan TKA ve TMA'nın sonuçları da TR hizmetinin TDP cerrahisi geçirmiş bireylerde kullanılabilir olduğunu ve bireylerin bu hizmetten memnun olduğunu göstermekteydi.

Bireylerin sosyo-demografik özelliklerinin (kadın cinsiyet, ileri yaş, yüksek VKİ vb.) TDP cerrahisi sonuçlarını etkilediği gösterilmiştir (23-25). Giesinger ve diğ. TDP cerrahisi geçirmiş 1565 bireyi retrospektif olarak analiz ettikleri çalışmalarında; bireylerin %62,2'sinin kadın, ortalama hasta yaşının 69,1 yıl, 817 (%52,2) olgunun sağ taraf diz etkilenimi ve %21,2'sinin (N= 332) normal kilolu

Tablo 3. Grup İçi ve Gruplar Arası Diz Eklem Hareket Açıklığı Derecesinin Karşılaştırılması

T1		TR-FTR (n=17)				YY-FTR (n=20)				
		T2	Δ	p[a]	T1	T2	Δ	p[a]	p[b]	
Diz Eklemi Ekstansiyon EHA	**Aktif**	5 (0/5)	0 (0/0)	-5 (-5/0)	0,012*	0 (0/5)	0 (0/0)	0 (-5/0))	0,007*	0,611
	Pasif	0 (0/0)	0 (0/0)	0 (0/0)	0,180	0 (0/0)	0 (0/0)	0 (0/0)	0,059	0,476
Diz Eklemi Fleksiyon EHA	**Aktif**	95 (90/100)	117 (115/120)	22 (15/30)	<0.001*	95 (90/102,5)	117 (110/120)	16,50 (10/25)	<0.001*	0,252
	Pasif	100 (93/107)	120 (120/125)	20 (15/28)	<0.001*	102,50 (96,5/109)	121 (120/125)	15 (10/25)	<0.001*	0,169

TR-FTR: Telerehabilitasyon Grubu, YY-FTR: Yüzyüze Fizyoterapi ve Rehabilitasyon Grubu, EHA: Eklem Hareket Açıklığı

T1: Tedavi öncesi, T2: Tedavi sonrası, Değerler medyan (25. / 75. yüzdelik dilim) olarak verildi.

Δ: Değerlendirmeler arasındaki değişimi temsil eder. [a]: Wilcoxon Signed Ranks Testi; [b] Mann–Whitney U-testi; *p<0,05.

Tablo 4. Grup İçi ve Gruplar Arası Fiziksel Performans Parametrelerinin Karşılaştırılması

	TR-FTR (n=17)				YY-FTR (n=20)				
	T1	T2	Δ	p[a]	T1	T2	Δ	p[a]	p[b]
ZKYT (sn)	16,67 (14,02/18,08)	13,00 (11,46/15,76)	-2,3 (-2,79/-1,73)	<0,001*	16,69 (12,23/18,98)	15,58 (10,38/17,72)	-1,74 (-3,40/-0,84)	0,014*	0,503
6DYT (m)	201,50 (126/270)	225 (190/330)	31 (16/104)	0,002*	153,75 (112,75/205,0)	169,00 (118,5/262,5)	35,50 (0,25/63,75)	0,008*	0,512
5TOKT (sn)	17,44 (16,32/21,6)	14,68 (13,12/17,85)	-2,92 (-3,38/-2,01)	<0,001*	20,51 (17,63/22,92)	18,01 (14,81/21,43)	-2,97 (-3,68/-1,13)	0,002*	0,604

TR-FTR: Telerehabilitasyon Grubu, YY-FTR: Yüzyüze Fizyoterapi ve Rehabilitasyon Grubu, ZKYT: Zamanlı Kalk Yürü Testi, 6DYT: 6 Dakika Yürüme Testi, 5TOKT: 5 Tekrarlı Otur Kalk Testi, m:metre, sn:saniye, T1: Tedavi öncesi, T2: Tedavi sonrası, Değerler medyan (25. / 75. yüzdelik dilim) olarak verildi. Δ: Değerlendirmeler arasındaki değişimi temsil eder.

[a]: Wilcoxon Signed Ranks Testi; [b] Mann–Whitney U-testi; *p<0,05.

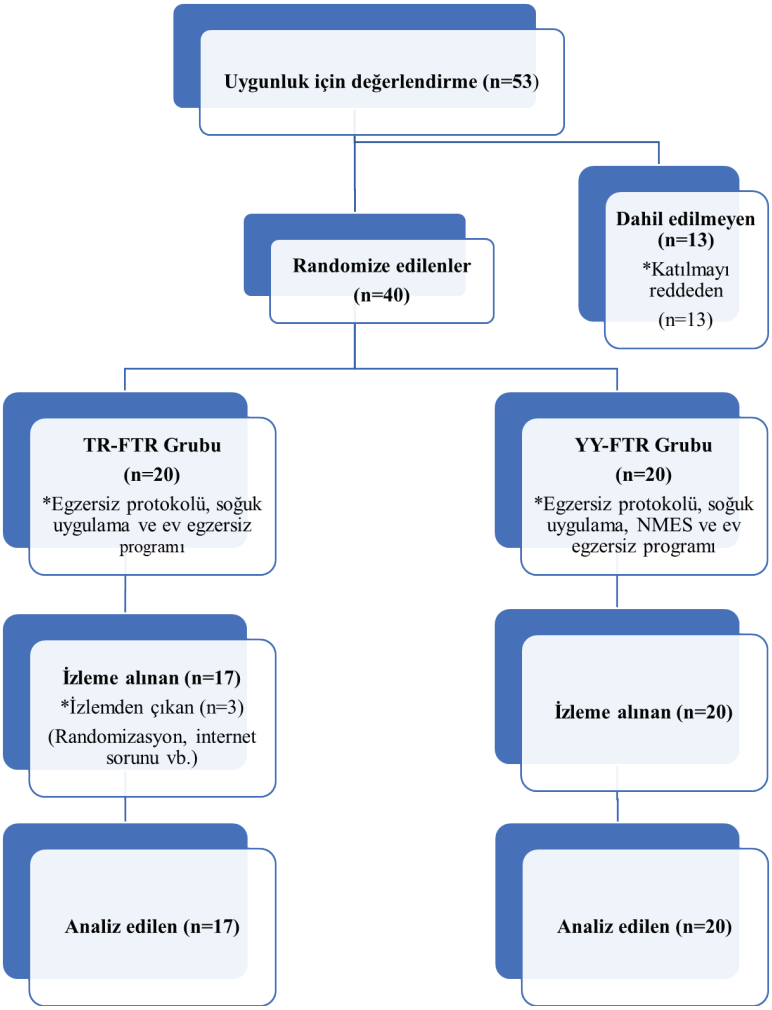
Tablo 5. WOMAC Skorlarının Grup İçi ve Gruplar Arası Karşılaştırılması

WOMAC	TR-FTR (n=17)				YY-FTR (n=20)				
	T1	T2	Δ	p[a]	T1	T2	Δ	p[a]	p[b]
Ağrı	11,45 (10,41/12,5)	3,12 (1,04/7,29)	-8,33 (-9,37/-4,17)	<0,001*	10,41 (9,37/11,98)	5,20 (2,60/7,29)	-6,25 (-7,81/-3,12)	<0,001*	0,090
Sertlik	5,70±1,34	2,26±1,48	-3,43±1,83	<0,001*	4,32±2,06	2,13±1,45	-2,19±2,43	0,001*	0,092
Fiziksel Fonksiyon	41,97±13,008	12,62±8,80	-29,35±15,70	<0,001*	40,93±15,72	23,25±11,91	-17,68±8,97	<0,001*	0,012*
Toplam	60,09±16,14	19,0±12,42	-41,09±20,86	<0,001*	56,14±18,86	30,57±14,68	-25,57±12,70	<0,001*	0,009*

TR-FTR: Telerehabilitasyon Grubu, YY-FTR: Yüzyüze Fizyoterapi ve Rehabilitasyon Grubu, WOMAC: Western Ontario ve McMaster Üniversiteleri Osteoartrit İndeksi.

T1: Tedavi öncesi, T2: Tedavi sonrası, SD:Standart deviasyon, Δ: Değerlendirmeler arasındaki değişimi temsil eder. Değerler ortalama±sd olarak verildi. [a]: Paired T Testi; [b]: Student T Testi; *: p<0,05

(VKİ <25,0 kg/m ²), %36,9'unun (N = 578) fazla kilolu (VKİ 25,0–29,9 kg/m²), %27,0'ının (N=423) 1. derece obez (VKİ 30,0–34,9 kg/m²) , %10,2'sinin (N= 160) 2. derece obez (VKİ 35,0–39,9 kg/m²) ve %4,6'sının (N=72) 3. derece obez (VKİ ≥ 40,0 kg/m²) olduğunu bildirmişlerdir (25). Yaptığımız bu çalışmada TR-FTR grubunun %94,1'i ve YY-FTR grubun %95,0'ı kadın; gruplara göre bireylerin sırasıyla yaş ortalamasının 66,71±7,22 ve 69,80±4,55 yıl; VKİ değerlerinin ise sırasıyla 31,33±3,10 kg/m² ve 32,19±3,86 kg/m² ile bireylerin 1. derece obez olduğu bulundu. TR-FTR ve YY-FTR grubundaki bireylerin sosyo-demografik özellikleri benzerlik göstermekteydi. Çalışmamızdaki veriler, olguların yaş, cinsiyet ve VKİ açılarından incelendiğinde sonuçların literatürle uyumlu olduğu görüldü (25, 26). Cinsiyet, yaş, VKİ, komorbiditeler gibi prognostik faktörler TDP



Şekil 1. Akış Diyagramı

cerrahisi sonuçlarını etkileyebilir.

Russel ve diğ. total diz artroplastisi üzerine yaptığı çalışmada, TR hizmetinin EHA, kas gücü ve fonksiyonelliği iyileştirdiğini bildirmişlerdir. Değerlendirmelerini yaptıkları her iki grubun (TR ve yüz yüze) WOMAC toplam skorlarında anlamlı bir iyileşme bulunurken, bu iyileşme TR-FTR grubunda WOMAC sertlik alt parametresinde daha fazla olarak bulunmuştur (27). Jiang ve diğ. yaptığı meta-analiz çalışmasında da TR uygulamasının YY-FTR'ye göre ağrı kontrolü ve fonksiyonel iyileşmede daha etkili olduğunu bildirmiştir (8). Bizim çalışmamızda da tedavi sonrası her iki grubun D-EHA ve WOMAC skorlarında anlamlı gelişmeler olduğunu bulunmuştur. TDP cerrahisi sonrası TR-FTR grubundaki bireylerin egzersiz protokollerini fizyoterapist gözetiminde ve kontrolünde kendi kendine uygulamalarının konforlu olduğu ve ağrı yönetimini sağlamaları açısından da etkili olduğu yönünde değerlendirilmiştir.

TDP cerrahisi öncesi ve sonrası fizyoterapist tarafından bireylerin fiziksel performansını değerlendirmek için klinikte sıklıkla kullanılan ZKYT, 6DYT ve 5TOKT güvenilir ve uygulaması basit testlerdir (28-30). Bu değerlendirmeler sonrasında elde edilen sonuçlar ile TDP cerrahisi geçiren bireylere özgü etkin egzersiz protokolü oluşturulabilmektedir. TDP cerrahisi geçirmiş bireylerde internet tabanlı bir TR-FTR ile klinikte YY-FTR'yi karşılaştıran bir çalışmada, D-EHA, WOMAC, ZKYT, yürüyüş, kuadriseps kas gücü açısından gruplar arasında anlamlı bir fark olmadığı ve bu iki yöntemin birbiri yerine kullanılabileceğinden bahsetmişlerdir. WOMAC, ZKYT, 5TOKT ve 6DYT ortopedik hasta popülasyonunda hem kullanım kolaylığı hem de basit olması nedeniyle tercih

edilmektedir (31, 32). Bu testlerin, TR hizmetleri öncesinde ve sonrasında klinikte yüz yüze yapılması da bu hizmetten alınacak sonuçları olumlu yönde etkileyebilir. Çalışmamızda bu testler açısından, her iki grubun da tedavi sonrası sonuçlarına baktığımızda anlamlı gelişmeler olduğu saptadık. Fakat 6DYT ve 5TOKT sonuçlarını literatüre kıyasladığımızda biraz daha düşük olduğunu bulduk (11, 29, 32). Bunun sebebinin bireylerin ilk değerlendirilmesinin cerrahiden hemen önce, ikinci değerlendirilmesinin ise cerrahiden 6 hafta sonra gibi kısa bir sürede yapılmış olduğu kanısına vardık. 6DYT protokolünde hastalara tanınan durma ve dinlenme sürelerinin bulduğumuz sonucu etkilediğini düşünmekteyiz. Gruplar arası karşılaştırdığımızda ise TR-FTR grubundakilerin yaşlarının ve VKİ değerlerinin YY-FTR grubundakilere göre nispeten daha düşük olduğundan kaynaklandığını düşünmekteyiz.

