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TÜRKİYE FİZYOTERAPİSTLER DERNEĞİ'nin bilimsel yayın organı ve yaygın süreli yayınıdır.
(The official scientific journal of Turkish Physiotherapy Association)

"Türk Fizyoterapi ve Rehabilitasyon Dergisi"; Web of Science (WOS)-Emerging Sources Citation Index (ESCI), Cumulative Index to Nursing and Allied Health Literature (CINAHL), EBSCO, Excerpta Medica (EMBASE), Türkiye Atıf Dizini ve Ulakbim Türk Tıp Dizini (TR Dizin)'nde yer almaktadır.

"Turkish Journal of Physiotherapy and Rehabilitation" is listed in Web of Science (WOS)-Emerging Sources Citation Index (ESCI), Cumulative Index to Nursing and Allied Health Literature (CINAHL), EBSCO, Excerpta Medica (EMBASE), Turkey Citation Index and Ulakbim TR Medical Index (TR Dizin).

"Açık Erişim Dergi" yılda 3 kez (Nisan, Ağustos, Aralık) yayınlanır.
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YAZARLARIN DİKKATİNE
Genel Bilgiler

Türk Fizyoterapi ve Rehabilitasyon Dergisi, Türkiye Fizyoterapistler Derneği'nin yayın organı olup, yılda 3 kez (Nisan, Ağustos ve Aralık) Türkçe ve İngilizce olarak yayınlanmaktadır. Bununla birlikte İngilizce gönderilen makalelere yayınlanma aşamasında öncelik verilecektir. Dergi fizyoterapi ve rehabilitasyon konuları ile ilişkili özgün araştırmalar, çağrılı derlemeler, ilginç olgu sunumları ve editöre mektupları değerlendirmek üzere kabul eder.

Etik

Editör

Türk Fizyoterapi ve Rehabilitasyon Dergisi, yayınladığı makalelerin konu ile ilgili en yüksek etik ve bilimsel standartlarda olması ve ticari kaygılarda olmaması şartını gözetmektedir. Derginin yazım kurallarında Uniform Requirements for Manuscripts Submitted to Biomedical Journals - International Committee of Medical Journal Editors (http://www.icmje.org) başlıklı belge ve Committee on Publication Ethics (COPE) (https://publicationethics.org)'in standartları temel alınmıştır.

Dergiye gönderilen makale biçimsel esaslara uygunsa, "Etik Kurul Onay Belgesi" yüklenmesi gerekir. "Telif Hakkı Devir Formunun" e-imza veya ıslak imza ile imzalanması ve taranarak makale ile birlikte sisteme yüklenmesi gerekmektedir. Dergi gerektiğinde ıslak imzalı üst yazı isteme hakkına sahiptir. Makale bilimsel değerlendirme için işleme alındıktan sonra ise, "Telif Hakkı Devir Formunda" belirtilmiş olan yazar isimleri ve sıralaması esas alınır. Bu aşamadan sonra hiçbir aşamada makaleye "Telif Hakkı Devir Formunda" imzası bulunanlar dışında yazar ismi eklenemez ve yazar sırası değiştirilemez. Makale yazarlarından herhangi birinin isminin makaleden çıkartılması için, tüm yazarların açıklamalı ve yazılı izinleri alınır. İletişimden sorumlu yazar, makalenin sunum aşamasından basımına kadar olan süreçlerde her türlü yazışmayı gerçekleştiren yazardır.

Telif hakkı devir formunda ismi belirtilmiş olan yazarların, gönderilen makaleye doğrudan katkısının olması gerekir. "Yazar Katkı Formu" doldurulup sisteme yüklenmelidir. Yazar olarak belirlenen isim aşağıdaki özelliklerin tümüne sahip olmalıdır.

• Çalışmanın planlanmasına ve 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.

Makalede, kitaplarda veya dergilerde daha önce yayınlanmış alıntı yazı, tablo, şekil vb. mevcutsa, yazarlar ilgili yazı, tablo, şekil, anket ve ölçeğin telif hakkı sahibinden ve yazarlarından yazılı izin almak, izin yazısını makale ile birlikte göndermek ve bunu makalede belirtmek zorundadır.

Editör, hakem ve yazar süreci COPE standartlarına göre yürütür.

Hakemler

Hakemler yazıya ilişkin bilgileri gizli tutmakla yükümlüdür. Hakemler, çıkar çatışması hakkında Türk Fizyoterapi ve Rehabilitasyon Dergisi'ne bildirimde bulunur.

Yazar

Yazıların bilimsel içeriği ve etik kurallara uygunluğu yazar(lar)ın sorumluluğundadır. Dergiye Etik kurul onayı almış ve Helsinki Bildirgesi'ne uygun yazılar kabul edilir. Çalışmada "Hayvan" öğesi kullanılmış ise yazar(lar), 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. "İnsan" öğesi ile yapılmış çalışmalardaysa yazar(lar), ilgili Etik Kurul onay belgesini makale ile birlikte yüklemelidir. Olgu sunumları için Klinik Araştırmalar Etik Kurul'undan alınan Etik Kurul onay belgesi sisteme yüklenmelidir. Etik Kurul onayı gerekmediğinde ise Klinik Araştırmalar Etik Kurulu'ndan alınan Etik Kurul muafiyet belgesinin sisteme olgu raporu ile birlikte yüklenmesi gerekir. Yazarlar araştırmaya katılan bireylerden yazılı aydınlatılmış onam (written informed consent) alındığını gönderilen makalede belirtmeli ve gerektiğinde onam formlarını belgeleyebilmelidir.

Yazım Kuralları

Türkçe makalelerde Türk Dil Kurumu'nun Türkçe Sözlüğü esas alınmalıdır. İngilizce makaleler ve İngilizce özetlerin, dergiye gönderilmeden önce dil uzmanı tarafından değerlendirilmesi gerekmektedir.

Dergiye yayımlanmak üzere gönderilen makaleler, sayfa A4 boyutunda olacak şekilde, PC uyumlu Microsoft Word programı ile "Times New Roman" yazı tipi kullanılarak 12 punto ve makalenin tüm bölümleri çift aralıklı olarak yazılmalıdır. Sayfanın her iki kenarında en az 2,5 cm boşluk bırakılmalı, sayfalar ve satırlar numaralandırılmalıdır. Makalenin ana başlıkları (Giriş, Yöntem, Sonuçlar, Tartışma, Kaynaklar), büyük harf kullanılarak ve koyu olarak yazılmalıdır. 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 sayının iki basamağı daha verilmelidir (örneğin: 13.31 veya 15,21), p ve r değerleri virgülden/noktadan sonra üç basamak olacak şekilde yazılmalıdır. Orijinal araştırma makaleleri 3000 kelime, derlemeler 5000 kelime, olgu sunumları 1000 kelime ve editöre mektuplar ise 500 kelimeyi aşmamalıdır.

Başlık Sayfası

Makalenin başlığı kısa fakat içeriği tanımlayıcı ve amaçla uyumlu olmalıdır. Başlıkta kısaltma kullanılmamalıdır. Makale başlığı Türkçe ve İngilizce yazılmalıdır. Türkçe ve İngilizce başlık 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 yapıldığı klinik, bölüm, enstitü, hastane veya üniversitenin açık adı ve adresi belirtilmeli ve her yazar için üst numaralandırma kullanılmalıdır. İletişimden sorumlu yazarın iletişim bilgileri ayrıca belirtilmelidir. Her yazarın iletişim bilgileri, 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. Türkiye Bilim Terimleri, MeSH (Medical Subject Headings) terimlerinin Türkçe karşılıklarının bulunduğu bir anahtar kelimeler dizinidir. 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 Türkçe ise İngilizce özet kısmındaki anahtar kelimeler (key words) Türkçe anahtar kelimelerin alfabetik sıralamasına uygun sıralanmalıdır.

İngilizce Özet (Abstract) ve Anahtar Kelimeler (Key Words)

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 (key words) 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, gerektiğinde 5 defadan fazla tekrar eden ifadeler için standart kısaltmalar kullanılmalıdır.

Giriş (Introduction)

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

Yöntem (Methods)

Çalışmadaki klinik, teknik veya deneysel yöntemler açıkça belirtilmelidir. Yöntem için uygun kaynaklar verilmelidir. 'İstatistiksel analiz', alt başlık halinde belirtilmelidir. İstatistik analiz için herhangi bir istatistik program kullanılmış ise kullanılan programın adı, sürüm numarası ve künyesi, firma bilgileri belirtilmelidir. İstatistik analiz yöntemleri gerekçeleri ile birlikte sunulmalı, gerektiğinde kaynaklarla desteklenmelidir.

Sonuçlar (Results)

Bulgular yorum yapmadan tanımlanmalıdır. Tablolarda sunulan verilerin, metin içinde tekrar edilmesinden kaçınılmalı, en önemli bulgular vurgulanmalıdır.

Tartışma (Discussion)

Tartışma çalışmada elde edilen en önemli sonuçlara ait bilgiler ile başlamalıdır. Çalışmadan elde edilen sonuçlar yorumlanmalı ve önceki çalışmaların sonuçları ile ilişkilendirilmelidir.

Tartışmada çalışmanın amacı ile uyumlu limitasyonları; 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 (Sources of Support)**
  Destekleyen kuruluşlar varsa belirtilmelidir.
- **Çıkar Çatışması (Conflict of Interest)**
  Çıkar çatışması varsa belirtilmelidir.
- **Etik Onay (Ethical Approval)**
  Etik kurul adı ve onay numarası yazılmalıdır.
- **Aydınlatılmış Onam (Informed Consent)**
  Yazılı aydınlatılmış onam alındığı belirtilmelidir.
- **Hakem Değerlendirmesi (Peer-Review)**
  Bağımsız dış hakemler tarafından değerlendirilmiştir.
- **Yazar Katkıları (Author Contributions)**
  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 (Acknowledgements)**
  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. Makaleyi İngilizce yönünden değerlendiren, yazarlardan biri değil ise, bu kişinin ismi "Açıklamalar" bölümünde yazılmalıdır.

Kaynaklar

Kaynaklar makale ana metninin hemen bitiminden sonra yer almalıdır. Kaynaklar metinde geçiş sırasına göre numaralandırılmalıdır. Kaynak sayısının 30'u 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. Kaynaklar metinde cümle sonunda parantez içinde Arabik rakamlarla gösterilmelidir. Birden çok kaynağa atıf varsa, kaynaklar arasına virgül konulmalı ve virgülden önce ya da sonra boşluk bırakılmamalıdır. Ana metin içinde isim ile belirtilecek olan makaleler İngilizce ise "Yazar adı et. al" (örnek: Burtin et al.'un çalışmasında...); makaleler Türkçe ise "Yazar adı ve ark." (örnek: Burtin ve ark.'ının çalışmasında...) olarak belirtilmelidir. Dergi adları Index Medicus'a göre kısaltılmış olarak sunulmalıdır. Standart dergide yayınlanmış bir makalede, yazar sayısı 6 ve daha az ise, tüm yazarların adı yazılmalı; yazar sayısı 6'dan çok ise, ilk 6 yazar yazılmalı ve diğerleri "et al." olarak belirtilmelidir. Endnote kullanacak yazarlar Endnote programı 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 volümü ve sayısı,
- Sayfa aralığı (Ör:10-5).

Kaynak yazım örnekleri aşağıdaki gibidir:

Dergi;

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 İlavesi;

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 Bölümü;

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.

Tablolar ve Şekiller

Tablolar, her biri ayrı sayfalarda olacak şekilde makalenin sonunda Microsoft Word dosyası olarak yer almalıdır. Tablo ve şekil sayısı toplam olarak en fazla 4 olmalıdır. Tablolarda her sütun başlığına kısa bir başlık yazılmalıdır. Tabloların sütunlarında her kelimenin ilk harfi büyük olmalıdır. Tablo başlığı tablonun üst kısmında yer almalı; koyu renk ile yazılmalı, iki nokta (:) ile ayrılmalıdır. Tabloların yatay ve dikey çizgileri 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 üstü ":" 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 (örneğin: 31,12 veya 20.10). Ortalama, yüzde ortanca değerleri dışındaki değerler (p, r, vb.) virgülden/noktadan sonra üç basamak olarak yazılmalıdır.

Şekiller profesyonel olarak çizilmeli, fotoğraflanmalı veya fotoğraf kalitesinde dijital baskı olarak sunulmalıdır. 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, tablo ve çizimler metin içinde geçiş sırasına göre numaralandırılmalıdır. İnsan öğesinin bulunduğu fotoğraflarda, kişiden yazılı izin alınmalı; kimliğini gizleyecek önlemler alınmalı, izin metni makale ile birlikte dergiye gönderilmelidir.

Makale Gönderme Formatı

Makaleler Microsoft Office Word dosyası formatında hem yazar isimleri olan hem de yazar isimleri olmayan iki kopya şeklinde DergiPark (http://dergipark.gov.tr/tjpr) sistemine kullanıcı olarak kayıt olunduktan sonra yüklenecektir. Yazar isimleri olmayan Word dosyasında yapılan kuruluş ve etik onay alınan kurumun da "X" ile kapatılması gerekmektedir.

Makale Değerlendirme Süreci

Makaleler derginin yayın kriterleri doğrultusunda değerlendirmeye alınacaktır. Derginin yayın ve 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 sisteminden takip edebilecektir. Gerek görüldüğü takdirde, ön kontrolden sonra yazardan ilk teknik düzeltmeler istenecek, daha sonra hakem değerlendirme süreci başlayacaktır. 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.

Instructions for Authors

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Journal Supplement:

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 Chapter:

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Published Congress Presentation:

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EDİTÖRDEN

Değerli Meslektaşlarımız,

2020 yılı son sayısı olan Aralık sayısında toplam 12 araştırma makalesine yer verilmiştir. Bu makalelerde, yeme ve içme becerileri sınıflandırma sisteminin serebral palsili çocuklarda değerlendirici iç güvenirliği ve diğer fonksiyonel sınıflandırma sistemleri ile ilişkisi; serebral palsili olgularda gövde ve alt ekstremite kas kuvveti ile fonksiyonel aktivite arasındaki ilişki; preterm çocuklarda okul öncesi dönemde duyusal işlemleme ve okula hazır oluşla ilişkisi; tipik gelişim gösteren çocuklarda dört kare adım alma testinin geçerlik ve güvenirliği; noninvaziv mekanik ventilasyon desteği olan ve olmayan akut solunum yetmezliğinde fonksiyonel bağımsızlık ve kas kuvveti; sağlıklı olgularda gövde kas enduransı, solunum fonksiyonları ve solunum kas kuvveti ilişkisi; sağlıklı genç yetişkinlerde dinamometre ile intrinsik ayak kas kuvveti değerlendirilmesinde "make" ve "break" testlerinin güvenirliği; yaşlı bireylerde pnömoni ve yutma fonksiyonları arasındaki ilişki; periferal vestibüler hipofonksiyonda vertigo, dizziness ve denge bozukluğu ile fiziksel aktivite, egzersiz kapasitesi, günlük yaşam aktiviteleri ve yaşam kalitesi arasındaki ilişki; tedavi gören erişkin kanser hastalarında yaşam kalitesi ve kas kuvveti; Suriyeli mülteci alt ekstremite amputelerinde proteze bağlı yaşam kalitesinin araştırılması ve fizyoterapi ve rehabilitasyon eğitiminde simüle hasta kullanımının öğrenme motivasyonu ve öğrenci geri bildirimine etkisi konuları incelenmektedir.

Türk Fizyoterapi ve Rehabilitasyon Dergisi'ne makale göndererek ve hakemlik yaparak katkı veren tüm meslektaşlarımıza teşekkür ederiz. Dünya genelinde oldukça zor süreçlerin yaşandığı 2020 yılının sonuna geldiğimiz bugünlerde, tüm meslektaşlarımızın yaklaşmakta olan yeni yılını kutlar, sağlıklı, verimli ve başarılı bir yıl temenni ederiz.

Saygılarımla,

Yayın Kurulu adına,

Prof. Dr. Deniz İnal İnce

Editör

EDITORIAL

Dear Colleagues,

Twelve original articles are included in December 2020 issue. These articles include the following topics: the Turkish version of eating and drinking ability classification system intrarater reliability and the relationships with the other functional classification systems in children with cerebral palsy; relationship between trunk and lower extremities muscle strength and functional activity in children with spastic cerebral palsy; sensory processing in preterm children at five years of age and its association with school readiness; validity and reliability of four square step test in typically developed children; functional independence and muscle strength in acute respiratory failure with and without non-invasive mechanical ventilatory support; relationship between trunk muscle endurance, pulmonary function, and respiratory muscle strength in healthy individuals; reliability of 'make' and 'break' tests in assessing intrinsic foot muscle strength using a handheld dynamometer in young healthy adults; relationship between pneumonia and swallowing function in elderly; relation of vertigo, dizziness and imbalance with physical activity, exercise capacity, activities of daily living, and quality of life in peripheral vestibular hypofunction; quality of life and muscle strength in adult cancer patients receiving treatment; quality of life related to prosthesis in Syrian Refugee lower extremity amputees; effect of simulated patient use on learning motivation and student feedback in physiotherapy rehabilitation education;.

We would like to thank all authors and the reviewers for contributing to Turkish Journal of Physiotherapy and Rehabilitation. As the end of 2020 approaches, which has been overwhelming in the recent history, we wish a healthy, productive, and successful new year to all colleagues.

Sincerely,

On behalf of the Editorial Board

Deniz Inal-Ince, PhD, PT

Editor

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İÇİNDEKİLER

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ARAŞTIRMA MAKALELERİ (ORIGINAL ARTICLES)

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THE TURKISH VERSION OF THE EATING AND DRINKING ABILITY CLASSIFICATION SYSTEM: INTRA-RATER RELIABILITY AND THE RELATIONSHIPS WITH THE OTHER FUNCTIONAL CLASSIFICATION SYSTEMS IN CHILDREN WITH CEREBRAL PALSY

ORIGINAL ARTICLE

ABSTRACT

Purpose: Oral motor problems, feeding and swallowing problems are one of the most common problems in children with cerebral palsy. The Eating and Drinking Ability Classification System (EDACS) is used to classify eating and drinking performance in children with cerebral palsy. The aims of this study were to translate the EDACS into the Turkish and to investigate its intra-rater reliability and the relationship with other functional classification systems.

Methods: The EDACS was translated from English into Turkish. The Turkish version of the EDACS was applied to 125 children with cerebral palsy. For intra-rater reliability, the Turkish EDACS was re-scored after two weeks. Gross Motor Function Classification System, Manual Ability Classification System, and Communication Function Classification System were also recorded to determine the functional status of children.

Results: Fifty-four females and 71 males with a mean age of 7.44±3.95 years were included. The intra-rater reliability of the Turkish EDACS was almost perfect (ICC=0.972, Confidence Interval=0.959-0.980, p<0.001). Significant correlations were found between the Turkish EDACS and Gross Motor Function Classification System, Manual Ability Classification System, and Communication Function Classification System (r=0.769, r=0.786, and r=0.824, respectively, p<0.001).

Conclusion: The Turkish EDACS was found as a highly reliable instrument. The level of functional eating and drinking abilities is related to motor functional levels and communication status of children with cerebral palsy.

Key Words: Cerebral Palsy; Drinking; Eating; Swallowing.

YEME VE İÇME BECERİLERİ SINIFLANDIRMA SİSTEMİNİN TÜRKÇE VERSİYONU: SEREBRAL PALSİLİ ÇOCUKLARDA DEĞERLENDİRİCİ-İÇİ GÜVENİRLİĞİ VE DİĞER FONKSİYONEL SINIFLANDIRMA SİSTEMLERİ İLE İLİŞKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Oral motor problemler ile beslenme ve yutma problemleri serebral palsili çocuklarda en sık rastlanan problemlerden bir tanesidir. Yeme İçme Becerisi Sınıflandırma Sistemi (EDACS) serebral palsili çocuklarda yeme ve içme performansını sınıflandırmak için kullanılır. Bu çalışmanın amaçları, EDACS'ı Türkçe'ye çevirmek, değerlendirici-içi güvenirliği ve diğer fonksiyonel sınıflandırma sistemleri ile ilişkisini araştırmaktı.

Yöntem: EDACS İngilizce'den Türkçe'ye çevrildi. EDACS'ın Türkçe versiyonu 125 serebral palsili çocuğa uygulandı. Değerlendirici-içi güvenirliği için Türkçe EDACS iki hafta sonra tekrar puanlandı. Çocukların fonksiyonel durumlarını belirlemek için Kaba Motor Fonksiyon Sınıflandırma Sistemi, El Becerileri Sınıflandırma Sistemi ve İletişim Fonksiyonları Sınıflandırma Sistemi seviyeleri de kaydedildi.

Sonuçlar: Yaş ortalaması 7,44±3,95 yıl olan 54 kız ve 71 erkek çalışmaya katıldı. Türkçe EDACS'ın değerlendirmeci-içi güvenirliği neredeyse mükemmeldi (ICC=0,972 ve Güven Aralığı=0,959-0,980, p<0,001). Türkçe EDACS ile Kaba Motor Fonksiyon Sınıflandırma Sistemi (r=0,769), El Becerileri Sınıflandırma Sistemi (r=0,786) ve İletişim Fonksiyonları Sınıflandırma Sistemi (r=0,824) arasında anlamlı pozitif korelasyon bulundu (p<0,001).

Tartışma: Türkçe EDACS son derece güvenilir bir araç olarak bulundu. Serebral palsili çocukların fonksiyonel yeme ve içme becerileri, motor fonksiyon seviyeleri ve iletişim durumları ile ilişkilidir.

Anahtar Kelimeler: Serebral Palsi; İçme; Yeme; Yutma.

INTRODUCTION

Cerebral palsy (CP) encompasses a heterogeneous group of disorders resulting from a non-progressive disruption or injury in fetal or infant brain. The CP is the most common neuromotor problem that causes physical disability in childhood (1). While the overall prevalence of CP was 2.11 per 1000 live births, the prevalence of CP was determined as 4.4 per 1000 live births in Turkey (2,3). The problems of sense, cognition, communication, speech, oral motor function, eating and drinking activities and nutrition may accompany motor disorders (4).

There is no adequate workable definition of oral motor disabilities, and measurement of prevalence rates varies enormously. However, Edvinsson and Lundqvist found that orofacial dysfunction occurred about 80% of the individuals and was present in all sub diagnoses in CP (5). Three out of four children with CP have oral motor disabilities that cause some difficulties with managing various food textures, choking on fluids and solids, slow eating, and handling utensils (6,7). Difficulties in the process of swallowing may cause dysphagia as disorders of eating and drinking activities. Two in three children with CP are estimated to have oropharyngeal dysphagia (8). Children who have dysphagia also encounter difficulties in participating in social life activities such as attending mealtimes with family and friends. It is reported that eating and drinking of adolescents with CP caused negative feelings including shame, frustration, fear of choking, concerns about future and distress (6). Children with CP are at risk for limited intake, malnutrition, aspiration, pneumonia, respiratory problems, and weak growth contribute significantly to increased morbidity and mortality (9,10). Therefore, evaluation and early management of eating and drinking difficulties become very important.