TDP cerrahisi sonrası bireylerde TR-FTR ve YY-FTR arasındaki ilişkiyi inceleyen çalışmalar olsa da, TR programlarının kullanılabilirliği ve hasta memnuniyeti açısından değerlendirilmesini içeren çok fazla çalışma bulunmamaktadır. Buvik ve diğ. yaptıkları çalışmada, uzaktan ortopedik danışmanlık hizmeti ile yüz yüze ortopedik konsültasyonlar arasındaki memnuniyeti araştırmışlardır. İki grup arasında fark gözlenmemesiyle birlikte uzaktan yapılacak danışmanlığın tedavinin devamlılığı açısından önem arz ettiği ve maliyetle ilgili faktörler açısından memnun edici sonuçlar elde edilebileceği belirtilmiştirler (33). Çalışmamız da TDP cerrahisi sonrası uygulanan TR-FTR'nin YY-FTR ile benzer etkisi olduğunu göstermiştir. Çalışmamıza dahil olan TR-FTR grubundaki bireylerin TR hizmetlerinden memnun olduğu ve tele-sağlık hizmetlerini kullanabilir olduğu sonucuna varılmıştır. Bunun sebebinin ise TR hizmetlerinin ortopedik rehabilitasyon alanında uzmanlaşmış fizyoterapistler tarafından verilmiş olması, TR seanslarının çalışmaya katılan bireylerin uygun olduğu saatlerde yapılması, egzersiz programının da bireylerin fiziksel ve fonksiyonel düzeylerine göre düzenlenmesi olabilir. TR hizmetlerinden yüksek düzeyde memnuniyet ise hasta motivasyonunu ve tedaviye uyumu arttırır.

Çalışmamıza dahil edilen birey sayısının kısıtlı olması, örneklemde kadın bireylerin fazla olması ve uzunlamasına takip sonuçlarının bulunmaması çalışmamızın limitasyonları olarak karşımıza çıkmaktadır.

TDP cerrahisi olan TR-FTR ve YY-FTR grubundaki bireylerin post-operatif değerlendirmelerinde, fiziksel ve fonksiyonel parametreler açısından anlamlı gelişmeler gözlendiği belirlenmiştir. TR-FTR'nin YY-FTR'ye kıyasla egzersize uyum ve hasta memnuniyeti açısından en az onun kadar etkili olduğu saptanmıştır. Sonuçlarımız, TDP adayı hastaların pre-operatif ve post-operatif dönemde fizyoterapistler tarafından hastaya ve kliniğine spesifik değerlendirme yöntemleriyle değerlendirilmesinin önemine dikkat çekmekle birlikte, hastaların tedavi programlarının belirlenmesinde ve hedeflenen fonksiyonel sonuçlara ulaşılmasında, doğru hasta seçimi gözetilerek, TR-FTR ve YY-FTR'nin birbiri yerine kullanılabileceğine, hasta uyumu ve memnuniyet açısından değerlendirildiğinde ise TR-FTR'nin YY-FTR'ye benzer sonuçlar vermesinden dolayı tercih edilebilir olduğuna dikkat çekmektedir.

Destekleyen Kuruluş: Yok

Çıkar Çatışması: Yok

Yazar Katkıları: Fikir/Kavram- N.B., N.F.; Tasarım- N.B., N.F.; Denetleme/Danışmanlık- N.B.; Kaynaklar ve Fon Sağlama- M.B.; Materyaller- N.F., A.D.K; Veri Toplama ve/veya İşleme- N.B., N.F., A.D.K; Analiz ve/veya Yorumlama- N.B., N.F.; Literatür Taraması- N.B., N.F.; Makale Yazımı- N.B., N.F.; Eleştirel İnceleme- N.B.

Açıklamalar: Yok

Teşekkür: Yok

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)246-257

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Received: *04.02.2022 (Geliş Tarihi)*
Accepted: *08.02.2024 (Kabul Tarihi)*

DISTANCE EDUCATION IN UNDERGRADUATE PHYSIOTHERAPY PROGRAMS: A SYSTEMATIC REVIEW

SYSTEMATIC REVIEW

ABSTRACT

Purpose: The use of distance education (DE) models and tools has become increasingly popular in health profession education, including physiotherapy (PT). However, there are few reviews focusing on DE in PT education, which could enable researchers to access comprehensive information, and reviews on various health profession groups often do not include physiotherapy studies. The aim of this study was to synthesize existing evidence and determine the effectiveness of DE systems in PT education.

Methods: This study was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. PubMed, Scopus, EBSCO, Web of Science, and ERIC were searched from inception to July 2020. The initial search resulted in 689 studies. The risk of bias was assessed using the Cochrane risk of bias tool.

Results: In this systematic review, 25 studies which included 2129 physiotherapy undergraduate students (11 DE models / 14 e-systems) were found suitable for review. Generally, outcome measures were students' knowledge, satisfaction, and skill. In 16 of the studies, the level of knowledge was investigated, and it was found that the knowledge increased. In 38% of these studies, the increase in the knowledge level of traditional education and DE was similar. It was found that 79% of the studies demonstrated an increase in satisfaction, 14% demonstrated a decrease in satisfaction, and satisfaction with traditional education and DE was similar in 7%. Skill was investigated in 12% of the studies, and all the studies showed the positive effects of DE.

Conclusion: DE can promote learning in undergraduate PT education, even though its effectiveness in some areas, such as practical skill acquisition or cost, is controversial. Further high-quality studies with long follow-up periods are needed to investigate the various aspects of the PT curriculum, including both theoretical and practical courses.

Keywords: Blended Model, Distance Education, E-System, Flipped Model, Hybrid Model

FİZYOTERAPİ LİSANS PROGRAMLARINDA UZAKTAN EĞİTİM: SİSTEMATİK DERLEME

SİSTEMATİK DERLEME

ÖZ

Amaç: Uzaktan eğitim (UE) modellerinin ve araçlarının kullanımı, fizyoterapi dahil olmak üzere sağlık mesleği eğitiminde giderek daha popüler hale geldi. Bununla birlikte, araştırmacıların kapsamlı bilgilere erişmesini sağlayabilecek olan fizyoterapi eğitiminde uzaktan eğitime odaklanan derlemeler az sayıdadır ve farklı sağlık meslek gruplarına ilişkin derlemeler sıklıkla fizyoterapi çalışmalarını içermemektedir. Bu çalışmanın amacı fizyoterapi eğitiminde mevcut kanıtları sentezlemek ve UE sistemlerinin etkinliğini belirlemektir.

Yöntem: Bu çalışma, Sistematik Derlemeler ve Meta Analizler için tercih edilen Raporlama Öğeleri Yönergelerine uygun olarak yürütülmüştür. PubMed, Scopus, EBSCO, Web of Science ve ERIC, başlangıçtan Temmuz 2020 tarihine kadar tarandı. İlk arama 689 çalışmayla sonuçlandı. Yanlılık riski, Cochrane yanlılık risk aracı kullanılarak değerlendirildi.

Sonuçlar: Bu sistematik derlemede 2129 fizyoterapi lisans öğrencisini içeren 25 çalışma (11 uzaktan eğitim modeli / 14 e-sistem) inceleme için uygun bulundu. Genel olarak, sonuç ölçütleri öğrencilerin bilgi, memnuniyet ve beceri düzeyleriydi. Çalışmaların 16'sında bilgi düzeyi araştırıldı ve bilginin arttığı tespit edildi. Bu çalışmaların %38'inde geleneksel ve uzaktan eğitimin bilgi düzeyindeki artışı benzerdi. Çalışmaların %79'unda memnuniyetin arttığı, %14'ünde memnuniyetin azaldığı, %7'sinde ise geleneksel ile uzaktan eğitim memnuniyetinin benzer olduğu belirlendi. Çalışmaların %12'sinde beceri düzeyi araştırılmış olup bu çalışmaların tamamında uzaktan eğitimin olumlu etkileri gösterilmiştir.

Tartışma: UE pratik beceri kazanımı veya maliyet gibi bazı alanlarda etkinliği tartışmalı olsa da fizyoterapi lisans eğitiminde öğrenme sürecini teşvik edebilir. Teorik ve pratik dersler de dahil olmak üzere fizyoterapi müfredatının çeşitli yönlerini araştırmak için uzun takip süreleri olan daha fazla sayıda yüksek kaliteli çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: Harmanlanmış Model, Uzaktan Eğitim, E-Sistem, Ters Yüz Model, Hibrit Model

INTRODUCTION

Distance education (DE) started with an advertisement published in a Swedish newspaper in 1833 offering composition lessons. Since then, technological developments have been the most important factor determining the content of DE. DE was at first provided through correspondence and television and later through computers (1). Today, digital technologies have become an indispensable resource for students and academicians (2). The ubiquitous use of the Internet and the introduction of social networks, interactive boards, and online learning environments and tools, along with Web 2.0 technologies, have provided opportunities for changes in higher education and the introduction of DE applications (3, 4).

DE provides students with a high degree of active participation, flexibility, and comfort. Moreover, it is effective in arousing students' interest in learning and promoting autonomy (5). The main aim of DE is to overcome the limitations of classical passive teacher-oriented learning and promote more active student participation (6). Students are continuously trained without traditional face-to-face or campus training; they receive education using different digital technologies, either web-based, online, computer-based/assisted, multimedia-supported, or virtual (5, 7). Various DE models have been developed, such as hybrid models, flipped classroom model, and online-only models (8, 9). However, the use of technology as a learning tool leads to complex results in terms of acquisition of knowledge and skills and moral and ethical behavior (9, 10). Therefore, the effectiveness of DE should be considered independently for each branch of health education.

With an increasing demand for qualified health-care providers worldwide in recent years, PT education has entered a period of rapid growth and development. Lectures include not only theoretical training but also practical skills, various technique applications, device training, and—most importantly—patient-oriented clinical problem-solving methods. To manage this versatility in PT education and to quickly adapt to changing student needs, academicians have sought new teaching and learning methods in light of the new opportunities of the digital age (11). Various derivatives of online education technologies have become important to meet the increasing vocational training needs of PT programs. A systematic review showed that online technologies bring considerable benefits to PT education (9). As of 2019, up to 75% of entry-level PT education curricula across the US used hybrid education systems to gain advantages of both learning environments (12).

The coronavirus disease 2019 pandemic has led to restrictions in almost all areas of social life and has had dramatic effects in the field of education. The temporary measures taken to contain the pandemic at the beginning of 2020 have tended to become permanent as vaccine and drug studies continue, and various organizations have been forced to operate under different systems. Governments have restricted or halted activities in some areas of daily life; however, education differs from other areas in that it cannot be stopped or delayed. Instructors have been struggling to educate students and meet their needs in a way that does not overlap with the scope of PT education. Obviously, we have never before experienced a situation in which students' competencies were at such risk and their vocational abilities so dependent on the skills and effort of the instructor. Consequently, online education systems in universities around the world have become a necessity rather than a choice amid the pandemic. It has necessitated a deeper understanding of the new learning strategies in PT education afforded by the new technologies. In these adverse conditions, academicians' most important responsibility is to maintain the highest possible quality of education. Therefore, it is imperative to improve our DE skills, which are admittedly at the beginner level.