In the last two decades, researchers have developed simple multi-level classification systems to determine the activity level and functional capacity of children with CP. These classification systems are practical scales defining a common international language that provides ease of communication between various disciplines while characterizing comprehensive profiles of children with CP (11). Gross Motor Function Classification System (GMFCS), Manual Ability Classification System (MACS), and Communication Function Classification System (CFCS) are the most well-known classification systems that have high validity and reliability and used in almost all CP-related research worldwide (12). Recently, the Eating and Drinking Ability Classification System (EDACS) has been developed for describing the oral functional capacity of children with CP aged three years and older (13). Once translated into Turkish, professionals in Turkey would able to use EDACS to identify children with CP in studies of swallowing function, eating and drinking skills. We could not find another valid and reliable classification system related to eating and drinking function of children with CP in Turkish language. This study would be the first classification system translated into Turkish to define the function of eating and drinking in children with CP.

The aims of this current study were to translate the EDACS into the Turkish language and to investigate the intra-rater reliability of the Turkish version of the EDACS, and to determine its relationship with the other functional classification systems. We hypothesized that the Turkish EDACS has sufficient intra-rater reliability, and the EDACS is related to the other classification systems including the GMFCS, MACS, and CFCS.

METHODS

Study Design

We performed a prospective cross-sectional psychometric study. This study has three parts including translation of the EDACS into the Turkish, intra-rater reliability, concurrent validity, and the relationship with the other classification systems. The ethical approval of the study was obtained from the Non-Interventional Clinical Research Ethics Committee (Approval Date: 10.10.2017 and Approval Number: GO17/787-16).

Participants

One hundred and twenty-five children with a diagnosis of CP undergoing a rehabilitation program at the Hacettepe University Faculty of Physical Therapy and Rehabilitation were included in the study. The sample size was identified after

power analysis based on study of Tschirren et al (14). The number of participants to be included in the study with 80% power with alpha error margin 0.05 and beta 0.20 was determined as at least 100 children with CP. Inclusion criteria were: diagnosed as CP by a pediatric neurologist, and older than three years of age. Children who were under three years of age were excluded from the study. Children with CP and their parents were informed about the study and written informed consent was obtained from the parents. All participants were classified according to Turkish versions of classification systems, GMFCS and the CFCS. Additionally, children aged four years and above classified with MACS by experienced physiotherapists about the motor and swallowing problems (Table 1).

The GMFCS was used to assess the sitting position, walking, and use of mobility devices. GMFCS shows the general performance of the child at home, school, or in society. It classifies the movement ability of a child with CP into five different levels between level I and V. Level I indicates "Walks without limitations," level II "Walks with limitations," level III "Walks using a hand-held mobility device," level VI "Self-mobility with limitations, may use powered mobility," and level V "Transported in a manual wheelchair." The GMFCS is a valid and reliable system in children with CP (15).

The MACS, classify the use of hands in handling objects during daily living activities and the need for self-help or adaptation into five levels in children with CP aged 4-18 years. According to MACS levels, level I subjects handle objects easily and successfully, and level II handles most objects, but with reduced quality and/or speed of achievement. The level III handles most objects, but with reduced quality and/or speed of achievement, level IV handles a limited selection of easily managed objects in simple actions, and level V does not handle objects and has severely limited ability to perform even simple actions. The MACS is a valid and reliable classification system in children with CP (16).

The CFCS classify the everyday communication of an individual with CP into one of five levels according to the effectiveness of communication. It consists of five levels describing everyday communication ability including level I a person who independently and effectively alternates between being a sender and receiver of information with most people in most environments. Level II subject is a person who independently alternates between being a sender and receiver with the most of the people in most environments, but the conversation may be slower. Level III is a person who usually communicates effectively with familiar communication partners, but not unfamiliar partners, in most environments. Level IV is the person who is not always consistent with communicating with familiar communication partners. Level V is a person who is seldom able to communicate effectively even with familiar people. The validity and reliability of the CFCS in children with CP have been shown (17).

The EDACS describes the functional eating and drinking abilities of children with CP aged three years and older by using five distinct levels. It refers to key features including "safety'" (aspiration and choking) and "efficiency" (amount of food lost and time taken to eat). The EDACS also provides a three-level ordinal rating scale to describe the degree of required assistance (independent; requires assistance, and dependent). The five distinct levels of ability include information about biting, chewing, and swallowing ability, food, and fluid textures that are managed, and breath changes associated with eating and/or drinking, and risk due to aspiration or choking. Level V shows an inability to eat and drink. The EDACS is a similar and complementary to five-level classification system to previous classifications. According to the EDACS levels, subjects in level I eat and drink safely and efficiently. Level II subjects eat and drink safely but with some limitations for efficiency. Level III subjects eat and drink with some limitations to safety, and there may be limitations to efficiency. The subjects in level IV eat and drink with significant limitations for safety. Level V subjects are unable to eat or drink safely – tube feeding may be considered to provide nutrition (13,14).

All children were observed in clinical settings to classify according to their gross motor and manual activities, and communication levels. An experienced physiotherapist directly observed their eating and drinking abilities in the clinical setting during feeding.

Translation Process

We obtained authorization and permission for validation from the owner (Seller D) of the EDACS copyright. The translation process of the EDACS consisted of two parts and based on the World Health Organization's instructions. The EDACS was translated into Turkish language by two native Turkish physiotherapists whose expertise was in the field of swallowing disorders in children with CP. Then, both translated documents were combined as draft translation. The translated version was translated back into the English by a native English speaker professional translator and compared with the original original measurement to correct translation mistakes. A linguist supported in crucial areas. After the translation process was completed, the Turkish version of EDACS was sent to three clinical physiotherapists to check if it is understandable.

Intra-rater Reliability

The intra-rater reliability is the degree to which the result of a test is consistent over time (18). All children were observed in their usual mealtime seating for at least one meal. The textures of food and fluids during mealtimes were similar to those the participant received at home. Children who need feeding adaptation were also recorded. The level of the Turkish EDACS was noted. After two weeks, the levels of the Turkish EDACS were re-scored by the same physiotherapist for intra-rater reliability.

Relationship between Classification Systems

The GMFCS, MACS, and CFCS levels of all children were recorded to investigate the relationship between eating and drinking function, locomotion level, manual ability, and communication status.

Statistical Analysis

Statistical analysis was performed using IBM-SPSS for Windows version 20 (IBM Corp, New York, USA). Descriptive analyses were performed For intra-rater reliability, the Intra-class Correlation Coefficient (ICC) value was used. Values of 0.41 to 0.60 indicate moderate agreement, 0.61 to 0.80 substantial agreements, and 0.81 to 1.00 almost perfect agreement (19). The Spearman's Correlation Coefficient was used to assess the correlation between the Turkish EDACS level and relationship with the other functional classification systems (GMFCS, MACS, and CFCS) (20).

RESULTS

A total of 125 children with CP, of which 56.80% (n=71) were males and 43.20% (n=54) were females included in the study between January 2018 and May 2018. The mean age of the children with CP was 7.44±3.95 years. Table 1 presents the frequencies of children with CP according to functional classification systems (GMFCS, MACS, and CFCS). Table 2 shows the descriptive characteristics of the children. According to the EDACS, there were 44 (35.2%) children in level I, 34 (27.2%) children in level II, 16 (12.8%) children in level III, 22 (17.6%) children in level IV, and nine (7.2%) children classified at the level V.

Agreement among therapists was almost perfect for the EDACS level within 95% Confidence Interval (ICC=0.972 Confidence Interval=0.959-0.980, p<0.001).

There were significant correlations between the EDACS, and GMFCS, MACS, and CFCS (r=0.769, r=0.786, and r=0.824, respectively, p<0.001) (Table 3).

Table 1: Distribution of Children According to Functional Classification Systems.

Levels	GMFCS		MACS		CFCS	
	n	%	n	%	n	%
I	22	17.60	33	26.40	35	28
II	26	20.80	28	22.40	24	19.2
III	22	17.60	22	17.60	22	17.6
IV	25	20	14	11.20	22	17.6
V	30	24	28	22.40	22	17.6

GMFCS: Gross Motor Function Classification System, MACS: Manual Ability Classification System, CFCS: Communication Function Classification System.

Table 2: Descriptive Characteristics of Children with Cerebral Palsy (n=125).

Parameter	Mean±SD	Min-Max
Age (years)	7.44±3.95	4-18
Gender	**n**	**%**
Female	54	43.2
Male	71	56.8
CP Types	**n**	**%**
Spastic	95	76
Dyskinetic	19	15.2
Ataxic	9	7.2
Hypotonic	2	1.6

CP: Cerebral Palsy.

Table 3: Relationship between Turkish Version of Eating and Drinking Ability Classification System and Gross Motor Function Classification System, Manual Ability Classification System, and Communication Function Classification System.

Parameters	GMFCS		MACS		CFCS	
	r	p	r	p	r	p
EDACS	0.769	**<0.001***	0.786	**<0.001***	0.824	**<0.001***

*p<0.05 EDACS: Eating and Drinking Ability Classification System, GMFCS: Gross Motor Function Classification System, MACS: Manual Ability Classification System, CFCS: Communication Function Classification System.

DISCUSSION

İn this study, we found that the Turkish EDACS had high intra-rater reliability and high correlations with the other functional classification systems as we hypothesized. The Turkish version of a new measurement for classifying eating and drinking abilities of children with CP with acceptable psychometric properties is vital to be used in clinical settings or research studies.

Eating and drinking difficulties in children with CP have been shown as a common problem by different studies (6,21). However, in their systematic review, Sellers et al. (13) identified the lack of a reliable ordinal scale to classify the eating and drinking abilities of children with CP in both clinical and research contex. Therefore, the EDACS may play a crucial role to classify eating and drinking abilities in individuals with CP, and it is essential to show its reliability in different languages (22). The EDACS identifies the critical features including safety (choking and aspiration risk) and efficiency (mealtime and food loss from the mouth) linked with limitations to oral skills required for biting, chewing, and swallowing (13).

After the World Health Organization has declared the International Classification of Functioning, Disability, and Health, activity and participation become a crucial issue for rehabilitation (23). Although there are several assessment methods related to oral motor problems, which mostly focus on body functions and structures, the Turkish EDACS is one of the systems that directly focus on feeding problems of children with CP, which is the activity part of the International Classification of Functioning, Disability and Health. Since it allows using a common language between professionals and parents, it could also help to focus on family-centered rehabilitation (24).

Sellers et al. noted that the level of intra-rater agreement was 78% during the development phase of the EDACS (13). Benfer et al. found that intra-rater reproducibility of the EDACS was strong and suggested that there was little variability between repeated evaluations by the same rater. It has an 88.3% intra-rater agreement, and ICC was 0.95 (8). We found that the Turkish EDACS had a high intra-rater agreement, and ICC value was 0.97, which is quite similar to the previous findings.

Correlations of the Turkish EDACS with other functional classification systems were found

moderate to high in previous studies (8,13,25). Tschirren et al. stressed that the EDACS correlated moderately to highly with GMFCS (r=0.52), MACS (r=0.69), and CFCS (r=0.64) (14). Benfer et al. found that the EDACS classification is strongly related to the GMFCS in children with CP (10). Monbaliu et al. stated that the EDACS was significantly related to GMFCS (r=0.78) and MACS (r=0.77) but moderately related with CFCS (r=0.49) in children with dyskinetic CP (25). Goh et al. compared the classification systems for oropharyngeal dysfunction in children with CP, and they used the EDACS, CFCS, GMFCS, and MACS for the classification (26). While the EDACS level presented strong relationship CFCS (r=0.74) and MACS (r=0.69), there was a weak relationship with GMFCS (r=0.51) (26). As a complementary result, we also found a high correlation between the Turkish EDACS and GMFCS, MACS, and CFCS. Therefore, all studies studies mentioned emphasized that the level of functional eating and drinking abilities is related to motor functional levels and communication status of children with CP.

The main limitations of the study were the lack of inter-rater reliability of the Turkish EDACS and concurrent validity of the Turkish version. It is recommended to be determined in future studies.

In conclusion, the study showed that the Turkish EDACS is a reliable instrument to describe the functional eating and drinking abilities of children with CP. The functional eating and drinking abilities of children with CP is also related to motor functional levels and communication status, which are measured by frequently used functional classification systems including GMFCS, MACS, and CFCS. We recommend that therapists and researchers could use the EDACS in their clinical and research practice in children with CP with eating and drinking difficulty as well as to describe their abilities of children with CP using the other classification systems. Further study is need to determine interrater reliability and concurrent validity of Turkish EDACS.

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Conflict of Interest: There is no conflict of interest.

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SEREBRAL PALSİLİ ÇOCUKLARDA GÖVDE VE ALT EKSTREMİTE KAS KUVVETİ İLE FONKSİYONEL AKTİVİTE ARASINDAKİ İLİŞKİNİN İNCELENMESİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Serebral palsili (SP) olgularda kas zayıflığı önemli motor problemler arasında yer almaktadır. Bu çalışmanın amacı, ambule spastik tip SP'li olgularda gövde ve alt ekstremite kaslarının izometrik kuvveti ile fonksiyonel aktivite arasındaki ilişkiyi incelemekti.

Yöntem: Çalışmaya yaşları 7-18 yıl arasında değişen ve yaş ortalamaları 12,53±3,27 yıl olan 54 spastik tip SP'li olgu dâhil edildi. Olguların gövde fleksor ve ekstansor kasları ve alt ekstremite kaslarının (kalça fleksor, ekstansor, abduktor ve adduktor, diz fleksor ve ekstansor, ayak bileği dorsifleksor ve plantar fleksor) izometrik kuvvet değerlendirmeleri el dinamometresi ile yapıldı. Olguların kaba motor fonksiyonları Kaba Motor Fonksiyon Ölçütü (KMFÖ)'nün D ve E bölümleri ile değerlendirildi ve Kaba Motor Fonksiyon Sınıflama Sistemi (KMFSS) ile seviyeleri belirlendi. Fonksiyonel aktivitenin değerlendirilebilmesi için süreli kalk yürü testi (TUG) ve otur kalk testi (OKT) kullanıldı.

Sonuçlar: KMFÖ D ve E puanları ile kalça fleksor, ekstansor, abduktor ve adduktor, diz ekstansor ve fleksor, ayak bileği dorsifleksor ve plantar fleksor kas kuvveti arasında anlamlı ilişki olduğu gözlemlendi ($p<0,05$). TUG testi ile kalça ekstansor ve abduktor, diz ekstansor ve ayak bileği plantar fleksor kas kuvveti arasında anlamlı ilişki olduğu belirlendi ($p<0,05$). OKT ile kalça fleksor, ekstansor, abduktor adduktor, diz ekstansor ve fleksor, dorsifleksor ve plantar fleksor kasları arasında anlamlı ilişki olduğu gözlemlendi ($p<0,05$).

Tartışma: Bu çalışma, SP'li çocuklarda gövde ve alt ekstremite kas kuvveti ile fonksiyonel aktivite arasında farklı seviyelerde, değişik şiddette ve yönde ilişki olduğunu göstermektedir. SP'li çocuklarda kas kuvveti fonksiyonel aktivite için kritik rol oynamaktadır.

Anahtar Kelimeler: Çocuk; Kas Kuvveti; Serebral Palsi.

AN INVESTIGATION OF RELATIONSHIP BETWEEN TRUNK AND LOWER EXTREMITY MUSCLE STRENGTH AND FUNCTIONAL ACTIVITY IN CHILDREN WITH SPASTIC CEREBRAL PALSY

ORIGINAL ARTICLE

ABSTRACT

Purpose: Muscle weakness is an motor important impairment among children with cerebral palsy (CP). This study investigated the correlation between trunk and lower extremity isometric muscle strength and functional activity in children with ambulatory spastic CP.

Methods: Fifty-four ambulatory children with spastic CP, aged 7-18 years (age=12.53±3.27 years) were included in this study. Hand dynamometer was used to determine trunk flexor and extansor and lower extremity muscles (hip flexos, extansor, abductor, and adductor, knee flexor and extansor, ankle dorsiflexor and plantarflexor muscles) isometric muscle strength. Gross motor function measured using Gross Motor Function Measure (GMFM) dimensions D and E, and Gross Motor Function Classification System (GMFCS) was used to classified gross motor function level. timed up and go test (TUG) and sit to stand test (SST) were used for the evaluation of functional activity.

Results: The GMFM D and E scores were significantly related to hip flexor, extansor, abductor and adductor, knee extansor and flexor, ankle dorsiflexor, and plantar flexor muscle strength ($p<0.05$). The TUG test was significantly associated with hip extansor and abductor, knee extansor and ankle plantar flexor muscle strength ($p<0.05$). The SST was significantly correlated with hip extansor and abductor, knee extansor and ankle plantar flexor muscle strength ($p<0.05$).

Conclusion: This study showed that there is a relationship between muscle strength of the trunk and lower extremity muscle strength in children with CP and functional activity at different levels, severity, and direction. Muscle strength might play critical role in functional activities in children with CP.

Key Words: Child; Muscle Strength; Cerebral Palsy.

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GİRİŞ

Serebral palsi (SP), hareket ve postur gelişiminde bozukluk olarak tanımlanmakta olup, Türkiye'de yapılan bir epidemiyolojik çalışmaya göre, 1000 canlı doğumda 4,4 oranında görülmektedir (1,2). SP'de motor bozukluklar ortaya çıkmakla birlikte tabloya duyusal, bilişsel, iletişim ve algılama problemleri de eşlik edebilmektedir (1).

SP'li olguların kaslarındaki yapısal anormallikler ve nöral kontroldeki değişiklikler (motor ünite deşarjlarında yetersizlik, agonist ve antagonist kaslar arasındaki yetersiz koaktivasyon), kas kuvveti gelişimini olumsuz etkilemekte ve kas zayıflığına sebep olmaktadır (3). Kas zayıflığının, izole motor kontrolde kayıp veya azalmaya sebep olduğu ve bu durumun fonksiyonel aktivite ve katılım kısıtlılığına yol açtığı ifade edilmektedir (1). Literatürde, yüksek fonksiyonel seviyeye sahip olan SP'li olgularda dahi tipik gelişim gösteren akranlarına kıyasla % 50 oranında daha düşük kas kuvvetinden bahsedilmektedir (4). Birçok çalışma SP'li çocuklarda alt ekstremite kas kuvveti ile fonksiyonel aktivite arasında ilişki olduğundan bahsetmektedir. (5-8). Hafif etkilenimli okul çağındaki spastik tip SP'li olgular bağımsız düzeyde olmalarına rağmen, mevcut kas zayıflıkları nedeni ile tipik gelişim gösteren akranlarına göre bozuk yürüme paterni ile yürümekte ve zaman içerisinde yürüme becerisinde gerilemeler meydana gelmektedir (5). SP'li olgularda yapılan bir çalışmada kalça abduktor ve diz fleksor kas kuvveti ile yürüme hızı, oturup kalkma aktivitesi, basamağa yan adım alma ve zamanlı basamak çıkma aktiviteleri arasında ilişki olduğunu belirtilmiştir (6). Ross ve ark., dorsifleksor, plantar fleksor, diz fleksor, diz ekstansor, kalça abduktor ve kalça adduktor kas zayıflığı ile fonksiyonel aktivite kısıtlılığı arasında güçlü bir ilişki olduğunu ifade etmiştir (5). Unger ve Engsberg, SP'li olgularda zayıf abdominal kas aktivasyonundan bahsetmektedir (7). Ayrıca, spastik tip SP'li olgularda yaptığı çalışmasında abdominal kas kuvvetinin pelvik tilt derecesi ile ilişkili olduğunu ve yürüme fonksiyonu ve oturup kalkma aktivitesi için belirleyici olduğunu belirtmiştir (8). Ancak gövde kas kuvveti ile fonksiyonel aktivite arasındaki ilişkiyi inceleyen az sayıda çalışmaya rastlanmaktadır. Bu çalışmanın amacı, ambule spastik tip SP'li olgularda gövde kas kuvveti, alt ekstremite kas kuvveti ve fonksiyonel aktivite arasında ilişkiyi incelemekti.

YÖNTEM

Çalışmaya, KKTC Doğu Akdeniz Üniversitesi Bilimsel Araştırma ve Yayın Etiği Kurulu'nun 18.12.17 tarih ve 2017/51-21 sayılı onay kararı doğrultusunda başlandı. Çalışma, Doğu Akdeniz Üniversitesi, Sağlıklı Yaşam Merkezi, Fizyoterapi ve Rehabilitasyon Bölümü Pediatrik Rehabilitasyon Ünitesi'ne Şubat-Ekim 2018 tarihleri arasında başvuran, yaşları 7-18 yıl arasında değişen spastik tip SP'li olgular üzerinde gerçekleştirildi. Aileleri çalışmaya katılmayı gönüllü olarak kabul eden olgular dahil edildi. Çalışma süreci ile ilgili bilgi verildikten sonra olgular ve ebeveynlerinden yazılı aydınlatılmış onam formları alındı. Çalışmaya sadece spastik tipde etkilenimi olan ve Kaba Motor Fonksiyon Sınıflama Sistemine (KMFSS) göre seviye 1 ve 2 olan olgular dahil edildi (9). Son bir yıl içerisinde alt ekstremitelerine yönelik cerrahi operasyon geçirmiş olan, son altı ay içerisinde Botulinum toksin enjeksiyonu uygulanmış olan, işitme problemi, görme problemi ve epilepsisi bulunan ve kooperasyonu iyi olmayan çocuklar çalışma dışı bırakıldı. Dahil edilen olgular, Avrupa Serebral Palsi İzleme Grubu'nun önerdiği sınıflama sistemi dikkate alınarak spastik unilateral (17 olgu) ve spastik bilateral (37 olgu) olarak kaydedildi (10). Kaba motor fonksiyonların ve aktivitenin değerlendirilebilmesi için Kaba Motor Fonksiyon Ölçütü (KMFÖ)'nün D ile E bölümleri (ayakta durma, yürüme, koşma ve zıplama değerlendirilmesine yönelik kısımları) uygulandı. Ölçekte test edilecek bölümlerdeki komutlar dikkate alınarak olgunun aktif olarak motor fonksiyonları yerine getirmesi istendi. Hareketin kalitesine bakılmaksızın başlatamaması (0 puan), başlatabilmesi (1 puan), devam ettirilebilmesi (2 puan) ve tamamlanması (3 puan) olmak üzere 0 ile 3 puan arasında skorlandı ve toplam puan kaydedildi (11).

Olguların izometrik kas kuvvetinin değerlendirilebilmesi için, standart pozisyonlarda el dinamometresi (Hand-Held Dinamometre, Lafayette Manual Muscle Tester, Model 01163, Lafayette Instrument Company, Sagamore Parkway North Lafayette, ABD) kullanıldı (12,13). Testler sırasında kompansasyonları engellemek ve

spastisiteyi artırmamak için standart pozisyonlar tercih edildi. Kullanılan standart ozisyonlar Tablo 1'de özetlenmiştir (12-14). Testler, çocukların anlayabileceği şekilde anlatıldıktan sonra, iki deneme tekrarı ile ve her test, yorgunluğu önlemek amacıyla, testler arasında 15 saniye dinlenme aralıkları verilerek uygulandı. Cihaz direnci ile elde edilen izometrik kasılma kuvveti değeri üç kez kaydedilip ortalaması alındı (12,13). Tüm olgularda gövde ekstansorleri ve fleksorleri, bilateral kalça fleksorleri, abduktorleri, adduktorleri, ekstansorleri, diz ekstansorleri ve fleksorleri, ayak bileği dorsi fleksorleri ve plantar fleksorlerinin izometrik kas kuvvet değerleri ölçüldü.

Tablo 1: Kas Kuvveti Testi için Kullanılan Standart Pozisyonlar.

Kas Grubu	Olgunun Pozisyonu	Stabilizasyon Noktası	Dinamometre Pozisyonu
Gövde Fleksorleri	Baş ve gövde dik pozisyonda, ayaklar yere tam temas halinde olacak şekilde oturma pozisyonunda ve eller umblikus seviyesinde birbirine kenetli iken yapıldı.	Pelvisten ve femur çevresinden geçirilen kemer ile sandalyeye stabilize edildi.	Dinamometrenin probu sternumun orta noktasında olacak şekilde yerleştirildi ve dinamometre bantları aksilla hizasından geçirilerek sandalyeye sabitlendi.
Gövde Ekstansorleri	Baş ve gövde dik pozisyonda, ayaklar yere tam temas halinde olacak şekilde oturma pozisyonunda ve eller karşıt omuzlarda çapraz halde iken yapıldı.	Pelvisten ve femur çevresinden geçirilen kemer ile sandalyeye stabilize edildi.	Dinamometrenin probu, skapulaların orta noktasında ve kolumna vertebralis üzerinde olacak şekilde bantla sandalyeye sabitlendi.
Kalça Fleksorleri	Baş ve gövde orta hatta ve test dışı ekstremiteler sabit, kalça ve diz 90 derece fleksiyonda iken sırtüstü pozisyonunda uygulandı.	SIAS hizası ve aksilla hizasından paralel iki kemer ile yatağa stabilize edildi.	Dinamometrenin probu femurun anterior iz düşümünde orta noktaya yerleştirildi.
Kalça Ekstansorleri	Baş ve gövde orta hatta ve test dışı ekstremiteler sabit, kalça ve diz 90 derece fleksiyonda iken sırtüstü pozisyonunda uygulandı.	SIAS hizası ve aksilla hizasından paralel iki kemer ile yatağa stabilize edildi.	Dinamometrenin probu femurun posterior iz düşümünde orta noktaya yerleştirildi.
Kalça Abduktorleri	Baş ve gövde orta hatta, test dışı ekstremiteler sabit halde, kalça ve diz ekstansiyonda iken sırtüstü pozisyonunda uygulandı.	Diğer ekstremite stabilize edildi.	Dinamometrenin probu femurun lateral iz düşümünde orta kısmına yerleştirildi.
Kalça Adduktorleri	Baş ve gövde orta hatta, test dışı ekstremiteler sabit halde, kalça ve diz ekstansiyonda iken sırtüstü pozisyonunda uygulandı.	Diğer ekstremite stabilize edildi.	Dinamometrenin probu femurun lateral iz düşümünde orta kısmına yerleştirildi.
Diz Fleksorleri	Baş ve gövde dik pozisyonda, kalça ve diz 90 derece fleksiyonda, ayaklar yere tam temas halinde olacak şekilde oturma pozisyonunda ve eller uyluk üzerinde iken uygulandı.	Pelvisten kemer ile sandalyeye stabilize edildi.	Dinamometrenin probu tibia posterior iz düşümünde 2/3'lük alt kısıma yerleştirildi.
Diz Ekstansorleri	Baş ve gövde dik pozisyonda, kalça ve diz 90 derece fleksiyonda, ayaklar yere tam temas halinde olacak şekilde oturma pozisyonunda ve eller uyluk üzerinde iken uygulandı.	Pelvisten kemer ile sandalyeye stabilize edildi.	Dinamometrenin probu tibia anterior iz düşümünde 2/3'lük alt kısıma yerleştirildi.
Dorsi Fleksorler	Baş ve gövde orta hatta ve test dışı ekstremiteler sabit, kalça ve diz ekstansiyonda iken sırtüstü pozisyonunda uygulandı.	Femur proksimalinden kemer ile yatağa stabilize edildi.	Dinamometrenin probu ayağın dorsal yüzünde orta kısıma yerleştirildi.
Plantar Fleksorler	Baş ve gövde orta hatta ve test dışı ekstremiteler sabit, kalça ve diz ekstansiyonda iken sırtüstü pozisyonunda uygulandı.	Femur proksimalinden kemer ile yatağa stabilize edildi.	Dinamometrenin probu ayağın plantar yüzünde orta kısıma yerleştirildi.

SIAS: Spina İliaka Anterior Superior.

Tablo 2: Çalışmaya Katılan Olguların Sosyo-demografik ve Klinik Özellikleri.

Değişkenler	SP (n=54)	
	X̄±SS	min-maks
Yaş (yıl)	12,53±3,27	7-18
Cinsiyet (K/E), n (%)	19/35	35,20/64,80
Boy (cm)	144,79±17,91	110-180
Vücut Ağırlığı (kg)	38,82±16,17	17-93
Beden Kütle İndeksi (kg/m²)	17,91±3,88	12,00-30,35
SP Sınıflandırması	n	%
Unilateral	17	31,50
Sağ Hemiparezi	9	16,70
Sol Hemiparezi	8	14,80
Bilateral	37	68,50
Kaba Motor Fonksiyon Sınıflama Sistemi	n	%
Seviye 1	13	24,10
Seviye 2	41	75,90
KMFÖ	X̄±SS	min-maks
D (%)	71,26±10,05	46,15-92,30
E (%)	68,44±10,43	48,61-88,89

KMFÖ: Kaba Motor Fonksiyon Ölçütü. SP: Serebral Palsi.

Çalışmamızda fonksiyonel aktiviteyi değerlendirmek için otur kalk testi (OKT) ve süreli kalk yürü testi (TUG) kullanıldı (14,15). OKT için iki deneme tekrarı yapıldıktan sonra her olgudan, kalça ve dizleri 90 derece fleksiyonda, ayakları yere tam temas halinde iken oturduğu kolçaksız ve sırt desteği olmayan sandalyeden kalkıp, tekrar geri oturması istendi. Kronometre ile 1 dakika içerisinde oturup kalkma sayısı kaydedildi (14). TUG testi için her olgudan, kalça ve dizleri 90 derece fleksiyonda, ayakları yere tam temas halinde iken, oturduğu kolçaksız sandalyeden kalkıp 3 metre olarak işaretlenen hedef noktaya kadar yürümesi ardından sandalyeye tekrar geri oturması istendi. Kronometre ile geçen süre kaydedildi (15). Tüm değerlendirmeler pediatri alanında tecrübeli fizyoterapist tarafından uygulandı ve her olgunun toplam değerlendirme süresi ortalama 45 dakika sürdü.

İstatistiksel Analiz

Verilerin analizi IBM SPSS Statistics 21.0 (SPSS Inc, Chicago, IL, ABD) programı ile yapıldı. Tanımlayıcı analizler; nominal ve ordinal veriler için frekans ve yüzde değerleri olarak kaydedildi. Verilerin normal dağılıma uygunluğu Shapiro-Wilk testi ile değerlendirildi. Normal dağılım göstermeyen veriler Spearman Korelasyon analizi testi kullanılarak incelendi. r değeri ≥0,91 ise, mükemmel, 0,90≥ r ≥0,71 ise, iyi, 0,70≥ r ≥0,51 ise, orta, 0,50≥ r ≥0,31 zayıf ve r≤0,30 ise, çok düşük ilişki olarak tanımlandı (16). Yanılma olasılığı p<0,05 olarak alındı. Çalışmaya dâhil edilmesi planlanan en küçük örneklem büyüklüğü G*Power (3.1.9.2, Franz Faul, Universitat Kiel, Almanya) bilgisayar programı ile hesaplandı. Çalışma kapsamındaki verilerin gruplar arası karşılaştırılmasında tek yönlü ANOVA kullanılarak, α=0,05, β=0,20 ve Cohen d etki büyüklüğünün d=0,80 varsayımları altında çalışmanın örneklem büyüklüğü toplam 54 birey olarak hesaplandı (17).

SONUÇLAR

Çalışmaya yaşları 7-18 yıl arasında değişen ve yaş ortalaması 12,53±3,27 yıl olan 54 olgu dahil edildi. Olguların sosyo-demografik verileri, klinik özellikleri ve KMFÖ puanları Tablo 2'de verilmiştir. İzometrik kuvvet değerleri, TUG ve OKT süreleri Tablo 3'te sunulmuştur. İzometrik kas kuvvet değerleri ile KMFÖ puanları, TUG ve OKT testleri değerleri arasındaki ilişki ise Tablo 4'te özetlenmiştir.

Olguların gövde fleksor izometrik kas kuvveti ile KMFÖ D puanı arasında çok düşük ilişki olduğu kaydedilirken (r=0,303 p<0,05), gövde ekstansör izometrik kas kuvveti ile ilişki olmadığı görüldü (p>0,05) (Tablo 4). SP'li olguların gövde fleksor ve ekstansor kasları izometrik kuvveti ile KMFÖ E puanları arasında anlamlı ilişki yoktu (p>0,05, Tablo 4). Ancak KMFÖ D puanları ile kalça fleksor,

Tablo 3: Kas Kuvveti ve Fonksiyonel Test Sonuçları.

Değişkenler		SP (n=54)	
		X̄±SS	Min-Max
Kas Kuvveti (N)			
Gövde Fleksorleri		8,02±3,31	3,50-21,00
Gövde Ekstansorleri		9,03±2,82	5,00-18,00
Kalça Fleksorleri	**Sağ**	6,28±2,24	2,30-12,20
	Sol	6,50±3,20	2,70-20,10
Kalça Ekstansorleri	**Sağ**	5,33±2,39	1,70-11,80
	Sol	5,22±2,80	1,40-14,50
Kalça Abduktorleri	**Sağ**	7,52±2,79	2,40-16,40
	Sol	7,85±3,64	1,80-20,50
Kalça Adduktorleri	**Sağ**	8,47±2,56	2,50-13,50
	Sol	8,85±3,21	2,70-19,80
Diz Fleksorleri	**Sağ**	7,27±2,88	3,10-15,30
	Sol	7,07±3,42	2,80-21,20
Diz Ekstansorleri	**Sağ**	8,32±2,54	3,20-15,00
	Sol	8,14±3,00	2,80-16,80
Dorsi Fleksorler	**Sağ**	3,95±1,76	0,00-8,30
	Sol	3,88±1,84	1,20-8,50
Plantar Fleksorler	**Sağ**	5,75±1,87	0,00-10,30
	Sol	5,73±1,95	1,70-12,10
Zamanlı Kalk Yürü Testi (sn)		13,53±3,02	6,42-19,52
Otur Kalk Testi (n/dk)		18,31±5,41	12,00-35,00

ekstansor, abduktor ve adduktor, diz ekstansor, diz fleksor (sağ r=0,340), ayak bileği dorsifleksor ve plantar fleksor kasları izometrik kuvveti arasında ilişki olduğu gözlemlendi (p<0,05, Tablo 4). KMFÖ E puanları ile kalça fleksor, ekstansor, abduktor ve adduktor, diz ekstansor, diz fleksor ayak bileği dorsifleksor ve plantar fleksor kasları izometrik kuvveti arasında ilişki olduğu belirlendi (p<0,05, Tablo 4).

Olguların gövde fleksor ve ekstansor kasları izometrik kuvveti ile TUG ve OKT değerleri arasında istatistiksel açıdan ilişki saptanmadı (p>0,05, Tablo 4). TUG ile kalça ekstansor ve abduktor, diz ekstansor ve ayak bileği plantar fleksor izometrik kas kuvveti ile arasında anlamlı ilişki olduğu belirlendi (p<0,05, Tablo 4). OKT ile kalça fleksor, ekstansor, abduktor adduktor, diz ekstansor ve fleksor, dorsifleksor ve plantar fleksor kasları arasında ilişki olduğu saptandı (p<0,05, Tablo 4).

TARTIŞMA

Bu çalışmanın amacı, ambule spastik SP'li olgularda gövde ve alt ekstremite kaslarının izometrik kuvveti ile fonksiyonel aktivite arasında ilişki olup olmadığını incelemekti. Çalışmamız sonucunda, SP'li olgularda alt ekstremite kas kuvveti ile KMFÖ-D ve E bölümleri, TUG ve OKT değerleri arasında ve gövde fleksor kas kuvveti ile KMFÖ D puanı arasında ilişki olduğu kaydedildi.

Kaba motor fonksiyonlar sırasında gövde kaslarının önemi bilinmesine rağmen, literatürde bu ilişkiyi inceleyen az sayıda çalışmaya rastlanmaktadır (18). Hong ve ark., ambule SP'li çocuklarda abdominal kas kuvvetinin KMFÖ-66 tüm alt skorları için belirleyici olduğunu ifade etmesine rağmen, çalışmasında sadece alt ekstremite ile olan ilişkisini incelemiştir (19).

SP'li olgularda, alt ekstremite kas kuvveti ile kaba motor fonksiyon arasında ilişkiyi inceleyen birçok çalışmaya rastlanmaktadır (4,5,6,20,21). Eek ve Beckung, tüm alt ekstremite kas kuvveti ile KMFÖ alt skorları arasında orta ile yüksek arasında değişen şiddette ilişki olduğunu ve kas zayıflığının yürüme becerisi için belirleyici olduğunu belirtmiştir (4). Goh ve ark., SP'li olgularda diz ekstansor kas kuvvetinin tek başına, koşma ve zıplama gibi kaba motor fonksiyonlarla ilişkili olduğunu ifade ederken (20), Dallmeijer ve ark., diz fleksor kas kuvveti ile daha kuvvetli ilişki elde edildiğini belirtmiştir (6).

Tablo 4: Kas Kuvvet Değerleri ile Fonksiyonel Aktivite Arasındaki İlişki.

Kas Kuvveti		KMFÖ-D		KMFÖ-E		TUG		OKT	
		r	p	r	p	r	p	r	p
Gövde Fleksor		0,303	**0,026***	0,185	0,181	-0,230	0,095	0,239	0,082
Gövde Ekstansor		0,033	0,814	0,071	0,612	-0,223	0,105	0,200	0,148
Kalça Fleksor	**Sağ**	0,383	**0,004***	0,331	**0,015***	-0,179	0,195	0,446	**0,001***
	Sol	0,294	**0,031***	0,309	**0,023***	-0,203	0,141	0,532	**<0,001***
Kalça Ekstansor	**Sağ**	0,498	**<0,001***	0,393	**0,003***	-0,258	0,060	0,404	**0,002***
	Sol	0,363	**0,007***	0,291	**0,033***	-0,337	**0,013***	0,459	**<0,001***
Kalça Abduktor	**Sağ**	0,339	**0,012***	0,389	**0,004***	-0,273	**0,046***	0,391	**0,003***
	Sol	0,296	**0,029***	0,345	**0,011***	-0,382	**0,004***	0,471	**<0,001***
Kalça Adduktor	**Sağ**	0,383	**0,004***	0,316	**0,020***	-0,131	0,345	0,358	**0,008***
	Sol	0,358	**0,008***	0,369	**0,006***	-0,234	0,089	0,475	**<0,001***
Diz Ekstansor	**Sağ**	0,504	**<0,001***	0,451	**0,001***	-0,386	**0,004***	0,510	**<0,001***
	Sol	0,356	**0,008***	0,377	**0,005***	-0,353	**0,009***	0,524	**<0,001***
Diz Fleksor	**Sağ**	0,340	**0,012***	0,282	**0,039***	-0,033	0,815	0,303	**0,026***
	Sol	0,262	0,055	0,224	0,104	-0,039	0,781	0,245	0,074
Dorsifleksor	**Sağ**	0,299	**0,028***	0,404	**0,002***	-0,159	0,251	0,245	0,074
	Sol	0,292	**0,032***	0,189	0,170	-0,204	0,139	0,345	**0,011***
Plantar Fleksor	**Sağ**	0,361	**0,007***	0,369	**0,006***	-0,295	**0,030***	0,397	**0,003***
	Sol	0,400	**0,003***	0,364	**0,007***	-0,437	**0,001***	0,663	**<0,001***

*p<0,05. KMFÖ: Kaba Motor Fonksiyon Ölçümü, TUG: Zamanlı Kalk Yürü Testi, OKT: Otur Kalk Testi.

Bu çalışmaların yanında, Shin ve ark., kalça ve diz eklemi fleksor ve ekstansor izometrik kas kuvveti ve KMFÖ skorları arasında ilişki olmadığını ifade etmişlerdir (22). Kamat ve ark ise, sadece kalça adduktor, diz fleksor, dorsifleksor ve plantar fleksor kas kuvveti ile KMFÖ skorlarının ilişkili olduğunu belirtmiştir (23). Literatürdeki bu farklılığın SP'li olguların klinik özelliklerindeki heterojenite kaynaklı olabileceği düşünülmektedir. Bizim çalışmamızda ise, sol diz fleksor kas kuvveti haricinde diğer alt ekstremite kas gruplarının kuvveti ile KMFÖ ayakta durma alt skoru arasında pozitif yönde ilişki olduğu kaydedildi. Jung ve ark., SP'li olgularda alt ekstremite proksimal kas gruplarının distal kaslara kıyasla daha kuvvetli olduğunu vurgulamıştır (24). Literatürdeki çalışmalarda da benzer farklılıkların olması kuvvet ve kaba motor fonksiyon ilişkisi ile birlikte spastisite şiddeti, denge gibi diğer faktörlerin etken olabileceğini düşündürmektedir. Bahsedilen bufaktörler değerlendirilmemiş olup bu nedenle sonuçlara olan etkilerini tartışmak zordur.

Yürüme hızı günlük yaşamda birçok fonksiyonel ve sosyal aktivite için önemlidir. SP'li olgularda yürüme hızının kas zayıflığı ile ilişkili olarak azaldığı ifade edilmiştir (25). Literatürde SP'li olgularda yürüme fonksiyonu ile gövde kas kuvveti arasındaki ilişkiyi inceleyen tek bir çalışmaya rastlandı. Unger, 6-13 yaş spastik tip SP'li olgularda abdominal kas kuvvetinin yürüme fonksiyonu ile ilişkili olduğunu ve kuvvetin artırılmasına yönelik uygulamaların yürüme hızını da artıracağını belirtmiştir (7).

Önceki çalışmalar SP'li olgularda alt ekstremite kas kuvveti ile yürüme hızı arasında pozitif yönde ilişki olduğunu belirtmişlerdir (6,21,22,26-28). Çalışmalar özellikle diz ekstansor kas kuvvetinin yürüme hızı için belirleyici olduğunu ifade etmektedir (21,26,28). Çalışmamızda, literatürle uyumlu olarak tüm olgularda diz ekstansor kas kuvveti ile yürüme hızı arasında ilişki elde edildi. Özellikle TUG testinin sandalyeden kalkma evresinde diz ekstansor kas kuvvetinin yürümeyi başlatma süresini hızlandırdığı düşünülmektedir (28). Spastik tip SP'li olgularda proksimal kas kuvveti ile yürüme hızı arasındaki ilişkiyi inceleyen Shin ve ark., diz çevresi kas kuvvetinin yanında, kalça fleksor ve kalça ekstansor kas kuvveti ile yürüme hızı arasında ilişki olduğunu kaydetmişlerdir (22). Bir diğer çalışma ise, kalça abduktor kas kuvvetinin yürüme hızı ile ilişkili olduğundan bahsetmiştir (6). Chen ve ark., SP'li çocuklarda genel olarak diz fleksor kas kuvvetinin diz ekstansor kas kuvvetine göre daha düşük olduğunu belirtmiştir (29). Bizim de çalışmamızda diz fleksor kas kuvvet değerlerinin, diz ekstansor kas kuvvet değerlerine göre daha düşük olduğu

görülmekte olup bu durumun yürüme hızı ile diz fleksor kas kuvveti arasındaki ilişkiyi etkilediği düşünüldü. Lamontagne ve ark.'nın yetişkin SP'li olgularda yaptıkları çalışmada, yürüme hızı ve TUG değeri için plantar fleksor kas kuvvetinin değil, dorsifleksor kas kuvvetinin esas belirleyici olduğunu ifade etmişlerdir (27). Çalışmamızda plantar fleksor izometrik kas kuvveti ile yürüme hızı arasında ilişki olduğu kaydedildi bu sonuç, SP'li olgularda yaygın olarak gözlemlenen artmış plantar fleksor kas tonusunun kuvvet testinde elde edilen yüksek değerler ile ilişkili olabileceğini düşündürmektedir. Bu durum ayrıca çalışmamızda yürüme hızı ile ilişkili bulunmayan dorsi fleksor izometrik kas kuvveti sonuçları için de açıklayıcı olmaktadır.

SP'li olgularda alt ekstremite kas kuvveti ile oturma ve kalkma aktivitesi arasındaki ilişkiyi inceleyen birçok çalışma olmasına rağmen, gövde kas kuvveti ile olan ilişkisini sadece Wang ve ark.'nın. incelediği görüldü. Wang ve ark., spastik tip SP'li çocuklarda oturup kalkma sıklığı ile gövde ekstansor kas kuvveti arasında pozitif yönde ilişki olduğunu belirtmiştir (30). Çalışmamızda, oturup kalkma aktivitesi ile gövde fleksor ve ekstansor izometrik kas kuvveti arasında ilişkili olmadığı görüldü. Bu durum alt ekstremite kas kuvvetinin oturmadan ayağa kalkma aktivitesi için daha belirleyici olduğunu göstermektedir. Dallmeijer ve ark., spastik tip SP'li çocuklarda oturup kalkma sıklığı ile kalça fleksorleri, abduktorleri, diz fleksorleri ve dorsifleksor kas kuvvetinin ilişkili olduğunu belirtmiştir (6). Benzer olarak Wang ve ark. izometrik kalça abduktor ve diz fleksor kas kuvvetinin oturup kalkma sıklığı ile ilişkili olup mobilite kapasitesi hakkında belirleyici olduğunu ifade etmiştir (30). Çalışmamızda sol diz fleksor ve sağ dorsifleksör kasları hariç tüm alt ekstremite kas gruplarının kuvveti ile oturup kalkma sıklığı arasında pozitif yönde ilişki olduğu gözlemlendi. Çalışmalarda oturup kalkma sıklığının değerlendirildiği testlerin standart olmadığı gözlemlenmektedir (31). Bu durum sonuçların tartışılmasını zorlaştırmaktadır.

Çoğu klinisyen SP'li olgularda fonksiyonel aktivite kısıtlılığı için spastisitenin ve anormal hareket paternlerinin en önemli faktörler olduğunu ifade ederken (32), günümüz çalışmaları bozukluklar arasından kas zayıflıklarının daha büyük etken olduğunu belirtmektedir (5,33).