The effectiveness of the online technology use in the undergraduate and postgraduate PT education was demonstrated by the Mącznik, A. K. et al in 2015 (9). Although this is an important study indicating the importance of online technology

use in PT education, it did not reflect the new educational conditions created by the COVID-19 pandemic. In addition, comparative studies on the use of DE systems in PT education are scarce, and research in various fields often ignores physiotherapy studies (10, 13). For these reason, this review aimed to synthesize the existing evidence and determine the effectiveness of DE systems in PT education. We hypothesized that implementation of DE systems and tools will improve knowledge, student satisfaction and skills in undergraduate physiotherapy programs.

METHODS

This review is registered with PROSPERO (registration no: CRD42020209645).

Search Strategy

We used PubMed, Web of Science, Scopus, EBSCO, and ERIC from inception until July 14th, 2020 to search for studies published.

Selection of Studies

This systematic review was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (14). The search was conducted by two reviewers (O.C. and T.M.) independently. The keywords used in the search are listed in the online supplementary material. One author (O.C.) exported all the studies found to reference manager (EndNote X7.5, Clarivate Analytics, Philadelphia, PA, USA) and deleted duplicates. The article titles and abstracts were then screened. Articles that met the inclusion criteria were obtained, and the full texts were screened for inclusion. The search and selection process is shown in the PRISMA flowchart (Figure 1).

Inclusion criteria

The following studies were included:

- Studies conducted in PT education programs at the undergraduate level.
- Studies using a DE model (flipped, blended or hybrid) or system (online and electronic systems).
- Cross-sectional, case-control, cohort studies, randomized controlled trials and qualitative studies.

Exclusion criteria

The following were excluded:

- Studies not involving undergraduate students exclusively.
- Studies on health care areas other than PT.
- Non-English or non-Turkish full-text articles.
- Reviews, commentaries, editorials, gray literature, case series, protocols, and letters.

Data extraction

Two reviewers (O.C. and ME.Y.) independently extracted data of studies meeting the inclusion criteria. The following information was retrieved from each article: authors' names, year of publication, country, course/participants, study description, outcome measures (tools/method), and conclusions. Any discrepancies were resolved in a meeting with the participation of a third reviewer (T.M.). The studies in this review were categorized and presented based on whether the intervention was a learning system or an online learning tool.

Risk of bias

Two reviewers (O.C. and T.M.) independently assessed the risk of bias in included randomized controlled trials using the Cochrane risk of bias assessment tool (15). In case of any disagreement, a third reviewer (ME.Y.) made the final decision. The domains were the following: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, and selective reporting. The domains were classified as low, high, or unclear risk of bias.

RESULTS

The initial search yielded 689 potential articles. References in some articles were also evaluated, and three additional articles were identified. After excluding duplicates, 330 articles remained for testing against the inclusion criteria. After scanning the titles and abstracts, 96 full articles were retrieved and reviewed. Of those studies, 25 did not involve undergraduate PT students exclusively, 12 were not based on a non-campus education model, 10 were not reported in English

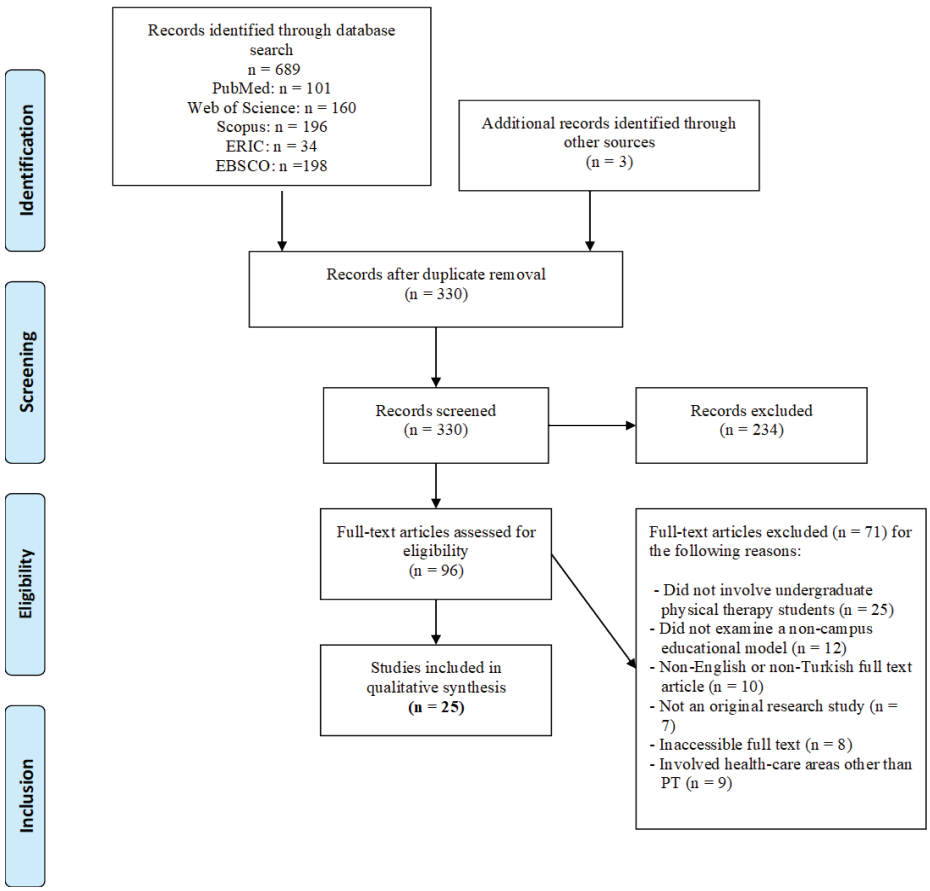

Figure 1. Flowchart

or Turkish, 7 were not original research studies, and 9 were related to health care areas other than PT. Additionally, the full text of eight articles could not be accessed. After excluding these studies, 25 remained for the analysis (Figure 1).

All included articles were published in English. The studies were conducted in various countries, including Australia, Brazil, Bangladesh, Canada, Norway, Denmark, India, Sweden, Hong Kong, South Africa, Spain, the UK, and the USA. Among the included studies were controlled trials, randomized controlled trials, descriptive studies, and cohort studies. The reviewed studies involved 2.129 first-, second-, third-, and fourth-year PT students. The studies were published from 2005 to 2020 in journals whose scopes include distance education and other education and technology topics.

The reviewed studies assessed DE models or e-system tools in basic sciences (e.g., anatomy) and various physiotherapy areas of practice (e.g., neurological analysis in neurological physiotherapy, oncological physiotherapy, and cardiovascular and cardiopulmonary curricula). Sixteen studies investigated the effectiveness of DE in knowledge acquisition, while seven explored PT students' perceptions. Other investigated aspects were skills, attitude, participation, perceived confidence, student feedback/opinions, student satisfaction, and quality and cost of education. The quality evaluation of trials using the risk of bias tool is shown in Table 1.

Table 2 presents the main aspects of 11 studies that applied DE models in PT education. Seven of them examined blended models, three investigated the flipped classroom approach, and one evaluated a hybrid model. In four of the seven studies examining the level of knowledge, it was determined that the knowledge increased; and in other three, the effect of traditional education and DE on knowledge were similar. Students' satisfaction was evaluated in three studies, and

Table 1. Cochrane Collaboration Tool for Assessing Risk of Bias

Author, Year	Random Sequence Generation	Allocation Concealment	Blinding of Personnel and Participants	Blinding Outcome Assessment	Incomplete Outcome Data	Selective Reporting
Arroyo-Morales, 2012	Low	Unclear	Unclear	Unclear	Low	Unclear
Cantarero-Villanueva, 2012	Low	Unclear	High	Low	Low	Unclear
Da Costa Vieira, 2016	Low	Unclear	High	High	Low	Unclear
Nicklen, 2016	Low	Low	Unclear	Unclear	Low	Unclear
Ulrich, 2019	Low	Unclear	Unclear	Low	Low	Unclear
Jones, 2010	Unclear	Unclear	Unclear	Low	Low	Unclear
Hossain, 2015	Low	Unclear	Low	Low	Low	Unclear
Lozano, 2020	Low	Unclear	Low	Low	Low	Unclear
Da Silva, 2012	Low	Unclear	Unclear	Unclear	Low	Unclear

skills were evaluated in two studies, all of which found that DE increased satisfaction and skills (Table 2).

Table 3 shows the main aspects of 14 studies involving DE systems in PT education. The effectiveness of online learning tools was assessed in 14 studies, with nine focusing on knowledge, eleven on satisfaction, and one on skill. In 33% of the studies investigating the level of knowledge, the effects of traditional education and DE were similar. The students' satisfaction was evaluated with their feedback and opinions. This study found that 73% of students had positive opinions about DE and 9% believed that traditional education and DE were similar. Only one study focused on skill outcomes and yielded positive results (Table 3).

DISCUSSION

This systematic review included 25 studies evaluating the effectiveness of DE and involved a total of 2129 undergraduate PT students. Our review suggests that DE seems to be at least as effective as traditional methods in increasing knowledge and developing skills. Furthermore, students expressed positive opinions about and high levels of satisfaction with DE programs in most studies.

Eleven studies examining the effectiveness of various models in PT education fell within the scope of this review (16-26). Two of them investigated the effectiveness of the flipped classroom model. Day (2018) reported an increase in students' knowledge level, whereas Roe et al. (2018) observed no change. Similarly, studies investigating the effectiveness of blended models found that the knowledge levels either increased (16, 23) or did not change (17). All studies investigating student satisfaction reported an increase in satisfaction levels (16-18, 24). Few studies examined the cost of DE, and whether DE is economical remains open to debate (22, 24). Only two studies reported skill improvement with a blended model (17, 18). Student feedback offered some important clues about the effectiveness of DE models. For example, students reported higher perceived workloads with a blended model (23). This suggests that students struggle with heavy loads during online education. This is unsurprising, given that students must learn to simultaneously manage the delivery environment, course content, and educational technologies. Instructors organizing such courses must adopt an organized and clear course design and select engaging materials and activities suitable for different learner levels to reduce the mental load (27). Students also reported that they perceived self-initiation in learning as an important factor for success (21).

We reviewed 14 studies investigating the effectiveness of e-system tools in PT education (28-41). These tools included educational software, online courses, video activities, discussion forums, e-modules, and virtual exams, which were

Table 2. Key Aspects of Distance Learning Models (Blended, Flipped, or Hybrid) in Physiotherapy Education Literature

Study	Country	Course/ Participants	Study Description	Outcome Measures (Tool/Method)	Conclusion
Aguilar-Rodriguez et al. 2019	Spain	Ethics and Physiotherapy course for third-year PT students	Prospective single-blinded clinical trial 1) Blended model (n =65) 2) Control (n = 64)	• *Attitude* toward learning professional ethics with AQPEPT • *Knowledge* with the Perceptions about Knowledge Regarding Professional Ethics in Physiotherapy questionnaire • *Perceptions* of online learning with a questionnaire comprising eight dichotomous questions and one open question	• Knowledge and attitudes toward learning professional ethics significantly improved in the blended model group. • Students were satisfied with the online program and the learning opportunities offered.
Arroyo-Morales et al. 2012	Spain	Palpation and Ultrasound Examination of Knee course for second-year PT students	Randomized controlled study 1) Blended model (ECOFISIO website) (n = 23) 2) Control (n = 23)	• *Skills* with an objective structured clinical examination • *Knowledge* with a multiple-choice questionnaire • *Quality* of the educational intervention with a questionnaire (5-point Likert scale)	• Skills were improved in the blended model group compared to the control group. • The groups were similar in terms of acquisition of theoretical knowledge. • Participants in the blended model group reported that they had more fun, learned more, were able to apply what they learned, and would like to participate in a study of another anatomical region. Participants in neither group would have preferred to be in the other learning program.
Cantarero-Villanueva et al. 2012	Spain	Palpation and Ultrasound Examination of Lumbopelvic Area course for undergraduate PT students	Single-blinded randomized controlled study 1) Blended model (ECOFISIO website) (n = 23) 2) Control (n = 21)	• *Skills* with an objective structured clinical examination • *Quality* of the educational intervention with a questionnaire (5-point Likert scale)	• Skills were improved in the blended model group compared to the control group. • The groups had similar opinions about the assessments of the educational intervention. • The blended model group reported a high level of satisfaction with the website's characteristics.
Cherry and Blackinton 2017	USA	First- (n =34) and second-year (n = 20) PT students	Mixed methodology 1) Hybrid program (n = 54) 2) Traditional program (n = 71)	• Factors influencing student success with Q-sort analysis	• Time management, academic work ethic, and ability to prioritize study focus were perceived as strongly influencing factors for success by both groups. • Only students in the hybrid group perceived student success, self-initiation in learning, problem-solving, and organization of courses as influencing factors. • Only students in the traditional program perceived the instructor's ability to organize course material as an influencing factor.
Davies et al. 2005	England	Neurologic Analysis within Neurological Physiotherapy course for undergraduate PT students	Qualitative research Lecture-based group activity: observing and discussing patient movement disorders on video Video clips on CD-ROM for personal use In the learning center: using video clips and online questions in WebCT Using learning technologies for a mock exam and assessment	*Student opinions* with a short questionnaire (n = 82) *Qualitative data* from four focus group discussions with 17 randomly selected students	• Students suggested that watching and discussing the video in a lecture-based group activity and their experience in the learning center added value to their learning experience. • Students were much less satisfied about their experiences in the context of the mock exam and assessment. • Students spoke of the importance of "flexible learning" in developing their physiotherapy skills.

Day 2018	USA	Gross Anatomy course for undergraduate PT students	Controlled study 1) Flipped classroom model (n = 112) 2) Control (n = 105) Kinesiology class grades as a second control for analysis	• *Knowledge* with three-unit examinations and one cumulative final examination • Analysis of long-term retention and knowledge transfer	• Students in the flipped anatomy class had higher grades on higher-level analytical questions. • Previously low-performing students showed better performance in subsequent courses (kinesiology) after participating in the flipped gross anatomy course.
Gaida et al. 2016	Australia	Skill classes for third-year PT students	Mixed methodology Blended model (n = 72) Two skills classes taught using a blended model	• *Students' perceptions* with an anonymous online survey. • *Costs* with year-on-year delivery were modeled by manipulating key variables, such as class size and the video update schedule.	• Students reported that they felt greater control over their learning (power shift), acquired a deeper understanding (skill development), and perceived greater efficiency in the teaching method (efficiency). • Video production costs were recouped after three years.
Green et al. 2016	Australia	Anatomy course for second-year PT students	Retrospective cohort study 1) Face-to-face education (n = 150) 2) Transitional group (some online content) (n = 160) 3) Fully blended (n = 151)	• *Knowledge* with a combination of practical tests and a final exam • *Student participation* with the number of posts on discussion forum. • *Student perceptions* with a questionnaire (5-point Likert scale)	• Grades were higher in the transitional and blended groups than in the face-to-face group. • The groups were similar in terms of student participation. • Students in the blended group reported heavier perceived workloads.
Nicklen et al. 2016a	Australia	Third-year PT students	Controlled study 1) Blended model (n = 78) 2) Control (previous third year students)	• *Cost* of education • *Satisfaction* with the quality of teaching and learning with a questionnaire (5-point Likert scale)	• The blended model was more economical. • Satisfaction was higher in the blended model group.
Roe et al. 2018	Norway	Musculoskeletal Disorders course for second-year PT students	Crossover design study 1) Flipped classroom model (n = 45) 2) Control	• *Knowledge* with an oral exam (6-point grading scale) • *Perceptions* of the flipped classroom model with open-ended questions and on a 10-point scale	• The groups were similar in terms of academic outcomes. • Flexibility and responsibility increased in the flipped classroom group. The disadvantages reported by the students were associated with little feedback and variation during learning activities
Roe et al. 2019	Norway	Musculoskeletal Disorders course for second-year PT students	Prospective, controlled cohort study 1) Flipped classroom model (n = 54) 2) Control (previous second year students)	• *Knowledge* with a course exam • *Perceptions* of the flipped classroom model with six open-ended questions	• Students in the flipped classroom group had higher grades and better performance than those in the control group. • The flipped classroom model increased the responsibility of learning.

AQPEPT: Attitudes Questionnaire towards Professional Ethics in Physiotherapy

Table 3. Key Aspects of Online Learning Systems/Tools in Physiotherapy Education Literature

Study	Country	Course/Participants	Study Description	Outcome Measures (Tool/Method)	Conclusions
Corrigan and Hardham 2011	Australia	Physiotherapy Rehabilitation Techniques course for third-year PT students	Mixed methodology Simulated practical exam task (n = 61)	• Pre-experience survey • Post-experience survey and preference feedback • Feedback evaluation	• A simulated practical exam task is a useful tool for evaluating and reflecting on students' performance according to set assessment criteria. • Feedback provided to the peer group is the preferred method for task evaluation and discussion. • Defining the learning outcomes of the simulated task and establishing clear links with a summative assessment can maximize student confidence and accuracy in self-assessment. • The contextual nature of the simulated task provides students with insights into possible treatments and interactions between patients and themselves as therapists.
Da Costa Vieira et al. 2017	Brazil	Oncological Physiotherapy course for second- to fourth-year undergraduate PT students	Prospective, controlled, randomized, crossover study 1) A traditional classroom model group (n = 35) 2) An e-learning group using the Articulate® application (n = 32)	• *Knowledge* with a diagnosis evaluation before the course and after each module	• The course resulted in significant acquisition of knowledge. • The level of information retention was similar between groups.
Green et al. 2014	Australia	Anatomy course for second-year PT students	Mixed methodology Participation in asynchronous online discussion forums (n = 138)	• *Knowledge* with a combination of practical tests and final exam	• Posting more regularly improved students' learning outcomes and final grades.
Hammarlund et al. 2015	Sweden	Basic Research Methodology course for PT students	Qualitative study Online course (n = 34)	• *Student feedback* with qualitative manifest content analysis	• The effects of external and internal factors on learning strategies and self-efficacy are important aspects to consider when designing online courses. • Factors such as pedagogical design, clarity of purpose and goals, and guidelines, as well as continuous opportunities for communication and collaboration, are important.
Hossain et al. 2015	Bangladesh	Physiotherapy Management of Spinal Cord Injuries course by MOOC for second- and third-year undergraduate PT students	Randomized controlled trial 1) MOOC (n = 24) 2) Physiotherapy-specific online learning module (n = 24)	• *Knowledge* with a multiple-choice test • *Perceived confidence* in treating patients with spinal cord injuries and *satisfaction* with the learning experience (10-point Likert scale)	• The MOOC was no better for students than working at their own pace through an online learning module for increasing knowledge, confidence, or satisfaction.
Jones et al. 2010	Hong Kong Canada USA	Cardiovascular and Cardiopulmonary curriculum for middle- and final-year PT students	Randomized controlled study 1) VL + web-based (n = 19) 2) Web-based (n = 19) 3) Traditional teaching (n = 26)	• *Knowledge* with standardized short-answer question quizzes. • *Satisfaction* with learning experience of participating with a questionnaire with closed-ended questions.	• VL learning outcomes were similar in conventional formats. • VL learning outcomes may augment students' learning satisfaction. • VL technology may play a role in reducing the demands on academic programs.
Keiller and Inglis-Jassiem 2015	South Africa	Problem-Based Learning Physiotherapy module for third-year PT students	Empirical study Videos and blogging (n = 18)	• *Student opinions* with a self-administered engagement questionnaire	• Student-generated videos of clinical skills could be successfully implemented with adequate support from staff.

Kumar and Kumar 2013	India	Physiotherapy Ethics course for final-year PT students	Descriptive study e-module (n = 25)	• *Knowledge* with a written examination • *Student opinions* with a questionnaire	• The e-module enhanced self-directed learning and can be implemented.
Lozano-Lozano et al. 2020	Spain	Ecofisio mobile app for sport pathologies for undergraduate PT students	Multicenter, double-blinded randomized controlled trial 1) Ecofisio mobile app (n = 55) 2) Control group (n = 55)	• *Knowledge* with MCQ • *Skills* with an objective structured clinical examination • *Satisfaction* with a questionnaire (5-point Likert scale)	• Knowledge and skills were improved. • The Ecofisio group showed a higher satisfaction level.
Maloney et al. 2013a	Australia	Fourth- year PT students	Mixed methodology Physeek for Web-based learning (n = 18)	• *Perceptions* of Physeek utilization and its impact on learning with a questionnaire (5-point Likert scale)	• Students perceived online repositories as a potential tool to support lifelong learning and health care delivery.
Maloney et al. 2013b	Australia	PT students in their final preclinical semester	Descriptive study Self-videos (n = 60)	• *Technical details* and *student opinions* with a questionnaire (5-point Likert scale)	• Despite some technical difficulties, web-based student self-video of performance with remote tutor feedback and guided reflection is a feasible method for increasing students' capacity for reflection and self-evaluation.
Marques da Silva et al. 2012	Brazil	Bronchial Hygiene Techniques course for fourth-year PT students	Randomized controlled trial 1) Online group (including multimedia resources) (n = 8) 2) Control group (n = 8).	• *Knowledge* with pre- and posttests	• The online group performed significantly better than the control group.
Nicklen et al. 2016b	Australia	Third-year PT students	Randomized controlled study 1) RO-CBL (n = 19) 2) Traditional face-to face CBL (n = 19)	• *Knowledge* with MCQ • *Satisfaction* with the RO-CBL with a questionnaire (5-point Likert scale) • *Perceptions* of remote learning with a questionnaire (3-point Likert scale)	• The groups were similar in terms of MCQ. • Satisfaction decreased in the RO-CBL group and they reported a perception that RO-CBL negatively impacted their learning.
Ulrich et al. 2019	Denmark	PT students	Randomized controlled study 1) E-learning with virtual reality (n = 28) 2) Regular video (n = 26) 3) Traditional teaching (n = 27)	• *Knowledge* with a final test. • *Satisfaction* with learning and climate with a questionnaire (13 items rated on a Likert scale)	• E-learning virtual reality was as effective in enhancing academic performance as regular videos and traditional teaching. • E-learning virtual reality and regular videos were less effective than traditional teaching in terms of student learning satisfaction.

MOOC: Massive Open Online Courses, VL: Virtual Learning, MCQ: Multiple Choice Question, RO-CBL: Remote-online case-based learning

mostly found to be effective in increasing knowledge. More frequent use of such systems was found to be associated with greater academic success (31). We believe that ease of access to information and effective use of time play an important role in increasing students' academic success. In addition, the inclusion of different components that stimulate learning, such as the variety of visuals and sound effects in the tools, may have helped increase success by helping students focus their attention. In most studies, the use of e-system tools increased student satisfaction, although a decrease (34) and indifference (35) were also reported. The reason for this may be that students prefer the classical classroom environment because of its social characteristics. Students generally stated that online teaching aids and repositories significantly supported lifelong learning (38). Nicklen et al. (2016b), who examined the effects of case-focused remote education, found no change in students' knowledge levels than tradition education and a decrease in perception and satisfaction levels, concluding that face-to-face instruction in patient-focused clinical training was superior (34). This study is particularly important since a certain number of hours of patient-focused clinical work was required for graduation.

The novel study by Mącznik et al. revealed the effectiveness of online technology in PT education in both undergraduate and post-graduate education up to 2015 (9). In our study, we chose to focus exclusively on undergraduate education, since online technology has been widely used and understood in 'Master of Science' and 'Philosophy of Doctoral' programs in the world's leading universities for a long time. Considering the pandemic has had a rather negative impact on undergraduate education by interrupting the face-to-face training required by practical training, it has become a necessity to examine in detail the undergraduate PT education. As we exclusively focus on the use of DE technologies alone in undergraduate education, we aimed to increase a better understanding and usage of DE technologies in undergraduate PT education.