Çalışmamızda kas kuvvetinin değerlendirilmesi için kullanılan el dinamometresinin henüz SP'li çocuklarda gövde kaslarının değerlendirilmesi için geçerlik ve güvenirliği çalışmasının olmaması en önemli limitasyondur. Ayrıca çalışmamıza heterojen dağılımı minimale indirmek için yalnızca fonksiyonel seviyesi yüksek olan (KMFSS 1 ve 2) olgular dahil edildi. Dolayısıyla elde edilen sonuçların, tüm SP'li çocuklara genellenmesi mümkün değildir. İleriki çalışmalarda şiddetli etkilenimli olguların da değerlendirilerek karşılaştırılması gerekmektedir.

sonuç olarak, SP'li olgularda gövde ve alt ekstremite kas kuvveti ile farklı seviyelerde, değişik şiddette ve yönde fonksiyonel aktiviteler arasında ilişki olduğu gözlemlendi. Bu sonuç, SP'de kas zayıflıklarının önemsenmesi gerekliliğini ve fonksiyonel aktivitelerin de üzerinde durulması gerektiğini bir kez daha vurgular niteliktedir.

Destekleyen Kuruluş: Yok.

Çıkar Çatışması: Yok.

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Yazar Katkıları: Konsept – AM, ÜD; Dizayn – AM, ÜD; Süpervizyon – AM, ÜD; Kaynaklar – ÜD; Materyaller - ÜD; Veri toplama ve/veya İşleme – ÜD; Analiz ve/veya Yorumlama – ÜD; Literatür Tarama – ÜD; Makale Yazımı – AM, ÜD; Eleştirel İnceleme – AK, ÜD.

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SENSORY PROCESSING IN PRETERM CHILDREN AT 5 YEARS OF AGE AND ITS ASSOCIATION WITH SCHOOL READINESS

ORIGINAL ARTICLE

ABSTRACT

Purpose: This study aimed to determine the sensory profile of preterm children an to investigate the relationship between sensory processing and school readiness at five years of age.

Methods: Seventy-six children aged 60–72 months (36 preterm children born <37 weeks of gestation and 40 age-matched term children) were enrolled in the study. Sensory processing was assessed using the Sensory Profile of Dunn, and school readiness was evaluated using the Marmara Primary School Readiness Scale.

Results: Sensory processing scores of the preterm group were significantly lower than the term group ($p<0.05$) at five years of age. Sensory symptoms in preterm preschoolers were associated with school readiness ($p<0.05$). Total Sensory Profile score was a significant predictor for school readiness in preterms ($p<0.05$).

Conclusion: Preterm children exhibited more sensory processing disorder than their term typical peers. Sensory processing disorders in preterm children may affect their school readiness at five years of age.

Key Words: Child Development; Premature Birth; Term Birth.

OKUL ÖNCESİ DÖNEMDE PRETERM ÇOCUKLARDA DUYUSAL İŞLEMLEME VE OKULA HAZIR OLUŞLA İLİŞKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı, okul öncesi dönemde preterm çocukların duyusal profilini belirlemek ve duyusal işleme ile okula hazır oluş arasındaki ilişkiyi araştırmaktı.

Yöntem: Çalışmaya 60-72 ay arası 76 çocuk (gestasyonel yaşı 37 haftadan küçük 36 preterm ve 40 term çocuk) dahil edildi. Duyusal işlemleme Dunn Duyu Profili ile değerlendirildi. Okula hazırlık durumu Marmara İlköğretim Okulu Hazır Oluş Ölçeği ile değerlendirildi.

Sonuçlar: Okul öncesi dönemdeki preterm grubun duyusal işlemleme skorları term gruptan anlamlı olarak daha düşüktü ($p<0,05$). Preterm çocuklarda duyusal semptomlar okul hazırlığı ile ilişkiliydi ($p<0,05$). Total Duyu Profili skoru, pretermlerde okula hazır oluşun anlamlı bir belirleyicisiydi ($p<0,05$).

Tartışma: Preterm çocuklar, akranlarından daha fazla duyusal semptom sergilediler. Beş yaşındaki preterm çocuklarda duyusal işlemleme bozuklukları, okula hazır olma durumlarını etkileyebilir.

Anahtar Kelimeler: Çocuk Gelişimi; Prematüre Doğum; Term Doğum.

INTRODUCTION

Preterm children may often have specific learning disabilities, attention deficit hyperactivity disorders, language and speech disorders, low Intelligence Quotient (IQ) levels, visuomotor disorders, language and speech problems, or low performance at school (1). Impaired neurological and biological systems may lead to sensory processing disorder (SPD) in preterm infants. SPD is described as an individual's inability to effectively register, process, organize, or respond to sensory stimuli (2). Neonatal Intensive Care Units (NICUs) cannot meet the sensory and developmental needs, unlike in uterus, which is the best environment for infants. Although the uterus is a dark, warm, and supportive environment with rhythmic sounds and vestibular input, NICUs largely deprive infants at risk from their natural sensory environment and cause excessive stimulation (3). In addition, there is a lower parasympathetic activity in preterm children due to the lower vagal tone response (4). All these problems may cause sensory problems in preterm infants. Moreover, it has been shown that SPD continues until the preschool and school-age, which is a critical period for learning (5,6).

Dunn's model for sensory processing could provide a possible explanation for the relationship between sensory processing abilities and behavioral output. Dunn's model summarizes the relationship between a person's central neurological thresholds and behavioral response (7,8). Among individuals with hyposensitivity, fundamental habit mechanisms support high limits. However among individuals with low thresholds, neurons are more easily triggered and thus react more frequently to stimuli from the environment, resulting in hypersensitivity (8). Children with sensory avoiding behavior have low neurological thresholds. Therefore they could not prevent stimuli that disturb them. They do not want to participate in the activities that cause excessive or new sensory stimuli (8). Children with sensory seeking behaviors have high neurological thresholds and often produce voices and display unsafe practices to meet their sensory needs (8). These behaviors may affect their social interactions with their peers and their participation in academic life. When they are unable to meet their sensory needs, the children may become explosive and aggressive in their daily life. For those children who have extreme sensory seeking, behaviors may disrupt attention so profoundly that learning is compromised or activities of daily living become challenging (2). Children who exhibit rapid and intense reactions to sensory stimuli often display emotional responses include irritability, moodiness, inconsolability, or poor socialization (2). A sensitive child may have problems focusing, and an external stimulus could easily disturb the child while trying to focus on the task. It may affect a child's ability to participate in academic, social, and play activities in the classroom. Children with low registration behaviors may not explore the environment, engage in socialization, or participate in school activities such as play and academic projects. In addition, these children are often apathetic and distracted in both at home and school settings (2).

School readiness is defined as children's academic and cognitive skills, language and literacy abilities, and social-emotional functioning when they enter school (9). In particular, school readiness could be better understood as property or product of the ecologies in which children are embedded to support their development and educational progress: a range of interactions and processes, environments (home, school, and child care), and institutions (communities, neighborhoods, and governments) (10). The school readiness is the result of direct and indirect interaction of children with these resources; it involves the acquisition of academic, language, and socio-emotional competencies that are invaluable to educators through social relationships between peers, familly, and teachers (10).

The teachers expect preschool children to focus on tasks, sit quietly, follow instructions, self-regulate their emotions, and collaborate with teachers and peers (11). Preschoolers with SPD may have difficulty in attending these school activities and adapting to classroom behavior (12). For this reason, it is essential to examine the relationship between sensory processing and school readiness.

The first aim of the current study was to evaluate sensory processing in pretem children at five years of age and compare with their typical peers. The

second aim of the present study was to investigate the association between sensory processing and school readiness.

METHODS

Participants

Ethical approval for this cross-sectional study was obtained from the Gazi University Ethics Committee (Approval Date: 10.10.2017 and Approval Number: E.149186). Written informed consent was obtained from the parents. The study was carried out between January 2017 and July 2017 at Gazi University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation. Participants were invited by calling the families of the 100 children (50 preterms and 50 terms) between 60 and 72 months of age who were born at Gazi University Hospital in Ankara, Turkey. The study was completed with 36 preterms and 40 term-born children who met the inclusion criteria (Figure 1). While children with gestational ages less than 37 weeks and without any complications were included in the preterm group, children with a gestational age greater than 37 weeks and without any significant health problems were included in the term group. Children with any neurological diagnosis (such as cerebral palsy), genetic disease (such as Down Syndrome), visual and hearing impairment were excluded from the study. The clinical information of children obtained from their hospital files.

Procedure

Dunn Sensory Profile (SP) which is a caregiver-completed questionnaire designed by Winnie Dunn, was used to assess sensory processing (13). Marmara Primary School Readiness Scale was applied to determine the level of readiness for primary education in the field of development and basic academic skills(14). The scale consists of two forms that are the Practice Form and the Development Form. Physiotherapist applied the Practice Form. The Development Form was applied by the teachers/parents. Permission for the use of both scales was obtained from their developers. Maternal education (<12 years, 12 years, and >12 years) was used as an indicator of socioeconomic status.

Outcome Measures and Variables

Demographics and health information: Sociodemographic and clinical characteristics were obtained from the parents. Age, gender, gestational age, birth weight, presence of consanguineous marriage, multiple gestation status, and type of delivery, and pregnancy were questioned.

Dunn Sensory Profile: It is a reliable and valid caregiver/parent questionnaire that assesses children's, aged 3-10 years, behavioral responses to sensory stimuli occurring in daily life. Turkish version study of the Dunn SP was conducted by Kayihan et al. (13). The SP has 125 items that describe the most common behaviors of children with sensory problems. Items are scored on a Likert scale ranging from 1 (always) to 5 (never). Lower scores on the total score and subscales indicate more sensory symptoms. The Dunn SP provides scores in "sections" and "quadrants." The sections are sensory processing, sensory modulation, and social-emotional responses. In addition, it gives scores for four quadrants: low registration, sensory seeking, sensory sensitivity, and sensory avoiding (15).

Marmara Primary School Readiness Scale: The scale was developed and standardized to measure the school readiness of the preschool children aged 60-78 months. The scale explicitly developed for Turkish children. The scale consists of two forms that are the Practice and the Development Forms. The Practice Form consists of five parts as mathematics, science, sound, drawing, and the labyrinth. The Practice Form includes 74 questions, and a researcher one to one applied each of them. The Development Form consists of four sub-scales that are mind and language development, socioemotional development, physical development, and self-care skills, as well as 175 items, and each item was filled by the teachers/parents (14). The item-total, item remaining, and discriminant analysis of the scale yielded significant results at the level of $p<0.001$. The scale showed high internal consistency. Cronbach α value of the Practice form and Development Form was found to be 0.930-0.982, respectively. The maximum total score was 459. Higher scores indicate better school readiness (15). The test has cutoff values for both the total

Table 1: Demographic Characteristics of the Participants.

Characteristics	Preterm (n=36)	Term (n=40)	p
Sex (female/male)	14/22	20/20	0.343[c]
Age (months)	66.64±4.72	68.72±4.80	0.063[a]
Gestational Age (weeks)	32.60±4.10	39.62±1.00	**<0.001*[a]**
Birth Weight (g)	1830 (1060-2268)	3450 (3150-3600)	**<0.001*[b]**
Cesarean Delivery, n (%)	29 (80.5)	20 (50)	**0.001*[c]**
Maternal Education Status **<12 years** **12 years** **>12 years**	 13 14 9	 4 21 15	**0.024*[c]**

*p<0.05. [a]Student t Test; [b]Mann Whitney U Test; [c]Chi-square Test.

score and the subdomains. School readiness status are classified as follows: children who have 75% or more of the scores "ready for school"; children who have 50% and 75% of the scores "need to be supported"; children who have scores below 50% of the scores "not ready for school" (14).

Statistical Analysis

Statistical analyses were performed using SPSS (IBM SPSS Statistics 22.0, IBM Ehningen, Germany). Frequency (percent) and mean±standard deviations (median [minimum-maximum]) for metric variables were given as descriptive statistics. Shapiro-Wilk test and histograms were used to assess distributions for the normality of data. If the data is normally distributed, parametric analyses were performed. Student t-test and Mann-Whitney U test were used, as appropriate. Chi-square test was performed to analyze categorical variables to compare groups. Factors affecting sensory processing scores were investigated using multiple linear regressions. The variables that were evident from a clinical perspective that they might be associated with the dependent variables or variables that were significant in a univariate test with a p-value of less than 0.1 were included in regression models. Outliers and multicollinearity assumptions were checked and handled in the multiple linear regression models. Correlation coefficients were calculated using Pearson and Spearman correlation coefficients, as appropriate. A p-value of <0.05 was considered statistically significant. G*Power (Version 3.1, Dusseldorf, Germany) power analysis program was used to determine the sample size. The parameters were set as α=0.05, 1-β=0.95, and the number of cases to be included in the study were found to be 36 for the two groups.

RESULTS

There was no difference in terms of age and gender between the groups (p>0.05). The birth weight and gestational age were significantly lower in the preterm children (p<0.05) (Table 1). Term children had no history of stay in NICU. They did not receive any mechanical ventilation support.

The sensory processing scores of the preterm group were significantly lower than the term group (p<0.05) (Table 2). In the preterm group, all quadrants of the Dunn SP were significantly correlated with the total scores of the Developmental and Practice Forms (p<0.05) (Table 3).

Table 2: Dunn Sensory Profile Scores and Sensory Group Classification.

Dunn Sensory Profile	Preterm (n=36)	Term (n=40)	p	Mean Difference 95% CI	Effect Size
Low Registration	61.00±11.50	69.77±5.79	**<0.001***	0.50–1.45	0.97
Sensation Seeking	99.71±16.58	107.83±12.84	**0.040***	0.09–1.01	0.55
Sensory Sensitivity	80.16±10.15	87.77±8.39	**0.004***	0.35-1.29	0.82
Sensation Avoiding	112.48±16.49	122.97±12.10	**0.007***	0.26-1.19	0.73
Total SP Score	499.03±70.98	530.79±47.93	**0.037***	0.14-0.91	0.53

*p<0.05. Mann Whitney U test. CI: Confidence Intervals. SP: Sensory Profile

Table 3: Relationship between Marmara Primary School Readiness Scores and Dunn Sensory Profile Scores within the Preterm Group.

Dunn Sensory Profile	Marmara Primary School Readiness Scale			
	Development Form Total Scores		Practice Form Total Scores	
	r	p	r	p
Low Registration	0.569	**0.001***	0.507	**0.004***
Sensation Seeking	0.435	**0.015***	0.364	**0.044***
Sensory Sensitivity	0.567	**0.001***	0.540	**0.002***
Sensation Avoiding	0.359	**0.047***	0.434	**0.015***
Total SP Score	0.589	**0.001***	0.604	**0.001***

*p<0.05. Spearman Correlation Coefficients.

Linear regression analysis was performed in the full sample to investigate the factors that predict sensory processing symptoms. The outcome variable for the model was Marmara Primary School Readiness Development Form and Practice Form scores, and the predictor variables included gestational age, maternal education, gender and total SP score. The model was significant at p<0.001 and explained 32.2% of the variance for the Development Form score. The model was significant at p<0.001, and explained 41.3% of the variance for the Practice Form score. The total SP score was the only significant predictor of school readiness (p<0.05) (Table 4).

DISCUSSION

The preterm children were found to be behind their term typical peers concerning sensory processing

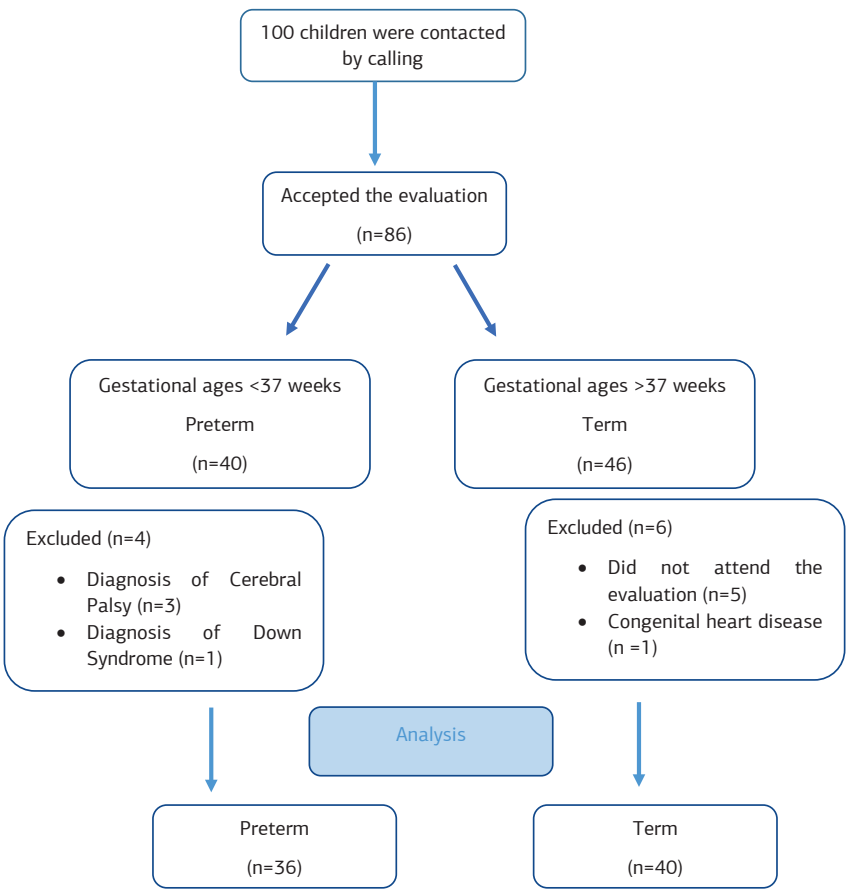

Figure 1: Flow Chart of Participants.

Table 4: Linear Regression Model within the Full Sample Predicting to School Readiness.

Outcome	Adjusted R^2	β	F	p
Development Form				
Total SP Score	0.322	0.38	7.655	**0.002***
R^2=0.320, p<0.001, constant=62.068				
Practice Form				
Total SP Score	0.413	0.52	6.955	**<0.001***
R^2=0.410, p<0.001, constant=-25.820				

*p<0.05. B: unstandardized coefficient, SE B: standard error of B, β: standardized coefficient. SP: Sensory Profile.

at five years of age. There was a positive correlation between SPD and school readiness in preterm children. Sensory processing might affect school readiness in the preterm preschoolers.

Sensory symptoms are associated with preterm birth. Studies conducted to date are primarily focused on preterm infants and toddlers (16,17). Eeles et al. stated that preterm children have lower scores on the Lower Registration, Sensation Seeking, Sensory Sensitivity, and Sensation Avoiding quadrants compared to their term peers (16). Adams et al. found that the percentage of preterm preschoolers classified as having elevated numbers of sensory symptoms as 37% (18). In another study with 107 preterm children, 39% of the children had atypical scores in at least one quadrant or section, and the auditory, tactile, and vestibular processing sections are most affected in preterm children (17). In addition, many studies have shown that SPD associated with preterm labor persist at later ages (5,18) These results support our findings that term children had better sensory processing skills than preterm children at five years of age. Therefore, sensory processing skills should not be ignored during the follow-up of preterm children. Specific tests, clinical observations, and questionnaires could be used for early diagnosis of the SPD. In addition, informing parents/caregivers and teachers about SPD might facilitate early diagnosis and intervention.

The SPD negatively affects children's social, emotional, and academic function (19,20). These children have difficulties in learning new information and performing tasks that would lead to problems in classroom activities (20). Physical and social stimulations in school settings seriously disturb children with SPD (21). Ayres stated that children with insufficient sensory processing skills could not acquire the skills necessary to succeed in school (22). Miller et al. have found that children experiencing sensory difficulties the early education period have more considerable challenges in achieving subsequent school achievement (2). A study showed that children with SPD had five dominant maladaptive behaviors, including extreme talkativeness, overly fidgety, lack of focus, inability to stay on task, and inability to remain seated/standing (23). Adams et al. found that sensory symptoms were associated with executive function impairment in preterm preschoolers (18). Therefore, it might be beneficial to screen preterm children before school age in terms of sensory processing (2). Thus, opportunities for effective intervention programs for educational settings may treet to be established.

School readiness is a multidimensional and dynamic process, and includes health and physical development, emotional well-being, social competence, approaches to learning, communication skills, and cognitive skills (24). It is essential to assess children both academic skills and developmental domains. In this study, it was an advantage of using the Marmara Primary School Readiness Scale, which measures multiple domains of school readiness, a scale developed for the Turkish population.

The limitation of our study is that preterm children are not classified as extremely, very, moderate, or late preterm according to their gestational age. The other limitation is sensory processing is only evaluated by a questionnaire filled by the parent/caregiver and has not been assessed using direct observational scale or electrodermal testing. Another limitation is that the maternal education status was different between the groups. In future studies, it is recommended to use objective and observational assessment methods so that more detailed information about specific

sensory conditions could be provided using direct observation.

In conclusion, the current study showed that SPD in preterm children was more common than term children. Sensory processing might affect school readiness in preterm children. The preschool period is the most complex and vital period of a child's development. If a child is ready for school, it is more likely to be successful. School readiness affects performance throughout academic life and academic success at work in adulthood. Therefore, early learning experiences, in turn, affect academic achievement. It is necessary to evaluate SPD that interferes with learning that could affect academic success and development of preterm children during the preschool period.

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VALIDITY AND RELIABILITY OF THE FOUR SQUARE STEP TEST IN TYPICALLY DEVELOPED CHILDREN

ORIGINAL ARTICLE

ABSTRACT

Purpose: The purpose of this study was to evaluate the reliability and the validity of the four square step test (FSST), and level of agreement between the FSST and the timed up and go test (TUG) in typically developed children.

Methods: Two raters assessed 150 children aged 5 to 10 years in two consecutive days. Concurrent and discriminative validities were determined. To evaluate the intra- and inter-rater reliability, the intra-class correlation coefficient (ICC) was used. The Bland-Altman plot and analysis were performed to evaluate the agreement between the measurements obtained by two raters and by the FSST and TUG.

Results: The FSST and TUG scores were strongly correlated (r=0.685, p=0.001). The FSST was able to distinguish between children by age groups (p=0.001). The ICC2.1 and ICC2.2 estimates were 0.86 and 0.81, respectively. For the assessments of two raters, the Bland-Altman plot showed that all values fell within 95% limits of agreement. Bias was calculated as -0.12±0.50. The 96% of the data points were within the ±1.96 SD of the mean difference for the FSST and TUG scores. Bias was calculated as 0.47±0.80.

Conclusion: The FSST is a valid and reliable test to assess the dynamic balance of typically developed children. However, the FSST cannot be substituted for the TUG.

Key Words: Balance; Children; Reliability; Validity.

TİPİK GELİŞİM GÖSTEREN ÇOCUKLARDA DÖRT KARE ADIM TESTİNİN GEÇERLİK VE GÜVENİRLİĞİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı, tipik gelişim gösteren çocuklarda dört kare adım testinin (FSST) güvenirlik ve geçerliğini ve FSST ve süreli kalk yürü testi (TUG) ile arasındaki uyum düzeyini değerlendirmekti.