DE has been introduced into many disciplines, including physiotherapy (PT) programs, and has become the new normal in education due to its positive outcomes in higher education. Similar to our study, a meta-analysis study of the flipped classroom model, including many different health disciplines such as physicians, nurses, dentists, showed that flipped classroom improved student learning significantly compared with traditional teaching methods (42). Another review conducted to analyze the effectiveness of DE during the Coronavirus Disease 2019 (COVID-19) epidemic in undergraduate students from various health disciplines. This study highlights the benefits of online learning in enhancing students' academic, clinical, and communication skills, despite potential connection issues and lack of interaction between teachers and students (43). A recent systemic review by Naciri and colleagues analyzing the effectiveness of e-learning systems has been reported similar results (44).

Studies investigating the effectiveness of DE in PT education have only included certain courses, which are only part of the curriculum. This limits our ability to arrive at safe conclusions on the effectiveness of DE models and/or e-system tools in PT education. Although the reviewed studies examined various aspects of PT education, hands-on training, which is a necessary part of PT competence, was generally not examined. Further studies are needed to investigate the various aspects of the PT curriculum, including both theoretical and practical courses.

Certain limitations of this review should be acknowledged. Only English and Turkish full-text articles were searched. A multicenter team proficient in more languages might have enabled us to include more articles. We are unable to reach a definitive conclusion regarding the quality of the studies included in this review because numerous categories were not assessed due to lack of information provided in the studies. Moreover, only nine studies had a high-quality (RCT) design, while the rest had descriptive, cohort, and other designs. Furthermore, these studies did not investigate the long-term effectiveness of DE. Therefore, future high-quality studies with long follow-up periods are needed to thoroughly investigate knowledge levels, skills, self-efficacy, and occupational satisfaction in

professional life. Numerous studies on DE in the PT field at the postgraduate and continuing education levels are also available in the literature. Further reviews might focus on the effectiveness of DE in postgraduate and continuing education. Finally, a meta-analysis was not possible due to the included studies' dissimilarity and heterogeneity. On the other hand, this review is valuable in that it systematizes implemented online education models and systems. It should be noted, however, that all included studies were conducted before the pandemic, when DE was an option rather than a necessity. Therefore, we cannot draw conclusions on how the global public health crisis has changed students' perceptions or satisfaction levels.

We synthesized studies on DE models and e-system tools used in PT education to evaluate their effectiveness in terms of students' knowledge, skills, and satisfaction. This review concludes that while DE can assist and complement traditional methods to provide an engaging and inspiring environment that improves teaching and learning, it cannot replace traditional face-to-face modes of education. Accordingly, DE can promote learning in PT education, even though its effectiveness in some areas, such as practical skill acquisition and cost, remains controversial.

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: The authors declare that there is no conflict of interest.

Author Contribution: MEY: Concept, Design, Materials, Data Collection and/or Data Processing, Analysis and/or Interpretation, Literature Review, Article Writing, Critical Review; TM: Concept, Design, Materials, Data Collection and/or Data Processing, Analysis and/or Interpretation, Literature Review, Article Writing, Critical Review; OC: Concept, Design, Materials, Data Collection and/or Data Processing, Analysis and/or Interpretation, Literature Review, Article Writing, Critical Review; NUY: Supervision and Consultancy, Article Writing, Critical Review; KB: Supervision and Consultancy, Article Writing, Critical Review; YY: Supervision and Consultancy, Article Writing, Critical Review

Explanations: None

Acknowledgement: None

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2024 35(2)258-272

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Received: *29.05.2024 (Geliş Tarihi)*
Accepted: *13.08.2024 (Kabul Tarihi)*

A SYSTEMATIC REVIEW ON THE EFFECTIVENESS OF BRAIN-BREAKS® VIDEO PROGRAMMING ON ACADEMIC PERFORMANCE AND PHYSICAL ACTIVITY OF SCHOOL CHILDREN

SYSTEMATIC REVIEW

ABSTRACT

Purpose: This study aimed to complete a systematic review of the effect of the Brain Breaks® video program on academic performance and health-related outcomes among schoolchildren.

Methods: A literature search was performed using Scopus, PubMed, ResearchGate, ScienceDirect, and Google Scholar databases to identify published manuscripts from December 2017 to December 2023. Dissertations, theses, monographs, and commentaries were excluded from this review.

Results: A total of 15 studies were included in the review. Most studies applied quasi-experimental design and were conducted in Asia and Europe with children. Nine of these studies found that Brain Breaks® improved students' attitudes toward physical activity (PA), and two found that it improved their PA levels. The other studies found that Brain Breaks® improved students' academic performance, perceived pros and cons of PA, transtheoretical model (TTM) constructs, motivation to participate in PA, cognitive function, muscle strength, muscular endurance, and flexibility, as well as the fitness knowledge test and the Fitnessgram test battery results.

Conclusion: It is thought that the Brain Breaks® web-based online video program has the potential to improve the academic performance and health-related physical fitness of school children

Keywords: Attitude, Brain-Breaks, Cognitive Functions, Childhood, Physical Activity

BRAIN-BREAKS® VİDEO PROGRAMININ OKUL ÇOCUKLARININ AKADEMİK PERFORMANSLARINA VE FİZİKSEL AKTİVİTELERİNE ETKİSİ ÜZERİNE SİSTEMATİK BİR İNCELEME

SİSTEMATİK DERLEME

ÖZ

Amaç: Bu çalışmanın amacı, BrainBreaks® video programının öğrencilerin akademik performansları ve sağlıkla ilgili sonuçları üzerindeki etkisinin sistematik incelemesini yapmaktır.

Yöntem: Aralık 2017'den Aralık 2023'e kadar yayınlanan makaleleri belirlemek için Scopus, PubMed, ResearchGate, ScienceDirect ve Google Scholar veritabanları kullanılarak literatür taraması yapılmış olup tezler, monografiler ve yorumlar bu incelemenin dışında bırakılmıştır.

Sonuçlar: İncelemeye toplam 15 çalışma dahil edilmiştir. Çalışmaların çoğunun yarı deneysel olduğu, Asya ve Avrupa'daki çocuklar üzerinde yürütüldüğü saptanmıştır. Bu çalışmaların dokuzu Brain Breaks®'in çocukların fiziksel aktiviteye karşı tutumlarını, ikisi ise fiziksel aktivite düzeylerini geliştirdiğini göstermiştir. Ayrıca diğer çalışmalar bu programın çocukların akademik performanısnı, fiziksel aktivitenin artı ve eksilerine ilişkin algılarını, transteorik model (TTM) bileşenlerini (değişim süreçleri, karar vermede denge ve öz yeterlik), fiziksel aktiviteye katılım motivasyonlarını, kognitif fonksiyonlarını, kas kuvvet ve enduranslarını, esnekliklerini, fiziksel uygunluk bilgi testi ve Fitnessgram test bataryası sonuçlarını geliştirdiğini ortaya koymuştur.

Tartışma: Brain Breaks® web tabanlı çevrimiçi video programının okul çocuklarında akademik performansı ve sağlıkla ilişkili fiziksel uygunluğu geliştirme potansiyeline sahip olduğu düşünülmektedir.

Anahtar Kelimeler: Tutum; Brain-Breaks; Bilişsel fonksiyon; Çocukluk; Fiziksel aktivite.

INTRODUCTION

Physical activity (PA) is considered an essential determinant for improving quality of life, adding to a healthy lifestyle, and reducing chronic disease risks such as hypertension, obesity, and diabetes (1-3). In addition, information found in the literature demonstrates that PA significantly influences various measures of cognitive performance and academic achievement among children (4, 5). A recent study by Xue et al., (6) suggests that long-term exercise programs used in school, sports, and PA programs may improve several areas of executive function, especially inhibitory control.

Despite the numerous health benefits associated with regular exercise, it remains an infrequent practice among large segments of the population in developed nations Radford et al. (7). For example, epidemiological studies highlight that a majority of American adults fail to meet recommended exercise levels (8, 9). In addition, Nicklett et al., (10) found that physically inactive adults faced a 50% to 60% higher risk of premature death compared to their active counterparts. Globally, physical inactivity contributed to 9% of deaths, while sedentary behavior was associated with 3.8% of deaths (11, 12).

According to the World Health Organization (WHO), children should engage in daily moderate-to-vigorous PA (MVPA) for 60 minutes (13). Despite the documented PA benefits (1), a significant portion of adolescents are sedentary, and PA is decreased during adolescence, with the decrease being greater in females than in males (2). Sedentary behavior refers to any waking behavior that involves an energy expenditure of less than 1.5 metabolic equivalents while in a sitting, reclining, or lying position (13). Berkey et al. (14) report that more time engaged with on-screen entertainment is associated with substantial increases in male and female children's body mass index (BMI). This negative lifestyle change is becoming a serious concern as childhood obesity is on the rise in most countries (15). The results of a meta-analysis demonstrate that the most effective approach to promoting and maintaining PA behaviors is through behavioral intervention (16).

In recent years, educational technology tools have gained greater utilization to facilitate teaching, learning, and behavioral change (17). The use of technology-assisted communications to administer and enhance medical and psychological treatments initially emerged in 2000 and has since become widely used (18). The perception that technology, such as web-based information delivery, online chat rooms, mobile devices, and video conferencing, has the potential to improve the efficacy of targeted interventions and comprise more universal and at-risk populations is what is driving this explosive growth (19). In particular, using technology can motivate students to raise their PA levels (20). For instance, technology such as online streaming, HOPSports Brain Break® videos, and virtual reality games like Pokemon GO were created to boost students' and adults' PA participation (21). In this review, we focused on the HOPSports Brain Breaks® video because this programming makes use of a dynamic online platform that is consistent with the Whole School, Whole Community, and Whole Child (WSCC) Guidelines and the 17 United Nation Sustainable Development Goals (UNSDG 17) (22, 23).

Brain Breaks® intervention (https://brain-breaks.com/) contributes to achieving the health and well-being targeted goals presented by the UNSDG's 17 Sustainable Development Goals, utilizing an average duration of three to five minutes each to promote and enhance positive PA behaviors among children and adolescents (24-27). Good health and well-being, high-quality physical education, PA interventions in schools, encouraging community PA actions, and active transportation are all included in the UNSDG goals, particularly in relation to targets 3, 4, and 11. These programs are easily accessed via the Internet. Only a school projector and internet access are needed for program implementation (22). Brain Breaks® programming and videos were initially introduced by HOP-Sports, are supported by The Foundation for Global Community Health (http://www.gchfoundation.org), and have been adopted by 70 countries (22). HOPSports®, Inc.'s ready-made safety, health, and educational solutions are used by schools, colleges, community-based groups, hospitals, recreation centers, and treatment facilities. HOPSports provides opportunities for increased physical activity, nutrition,

and character education as part of its programs designed to support students' welfare, academic performance, and overall health.

Brain Breaks® is designed as a classroom activity in addition to the schools' normal physical education curriculum. Emeljanovas et al. (28) state that physical education should not be regarded as bodily movement alone but as a comprehensive educational philosophy promoting educational continuity, self-reliance, and competency among children. Brain Breaks® programming and videos are usually applied twice daily, five days a week, throughout the academic year, and the results from studies using this intervention show that Brain Breaks® videos promoted positive children's attitudes toward PA, mental health, learning ability, and academic achievement (29-33). Mok et al. (34) found that when Brain Breaks® intervention programming was applied twice daily, five days a week, for four months, children's attitude toward PA increased. In addition, Krause and Benavidez (35) reported that technology-based programs are more likely to improve PA participation in children as compared to non-technology-based games and sports. Furthermore, Primack et al. (36) found that video games positively affect health education outcomes by 42%, and digital programs such as Brain Breaks® enhance cognitive achievement with PA self-motivation, improving positive health behaviors (22, 31).

Active breaks are 5- to 15-minute MVPA sessions facilitated by teachers incorporating brief intervals of PA in conjunction with academic lessons. Active breaks do not need specialized staff or unique locations and equipment, so they can be implemented in any kind of educational setting (37, 38). Early Brain Breaks® research studies (e.g., (24, 34)) report that breaking up sit-time with PA during the school day contributed to improved student attention, enhanced knowledge acquisition, general alertness, on-task behaviors, self-awareness, and improved PA engagement. Brain Breaks® research has also demonstrated the potential for improving children's academic understanding of music, language, culture, and art (22), as well as maintaining behavioral change (39).