Yöntem: 5-10 yaş arası 150 çocuk iki değerlendirici tarafından ardışık iki günde değerlendirildi. Eş zamanlı ve ayırt edici geçerlikler belirlendi. Değerlendirici içi ve değerlendiriciler arası güvenirliği değerlendirmek için, sınıf-içi korelasyon katsayısı (ICC) kullanıldı. İki değerlendirici tarafından yapılan ölçümler ve FSST ve TUG arasındaki uyumu değerlendirmek için Bland-Altman grafiği ve analizi yapıldı.

Sonuçlar: FSST ve TUG kuvvetli şekilde ilişkiliydi (r=0,685, p=0,001). FSST, çocukları yaş gruplarına göre ayırt edebildi (p=0,001). ICC2.1 ve ICC2.2 tahminleri sırasıyla 0,86 ve 0,81'di. İki değerlendiricinin değerlendirmeleri için, Bland-Altman grafiği, tüm değerlerin % 95'lik uyum limitleri içinde olduğunu gösterdi. Yanlılık -0,12±0,50 olarak hesaplandı. Veri noktalarının % 96'sı FSST ve TUG skorları için ortalama farkın ±1,96 standart sapması içindeydi. Yanlılık 0,47±0,80 olarak hesaplandı.

Tartışma: FSST, tipik gelişim gösteren çocuklarda dinamik dengeyi değerlendirmek için geçerli ve güvenilir bir testtir. Bununla birlikte, FSST, TUG testinin yerine kullanılamaz.

Anahtar Kelimeler: Denge; Çocuk; Güvenirlik; Geçerlik.

INTRODUCTION

Balance is a complex motor characteristic that has physiological, biomechanical, and psychological components, and it may be static or dynamic. Both the static or dynamic balance is essential for accomplishing in functional tasks involved in activities of daily living (1,2). Static balance refers to maintain the center of mass within the base of support while the body is not moving. In contrast, dynamic balance refers to anticipating and reacting to changes in balance as the body moves through space (3). Recent research has shown that independent mobility is linked to emotional, social, motor, language, and other developmental benefits in children. Independent and safe mobility allows children to increase their interaction with the peers (4). Therefore, assessing children's balance using valid and reliable instruments is vital for ensuring the development of safe mobility and independence with functional tasks. Currently, dynamic balance could be evaluated using clinical or laboratory tests. However, clinical balance tests are more practical and cheaper than laboratory-based tests (5). In clinical settings, both single balance measures and batteries of balance tests can be used for evaluating stability during locomotion in typically developed children. The timed up & go (tug) test, pediatric balance scale, berg balance scale, functional walking test, and timed up and down stairs are commonly used tests and have evidence for good validity and reliability (6). Among these tests, no single measure has been reported as the gold standard in the assessment of dynamic balance in children. Therefore, the use of tests, in combination, could substantially enhance the prediction of overall dynamic balance (6). In recent years, in addition to these dynamic balance tests, the four square step test (FSST), which was originally designed for the elders (7), has been the subject of research for dynamic balance assessment of pediatric populations. It was shown that FSST was a valid and reliable measure for assessing the dynamic balance in children with cerebral palsy and Down syndrome (8,9). In a pilot study conducted in 15 typically developed children, Salis and Samuel have found that the FSST had good inter- and intra-rater reliability. The authors have noted the need for further researches in large sample size (10). In another study conducted in 30 typically developed children, Leizerowitz and Katz-Leurer have reported that the lenient version of the FSST was a feasible, moderately reliable, and valid test to assess dynamic balance in this population (11). Based on the current literature, it appears that there is insufficient evidence to support the use of the FSST in typically developed children. The purpose of this study was to evaluate the concurrent and discriminative validity and reliability of FSST, and the level of agreement between the raters for, TUG and FSST in typically developed children.

METHODS

Study Design and Participants

This observational study was carried out at Cihangir-Düzova Elementary School in Famagusta, North Cyprus, between October 2018 and January 2019 after the approval of the Eastern Mediterranean University BAYEK Health Ethics Subcommittee. Before the study, the Directorate of North Cyprus Primary Education Department was informed for the study and the permission was obtained. Written informed consent was obtained from all participants' primary caregivers and assent. A priori sample size calculation was performed using the PASS (2005), taking into account the statistical tests to be used in the analyses (12). A sample size of 146 subjects with four observations per subject achieves 80% power to detect an ICC of 0.60 under the alternative hypothesis when the ICC under the null hypothesis is 0.50 using an F-test with a significance level of 0.05. Considering the drop-out risk of the participants due to various reasons, the initial sample size was increased to 150 subjects. Inclusion criteria used for selecting the subjects were (1) aged 5 to 10 years, (2) absence of musculoskeletal or neurological disorders, (3) no history of any orthopedic surgery, and (4) not uncorrected visual acuity.

Assessors and Procedures

Two physiotherapists with four years of experience in physiotherapy and rehabilitation units assessed participants on two separate days. Before the trial, testing instructions to be delivered to participants (7,13) were translated and adapted into Turkish.

In order to maximize potential agreement and to improve rating accuracy, reliability, and validity, assessment skills of the raters were refreshed through training.

The administration of the tests was performed in a corridor of the school. Assessments were performed in a quiet and adequately lighted environment to minimize the distraction. Participants were tested with their regular footwear. The demographic information of participants was recorded. The dynamic balance performances on the FSST were assessed by Rater A and B independently, and this assessment repeated 24-h later. In order to avoid any discrimination between children participating in the study, the TUG test also was repeated by two raters with a 24-hour interval. The participants were allowed to rest up to five minutes between the sessions. A stopwatch was used to measure time to complete the FSST and TUG tests.

FSST Assessment Protocol

A square was formed by using four 90 cm long canes placed on the ground. The sequence was explained and demonstrated to the participants. They were allowed one practice trial and, subsequently, two trials. Instructions were given and encouraged to complete the sequence as fast as possible without touching the canes. The sequence of trial was 1,2,3,4,1,4,3,2,1. If a participant touched canes or performed test sequences inaccurately, or both feet of the participant did not make contact with the floor in each square, the trial was considered as unsuccessful, and the test was repeated. One unsuccessful trial was allowed. The best time was taken as the score of FSST, which was completed successfully (10,11).

TUG Assessment Protocol

A three-meter pathway on the testing floor was marked with red-colored masking tape. The TUG was administered using one standard chair. The TUG was explained and demonstrated to the participants. They were allowed one practice trial and, subsequently, two trials. If the participant ran on the pathway, or stopped at the turn, or did not sit down right away, the trial was considered as unsuccessful, and the test was repeated. One unsuccessful trial was allowed. The best time was taken as the score of TUG, which was completed successfully (6).

Statistical Analysis

All statistical analyses were carried out using the IBM SPSS Statistics software version 22.0 (IBM Corporation, Armonk, NY, USA). Before statistical tests were conducted, we checked potential outliers and missing data. Normal distribution assumptions of the data were checked using the Shapiro-Wilk test. Evaluations of concurrent and discriminative validity were based on the mean scores from the first measurement of rater A. Pearson's correlation coefficient (r) was used to assess the concurrent validity of FSST. Pearson's correlation coefficient was interpreted as follows: 0.00-0.19=very weak; 0.20-0.39=weak; 0.40-0.59=moderate; 0.60-0.79=strong; and 0.80-1.00=very strong (14). Dynamic balance is influenced by multiple variables, including biological fitness and age (15,16). Based on the literature, we hypothesized that FSST classifies children into age groups based on the dynamic balance assessments. The children were divided into three age groups: (1) 5- to 6-year-olds (2) 7- to 8-year-olds, and (3) 9- to 10-year-olds. Between-groups discriminative validity of the FSST was evaluated using the one-way analysis of variance (ANOVA) with Bonferroni post-hoc test. Both intra- and inter-rater reliability were assessed using intraclass correlation coefficients (ICC). ICC2.1 and ICC2.2 estimates and their 95% confidence intervals were calculated based on absolute-

Table 1: Characteristics of the Participants (n=150).

Variables	Participants (n=150)	
	Mean±SD	Min-Max
Age (years)	7.79±1.68	5-10
Gender (females/males)	77/ 73[§]	51.3/48.70[∂]
Weight (kg)	29.24±9.30	16-67
Height (cm)	128.83±10.42	104-157

[§]frequency, [∂]percentages.

Table 2: Our Square Step Test Scores of Children by Age Groups Based on the First Assessment of Rater A.

Age Groups	n	Mean±SD	Min-Max	95% CI† for mean	p§
5-6 years	31	5.43±0.95	4.03-7.47	5.08-5.78	**0.001***
7-8 years	53	4.41±0.80	3.05-6.53	4.19-4.63	
9-10 years	66	3.95±0.66	3.00-5.61	3.79-4.11	

*p<0.05. §One-way ANOVA, Bonferroni Alpha=0.016, †CI: Confidence Interval.

agreement (17,18). ICC estimates were interpreted as follows: <0.50=poor; 0.50-0.75=moderate; 0.75-0.90=good; and >0.90=excellent reliability (17).

Bland and Altman plots were constructed to demonstrate agreement between TUG and FSST, and between assessments of rater A and B. The mean difference between the assessments was reported as bias. The mean difference ± (standard deviation of the mean difference multiplied by 1.96) was reported as 95% limits of agreement (LOA). Bland and Altman recommended that 95% of data points should lie within two standard deviations of the mean difference for a good agreement (19). The statistical significance level was set at p<0.05.

RESULTS

The characteristics of the participants are shown in Table 1. A total of 150 subjects aged between 5 and 10 were included in the study.

The FSST demonstrates statistically significant strong positive correlation (r=0.685, 95% CI; 0.589-0.761 p=0.001) with the TUG. As shown in Table 2, results from the one-way ANOVA analysis showed that dynamic balance assessed using the FSST were able to distinguish between the groups ($F_{(2.147)}$=38.293, p=0.001). Bonferroni post-hoc analysis indicated significant differences between the mean FSST score of each age category (all p's <0.05). The 95% confidence intervals of the FSST scores in each age category did not overlap.

ICC2.1 estimate for inter-rater reliability was 0.86 (95% CI; 0.81-0.90). ICC2.2 estimate for intra-rater reliability was calculated as 0.81 (95% CI 0.74-0.86).

On the Bland and Altman plot, for the first day assessments of the FSST, the 95% of the data points were within the ±1.96SD of the mean difference (Figure 1). Upper LOA and lower LOA were -1.11 and 0.87, respectively. Bias was calculated as -0.12±0.50 (95% CI -0.3-0.04).

The Bland and Altman plot for data based on the Rater B assessments of TUG and FSST indicated that 96% of the data points were within ±1.96SD of the mean difference (Figure 2). Upper LOA and lower LOA were 2.04 and -1.1, respectively. Bias

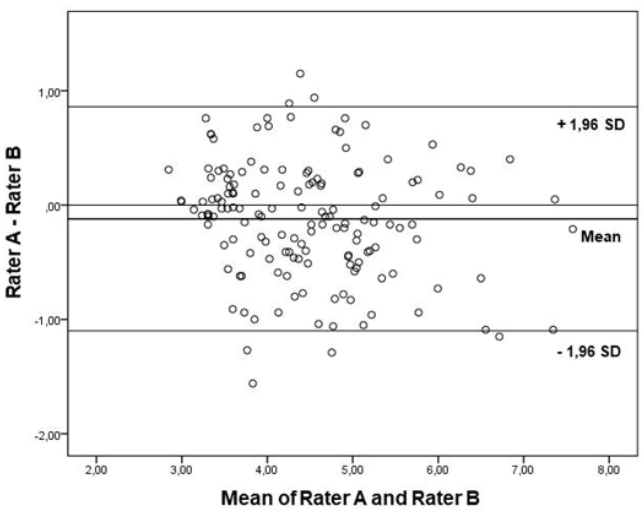

Figure 1: Bland and Altman plot for the data based on first the four square step test assessments of Rater A and Rater B.

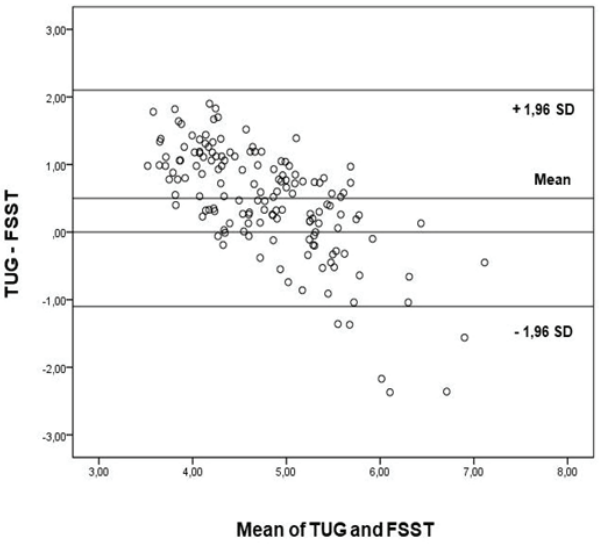

Figure 2. Bland and Altman plot for data based on the Rater B assessments of the timed up and go test and the four square step test.

was calculated as 0.47±0.8 (95% CI 0.3-0.6).

DISCUSSION

The results of this study indicated that the FSST was significantly related to the TUG. It also demonstrated good discriminative validity by differentiating children according to their age groups. The FSST scores were stable and consistent over repeated administrations. There was a good inter-rater agreement. However, the level of agreement between the FSST and TUG was not sufficient.

Leizerowitz and Katz-Leurer have found a moderately significant correlation between the original form FSST and TUG scores (rs=0.53; 95% CI 0.21-0.75, p<0.05) (11). Contrary to their finding, we found a strong correlation between FSST and TUG scores (r=0.69, 95% CI 0.59-0.77, p=0.001). If we consider 95% CI's of the size of correlation coefficients, it is clear that there is an overlapping between the interval estimates. Therefore, this result could not be interpreted as dissimilarity of the findings of two studies.

Maturation and maintenance of balance is a complex and active sensorimotor function (20,21). Proprioceptive, visual, vestibular, and cognitive systems play a significant role in balance control. The maturation of these systems does not take place at the same time. Previous studies reported that maturation of the proprioceptive system takes place at 3 to 4 years of age, subsequently visual and vestibular systems (22,23). Lonescu et al. reported that the maturation process occurs throughout childhood until the age of 12 years (24) and does not reach adult level, even at the age of 14-15 years (25). Based on this finding, it was expected that any test used to assess the dynamic balance of typically developing children should differentiate the age groups. In this study, those children with lower age groups were rated as exhibiting low levels of dynamic balance control. This is an expected finding indicating that the FSST has also a good discriminative validity. However, it should be noted that no other studies have been conducted to investigate the discriminative validity of the FSST on these age groups, therefore it is difficult to support this finding in relation to the literature.

ICC based results of this study showed that the inter-rater reliability of the FSST scores was good. Intra-rater estimates ranged from moderate to good. Both findings were in agreement with the previous studies (10,11).

In this study, we found that 95% of the data points of Rater A and B were within ±1.96 SD of the mean difference of their assessments. The bias was

not significant because the line of equality that is "0" line was within the confidence interval of the mean difference of two assessments. This finding indicated that the inter-rater agreement of the FSST scores was good. On the contrary, there was a significant bias on the mean difference of the FSST and TUG scores. Because the line of equality was not within the confidence interval of the mean difference of the FSST and TUG scores, based on this result, we concluded that the FSST could not be used in place of the TUG. It was not surprising that the TUG, and FSST was used to detect different types of balance and mobility. The FSST is used to assess dynamic stability and the ability of the subject to step over low objects forward, sideways, and backward. On the contrary, the TUG test is used to assess a person's mobility that requires both static and dynamic balance.

This study was conducted on children aged 5-10 years. Therefore, results cannot be generalized to children of all ages. It is a limitation of the study. The strength of this study was two folds. Firstly, the study was conducted on a sufficiently powered sample size. Secondly, in this study, both statistical and graphical methods were used to establish the agreement of two tests. In conclusion, the FSST test is a valid and reliable method to measure the dynamic balance of typically developed children. Further study is needed to establish strong evidence on the issue.

Sources of Support: No funding was received for this study.

Conflict of Interest: The authors declare no conflict of interest for the study.

Ethical Approval: The Eastern Mediterranean University BAYEK Health Ethics Subcommittee, ETK00-2018-0252 (Approval Date: 15.10.2018, and Approval Number: ETK00-2018-0252).

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FUNCTIONAL INDEPENDENCE AND MUSCLE STRENGTH IN ACUTE RESPIRATORY FAILURE WITH AND WITHOUT NON-INVASIVE MECHANICAL VENTILATORY SUPPORT

ORIGINAL ARTICLE

ABSTRACT

Purpose: Development of muscle weakness is common in the course of acute respiratory failure (ARF). This study aimed to compare muscle strength and physical function in subjects with ARF undergoing noninvasive mechanical ventilation (NIV) added to standard medical treatment (SMT) and SMT only in the intensive care unit.

Methods: Thirty-two subjects with ARF (19 NIV and 13 SMT) were included. Subject characteristics were recorded. Peripheral muscle strength was measured using the Medical Research Council Scale (MRC) and handgrip strength. Functional independence was evaluated using the Barthel Index (BI).

Results: In the NIV group, proximal muscle strength (shoulder abduction) was significantly lower than distal limb strength (wrist extension) (p=0.030). In both groups, proximal lower limb strength (hip flexion) was also significantly lower than distal limb strength (ankle dorsiflexion) (p=0.002). The BI total score was significantly lower in the NIV group than that of the SMT group (p=0.016). The BI score was significantly related to the MRC sum score (r=0.633) and handgrip strength (r=0.629, p<0.05).

Conclusion: Functional independence and proximal muscle strength compared to distal adversely affected in patients undergoing NIV for ARF. Weakness or functional limitations may prevent patients from functioning adequately in rehabilitation practices in intensive care.

Key Words: Intensive Care; Muscle Strength; Noninvasive Ventilation; Respiratory Failure.

NONİNVAZİV MEKANİK VENTİLASYON DESTEĞİ OLAN VE OLMAYAN AKUT SOLUNUM YETMEZLİĞİNDE FONKSİYONEL BAĞIMSIZLIK VE KAS KUVVETİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Akut solunum yetmezliği (ASY) sürecinde kas zayıflığı gelişimi sıktır. Bu çalışmanda yoğun bakımda ASY nedeni ile tek başına standart medikal tedavi (SMT) ve SMT'ye ek olarak noninvaziv mekanik ventilasyon (NIV) uygulanan olgularda kas kuvveti ve fonksiyonel bağımsızlığı karşılaştırılmak amaçlandı.

Yöntem: Çalışmaya ASY ile izlenen 32 olgu (19 NIV ve 13 SMT) dahil edildi. Olguların özellikleri kaydedildi. Periferal kas kuvveti için Medical Research Council Skalası (MRC) kullanıldı ve el kavrama kuvveti ölçüldü. Fonksiyonel bağımsızlık düzeyi Barthel İndeksi (Bİ) ile değerlendirildi.

Sonuçlar: NIV grubunda proksimal kas kuvveti (omuz abduktorleri) distal ekstremite kas kuvvetinden (el bileği ekstansorleri) anlamlı olarak daha düşüktü (p=0,030). Her iki grupta, proksimal alt ekstremite kas kuvveti (kalça fleksiyonu), distal ekstremite kas kuvveti (ayak bileği)'nden anlamlı olarak daha azdı (p=0,002). NIV grubunun Bİ toplam puanı SMT grubundan anlamlı olarak daha düşüktü (p=0,016). Bİ puanı, MRC toplam puanı (r=0,633) ve el kavrama kuvveti (r=0,629) ile ilişkiliydi (p<0,05).

Tartışma: ASY nedeni ile NIV uygulanan hastalarda fonksiyonel bağımsızlık ve distal kas kuvveti ile karşılaştırıldığında proksimal kas kuvveti olumsuz yönde etkilenmektedir. Yoğun bakımda rehabilitasyon uygulamalarında zayıflık veya fonksiyonel kısıtlılığın hastaların uygun fonksiyon görmesini engelleyebileceği göz önünde bulundurulmalıdır.

Anahtar Kelimeler: Yoğun Bakım; Kas Kuvveti; Noninvaziv Ventilasyon; Solunum Yetmezliği.

INTRODUCTION

Muscle wasting and functional weakness are common after intensive care unit admission resulting from presenting illness, immobility, and treatments, including prolonged mechanical ventilation (1-2). Assessment of limb muscle strength is essential in subjects who are at risk of developing intensive care unit acquired weakness (3,4). Peripheral muscle weakness is associated with significant disability, mortality, and delayed rehabilitation (3,4).

Current practice in the intensive care unit has been changed to use less sedation, more physical activity, and mobilization. In acute respiratory failure, noninvasive mechanical ventilation (NIV) provides ventilatory support without a need for an invasive airway approach. The NIV has been shown to reduce mortality, need for intubation, and length of intensive care unit stay (5-7). The NIV has also been used to allow mobilization during the stay in the intensive care unit (8). It has been suggested that the NIV application might allow breathless subjects to exercise and prevent loss of muscle strength and function (9).

Although, the use of NIV is a common practice in the intensive care unit, to our knowledge, no previous study in the literature investigated whether muscle strength and physical function of subjects undergoing NIV were similar to less severe subjects receiving standard medical treatment (SMT). Therefore, the present study aimed to investigate muscle strength and functional capacity in subjects with acute respiratory failure undergoing NIV added to SMT compared to SMT alone. The secondary aim of the study was to investigate the association between peripheral muscle strength and functional independence in patients with acute respiratory failure.

METHODS

During two years (February 2009 and February 2011), we observed consecutive subjects with acute respiratory failure in a 9-bed adult medical intensive care unit of a university hospital. Hacettepe University Ethics Committee approved the study (Approval Date: 27.01.2009 and Approval Number: LUT 08/52-4). Subjects or relatives, as appropriate, gave informed consent to participate in this study. Intensive care subjects with acute respiratory failure (10), as judged by the attending physician, were included in this study. Exclusion criteria applied at intensive care unit admission were previous intubation before admission to intensive care unit, recruitment for invasive mechanical ventilation, previous neuromuscular weakness, stroke, postoperative status, pregnancy, injury preventing the evaluation of six muscle groups, inability to follow verbal instructions, and inability to provide informed consent. Hemodynamic instability (systolic blood pressure >200 mmHg and <80 mmHg, diastolic blood pressure >100 mmHg and <50 mmHg) was checked at the time of strength testing. Subjects' respiratory status (MV, oxygen therapy using a nasal cannula or venturi mask) was recorded from the nursing charts daily. The primary intensive care unit team provided the treatments. The attending physician took the decisions related to management. All subjects received SMT (antibiotics, bronchodilators, corticosteroids, mucolytics, theophylline, oxygen therapy with a nasal cannula, and venturi mask). The dose of corticosteroids was 20-40 mg/day. Subjects in the NIV group received noninvasive ventilatory support besides the SMT. Whether subjects received physiotherapy rehabilitation, applied by the primary physiotherapy team, in the intensive care unit, was recorded.