Despite the diverse findings for Brain Breaks® technology, several research questions remain unanswered: 1) What are the effects of Brain Breaks® video programming on children's physical fitness and their attitude toward PA (i.e., perceived benefits, importance, learning, self-efficacy, fun, fitness, and personal best)? 2) What methods are best used in Brain Breaks® intervention studies? 3) What age groups were used or evaluated in Brain Breaks® intervention studies? 4) Where have the Brain Beaks® intervention video program and its effects been utilized across the globe? 5) Have Brain Breaks® intervention studies been conducted among children of different races and ethnicities? 6) What are the estimated sample sizes from past studies? 7) What outcome measures were used to assess the effect of the Brain Breaks® video programming?

Given the diverse intervention findings regarding the use of Brain Breaks® programming and videos and that the findings are consistent with UNSDGs for good health, a need exists for a comprehensive systematic review of the present literature to develop clear and specific conclusions and recommendations concerning Brain Breaks® programming and video effects on health-related outcomes. Furthermore, Brain Breaks® programs are interactive web-based structured videos on nutrition, hygiene (lifestyles), and physical exercise that are designed to improve students' interest in learning and promote better health (40). Therefore, the purpose of this review is to provide a comprehensive, systematic review of the impact of Brain Breaks® programs and videos on academic performance and outcomes related to health in school-aged children. This review will lend support to the necessary investigation to assess and deepen our understanding of Brain Breaks® programs and videos, as well as beneficially influence the UNSDGs about children's health and wellbeing.

METHODS

Study Design

This review utilized the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) Search Strategies (41). The review was registered in the International Prospective Register of Systematic Reviews (PROSPERO; record #CRD 42022315938). The ethical approval was granted by the Universiti Sains Malaysia's Human Re-

search Ethics Committee (USM/JEPeM/21050370). A literature search for relevant studies was conducted between January 2024 and February 2024. The electronic databases searched were PubMed, ScienceDirect, Scopus, ResearchGate, and Google Scholar. Search keywords used were combinations of the following: (1) Brain Breaks®; music, culture, and language, (2) Brain Breaks®; PA, (3) Brain Breaks®; academic performance, (4) Brain Breaks®; health, (5) Brain Breaks®; UNSDG, and (6) Brain Breaks®; motives and attitudes toward PA. In PubMed, the search string used was "Brain Breaks®" or Brain Breaks video technology) OR "Brain Breaks® physical activity intervention" OR "Brain Breaks® video intervention." [Title/Abstract/Keywords] AND (schoolchildren) [Title/Abstract/Keywords] AND (effect of Brain Breaks® on physical activity, academic performance, achievement, cognition, motivation, attitude, and self-efficacy); ScienceDirect, [Title/Abstract/Keywords] AND (child* OR school-age OR schoolchildren); in Scopus, [Title/Abstract/Keywords] AND ("experimental studies [Title/Abstract/Keywords]; in ResearchGate, "Brain Breaks" AND "physical activity" AND "academic performance" AND "health outcomes"; and in Google Scholar, "Brain Breaks" "physical activity breaks" "academic performance" "health outcomes". Some search words were changed in accordance with the specifications of the database. The reference lists of the included reviews were searched, and the search was conducted without any restrictions. Two authors searched from its inception until December 2023.

Eligibility Criteria

The inclusion criteria for articles used in this review were: 1) studies conducted among schoolchildren regardless of ethnicity, country, or health condition; 2) experimental studies that tested the effect of Brain Breaks® programming and videos; 3) studies related to Brain Breaks® and outcomes related to health such as PA and academic achievement; and 4) reports on Brain Breaks®. Reports considered eligible were: 1) the articles published in English; and 2) Publications from Brain Breaks® programming between the year of launch and December 2023. Exclusion criteria were non-experimental studies, studies conducted on adults, and studies conducted on non-school children.

Data Extraction

The Cochrane Consumers and Communication Review Group's template (42) was used to extract data, and all authors contributed to the data extraction process. For example, the Cochrane Consumers and Communication Review Group has created this template for its review authors. The template aims to collect all relevant details about the included studies and their outcomes. The template consists of seven sections: general review information, study methods, risk of bias assessment, study characteristics (participants), study characteristics (interventions and comparisons), study characteristics (outcomes), and data and results. Data extraction and review were initially completed by two investigators (GK and AS). Studies deemed not relevant based on the review of the title and abstract were excluded. Conflicts were solved by a third reviewer (YCK). The articles selected in the previous step were read in full-text version and checked again on the eligibility criteria (GK and AS). Any disagreements were solved by a third reviewer (YCK). In addition, the remaining authors reviewed the quality of the final data collection and entry. Information extracted from the retrieved studies were a) characteristics of participants (sample size, gender, and age); b) study design; c) country where the study was completed; d) follow-up time in week or month (Brain Breaks® intervention period); and e) study outcome.

Risk of Bias Assessment

In this review, we applied the ROBINS-I ("Risk of Bias in Non-randomised Studies—of Interventions"), which is concerned with assessing the risk of bias in estimates of the effectiveness or safety (benefit or harm) of intervention from studies that did not use randomization to allocate interventions, since 16 of the included studies used a non-randomized design (43). Two independent investigators assess the methodological quality of the included studies. The risk of bias was assessed using seven domains: 1) Bias due to confounding, 2) Bias in selection of participants into the study, 3) Bias in classification of interventions, 4) Bias due to deviations from intended interventions, 5) Bias due to missing data, 6) Bias in measurement of outcomes, and 7) Bias in selection of the reported result. The

research was classified as "low risk of bias." If the study is judged to be at low risk of bias for all domains; "moderate risk of bias" if the study is judged to be at low or moderate risk of bias for all domains; "serious risk of bias" The study is judged to be at serious risk of bias in at least one domain, but not at critical risk of bias in any domain; "critical risk of bias" The study is judged to be at critical risk of bias in at least one domain; and "no information" if there is no clear indication that the study is at serious or critical risk of bias and there is a lack of information in one or more key domains of bias (43). In this review, we rated 13 studies as "low risk" due to the clear definition and consistent application of the intervention (Brain Breaks®) across all participants, while we rated 3 studies as "moderate risk" due to inadequate control for socioeconomic status, which could influence both physical activity levels and academic performance.

RESULTS

Criteria for relevant articles concerning the effect of Brain Breaks® followed the PRISMA guidelines (see Figure 1) (35). A total of 2338 records were identified using Google Scholar, PubMed, Scopus, Web of Science, and ResearchGate databases, and seven additional records were identified through other sources. All duplicate records were removed (n = 818), leaving 1520 records. After screening for the title and abstract content was completed, 40 studies were identified. We excluded 20 out of these 40 studies because they did not meet the study inclusion criteria, which included non-experimental studies, studies conducted on adults, and studies conducted on non-school children. A total of 20 studies were considered eligible and relevant to the research objectives for this review. Five more articles were excluded after reading the full text. Articles removed were published by Kuan, Rizal (22), Dinc, Saçlı Uzunöz (24), Mok, Chin (26), Hidrus, Kueh (44), and Hidrus, Kueh (45). One article is an update concerning Brain Breaks®; two articles tested the psychometric properties of attitudes toward PA scores on the attitude toward physical activity scale (APAS); and the two articles from Hidrus concern Type-2 Diabetic patients.

A total of 15 studies (23, 28, 29, 34, 39, 40, 46-54) presented in Table 1 between December 2017 and December 2023 were identified, and of these studies, nine reported the positive effects of Brain Breaks® on attitude towards PA using APAS, two reported the positive effects of Brain Breaks® on PA level, whereas the remaining studies reported the positive effects of Brain Breaks® on students' academic performance, perceived pros and cons of PA, TTM constructs, motivation for PA participation, muscle strength, muscular endurance, and flexibility fitness knowledge test for children, and the fitnessgram test battery. Furthermore, of the nine studies included in the analysis using APAS to measure outcomes, six studies employed APAS using the seven constructs developed by Mok, Chin (26), including benefits, importance, learning, self-efficacy, fun, fitness, and personal best.

Regarding studies that used APAS, eight of the nine studies reported a significant increase in the mean scores of all APAS constructs with time in the experimental group compared to the control group (i.e., benefits, importance, learning, self-efficacy, fun, fitness, and personal best). In the remaining study by Glapa et al. (40), three scales (i.e., benefits, self-efficacy, and fun) increased their means with time in the experimental group. For students' motives for PA participation, a significant improvement in their enjoyment, competitiveness, appearance, and psychological condition was observed, whereas no significant improvement was detected in mastery, affiliation, or physical condition. Two studies reported PA level as an outcome; one study reported a small, non-significant increase in energy expenditure during the school day and also a non-significant increase in sedentary time. The remaining study reported that during the intervention, children's sedentary behavior significantly decreased, while vigorous PA significantly increased. For TTM, changes with time in cognitive process, behavioral process, and internal feeling were found. Also, a significant difference between groups on cons existed.

A review of the literature revealed that 14 of the 15 included studies used a quasi-experimental design and the remaining study used a randomized controlled trial (RCT) design. Of the 15 studies, nine employed an intervention period of three months, four studies utilized an intervention duration of four months, and the remaining three studies used

an intervention of six to ten weeks. Furthermore, 14 of the 15 included studies investigated the group effect (control and experimental) and the time effect (follow-up time), while the remaining study investigated only the time effect of Brain Break programming.

Within the 15 selected studies, five studies were conducted in Malaysia, four studies were conducted in Türkiye, three studies were conducted in South Africa, two studies were conducted in a study carried out in Croatia, Lithuania, Macedonia, and Poland, and one study was conducted in a study carried out in China, Singapore, Romania, Slovakia, and Serbia. The study sample size ranged from 48 to 3036 subjects, and the mean participant age ranged from 6.0 to 12 years.

DISCUSSION

The present manuscript presents a comprehensive literature review evaluating the health effects of Brain Breaks® programming and video as a PA intervention for children. The findings support the use of this intervention to achieve the health and well-being target goals presented by the UNSDG (24-27), especially goals 3, 4, and 11, which refer to good health and well-being, quality physical education, PA interventions in schools, promoting community PA actions, and active transportation. This review confirms that Brain Breaks® is becoming globally available through the internet and easily accessible in situations such as the pandemic when individuals do not have easy access to outdoor activities. With ease of use in any environment, studies reviewed show these online exercise videos offer comprehensive education opportunity that incorporates cultural knowledge, PA, and music.

The findings of this review reveal that 14 of the 15 studies used a quasi-experimental design. RCTs, on the other hand, are the most reliable method to examine the effectiveness of new treatments or interventions (55), while the quasi-experimental design is more suitable for estimating the effect of an intervention when repeated measures design or analysis is used and pre-post testing is used (56, 57). Also, all of the 15 studies that employed a quasi-experimental design used a repeated measures design. The intervention time for the Brain Breaks® application ranged from one week to four months, and the findings of this review support Brain Breaks® as providing a positive effect on academic performance and health-related fitness outcomes.

The children's mean ages in this literature analysis ranged from 6.0 to 12 years. This age range illustrates that all studies included in this review investigated the effect of Brain Break programming among schoolchildren. Previous studies reported that Brain Breaks® videos promote students' self-efficacy, learning, self-awareness, participation, concentration, and attitude toward PA (28, 40, 47, 52). Additionally, the findings of this review show that Malaysia had the most Brain Breaks® studies, followed by Türkiye and South Africa. These findings show that while the Brain Break programming effectiveness has been investigated throughout the globe, most research studies were carried out in Asia and Europe. This observation suggests that Brain Break programming has to be investigated further in various other regions of the world. Furthermore, individual study sample sizes ranged from 48 to 3036 subjects, supporting that Brain Breaks® programming and video intervention have a broad application among schoolchildren.