Patient characteristics, admission findings, chest radiography findings, and arterial blood gas tensions were recorded (10). Functional status before the development of acute respiratory failure was assessed using a 0-4 point category scale (0=working, 1=independent, 2=restricted, 3=housebound, 4=bed-or-chair bound). Lower scores were indicating a higher level of functional status (11). Illness severity and level of consciousness were evaluated using the Acute Physiology and Chronic Health Evaluation II (APACHE II) system and the Glasgow Coma Scale, respectively (10). The presence of delirium judged by psychiatric evaluation was recorded. Length of stay in the intensive care unit and duration of NIV were recorded.

Upper and lower extremity muscle strength was evaluated using the the Medical Research Council (MRC) scale. The range of MRC muscle test scores is 0 to 60 (six muscle groups, shoulder abduction, elbow flexion, wrist extension, hip flexion, knee extension, and ankle dorsiflexion, were examined on each side between 0 and 5 grade). A clinical diagnosis of intensive care-acquired weakness is made based upon a sum score of less than 48/60 (1,12). Handgrip strength was measured using a dynamometer (Baseline Standard Hydraulic Hand Dynamometer 90 kg, Baseline, USA) (13) upon subjects' clinical stability and obeying simple commands and when they were clinically stable, as judged by the attending physician, from clinical findings, hemodynamics, and arterial blood gases. A physiotherapist independent of clinical decisions for the subjects performed the measurements of strength and functional independence test.

Subjects' physical function and level of disability were assessed using the Barthel Index (14). Each item is rated on a 3-point scale (0=unable, 1=needs help, 2=independent). The final score is multiplied by five to get a number on a 100-point score. In Barthel Index, scores of 0-20 indicate "total" dependency, 21-60 indicate "severe" dependency, 61-90 indicate "moderate" dependency, and 91-99 indicate "slight" dependency. The Barthel Index was

Table 1: Characteristics of the Subjects.

Variables	NIV (n=19)	SMT (n=13)	p value
	Mean±SD	Mean±SD	
Age (years)	57.53±13.86	54.69±16.07	0.820
Gender (male/female), n	15/4	7/6	0.130
Height (cm)	169.58±6.17	165.23±7.80	0.140
Body Weight (kg)	76.79±17.11	77.61±19.82	0.850
Body Mass Index (kg/m^2)	25.46±6.29	28.70±8.54	0.430
Admission Findings			
Heart Rate (bpm)	102.53±19.71	106.08±24.39	0.880
Systolic Blood Pressure (mmHg)	122.21±28.72	125.23±32.15	0.650
Diastolic Blood Pressure (mmHg)	72.11±20.36	75.69±17.12	0.650
Respiratory Rate (bpm)	33.68±621.41	27.54±5.30	0.570
Blood Glucose (g/dL)	124.68±31.05	131.59±33.22	0.910
Albumin (g/dL)	3.28±0.56	3.67±7.68	0.075
Creatinine (mg/dL)	1.35±1.01	2.70±5.60	0.590
ALT (U/L)	84.75±158.89	99.87±258.16	0.320
APACHE II Score (0-71)	17.95±5.70	16.15±5.71	0.550
Acute Physiology Score	9.58±4.45	8.77±3.51	0.710
Glasgow Coma Scale (0-15)	14.58±1.02	15.00±00	0.470
Arterial Blood Gases			
pH	7.32±0.09	7.41±0.05	**0.011***
$PaCO_2$ (mmHg)	67.10±25.16	39.56±14.18	**0.002***
PaO_2 (mmHg)	52.67±15.14	60.81±25.36	0.570
Length of Stay in ICU (days)$^\phi$	7.91 (2.77-22)	5.01 (0.67-19.98)	**0.022***
Time for Evaluation (day) $^\phi$	5 (2-16)	2.5 (1-13)	**0.017***
MRC Sum Score (0-60)	55.68±3.67	57.85±3.00	0.180
Handgrip Strength (kg)	26.63±8.29	25.00±7.27	0.680
Barthel Index Total Score (0-100)	46.05±16.46	66.92±17.02	**0.016***

*p<0.05. $^\phi$Median (Min-Max). Mann Whitney-U test. NIV: Noninvasive Mechanical Ventilation, SMT: Standard Medical Treatment, ALT: Alanine Aminotransferase, APACHE II: Acute Physiology and Chronic Health Evaluation II, $PaCO_2$: Arterial Carbon Dioxide Pressure, PaO_2: Arterial Oxygen Partial Pressure, MRC: Medical Research Council, ICU: Intensive Care Unit.

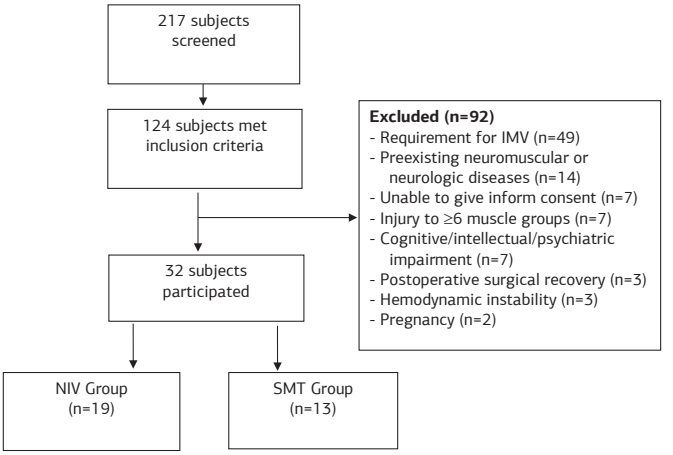

Figure 1: Flow Diagram of the Participants in the Study. (IMV: İntensive Mechanical Ventilations, NIV: Noninvasive Ventilation, SMT: Standard Medical Treatment).

applied on the same day as strength measurements.

Statistical Analysis

Statistical analysis was performed using SPSS 16.0 program (SPSS Inc, Chicago, IL, USA). Results were expressed as mean±standard deviation (mean±SD), median (mix-max) frequencies, and percentages. The normality of the data was checked using the Shapiro-Wilk test. Because of nonparametric test conditions, groups were compared using Mann Whitney u test and Chi-square test, as appropriate. Spearman rank correlation was used to analyze the relationship between the variables. Analyses were performed as a two-tailed, and the descriptive level of significance was set at $p<0.05$. According to the post hoc power analyses (G*Power, ver. 3.1, Heinrich Heine University Düsseldorf, Düsseldorf, Germany) based on the Barthel Index scores of two groups, the power of the study (1-β) was 90%.

RESULTS

Two hundred and seventeen subjects were screened during the study period. One hundred twenty-four subjects met the inclusion criteria, and 92 subjects were excluded (Figure 1). Thirty-two intensive care subjects with acute respiratory failure were included. Nineteen subjects were in the NIV group, and 13 subjects were in the SMT only group (served as controls). The NIV and SMT groups were similar in terms of age, gender, height, body weight, body mass index, and admission findings ($p>0.05$, Table 1), except arterial pH and arterial carbon dioxide

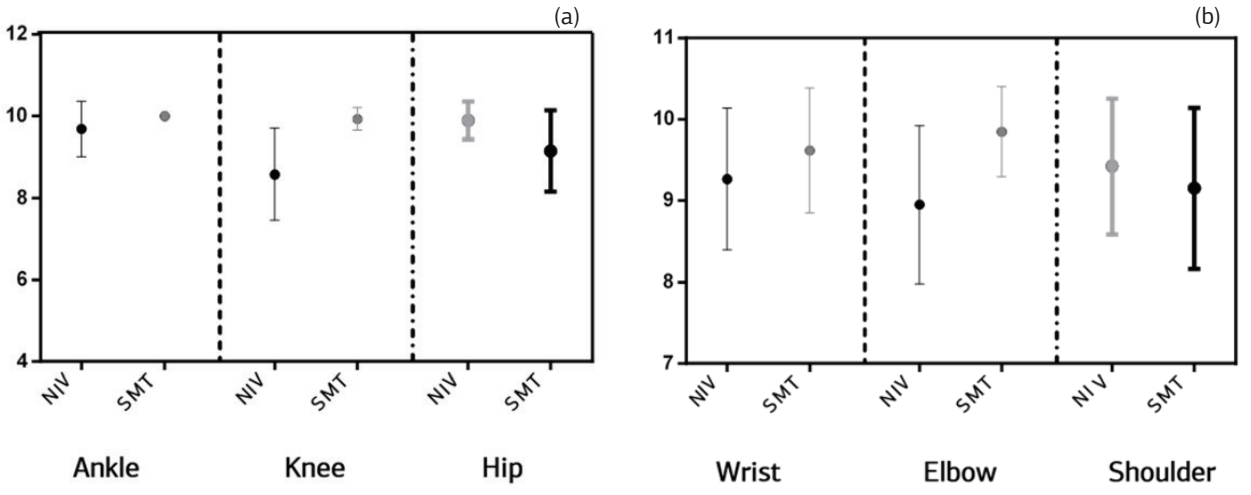

Figure 2: Strength Assessment by the Muscle Group. (a) Lower Extremity and (b) Upper Extremity in NIV and SMT Groups (NIV: Noninvasive Mechanical Ventilation, SMT: Standard Medical Treatment).

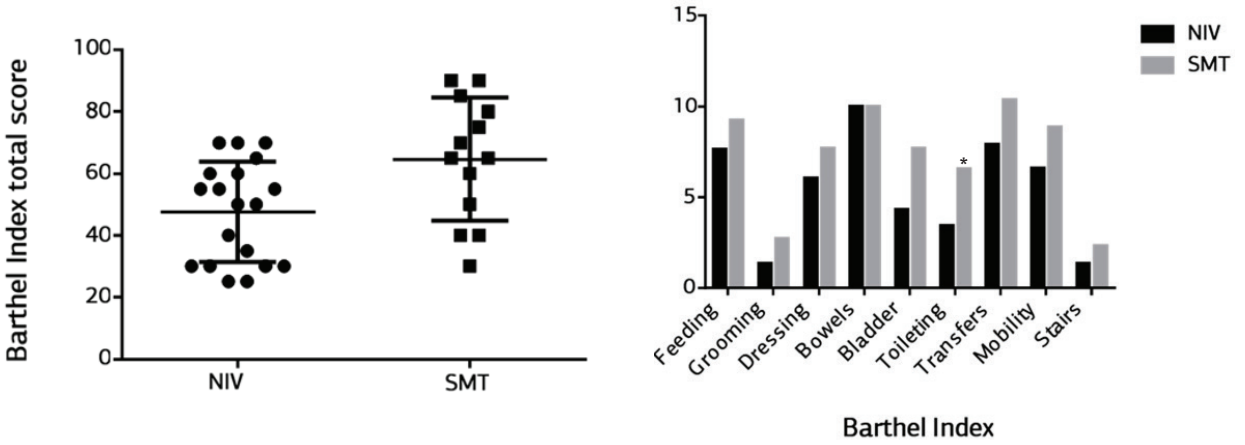

Figure 3: Distribution of Score of Barthel Index Total Score (a) and Individual Items (b) as well as the Barthel Index Total Score (b) in NIV and SMT Groups (p=0.016 for Barthel Index Total Score and *p=0.016 Toileting Score) (NIV: Noninvasive Mechanical Ventilation, SMT: Standard Medical Treatment).

pressure (p<0.05, Table 1). According to pre-admission functional capacity, 15.8% of patients were working, 31.6% of patients were independent, 26.3% of patients were restricted, 21.1% of patients were housebound, and 5.3% of patients were bed-or-chair bound in the NIV group. The 15.4% of patients were working, 23.1% of patients were independent, 46.2% of patients were restricted, and 15.4% of patients were housebound in the SMT group. There was no statistically significant difference in terms of pre-admission functional capacity between the groups (p=0,754). The 26.3% of patients had a type-I respiratory failure, and 73.7% of patients had type-II respiratory failure in the NIV group as admission diagnosis. In the SMT group, 61.5% of patients had a type-I respiratory failure, and 38.5% of patients had a type-II respiratory failure. No significant differences were found in the acute physiology score, APACHE II score, and Glasgow Coma Scale score between the two groups (p>0.05, Table 1). Drug therapy used was similar between the groups, and none of the subjects required sedation (p>0.05). One subject from NIV group had delirium (p=0.59). Ten subjects from the NIV group and six subjects from the SMT group received physiotherapy and rehabilitation during the intensive care unit stay (p>0.05, Table 1). In the NIV group, duration of ventilatory support was 2.66 (0.66-5.55) days, and pressure support (n=16) and pressure-controlled modes (n=3) were

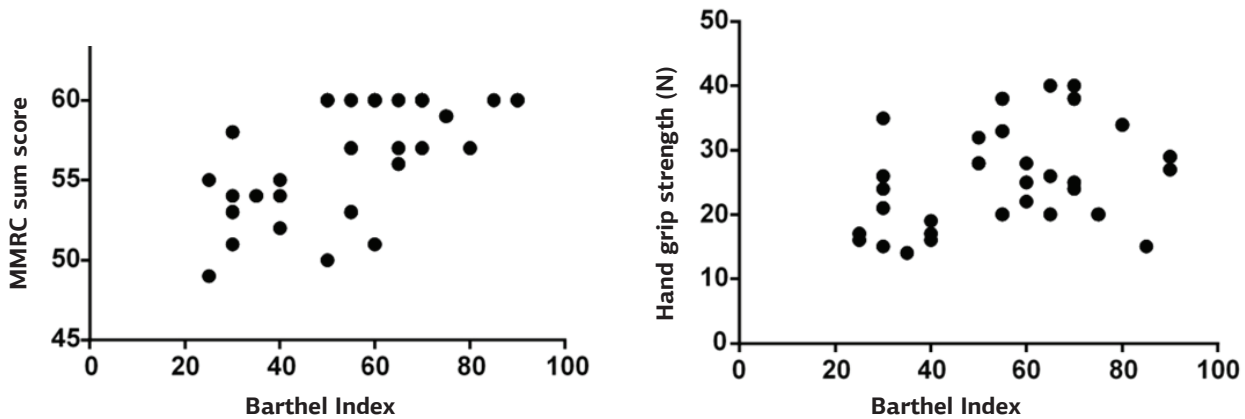

Figure 4: Relationship between the Barthel Index Total Score and (a) the MRC Scale Sum Score (r=0.633, p=0.004) and (b) Handgrip Strength (r=0.629, p=0.004) in NIV and SMT Groups (NIV: Noninvasive Mechanical Ventilation, SMT: Standard Medical Treatment).

used as ventilatory support.

Neither MRC scale sum score, upper and lower muscle strength, and handgrip strength nor MRC sum score and handgrip strength expressed relative to body weight were not significantly different between the two groups ($p>0.05$, Table 1). In the NIV group, proximal muscle strength (shoulder abduction) was significantly lower than distal limb strength (wrist extension) ($p=0.030$) and elbow flexion strength ($p=0.034$, Figure 2). In both NIV and SMT groups, proximal lower limb strength (hip flexion) was also significantly lower than distal limb strength (ankle dorsiflexion) ($p=0.002$, Figure 2).

Thirteen of NIV subjects and four of SMT subjects had a severe disability, and six of NIV and nine of SMT subjects had a moderate level of disability, based on the Barthel Index ($p<0.05$). The total Barthel Index score and toileting subscale score were significantly lower in the NIV group than those of the SMT group ($p<0.05$, Table 1, Figure 3).

The Barthel Index score was significantly related with MRC sum score ($r=0.633$, $p=0.004$, Figure 4), MRC upper extremity sum score ($r=0.597$, $p=0.007$) and lower extremity sum score ($r=0.584$, $p=0.009$), shoulder muscle strength ($r=0.681$, $p=0.001$) and hip muscle strength ($r=0.542$, $p=0.016$). Similarly, there was a significant relationship between Barthel Index score and dominant handgrip strength ($r=0.629$, $p=0.004$, Figure 4) and handgrip strength expressed relative to the body weight ($r=0.670$, $p=0.002$).

DISCUSSION

The main findings of the present study were that subjects undergoing NIV due to acute respiratory failure had lower proximal muscle strength and physical function as compared with the subjects receiving SMT only.

NIV is the first-line treatment for certain forms of acute respiratory failure in the intensive care. However, no previous study has investigated muscle strength in subjects undergoing NIV in the intensive care unit. In the current study, by measuring peripheral muscle strength using two different approaches, we found that subjects undergoing NIV had similar handgrip strength and MRC sum scores but had a lower proximal muscle group strenght both in the upper and lower extremities. Previously, a more reduction in proximal muscle strength compared with distal muscle strength has been observed (12). Underlying myopathic changes could affect mainly proximal regions of the limb (12,15). Despite having more severe acute respiratory failure, our subjects undergoing NIV did not develop severe total weakness. Application of NIV may allow functioning and might prevent muscle dysfunction in our subjects.

Acute illness, immobilization, mechanical ventilation, sedation, and corticosteroids are the parameters affecting functional capacity in the intensive care unit (16). The Barthel Index is relevant to assess functional status for subjects across their continuum of acute illness (4,17). Lower Barthel Index total score in the NIV group as compared with the SMT only indicated a different physical function in the intensive care unit. We found severe disability (<55 points) in 13 subjects and a moderate level of disability (55-90 points) in six subjects undergoing NIV plus SMT according to the Barthel Index. In contrast, the number of subjects having a severe and moderate level of disability in SMT only group was somewhat lower (four and nine subjects, respectively). These findings suggested that there were substantial differences between functional measurements, probably due to proximal muscle weakness. There is a lack of data linking muscle strength to objective measures of physical function in acute illness. We found that physical function measured using the Barthel Index scores was associated with global strength as well as proximal muscle strength. Determining muscle strength separately in upper and lower extremities and specific muscle groups using the MRC scale may help prognosticate a patient's ability to perform specific functional tasks (18). The ratio of muscle strength and muscle size (body mass) is known as a specific force and considered to be an expression of muscle quality (18). In our study, physical function was associated with the specific force determined using handgrip strength, and MRC sum score. Subjects with mild or no weakness, could still have either weakness relative to their baseline or limited function due to impairments in associated elements of neuromuscular control (19). Determination of factors affecting physical function and effects

application of an early individual activity training needs further investigation.

There are some limitations to our study. We used volitional tests to measure muscle strength, and this approach may affect the obtained results. However, these tests are frequently used in intensive care unit studies (1,11,18). In volitional tests, determination of the force generated by an isolated muscle group using electrical or magnetic neuromuscular twitch stimulation, are challenging to perform in an intensive care unit setting (expenses, time investment, and requirement of expert knowledge), and therefore have limited widespread clinical applicability (3,20). Secondly, the timing of strength and functional capacity assessments in NIV and SMT groups occurred within three and two days, respectively, which could create a difference in physical function between the groups, but it reflects transparent reporting practice. Third, there were more males in the NIV group, which was due to a higher number of chronic obstructive pulmonary disease subjects in this group that is a primary indication for the use of NIV in acute respiratory failure. In addition, the inclusion of subjects with respiratory failure from multiple causes of a variety of etiologies may have resulted in varying levels of functional capacity before illness (10) that may have an impact on the results, particularly if at a chronic level. However, there was no significant difference in pre-admission functional status at admission across the groups. Besides, this could reflect common practice in the acute care setting. The studies performed in the intensive care unit include subjects with diverse etiological factors and drive similar physiological derangements, which could be quantified in physiological scoring systems and used within variable success to predict intensive care outcomes. In addition, muscle biopsies from critically ill subjects demonstrate histopathological similarities across different disease groups (20).

In conclusion, subjects undergoing NIV due to acute respiratory failure have proximal muscle weakness and impaired physical function. The use of the Barthel Index could determine the functional loss in intensive care subjects. Either weakness or limited function due to impairments in associated elements of neuromuscular control may prevent subjects from functioning more efficiently in rehabilitation practices in intensive care. Further study is needed to clarify the mechanism of muscle dysfunction and functional independence in the intensive care.

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RELATIONSHIP BETWEEN TRUNK MUSCLE ENDURANCE, PULMONARY FUNCTION, AND RESPIRATORY MUSCLE STRENGTH IN HEALTHY INDIVIDUALS

ORIGINAL ARTICLE

ABSTRACT

Purpose: Trunk muscles are acrive in the forceful expiration, and trunk this study aimed to examine the relationship between pulmonary function, respiratory muscle strength, and trunk muscle endurance.

Methods: The study was conducted with 60 volunteer and healthy individuals whose ages varied between 20 and 36 years. Pulmonary function and maximum inspiratory and expiratory pressure (MIP and MEP) were measured using a desktop spirometer. Trunk muscle endurance of the subjects was evaluated using the prone bridge, side bridge, flexor endurance, and Sorensen tests.

Results: A positive significant relationship was observed between the percentage of forced vital capacity (%FVC) and prone bridge (r=0.395, p=0.002), flexor endurance (r=0.256, p=0.049), and Sorensen (r=0.255, p=0.049) tests. Likewise, a positivesignificant correlation was found between the percentage of forced expiratory volume in 1 second (%FEV_1) and prone bridge (r=0.408, p=0.001), flexor endurance (r=0.358, p=0.005), and side bridge (r=0.277, p=0.032) tests. The results revealed a positive relationship between MIP and prone bridge (r=0.376, p=0.003) and side bridge tests (r=0.470, p<0.001). Likewise, there was a positive correlation between MEP and prone bridge test (r=0.401, p=0.004) and side bridge test (r=0.365 p=0.002).

Conclusion: Pulmonary function and respiratory muscle strength are associated with the endurance of the trunk muscles, which ensure core stability. Trunk muscle endurance exercises may have a positive influence on respiratory function.

Key Words: Diaphragm; Endurance; Pulmonary Function; Respiratory Muscles; Trunk.

SAĞLIKLI OLGULARDA GÖVDE KAS ENDURANSI, SOLUNUM FONKSİYONLARI VE SOLUNUM KAS KUVVETİ İLİŞKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Gövde kasları zorlu ekspirasyon ve gövde stabilizasyonunda aktiftir. Bu çalışmanın amacı solunum kas kuvveti, solunum fonksiyon testi değerleri ve gövde kas enduransı arasındaki ilişkiyi incelemekti.

Yöntem: Çalışma yaşları 20 ile 36 yıl arasında değişen 60 sağlıklı gönüllü üzerinde yapıldı. Olguların maksimum inspiratuar ve ekspiratuar kas kuvveti (MIP ve MEP) ve solunum fonksiyon testi masaüstü spirometre ile değerlendirildi. Bireylerin gövde kas enduransı yüzüstü köprü, yan köprü, fleksör endurans ve Sorensen testleri ile belirlendi.

Sonuçlar: Zorlu vital kapasite yüzdesi (%FVC) ile yüzüstü köprü (r=0,395, p=0,002), fleksor endurans (r=0,256, p=0,049) ve Sorensen testleri (r=0,255 p=0,049) arasında pozitif yönde anlamlı ilişki tespit edildi. Birinci saniyedeki zorlu ekspiratuar volüm (%FEV_1) ile yüz üstü köprü (r=0,408, p=0,001), fleksör endurans (r=0,358, p=0,005) ve yan köprü testleri (r=0,277, p=0,032) arasında pozitif anlamlı korelasyon bulundu. MIP ile yüz üstü köprü (r=0,376, p=0,003) yan köprü testleri (r=0,470, p<0,001) arasında pozitif ilişki saptandı. MEP ile yüzüstü köprü (r=0,401, p=0,002) ve yan köprü (r=0,365, p=0,004) testleri arasında pozitif yönde anlamlı korelasyon olduğu bulundu.