The results of this review demonstrate that Brain Breaks® programming and videos have positive effects on attitudes towards PA participation measured using APAS. The APAS was developed by Mok, Chin (26) in English and is a valid and reliable questionnaire to measure primary schoolchildren's attitudes towards, perceptions of, and beliefs about various aspects of PA engagement, with a focus on PA using video games. The scale covers seven sections, including promoting holistic health; the importance of exercise habits; self-efficacy in learning with video exercises; self-efficacy in selecting video exercises for themselves; exercise motivation and enjoyment; self-confidence in physical fitness; and trying to do my personal best. To ensure the validity and comparability of the data gathered, some authors applied the APAS questionnaire in its English version while other countries translated APAS to different languages, reviewed the questionnaire for cultural appropriateness, and made any necessary modifications, including China (3), Lithuania (28), Macedonia (52), Malaysia (29), Poland (40) and Türkiye (49). However, all translated versions had the same number of constructions

and items as the original English version. Future research should homogenize both the interventions and the assessments (with the same instruments). Developing a bio-psycho-social study—that is, considering sociological difficulties in addition to psychological and physiological aspects is of interest.

A study by Bonnema et al. (47) found that before the intervention program, there was no difference in attitudes towards physical activity (PA) and fitness between the control and experimental groups, except for the importance of PA. After completing the HOPSports Brain Breaks® intervention program, the experimental group showed statistically and practically significant improvements in their attitudes towards PA and fitness. These improvements included attitudes towards the benefits of PA, self-efficacy in using video exercises for PA, and attitudes towards environmental support and interest in PA, indicating a dramatic positive shift in their perspectives. These findings align with a study by Mok, Chin (58) involving 2,751 learners from Grade 3 to Grade 5 across seven countries: Türkiye, Serbia, Croatia, Romania, Poland, Lithuania, and South Africa. The constructs with the strongest effect sizes were self-efficacy in using video exercises for PA, followed by attitudes towards the benefits and importance of PA. Similarly, Uzunoz et al. (49) reported significant improvements among 300 Grade 3 to Grade 5 learners from Türkiye in self-efficacy in using videos, personal best, importance of PA, self-confidence in physical fitness, and motivation and enjoyment of PA.

While various mobile applications and online video platforms are available to promote PA participation in children, Brain Breaks® programming and videos are online classroom-based videos with experimental data supporting improved children's interest and cognitive function (59). The benefits of Brain Breaks® on cognitive functions are supported by the association between exercise and cognitive function (60). WHO guidelines regarding PA and sedentary behaviors indicate that regular PA benefits mental health and cognitive functions, including academic performance and executive function in children (13). PA Guidelines for Americans (61), provide further support for cognitive function benefits and performance on academic achievement tests, executive function, mental processing speed, and memory in children aged 6 to 13 years. These guidelines are based on perspectives obtained from studies concerning a single exercise session and long-term practiced PA or exercise (61). Exercise is known to positively affect cognitive function (59, 62), regardless of age (63), and includes children with special conditions (e.g., attention deficit and hyperactivity disorder) (59, 64).

This review reveals changes with time in cognitive processes, behavioral processes, and internal feelings. Other studies using neuro-electrical instruments, event-related potential (ERP), electroencephalography (EEG), functional Magnetic Resonance Imaging (fMRI), and measurement of neuropsychological biomarkers such as memory or cognitive function provide insight into the mechanisms and confirm the relationships between PA, exercise, and brain health. For example, a single exercise session induced a larger P3 amplitude of ERP in preadolescents (65) and children (66), suggesting that more attentional mental resources become available when individuals are engaged in cognitive tasks (65). The upregulation of neurochemicals, such as neurotrophins (e.g., brain-derived neurotrophic factor [BDNF]), following PA or exercise, provides another exercise benefit because BDNF activity plays a crucial role in neuron transmission, modulation, and plasticity. These physiological responses influence cognitive functions (66).

Incorporating PA into academic lessons (e.g., students need to incorporate PA into other academic areas such as in math), scheduling brief (5–15 minute) PA breaks between lessons (e.g., having students follow a sequence of exercises), or incorporating PA into main transition periods (e.g., having students hop around the classroom before getting in line to go to lunch) are the three main approaches that have been used to include PA during school time (37, 38). The novelty of Brain Break is the diverse cultural features included in the videos such as traditional dance specific to each country, sports, and contemporary movements (52). Brain Breaks provides teachers with a wide selection of PA videos to choose from while adding classroom variety (28). These videos often result in improvements in students' PA attitudes and self-esteem, and students are provided the opportunity to master new motor skills (28).

The use of Brain Breaks® programming is relatively new, and few studies related to its efficacy exist. Given that most of the existing studies examined the effect of this program on PA and students' academic performance, future studies should examine the effect of Brain Breaks® on other health-related outcome measures such as anxiety, depression, emotional control, and exercise endurance. This observation is meant to encourage interested researchers to explore the direct and mediating effects of Brain Breaks® on many health-related outcomes (for example, disease risk, cardiorespiratory fitness, muscle strength, endurance, flexibility, and body composition). A need exists to implement Brain Breaks® intervention in various parts of the world, across a wide range of age groups, and to examine various mechanisms for change like the studies performed by Chu et al. (65) and Chang et al. (66). Future research studies will continue to create awareness and provide additional information for policymakers about the benefits of online video programming, and studies should be designed to provide information and insight into the mechanism responsible for change and how to better utilize this web-based video intervention. A main limitation of the studies reviewed was that most studies used non-randomization designs (quasi-experimental designs). However, given that all studies used repeated measures of statistics, study outcomes are considered reliable (55).

For future research investigations, the potential exists to advance the understanding of online videos and cognitive function via systematic exploration. Chang et al. (67) proposed a 3W1H framework, representing the three "Ws" (i.e., what, who, when) and one "H" (i.e., how), to consider the relevance of sequential studies associated with a single exercise session, regularly practiced exercise and cognitive function. Systematic investigations using this framework will further advance the knowledge base regarding the optimization of a single exercise session and regularly practiced exercise, and the PA effects on cognitive function and brain health in children while establishing a stronger foundation for understanding and customizing exercise programming and prescriptions.

The findings of this review illustrate the importance of online video programming as a web-based intervention designed to promote better health for schoolchildren by improving their attitudes toward PA, motives for PA, short-term memory, perceived pros and cons of PA, PA level, and TTM constructs, cognitive, affective, and behavioral components of students' attitudes toward physical activity, muscle strength, muscular endurance, and flexibility fitness knowledge test for children, and the fitnessgram test battery. Most importantly, Brain Breaks® intervention programming provides a means to achieve the health and well-being target goals presented by the UNSDG. Future studies should consider studying the effect of the Brain Breaks® intervention across various cultural and gender differences as well as other health-related outcome measures such as anxiety and depression. Finally, as studies are being designed and implemented, consideration should be given to using outcome measures such as physiologic and biochemical variables to gain new insight into the physiologic and biochemical mechanisms responsible for changes brought about by online video intervention.

Sources of Support: This review study was reviewed approval was granted by the Universiti Sains Malaysia's Human Research Ethics Committee (USM/JEPeM/21050370).

Conflict of Interest: All authors declared no conflict of interest occurred.

Author Contributions: GK, M-KC, AS, and YCK conceptualized and designed the original study, from which the data of the analyses presented here were obtained. GK, AS, and YCK completed data collection, data analysis, and initial writing. JLD cooperated in manuscript writing. All authors participated in writing and commenting on manuscript development and writing, editing, and approving the final manuscript version. All authors have read and agreed to the published version of the manuscript.

Explanations: None.

Acknowledgments: The authors would like to acknowledge the Foundation for Global Community Health (GCH) for technical support.

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Table 1. Summary of Existing Literature Relating to Brain-Breaks Research

Author	Study design	Characteristics of intervention	Country/characteristics of participants	Follow-up time	Follow-up time Mean±SD/%	Study outcome [measurement scale]	Risk of bias
Balasekaran et al. (46)	Quasi-Experimental	Classroom-based Brain Breaks® Physical Activity Solution, averaging three-five minutes daily during their class time, five days per week.	Singapore (n = 113) M = 47 F = 66 Mean age = 9.68	10 wks.	CG Pre-Post F1: 3.19±0.55-3.13±0.64 F2: 3.28±0.61-3.32±0.60 F3: 2.77±0.78-2.32±0.88 F4: 3.10±0.60-2.82±0.74 F5: 3.18±0.58-3.19±0.66 F6: 3.05±0.73-3.07±0.69 F7: 3.29±0.65-3.32±0.63 EG F1: 3.06±0.51-3.61±0.37 F2: 3.29±0.52-3.74±0.31 F3: 2.65±0.67-3.64±0.36 F4: 3.02±0.62-3.62±0.51 F5: 3.17±0.48-3.58±0.38 F6: 2.97±0.73-3.65±0.39 F7: 3.20±0.61-3.66±0.43	APAS [Attitudes toward Physical Activity Scale]	LR
Bonnema et al. (47)	Quasi-Experimental	Brain Breaks® intervention program once a day.	South Africa (n = 114) M = 56 F = 58 Mean age (EG) = 11.4 Mean age (CG) = 11.71	3 mo.	CG Pre-Post F1: 3.16±0.42-3.19±0.47 F2: 3.51±0.43-3.07±0.73 F3: 2.42±0.55-2.38±0.70 F4: 2.72±0.70-2.86±0.70 F5: 3.19±0.48-3.07±0.43 F6: 3.35±0.52-3.11±0.65 F7: 3.53±0.51-3.12±0.58 EG F1: 3.9±0.42-3.72±0.29 F2: 3.34±0.44-3.53±0.40 F3: 2.32±0.95-2.58±0.68 F4: 2.63±1.11-3.42±0.42 F5: 3.26±0.46-3.60±0.37 F6: 3.23±0.57-3.61±0.40 F7: 3.39±0.58-3.50±0.47	APAS [Attitudes toward Physical Activity Scale]	LR
Bulca et al. (48)	Quasi-Experimental	The experimental group received PE lessons once per week with the BB PA program and extra videos at home three days a week, while the control group received routine PE lessons during this period.	Türkiye (n = 62) Mean age = 10.48 (EG) and 10.59 (CG)	8 wks	EG Pre-Post FKTC: 19.18±3.37-30.04±4.29 20-M shuttle run: 22.61±7.56-25.04±6.13 Sit-reach (cm): 19.04±7.00-28.71±7.08 Sit-up test: 23.89±5.69-31.64±5.45 Push-up test: 18.93±4.49-23.00±4.68 Heart rate (Bpm): 144.96±18.10-137.80±5.40 CG Pre-Post FKTC: 21.47±3.75-28.59±3.95 20-M shuttle run: 24.76±6.74-24.94±4.02 Sit-reach (cm): 18.29±5.02-26.52±6.29 Sit-up test: 24.38±4.69-31.85±4.40 Push-up test: 19.29±4.21-21.82±6.54 Heart rate (Bpm): 138.76±17.00-140.60±15.20	Fitness Knowledge Test for Children and the Fitnessgram Test Battery	MR
Emeljanovas et al. (28)	Quasi-Experimental	Brain Breaks video exercise intervention every school day in their classrooms during class breaks.	Lithuania (n = 181) M = 98 F = 83 Mean age = 8.54	3 mo.	CG Pre-Post F1: 3.38±0.0.47-3.18±0.49 F2: 3.35±0.49-3.22±0.45 F3: 1.92±0.64-1.84±0.60 F4: 2.88±0.81-2.64±0.83 F5: 2.16±0.66-1.98±0.70 F6: 2.82±0.34-2.62±0.83 F7: 3.33±0.48-3.25±0.49 EG F1: 3.09±0.48-3.55±0.48 F2: 3.23±0.52-3.68±0.46 F3: 1.92±0.73-2.79±0.73 F4: 2.71±0.83-3.54±0.55 F5: 1.94±0.76-2.91±0.70 F6: 2.60±0.0.42-2.87±0.40 F7: 3.20±0.60-3.65±0.46	APAS [Attitudes toward Physical Activity Scale]	LR