Tartışma: Solunum fonksiyonları ve solunum kas kuvveti ile gövde stabilizasyonu sağlayan kasların enduransı ilişkilidir. Gövde kas enduransı egzersizlerinin solunum fonksiyonlarına pozitif yönde etki edebileceği söylenebilir.

Anahtar Kelimeler: Diyafragma; Endurans; Solunum Fonksiyonları; Solunum Kasları; Gövde.

INTRODUCTION

Diaphragm constitutes the upper group for core stability (1). Diaphragm muscle, constitutes the upper part of the cylinder involving the muscles at the back and the abdominals. When it contracts, pressure in the abdomen increases, which contributes to core stability. Diaphragm contracts in advance before extremity movements and during extremity movements, thus helping to maintain postural control (2). The diaphragm is the primary respiratory muscle that is responsible for inspiration at the same time. Functional loss that could occur in the diaphragm, which is responsible for 65 to 80 percent of the vital capacity on its own, may lead to a significant decrease in inspiratory capacity (3,4).

Anatomically, diaphragm originates from the lumbar vertebrae, and the structures involved in the diaphragm are made up of the fascia of quadratus lumborum and psoas major, which contribute to core stability. Therefore, it has a vital role in the muscular endurance of the trunk (3,5).

Of the muscle fibrils in the diaphragm, 55% are Type I, while 21% and 24% of the muscle fibrils are Type IIa and Type IIb, respectively. Type I and Type IIa fibrils have a high oxidative capacity. They contract more slowly, yet are more resistant to exhaustion (6). The intensity of these fibers makes the diaphragm a significant muscle in terms of endurance.

It was previously shown that 10% of maximal contraction is adequate to ensure spinal stabilization (7), which reveals that endurance is more important than strength in core stability. Previous studies showed that trunk muscle endurance is more functional in supporting the core structure compared to muscle strength (8). Therefore, compared to the other structures, the diaphragm may be more critical in terms of supporting trunk stability endurance due to its fiber type.

During forced expiration, particularly M. rectus abdominis, M. transversus abdominis, M. obliquus internus, and externus function actively (4). Particularly M. transversus abdominis increases the pressure in the abdomen like the diaphragm, and thus supports trunk stabilization (1). Hackett et al. showed that maximal expiratory pressure is associated with the bench press, squat, and deadlift strengths (9). In another study, the relationship between lung function, respiratory muscle strength, and peripheral muscle strength has been demonstrated (10). On the other hand, the relationship of respiratory muscle strength with the endurance of the muscles that provide core stability is uncertain. In light of this information, this study aimed to examine the relationship between the endurance of the muscles that ensure trunk stabilization and respiratory muscle strength in healthy individuals.

METHODS

Subjects and Study Design

This study was conducted in March 2017 at Gazi University, Faculty of Health Sciences, Athlete's Health Unit. The study sample was selected from the volunteers who applied to the advertisement posted at the entrance of the Athlete's Health Unit. Inclusion criteria were no chronic disease and being the ages of 18-40 years. Exclusion criteria were history of cardiopulmonary and neurological diseases, pregnancy, morbid obesity, and major surgery. After the demographic data of 73 healthy cases were collected, pulmonary function and respiratory muscle strength were measured. Since twelve subjects were not cooperating during pulmonary function and respiratory muscle strength tests, they were excluded from the study. Additionally, one subject could not complete the trunk muscle endurance tests due to abdominal pain and was excluded from the study. Therefore, statistical analysis was conducted with 60 subjects who completed all the measurements (Figure 1).

Ethical approval was obtained from Osmangazi University, Clinical Research Ethics Committee (Approval Date: 09.03.2017 and Approval Number: 15). All the subjects who volunteered to participate in the study signed the written informed consent form. All the procedures were carried out following the Helsinki Declaration.

Pulmonary Function Test

Lung function testing was performed using a

spirometer (Cosmed Pony FX Desktop Spirometer, Rome, Italy) using nose clips while the subjects were in a 90-degree relaxed sitting position. Each subject performed the test at least three times, at most eight times, and the subjects who failed to complete the maneuver successfully after eight tests were excluded from the study. Forced expiratory volume in 1 second (FEV_1), forced vital capacity (FVC), peak expiratory flow (PEF), forced expiratory flow from 25–75% ($FEF_{25-75\%}$), and percentages of predictive values were recorded. Following three successful tests, the test with the highest FVC and FEV_1 was recorded as recommended by the American Thoracic Society and the European Respiratory Society (11). Percentages of predicted values were calculated (12).

Respiratory Muscle Strength

Following the pulmonary function tests, maximal inspiratory and expiratory pressure (MIP and MEP) measurements of the subjects were performed using the Cosmed Pony FX model (Cosmed, Rome, Italy) while the subjects were in the same position with a nose clip. In both measurements, the air leak was checked strictly. Minimum five maneuvers were performed, and special attention was paid not to have more than 10 cm H_2O or 10% difference between the two best measurements. Quality control of the measurements was conducted by interpreting the pressure-time curve. Careful attention was given to obtain the highest pressure value at the beginning of the measurement. The obtained values were recorded (13,14). Percentages of predicted values were calculated according to age and gender (15).

Trunk Muscle Endurance Tests

Trunk muscle endurance of the subjects was measured using four different tests; side sridge test (SBT), prone bridge test (PBT), flexor endurance test (FET), and Sorenson test (ST). Each test position was demonstrated to the subjects, and the subjects tried the positions for a few seconds. In side bridge test application, the subjects were initially in the side-lying position (on the dominant side), but when they were ready, they were asked to raise their hip without any instruction, to support themselves with one arm in a way to keep the body in a straight line and to keep this position as long as possible. The subjects were instructed to put their free hand on the other shoulder. The duration of time in which they could maintain their position was recorded in seconds (16). In the prone bridge test application, the subjects were face down on their knees and forearms as the starting position. The subjects were asked to raise their knees parallel to the ground without any instruction when they felt ready and stand on their forearms and toes. The duration of time in which they could maintain their position was recorded in seconds. In the flexor endurance test, the subjects lay on their back as the starting position. When they felt ready, without any instruction, they pulled their knees toward their abdomen in a way to keep the knees parallel to the ground and arms wrapped around, they raised their upper trunk in a way to raise the lower end of the scapula from the ground. The duration of time in which they could maintain their position was recorded in seconds (16). In the Sorenson test, the subjects lay on a stretcher face down as the starting position, and their upper trunk overhung the stretcher. The subjects were re-positioned in a way that the part of the body that contacted with the bed was spina iliaca anterior superior. The subjects kept their balance by holding a chair with their hands. A physiotherapist fixed the subjects' legs, and when the subjects felt ready, they crossed both hands on their shoulders without any instruction, and their position was parallel to the ground. The duration of time in which they could maintain their position was recorded in seconds (16,17).

Statistical Analysis

The IBM SPSS (Statistical Package for Social Sciences) Statistics 21.0 (IBM Corp. Armonk, NY, USA) was used to conduct the statistical analysis of the data. Percentage, mean, and standard deviation values of the descriptive data were calculated. The data were analyzed using the Kolmogorov-Smirnov test and according to their skewness and kurtosis coefficients. As it was found that the data showed a normal distribution, parametric tests were used. Pearson product-moment correlation coefficient (r) was used to assess the relationship between the variables. The level of significance was taken as $p<0.05$. Power analysis was calculated as post hoc with G*power 3.1.9.2 Software (Franz Faul, Universitat Kiel, Germany). The power of the study

Table 1: Characteristics of the Subjects.

Characteristics	Healthy Subjects (n=60)	
	Mean±SD	Min-Max
Age (years)	26.33±3.98	20-36
Weight (kg)	71.23±14.70	47-36
Height (cm)	172.40±8.51	155-190
Body Mass Index (kg/m²)	23.79±3.50	18-35.41

was calculated as 96%, with an effect size of 0.49.

RESULTS

Demographic data of 60 volunteers (33 males, 27 females) are given in Table 1. The measured and percent-predicted values of FEV_1, FVC, PEF, and $FEF_{25-75\%}$ are given in Table 2. The MIP, %MIP, MEP, and %MEP, as well as trunk muscle endurance, are presented in Table 2.

Positive relationships were observed between FVC, and prone bridge test (r=0.432, p=0.001) and side bridge test (r=0.295, p=0.022) tests. The relationships between %FVC and prone bridge test (r=0.395, p=0.002), and flexor endurance test (r=0.256, p=0.049) and Sorenson test (r=0.255, p=0.049) were found to be positive and significant. There were positive significant relationship between FEV_1 and prone bridge test (r=0.414, p=0.001), flexor endurance test (r=0.268, p=0.038), and side bridge test (r=0.313, p=0.015) tests. Positive significant relationships were found between $\%FEV_1$ and prone bridge test (r=0.408, p=0.001), flexor endurance test (r=0.358, p=0.005), and side bridge test (r=0.277, p=0.032) tests. The relationship between PEF and the prone bridge test (r=0.380, p=0.003) test was found to be positive as

Table 2: Lung Function, Respiratory Muscle Strength, and Trunk Stabilization.

Measurements	Healthy Subjects (n=60)	
	Mean±SD	Min-Max
Lung Function		
FVC (L)	4.75±1.04	3-6.92
FVC (%)	104.06±10.09	81-130
FEV_1 (L)	3.87±0.76	2.47-5.26
FEV_1(%)	99.51±8.19	81-123
FEV_1/FVC	81.85±5.22	68.7-93.1
PEF (L/s)	8.60±2.07	4.05-13.41
PEF (%)	98.15±14.23	61-141
$FEF_{25-75\%}$ (L)	3.94±0.96	2.37-7
$FEF_{25-75\%}$ (%)	85.95±16.65	56-134
Respiratory Muscle Strength		
MIP (cmH_2O)	95.86±32.97	36-229
%MIP	102.86±31.09	49-204
MEP (cmH_2O)	126.60±41.20	46-268
%MEP	104.00±23.17	50-187
Trunk Stabilization		
Prone Bridge Test (s)	76.05±38.37	28-180
Flexion Endurance Test (s)	72.35±44.49	17.36-180
Side Bridge Test (s)	50.26±22.09	13.46-100.7
Sorensen Test (s)	100.49±36.58	35.82-180

FVC: Forced vital capacity, FEV_1: Forced expiratory volume in one second, PEF: Peak Expiratory Flow, $FEF_{25-75\%}$: Forced expiratory flow from 25–75%, MIP: Maximum Inspiratory Pressure, MEP: Maximum Expiratory Pressure.

Table 3: Relationship between Trunk Muscle Endurance and Lung Function and Respiratory Muscle Strength.

Measurements		Prone Bridge Test	Flexor Endurance Test	Side Bridge Test	Sorensen Test
FVC (L)	r	0.432	0.241	0.295	0.099
	p	**0.010***	0.064	**0.022***	0.450
FVC (%)	r	0.395	0.256	0.229	0.255
	p	**0.002***	**0.049***	0.078	**0.049***
FEV_1 (L)	r	0.414	0.268	0.313	0.075
	p	**0.001***	**0.038***	**0.015***	0.569
FEV_1 (%)	r	0.408	0.358	0.277	0.214
	p	**0.001***	**0.005***	**0.032***	0.101
FEV_1/FVC	r	-0.167	0.36	-0.083	-0.071
	p	0.203	0.785	0.530	0.592
PEF (L)	r	0.380	0.227	0.248	0.030
	p	**0.003***	0.081	0.056	0.819
PEF (%)	r	0.259	0.207	0.092	0.091
	p	**0.045***	0.112	0.485	0.491
$FEF_{25-75\%}$ (L)	r	0.191	0.257	0.205	-0.22
	p	0.144	**0.047***	0.116	0.869
$FEF_{25-75\%}$ (%)	r	0.059	0.239	0.085	-0.029
	p	0.653	0.066	0.517	0.827
MIP (cmH_2O)	r	0.376	0.147	0.470	0.100
	p	**0.003***	0.263	**0.001***	0.447
%MIP	r	0.160	0.030	0.259	0.139
	p	0.221	0.820	0.045*	0.291
MEP (cmH_2O)	r	0.401	0.166	0.365	0.148
	p	**0.002***	0.205	**0.004***	0.260
%MEP	r	0.197	0.086	0.180	0.244
	p	0.131	0.512	0.169	0.060

*p<0.05. r: Pearson correlation coefficient. FVC: Forced vital capacity, FEV_1: Forced expiratory volume in one second, PEF: Peak expiratory flow, $FEF_{25-75\%}$: Forced expiratory flow from 25–75%, MIP: Maximum inspiratory pressure, MEP: Maximum expiratory pressure.

well. In addition, a positive correlation was found between %PEF and prone bridge test (r=0.049, p=0.047). There was also a positive relationship between $FEF_{25-75\%}$ and flexor endurance test (r=0.257, p=0.047) (Table 3).

When the correlation tests were examined, positive relationships were observed between MIP and prone bridge test (r=0.376, p=0.003) and side bridge test (r=0.470, p<0.001). When the correlation between the %MIP values and side bridge test was examined, a positive relationship was revealed (r=0.259, p=0.045) (Table 3). In addition, the relationships between MEP and prone bridge test (r=0.401, p=0.002) and side bridge test (r=0.365, p=0.004) were found to be positive and statisticly significant (Table 3).

DISCUSSION

This study was conducted to examine the relationship between the endurance of the core muscles, which have a significant role in trunk stabilization, respiratory muscle strength, and pulmonary function. In this context, it was shown in this study that strong core stability is associated with better respiratory muscles and better pulmonary function. While previous studies have shown the relationship between lung function, peripheral muscle strength, and handgrip strength, this is the first study to show the relationship between core stability and respiratory dynamics (10,18,19).

The handgrip is an important marker that reflects general muscle strength (20). Smith et al. showed that handgrip strength and spirometry values are related in their comprehensive study in adolescents (19). This situation reveals a possible relationship between general muscle strength and respiratory functions. In this study, it has been shown that there

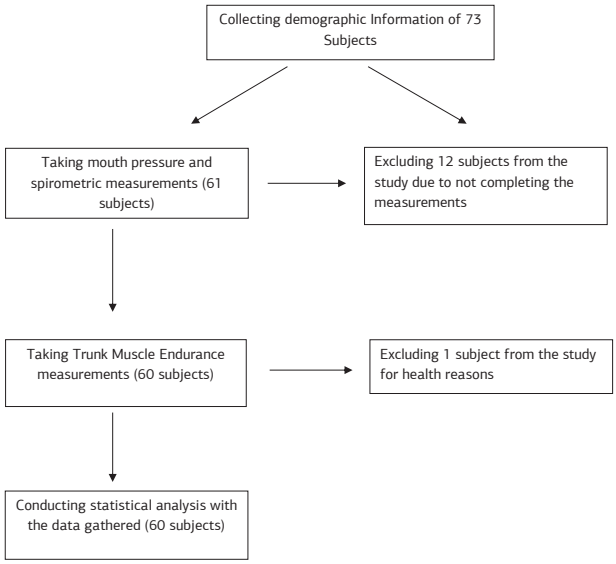

Figure 1: Flow Chart of the Study.

is a relationship between core stability, endurance, and lung function. Core stability is a major phenomenon leading to peripheral movements. It is possible that there is a relationship between handgrip force, peripheral muscle strength, core stabilization, and respiratory parameters in the body, which moves as a whole through the kinetic chain.

Al-Bilbeisi and McCool showed that during weight lifting activities, transdiaphragmatic pressure (PDI) increased by 20 percent. This rate increases to 40% during the bench press movement, depending on the weight. The same study demonstrated that PDI increased to more than 40% during sit-ups (21). The PDI helps gain an insight into the extent of the diaphragm activity. Strongoli et al. (22) conducted a study of six healthy individuals and compared the transdiaphragmatic pressure in the rest position with PDI during 13 different abdominal exercises. The results pointed to a significant difference. In the same study, PDI measurements were conducted during maximal inspiratory pressure, and the measurements were compared with 13 different abdomen exercises. Of all the 13 exercises, it was found that in seven exercises, the PDI measured during MIP increased 50-65% (22). All these exercises support both respiratory parameters and core stability with an increased diaphragm and abdominal muscle activation. All movements in daily life, including exercises, create an adaptation in accordance with the (specific adaptations the imposed demands) (SAID) principle (23,24). This adaptation also applies to respiratory muscles and trunk stabilization. Our study also showed to the positive relationship between prone bridge and side bridge exercises, and respiratory muscle strength (MEP and MIP).

It was previously shown that respiratory muscle training could be used in healthy individuals to increase sports performance (25). There are studies showing that respiratory functions are associated with athletic performance (26,27). Similarly, some studies show that core stability is associated with athletic function and performance (28-31). In this context, the current study connects these two concepts. While respiratory dynamics and core stabilization support performance, they are also interrelated.

Pulmonary function test values may change depending on age, gender, race, weight, and height. Therefore, it would be more accurate to evaluate the percentage values taken over the determined values based on standards. This study revealed positive relationships between %FVC value and prone bridge, flexor endurance test, and Sorensen test. The relationships between $\%FEV_1$ and prone bridge, flexor endurance test, and side bridge were also found to be positive. Pulmonary function is

shaped by the interaction between the diaphragm, chest wall, and lung. When it is considered that there is no pathology in the lung, diaphragm, and chest wall of the healthy subjects we examined, diaphragm strength may have a direct effect on the emergence of these parameters. The positive correlation between %FVC, %FEV_1, and MIP values supports this finding. The FVC and FEV_1 maneuvers may change depending on effort. In healthy individuals, the other factor that affects the effort is the strength of the abdominal muscles that leads to a sudden, explosive expiration following maximal inspiration (4). Strong abdominals increase the effort and directly directly affect FVC and FEV_1 values. Furthermore, this muscle group affects the values in the endurance tests because of its role in trunk stabilization.

In the literature, although it is stated that FVC measurement depends on both inspiration and expiration effort, and thus it could be used instead of MEP and MIP measurements. However, it has also been reported that FVC does not reflect the state of muscle functions in a standing or sitting position (32). In 2016, Oh et al. worked with 18 patients who had a stroke. In addition to the routine rehabilitation program, the patients performed lumbar stabilization exercises three times a week for eight weeks. Respiratory parameters were measured at the beginning, at week 4, and the end of week 8. The study revealed a significant increase in week 4 and week 8 in FVC, FEV_1, and PEF values of the stabilization group (33) Another study combined 4-week dynamic upper extremity exercises with respiratory exercises and revealed a positive effect on FVC values. This improvement was explained by increased diaphragm activation during extremity movements (34). In a study conducted by Kim and Lee in healthy students, deep abdominal muscles were strengthened, and as a result, positive and significant changes were observed in respiratory function (35).

On the other hand, Cavaggioni et al. conducted a study in which they compared the effects of traditional abdominal exercises (prone bridge, side bridge, crunch, and rotational crunch) with those of diaphragmatic respiration-based core stability exercises. They found that diaphragmatic respiration-based exercises are superior to the traditional exercises (in terms of their contribution to respiration parameters) (36). However, shorter duration and less repetition frequency of traditional exercises might have affected the results in the study.

There are several limitations to this study. The first is that it was performed only in healthy individuals. Current results may differ in disease states. In addition, our study was conducted in a limited age range, and results could not be generalized for other age groups. Although diaphragm and abdominal muscles are very important for ventilation, mouth pressure measurement does not only reflect the strength of the diaphragm and abdominal muscles.

In conclusion this study revealed that a strong core muscle structure is observed together with strong respiratory muscles. Although the function of the diaphragm and abdominal muscles in ventilation and trunk stabilization is different, there is a clear relationship between them. Studies may be conducted to examine respiratory muscle strength following the strengthening exercises performed for core structure and to show how transdiaphragmatic pressure and the diaphragm affect electromyographic values during core exercises. Similar studies may be conducted with different age groups, with patients who have respiratory disorders, and with groups having different body mass. It may also be beneficial to evaluate the respiratory muscle strength measurements of individuals to be included in a trunk endurance training program before and after the program.

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RELIABILITY OF MAKE AND BREAK TESTS IN ASSESSING INTRINSIC FOOT MUSCLE STRENGTH USING A HANDHELD DYNAMOMETER IN HEALTHY YOUNG ADULTS

ORIGINAL ARTICLE

ABSTRACT

Purpose: The make and break tests are used in isometric muscle measurement via a handheld dynamometer. This study aimed to compare the reliability of intrinsic foot muscle strength assessment with break and make tests in healthy young adults.

Methods: Seventy-five healthy adults completed the test-retest protocol with five days between tests. The maximal isometric strength measure of intrinsic foot muscles was measured during make/break tests using a handheld dynamometer. Test-retest reliability was calculated using intra-class correlation coefficients (ICC). Minimal detectable changes were calculated using standard error measurements.

Results: According to the analysis, the strength results of the break test were higher in all muscles when compared to the make test ($p<0.05$). The strength measurements of the intrinsic foot muscles was found to have almost perfect test-retest reliability in the make and break test (ICC=0.938-0.986).

Conclusion: Healthy adults showed stable test-retest results on all muscle strength measurements of the intrinsic foot muscles. The make and break test carried out usnig the handheld dynamometer is a reliable method for assessing intrinsic foot muscle strength in healthy adults. Both make and break tests are reliable measurements for the strength of intrinsic foot muscles.

Key Words: Adult; Foot; Muscle Strength; Reproducibility.

SAĞLIKLI GENÇ YETİŞKİNLERDE DİNAMOMETRE İLE İNTRİNSİK AYAK KAS KUVVETİ DEĞERLENDİRİLMESİNDE "MAKE" VE "BREAK" TESTLERİNİN GÜVENİRLİĞİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: "Make" ve "break" testleri el dinamometreleri ile izometrik kas kuvvet ölçümü sırasında kullanılan değerlendirme teknikleridir. Bu çalışmanın amacı, sağlıklı genç yetişkinlerde el dinamometresi ile yapılan "make" ve "break" testlerinin intrinsik ayak kas kuvveti değerlendirmesinde güvenirliğinin incelenmesiydi.

Yöntem: Yetmiş beş sağlıklı yetişkin test-tekrar test protokolünü beş gün ara ile tamamladı. İntrinsik ayak kaslarının maksimum izometrik kuvvet ölçümü "make" ve "break" testleri ile dijital el dinamometresi kullanılarak ölçüldü. Test-tekrar test güvenirliği sınıf içi korelasyon katsayıları (ICC) kullanılarak hesaplandı. Minimal tespit edilebilir değişiklikler, standart hata ölçümleri kullanılarak hesaplandı.

Sonuçlar: Analizlere göre, "break" testinin kuvvet sonuçlarının tüm kaslarda "make" testine göre daha yüksek olduğu bulundu ($p<0,05$). İntrinsik ayak kaslarının kuvvet ölçümlerinin, hem "make" hem de "break" testinde neredeyse mükemmel bir test-tekrar test güvenirliğine sahip olduğu belirlendi (ICC=0,938-0,986).