Glapa et al. (40)	RCT	Brain Breaks® videos two times per day in three to five minutes.	Poland (n = 326) M = 170 F = 156 Mean age = 9.7	4 mo.	CG: Pre-Post Promoting holistic health: 2.9±0.47-2.8±0.63 Importance of exercise habit: 3.3±0.56-3.2±0.68 Self-efficacy in learning: 1.5±0.86-0.8±0.75 Exercise motivation and enjoyment: 2.9±0.47-2.8±0.75 Self-confidence in physical fitness: 2.9±0.73-2.9±0.85 Trying to do personal best: 3.2±0.58-2.9±0.99 EG: Pre-Post Promoting holistic health: 3.0±0.56-3.1±0.60 Importance of exercise habit: 3.3±0.81-3.3±0.67 Self-efficacy in learning: 1.7±1.03-2.6±0.71 Exercise motivation and enjoyment: 3.0±0.58-3.1±0.65 Self-confidence in physical fitness: 3.1±0.69-3.1±0.77 Trying to do personal best: 3.2±0.77-3.2±0.87	APAS [Attitudes toward Physical Activity Scale]	-
Hajar et al. (29)	Quasi-Experimental	Brain Breaks® videos five times per day in three to five minutes.	Malaysia (n = 335) M = 159 F = 176 Mean age = 10.51	4 mo.	CG Pre-Mid-Post Enjoyment 13.93±4.37-13.04±4.08-12.18±4.19 Mastery: 12.85±3.42-12.72±3.54-12.65±.62 Competition: 11.36±3.63-11.88±3.46-11.80±3.59 Affiliation: 11.63±3.12-12.23±3.66-12.35±2.88-12.02±3.20 Appearance: 14.92±3.51-14.06±3.57-13.44±3.57 Physical: 13.45±3.56-13.06±3.50-13.06±3.51 Psychological: 13.12±4.02-12.90±3.41-12.07±3.41 EG Pre-Mid-Post Enjoyment: 12.29±3.24-12.28±3.18-11.81±3.06 Mastery: 12.31±2.98-12.10±3.01-12.29±2.66 Competition: 10.65±3.37-10.84±2.94-11.98±3.24 Affiliation: 11.63±3.12-11.75±2.92-12.15±2.96 Appearance: 13.64±3.64-13.77±3.08-13.93±2.99 Physical: 12.79±3.76-13.31±3.31-12.82±3.42 Psychological: 12.18±3.37-13.03±3.20-12.73±2.81	Motives of participation in PA [Physical Activity and Leisure Motivation Scale-Youth-Malay (PALMS-Y-M)]	LR
Lim et al. (50)	Quasi-Experimental	Brain Breaks® videos	Malaysian (n = 70) M = 33 F = 37 10-12 years	-	M EG Pre-Post 3-min step test: 96.13±13.01-88.13±12.48 Push-ups: 13.56±3.05-15.56±3.24 Curl-ups: 16.50±1.90-18.75±2.11 Sit and reach: 25.56±5.07-26.37±6.68 CG Pre-Post 3-min step test: 105.82±16.80-109.94±19.54 Push-ups: 11.71±4.77-11.65±4.60 Curl-ups: 14.18±3.52-15.00±2.50 Sit and reach: 23.79±5.95-24.85±6.00 F EG Pre-Post 3-min step test: 111.32±24.98-103.89±23.86 Push-ups: 14.16±3.47-16.68±2.87 Curl-ups: 15.47±1.68-17.74±1.73 Sit and reach: 28.06±5.11-28.74±6.79 CG Pre-Post 3-min step test: 105.67±21.52-111.89±23.88 Push-ups: 15.89±5.06-14.78±4.57 Curl-ups: 13.78±4.31-13.83±3.31 Sit and reach: 27.33±4.99-27.72±4.19	Muscle strength, muscular endurance, and flexibility using a 3-minute step test, push-ups, curl-ups, and sit-and-reach	MR

Mok et al. (34)	Quasi-Experimental	Brain Breaks® Videos were 3–5 minutes in length, presented two times per day, five days each week.	Eight countries: Croatia. Lithuania. Macedonia. Poland. Romania. Serbia. South-Africa. Türkiye. (N = 3036) M = 1496 F = 1540 Age range = 8 - 11	4 mo.	CG Pre-Post F1: 2.888±0.650-3.021±0.619 F2: 3.231±0.634-3.298±0.589 F3: 2.268±0.709-2.374±0.748 F4: 2.550±0.822-2.619±0.847 F5: 3.008±0.673-3.143±0.616 F6: 3.081±0.715-3.206±0.658 F7: 3.237±0.771-3.315±0.732 EG F1: 2.929±0.691-3.235±0.538 F2: 3.246±0.659-3.452±0.536 F3: 1.997±0.827-2.681±0.696 F4: 2.288±0.997-3.219±0.624 F5: 3.068±0.686-3.271±0.593 F6: 3.164±0.692-3.322±0.590 F7: 3.203±0.811-3.399±0.658	APAS [Attitudes toward Physical Activity Scale]	LR
Podnar et al. (51)	Quasi-Experimental	Five-minute PA daily was performed in the middle of a 45-minute academic lesson by imitating video animations projected on the Brain Breaks® Physical Activity Solutions.	Croatia (n = 98) Age range = 6 - 10	12 wks.	Pre-Post TEE: 257.88±10.57-281.79±11.85 Steps: 2717.51±109.55-2868.79±122.87 Sedentary: 177.46±3.28-181.59±3.68 Moderate: 19.09±1.48-19.09±1.664 Vigorous: 6.79±1.05-7.224±1.18 METs: 2.32±0.08-2.392±0.09	PA level [SenseWear Armband Body Monitor (BodyMedia Inc., Pittsburgh, PA, USA)]	LR
Popeska et al. (52)	Quasi-Experimental	The active breaks were applied each school day for 3–5 minutes, five days per week, during one particular class selected by the teacher.	Macedonia (n = 283) M = 155 F = 128 Mean age = 9.21	3 mo.	CG Pre-Post F1: 2.93±0.58-2.90±0.61 F2: 3.30±0.56-3.34±0.62 F3: 2.60±0.76-2.63±0.75 F4: 2.83±0.68-2.79±0.73 F5: 3.17±0.61-3.22±0.62 F6: 3.16±0.63-3.28±0.65 F7: 3.39±0.59-3.46±0.58 EG F1: 3.12±0.77-3.38±0.51 F2: 3.58±0.58-3.70±0.46 F3: 2.88±0.87-3.07±0.87 F4: 3.16±0.72-3.62±0.50 F5: 3.48±0.56-3.58±0.49 F6: 3.47±0.59-3.56±0.51 F7: 3.62±0.51-3.74±0.41	APAS [Attitudes toward Physical Activity Scale]	LR
Rizal et al. (39)	Quasi-Experimental	The students were given the Brain Breaks Physical Activity Solutions intervention video for an accumulated time of 30 minutes per week.	Malaysia (n = 322) M = 159 F = 163 Mean age = 10.53	12 wks.	CG Pre-Post Stages of change: 3.35±1.21-3.07±1.23 Pros: 15.79±4.25-14.32±4.61 Cons: 12.40±4.16-13.16±4.64 Cognitive process: 25.36±5.77-23.81±6.77 Behavioral process: 38.90±11.81-38.70±11.20 Internal feeling: 11.28±4.21-11.36±4.44 Situational: 9.79±3.89-10.35±3.99 Competing demand: 10.28±3.72-10.39±3.53 Total METs: 66.54±27.27-67.38±27.20 EG Pre-Post Stages of change: 3.03±1.15-3.18±1.04 Pros: 14.07±3.81-15.22±3.51 Cons: 11.66±3.93-11.87±3.56 Cognitive process: 24.52±5.66-24.23±5.67 Behavioral process: 36.56±10.21-39.86±9.23 Internal feeling: 11.08±3.75-12.27±3.94 Situational: 9.90±3.75-10.28±3.71 Competing demand: 9.64±3.17-10.30±3.26 Total METs: 61.55±25.13-64.09±25.15	TTM (process of change, decisional balance, and self-efficacy) [stages of change questionnaire, process of change questionnaire, decisional balance scale, self-efficacy scale, and Godin Leisure-Time Exercise Questionnaire (GLTEQ)]	LR

Tománek et al. (53)	Quasi-Experimental	a 5-minute physical activity break during a random lesson every school day.	Slovakia (n = 229) M = 106 F = 123 Mean age = 11.18	3 mo.	M EG Pre-Post Cognitive: 23.72±4.72-24.31±4.34 Affective: 24.68±6.91-26.32±5.99 Behavioral: 25.12±5.91-25.82±5.33 CG Cognitive: 24.16±4.71-22.88±5.22 Affective: 23.10±7.68-21.06±6.79 Behavioral: 23.10±6.70-22.00±5.89 F EG Pre-Post Cognitive: 23.64±5.10-23.83±5.31 Affective: 22.43±6.89-24.48±6.89 Behavioral: 24.31±6.31-24.95±6.82 CG Cognitive: 24.52±5.04-23.95±5.66 Affective: 24.91±6.81-23.88±7.13 Behavioral: 25.32±6.29-23.89±4.57	Cognitive, affective, and behavioral components of students' attitudes toward physical activity.	MR
Uzunoz et al. (49)	Quasi-Experimental	The students were given the Brain Breaks Physical Activity Solutions intervention video daily for an accumulated time of 3-5 minutes at various intervals.	Türkiye (n = 300) Mean age = 9.55	4 mo.	CG Pre-Post Self-efficacy in learning with video exercise: 2.11±0.62-2.11±0.42 Exercise motivation and enjoyment: 2.12±0.57-2.16±0.40 Self-confidence in physical fitness: 2.29±0.57-2.34±0.45 Promoting the holistic health: 2.41±0.67-2.44±0.47 Importance of exercise habit: 2.69±0.72-2.70±0.47 Trying to do personal best: 1.90±0.56-1.94±0.47 EG Pre-Post Self-efficacy in learning with video exercise: 2.12±0.65-2.62±0.34 Exercise motivation and enjoyment: 2.11±0.54-2.41±0.44 Self-confidence in physical fitness: 2.26±0.60-2.58±0.47 Promoting the holistic health: 2.39±0.66-2.78±0.50 Importance of exercise habit: 2.71±0.69-3.05±0.47 Trying to do personal best: 1.92±0.55-2.28±0.53	APAS [Attitudes toward Physical Activity Scale]	LR
van Stryp et al. (54)	Quasi-Experimental	10-minute classroom-based active brain-break intervention twice a week. The first active Brain Break took place early in the morning (between 08:15 and 08:45), and the second one later in the morning (between 10:30 and 11:00).	South Africa (n = 48) M = 28 F = 20 Mean age = 6.6	6 wks.	Overall (baseline) Sedentary: 106.2±30.9 Moderate: 43.7±13.7 Vigorous: 26.5±13.6 Overall (intervention) Sedentary: 100.1±20.0 Moderate: 41.9±11.6 Vigorous: 34.1±11.9	School PA Level (in minutes) [Wrist-worn Actigraph GT3X+ accelerometer (Actigraph LLC, Pensacola, FL, USA)]	LR

Zhou et al. (23)	Quasi-Experimental	Brain Breaks® video intervention for 3–5 min daily, at low-to-moderate intensity.	China (n = 704) M = 370 F = 334 Mean age = 9.24	3 mo.	CG Pre-Post F1: 2.70±0.58-3.031±0.49 F2: 3.08±0.50-3.15±0.49 F3:2.34±0.48-2.56±0.56 F4: 3.09±0.55-3.20±0.46 F5: 3.03±0.56 3.14±0.41 F6: 2.85±0.49-3.10±0.38 F7: 2.93±0.44-3.15±0.46 EG Pre-Post F1: 2.69±0.63-2.91±0.65 F2: 2.99±0.49-3.26±0.53 F3:2.42±0.63-2.65±0.77 F4: 3.14±0.54-3.17±0.58 F5: 3.04±0.54 3.28±0.50 F6: 2.90±0.48-3.23±0.47 F7: 2.99±0.50-3.36±0.54	APAS [Attitudes toward Physical Activity Scale]	LR

APAS = Attitude towards physical activity, CG = Control group, EG = Experimental group, F = Female, F1 = Benefits, F2 = Importance, F3 = Learning, F4 = Self-efficacy, F5 = Fun, F6 = Fitness, F7 = Personal best, TEE = total daily energy expenditure, FKTC = Fitness Knowledge Test for Children, LR = Low risk of bias, M = Male, mo = Month, MR = Moderate risk of bias, PA = Physical activity, SD = Standard deviation, Transtheoretical model (TTM) constructs = process of change, decisional balance, and self-efficacy in physical activity, yr = Year, wks = Weeks.

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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	