Tartışma: Sağlıklı yetişkinlerin, intrinsik ayak kaslarının tüm kas kuvveti ölçümlerinde test-tekrar test sonuçlarının stabil olduğu gösterilmiştir. El dinamometresi ile değerlendirilen "make" ve "break" testleri sağlıklı yetişkinlerde intrinsik ayak kaslarının kuvvet ölçümünde güvenilir yöntemlerdir.

Anahtar Kelimeler: Yetişkin; Ayak; Kas Kuvveti; Tekrarlanabilirlik.

INTRODUCTION

The human foot is a complex structure, which serves functions such as support and mobility. These functions are accomplished through the arch's deformation controlled by intrinsic and extrinsic foot muscles (1). The intrinsic muscles have an essential role in the dynamic stabilization of the foot due to their structurally short force levers and small diameters (2,3). Many studies are have reported that intrinsic foot muscle weakness is directly related to pathologies such as structural or functional toe deformities, pes planus, hallux valgus, and plantar fasciitis (4-9). Therefore, it is essential to evaluate these muscles' strength objectively and reliably (10).

Health professionals frequently prefer manual muscle testing (MMT) because it is useful in clinical practice. However, MMT is a subjective and non-sensitive method, and it could only provide subjective information for clinicians (11). Measurement methods that assess muscle strength precisely are necessary for better clinical decision making with more objective and reliable results. A digital handheld dynamometer (HHD) is a device used in the objective measurement of muscle strength. HHDs are easy to use, inexpensive, allow comparison, and could objectively display the amount of force used in the muscle test (12). Although instruments have been developed for objective measurement of muscle strength, the method of measurement, the patient's condition, position, or clinician's measurement technique may change the measurement results. Additionally, it is still controversial whether muscle strength testing should be performed in the muscles' shortest position or during movement (11).

Measuring the strength of intrinsic foot muscles is vital for preventing pathologies or slowing their progression. Isokinetic devices usually used for objective evaluation of muscle strength cannot be used in these small muscles. In scientific studies, reliable methods are necessary for the objective evaluation of muscle strength. Therefore, this study aimed to compare the reliability of intrinsic foot muscle strength assessment with make test (MT) and break test (BT) using a HHD in healthy young adults. In this context, we hypothesized that no difference would be observed between make/break tests.

METHODS

Participants

Seventy-five healthy adults (36 males, 39 females) completed the test-retest protocol with five days between the tests. Those who were 18-40 years of age, had a body mass index (BMI) of (18.5 kg/m^2 ≤ BMI ≤ 24.9 kg/m^2) were included in the study. Those who had any neurological problems, had a history of lower extremity trauma or surgery, were diagnosed with a severe low back problem, had vestibular or visual system problems, had a navicular drop test >10 mm and limitation of the first metatarsophalangeal joint range of motion (hallux rigidus-limitus) were excluded from the study. Before recruiting participants for this study, a power analysis was performed with GPower Version 3.1.9.5 (Universität Kiel, Kiel, Germany), and the target sample size was reached with a probability of 0.05 and 80% power. Written informed consent forms were obtained from the participants stating that they were willing to participate in the study. This study was approved by the Ethical Committee of Gazi University with the approval number of 2019-346 (Approval Date: 11.11.2019, and Approval Number: 2019-346) and the author followed the ethical guidelines of the 1975 Declaration of Helsinki.

Study Design and Procedures

This study had a cross-sectional design that included healthy adults. The study was conducted from January 2020 to April 2020 at Gazi University. Upon arrival at the first assessment, the participants filled out informed consent and medical history form that included demographic information and answered questions determining inclusion/exclusion criteria for the study.

A digital HHD (Lafayette® Instrument Company Model-01165, Indiana, USA) was used for measuring the maximum voluntary isometric contraction of the intrinsic foot muscles in Newtons, for comparing with the MT and BT results. Two different methods are used in measuring muscle strength via an HHD; the MT and the BT (13).

During these tests, the examiner and participants play opposite roles. The MT requires a body part is positioned at the start of its range of motion, and the participant is asked to exert maximal force against the examiner. In a BT, increasing force is applied to a body part after it has completed its range of motion until the subject's maximal muscle force is overcome, and the joint being tested gives way (14). In the two tests, force is applied differently; the dynamometer receives different amounts of force, and different results may be generated (14). All measurements were repeated after five days to assess test-retest reliability. The order of the MT and BT was randomized by flipping a coin. The strength measurement of the dominant side was performed as a tested side. A ball was placed in the middle of two feet while the individual was standing to determine the dominant foot. The individual was asked to kick the ball with his/her foot. The foot that the individual kicked the ball was considered dominant (15). Three different padded plastic stirrups of the dynamometer were used during the assessment. The appropriate stirrup was selected by the evaluator based on the region to be measured. Among the intrinsic plantar muscles, m. abductor hallucis (AH), m. flexor hallucis brevis (FHB), m. flexor digitorum brevis (FDB), and m. flexor digiti minimi (FDM) muscles were evaluated in the stated order. The ankles of the participants were stabilized by the evaluator to prevent lower limb compensation. While evaluating hallux and toe flexors, the ankle was passively positioned at maximum plantar flexion, and the effect of co-contraction of ankle plantar flexors on the outcome was prevented. The dynamometer position was adjusted not to allow interphalangeal joint flexion to minimize and inhibit long flexors' effect, and measurements were performed at this position. Evaluations were performed according to MT and BT protocols separately (16). Before the experimental procedure, the participants were familiarized with the MT and BTs to minimize measurement errors. Assessment trials were performed until the participant understood the test precisely. After the trial application, three measurements were performed, and the highest result was included in the analysis. A 30 s rest period was given to prevent fatigue between measurements. Tests were evaluated by the same physiotherapist, with the individuals in the semi-sitting position with hip and knee at semi-flexion (16).

Statistical Analysis

Statistical analysis was conducted using the SPSS for Windows version 22.0 (Statistical Package for Social Sciences Inc, Chicago, IL, USA) computer software system. The variables were investigated using visual (histograms, probability plots) and analytical methods (Kolmogorov-Smirnov/ Shapiro-Wilk's test) to determine whether they are normally distributed. Descriptive analyses were presented using means and standard deviations (SD) for normally distributed variables. Systematic differences were identified using a paired t-test. Statistical significance for this study was set at $p<0.05$ level. For the reliability, test-retest analysis intra-class correlation coefficient (ICC) with absolute agreement and 95% confidence interval (CI) were determined between the first and second assessments. The minimal detectable change (MDC), also referred to as the "smallest detectable difference," is an absolute measure of reliability, which accounts for various variability in defining a confidence interval in units of the measure. The MDC is the smallest change one could measure above the systematic error. The MDC was calculated by multiplying the SD of the difference with 1.96. When evaluating interventions, the pre-post difference must be more significant than the MDC to express real improvement. The standard error of measurement (SEM) also provides a measure of variability, it was primarily used for calculating the MDC. The SEM values were calculated as follows: $SEM=SD\times\sqrt{(1 - ICC)}$, The ICC values were defined as; almost perfect (higher than 0.81), high (0.61-0.80), moderate (0.41-0.60), fair (0.21-0.40) (17).

RESULTS

A total of 75 healthy young adults were enrolled in this study (mean age=24.40±5.60 years). In the BT the strength of all muscles was significantly higher compared to those of the MT ($p<0.05$, Table 1). The intrinsic foot muscles were found to have almost perfect test-retest reliability both in the MT (ICC varied from 0.954 to 0.986, Figure 1), and the BT (ICC varied from 0.938 to 0.978, Figure 1). There was no significant difference between the test and

Table 1: Make and Break Test Results of the Participants.

Muscles		Make Test Mean±SD	Break Test Mean±SD	p
M. Abductor Hallucis (N)	**Dominant**	17.31±6.72	26.29±9.91	**<0.001***
	Non-Dominant	15.72±6.23	24.91±92.06	**<0.001***
M. Flexor Hallucis Brevis (N)	**Dominant**	96.04±29.11	114.27±31.70	**<0.001***
	Non-Dominant	93.83±30.15	114.11±35.03	**<0.001***
M. Flexor Digitorum Brevis (N)	**Dominant**	72.52±20.13	93.81±22.06	**<0.001***
	Non-Dominant	69.01±18.92	84.00±20.63	**<0.001***
M. Flexor Digiti Minimi (N)	**Dominant**	24.78±9.03	31.14±9.68	**<0.001***
	Non-Dominant	24.30±8.88	29.96±9.92	**<0.001***

*p<0.05.

re-test mean scores according to paired t-test for any intrinsic foot muscle strength measures, which indicates an absence of any systematic bias (p>0.05). The ICC, 95% CI, SEM, MDC, Mean, SD, and level of significance (p) values of test and re-test intrinsic foot muscle strength measurements of dominant and non-dominant sides are presented in Table 2.

DISCUSSION

This study provided evidence related to test–re-test reliability and MDC values of intrinsic foot muscle strength assessment via the MT and BT in healthy young adults. The present study showed that the MT and BT strength measurement tests of the intrinsic foot muscles via HHD were reliable. This

Table 2: The Reliability of the Make and Break Test Results.

Test			ICC	95% CI		SEM	MDC	Test	Re-test	p
				Lower Bound	Upper Bound			Mean±SD	Mean±SD	
Make Test	**M. Abductor Hallucis**	**Dominant**	0.954	0.927	0.971	1.44	3.99	17.11±6.58	17.51±6.80	0.255
		Non-Dominant	0.961	0.923	0.974	1.32	3.66	15.58±6.21	16.64±7.22	0.419
	M. Flexor Hallucis Brevis	**Dominant**	0.981	0.970	0.988	4.02	11.14	95.82±29.22	96.16±29.17	0.665
		Non-Dominant	0.986	0.978	0.991	3.58	9.92	94.19±30.38	93.38±30.12	0.321
	M. Flexor Digitorum Brevis	**Dominant**	0.965	0.944	0.978	3.76	10.42	71.90±18.89	73.13±21.26	0.162
		Non-Dominant	0.957	0.933	0.973	3.94	10.92	69.11±19.51	69.02±18.52	0.948
	M. Flexor Digiti Minimi	**Dominant**	0.964	0.940	0.977	1.76	4.88	24.57±9.33	25.51±9.30	0.242
		Non-Dominant	0.966	0.935	0.977	1.67	4.63	24.02±9.09	25.17±9.02	0.062
Break Test	**M. Abductor Hallucis**	**Dominant**	0.963	0.943	0.977	1.91	5.29	26.29±9.79	26.32±10.11	0.936
		Non-Dominant	0.976	0.954	0.984	1.37	3.80	24.63±8.81	25.52±8.88	0.068
	M. Flexor Hallucis Brevis	**Dominant**	0.967	0.947	0.979	5.76	15.97	115.25±33.72	113.27±29.66	0.131
		Non-Dominant	0.978	0.965	0.986	5.21	14.44	114.91±35.37	113.22±34.83	0.144
	M. Flexor Digitorum Brevis	**Dominant**	0.953	0.927	0.971	4.79	13.28	93.52±21.08	94.08±23.12	0.566
		Non-Dominant	0.954	0.927	0.971	4.43	12.28	84.29±20.12	83.57±21.17	0.511
	M. Flexor Digiti Minimi	**Dominant**	0.938	0.900	0.960	2.43	6.74	31.51±9.40	30.79±10.06	0.161
		Non-Dominant	0.964	0.941	0.977	1.88	5.21	29.67±9.73	30.38±10.11	0.119

ICC: intraclass correlation coefficient, CI: confidence interval, SEM: standard error measurements, MDC: minimal detectable change.

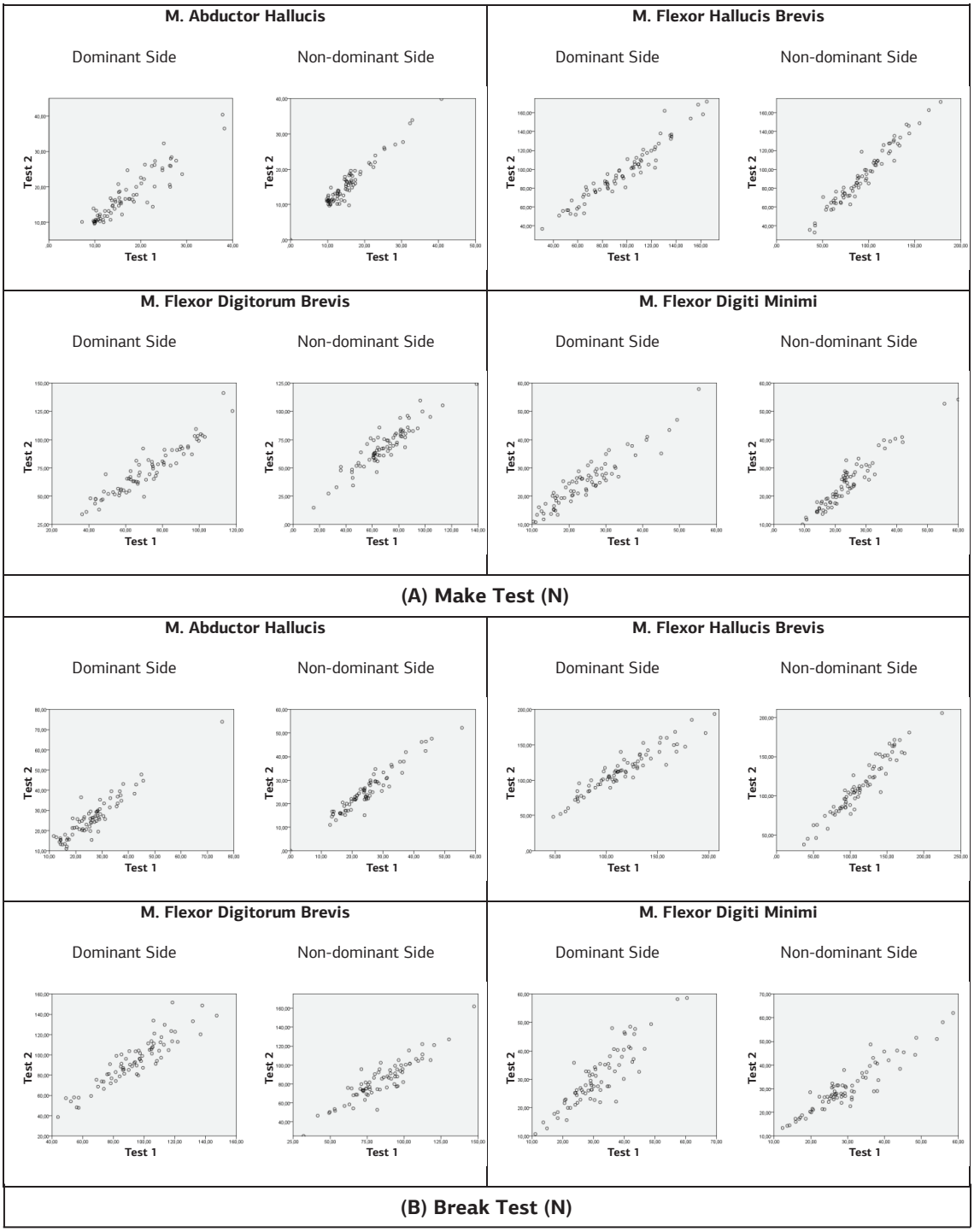

Figure 1: Unity Line Score Plots for Muscle Strength Outcome Measures (A, Make Test and B, Break Test). Dots on the Unity Line Represent Identical Test-Retest Scores.

study is the first to assess the MT and BT reliability measuring the intrinsic foot muscle strength.

Test-retest reliability involves validation of an assessment over multiple time points, and it measures the extent to which a testing measure is consistent and repeatable (18). Reliability is expressed using a correlation coefficient, which ranges from 0 to 1. The closer the coefficient is to 1, the more reliable a testing measure, suggesting

that the actual score is assessed with little error variance (18). The ICC values in the present study ranged from 0.954 to 0.986 between consecutive measurements performed in five days in the MT and 0.938 to 0.978 in BT, respectively. The present study results found that both the MT and BT had almost perfect reliability in measuring the intrinsic foot muscle strength (abductor hallucis, flexor hallucis brevis, flexor digitorum brevis, flexor digiti minimi) via HHD.

The MDC values could help identify an actual change in measured performance beyond random variations (19). The MDC values provide an understanding of reliability of the outcome measure. In this study, the MDC values for the MT ranged from 3.66 to 11.14, and the BT ranged from 3.80 to 15.97. These results showed that measuring the muscle strength of the intrinsic foot muscles via HHD has little measurement error.

In assessing the response stability of a measure, the SEM is used. The standard error in a set of repeated scores could be estimated via the SEM. Muscle strength assessments using HHD must be applicable in a clinical setting in order to be effective. The SEM for the MT ranged from 1.32 to 4.02 and the BT ranged from 1.35 to 5.76.

Even though this is the first study investigating the reliability of the MT and BT in intrinsic foot muscles using HHD, the reliability of the MTs and BTs in other muscles has been investigated in previous studies. Schmidt et al. examined the reliability of the MT and BT for hip abduction assessment using HHD and found that both tests proved to be highly reliable (20). Likely, Bohannon et al. investigated the reliability of the MT and BT for elbow flexor muscle strength in healthy subjects and reported that, both methods were reliable, and one type of testing could not be considered superior to the other (21). In the study in which they compared the MT and BT in measuring palmar abduction strength of the thumb, Lim et al. concluded that both tests were reliable (14). The results of our study are consistent with the findings of these studies. Therefore, in our opinion, when assessing muscle strength, the MT and BT could be used in a healthy population.

Jeon investigated the reliability of iliopsoas muscle strength in subjects with lumbar extension syndrome using MT and BT and concluded that the MT was more reliable than BT (22). In another study, Jeon examined gluteus medius strength using MT and BT in subjects with a pelvic drop. The author stated that MT offers a more reliable assessment of unilateral hip abductor strength in subjects with a pelvic drop (23). The fact that the populations included in these studies did not consist of healthy subjects may have led to a difference in reliability. We found, no difference found between the two assessment methods in reliability analysis. This finding is probably due to the inclusion of healthy adults.

Foot intrinsic muscles are useful in function, such as walking and balance (4-9). These muscles are small, and clinicians do not have the opportunity to measure them as simple as gross muscles. For example, the strength of a quadriceps muscle can be measured objectively via isokinetic devices. However, it is not possible to measure the strength of intrinsic foot muscles objectively with such/ devices. Therefore, the present study results concluded that both MT and BT are reliable when measuring the strength of intrinsic foot muscles. Clinicians could use both tests to measure the strength of intrinsic foot muscles.

This study has a few limitations. The participants' age range was limited to 18-40 years, and findings could not be generalized to the whole healthy adult population.

In conclusion, the current study established the reliability, MDC, and SEM values of MT and BT in healthy subjects. The evidence from this study shows that the strength measurement of the intrinsic foot muscles via HHD is reliable. Intrinsic muscle strength could be measured and reproduced using both the MT and BT.

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RELATIONSHIP BETWEEN PNEUMONIA AND SWALLOWING FUNCTION IN ELDERLY

ORIGINAL ARTICLE

ABSTRACT

Purpose: Anatomical and physiological changes due to aging decrease the efficiency of swallowing and increase the risk of aspiration pneumonia. One of the underlying causes of recurrent pneumonia is swallowing dysfunction, with aspiration. This study aimed to compare the swallowing function in elderly patients with and without pneumonia and to investigate its association with malnutrition.

Methods: A total of 44 elderly individuals with 22 aspiration pneumonia history (age=73.00±7.93 years) (study group) and 22 without aspiration pneumonia history (age=70.00±6.39 years) (control group) were included in the study. The swallowing function was evaluated using the Swallowing Ability Function Evaluation (SAFE) and water-swallowing test. Nutritional assessment was performed using the Turkish version of the Mini-Nutritional Assessment.

Results: Decreased swallowing ability was observed in 59.1% of the study group and 9.1% of the control group (p<0.001). While the study group had severe disorder the 22.7% of the oral phase and 31.8% of the pharyngeal phase, the control group had no severe disorder. However, there was a 9.1% moderate disorder in the oral and pharyngeal phases in the control group (p<0.001). There was a relationship between the nutritional assessment results of the study group and the oral (r=0.498, p=0.018) and pharyngeal phases of SAFE (r=0.622, p=0.002).

Conclusion: Our study showed that the swallowing function is affected in the elderly with a history of pneumonia. It was also observed in the elderly without a history of pneumonia. For this reason, a detailed swallowing evaluation must be performed both elderly patients with and without pneumonia, and a protective swallowing rehabilitation program should be developed through an interdisciplinary approach.

Key Words: Dysphagia; Elderly; Pneumonia; Swallowing.

YAŞLI BİREYLERDE PNÖMONİ VE YUTMA FONKSİYONLARI ARASINDAKİ İLİŞKİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Yaşlanma ile birlikte oral motor yapılardaki zayıflık, reflekslerde yavaşlama gibi anatomik ve fizyolojik değişimler yutma etkinliğinde azalmaya yol açarak aspirasyon pnömonisi riski oluşturmaktadır. Tekrarlayan pnömoninin altında yatan nedenlerden biri, aspirasyon ile birlikte yutma disfonksiyonudur. Bu çalışmada pnömoni öyküsü olan ve olmayan yaşlılarda yutma fonksiyonlarının karşılaştırılması ve malnutrisyon ile ilişkisini incelenmesi amaçlandı.

Yöntem: Çalışmamıza 22 aspirasyon pnömoni öyküsü bulunan (yaş=73,00±7,93 yıl) (çalışma grubu) ve 22 aspirasyon pnömoni öyküsü bulunmayan (yaş=70,00±6,39 yıl) (kontrol grubu) toplam 44 yaşlı birey dahil edildi. Yutma fonksiyonu değerlendirmesinde Yutma Yeteneği ve Fonksiyonu Değerlendirmesi (SAFE) ve su yutma testi kullanıldı. Beslenme değerlendirmesi, Mini-Nutrisyonel Değerlendirme'nin Türkçe versiyonu ile yapıldı.

Sonuçlar: Çalışma grubunun % 59,1'inde yutma becerisinde azalma bulunurken, kontrol grubunda bu oran % 9,1'di (p<0,001). Çalışma grubunda oral fazın % 22.7'sinde ve faringeal fazın % 31,8'inde şiddetli bozukluk gözlenirken, kontrol grubunda şiddetli bozukluk yoktu ancak kontrol grubunda oral ve farengeal fazlarda % 9,1 oranında orta düzeyde bozukluk gözlendi (p<0,001). Çalışma grubunun beslenme değerlendirme sonuçları ile SAFE'nin oral (r=0,498, p=0,018) ve farengeal (r=0,622, p=0,002) evreleri arasında ilişki olduğu görüldü.

Tartışma: Çalışmamız pnömoni öyküsü olan yaşlılarda yutma fonksiyonunun etkilendiğini göstermiştir. Bununla birlikte pnömoni öyküsü olmayan yaşlılarda da etkilenim gözlenmiştir. Bu sebepten dolayı pnömoni öyküsü olan ve olmayan yaşlılara detaylı bir yutma değerlendirmesi yapılmalı ve interdisipliner bir yaklaşımla koruyucu yutma rehabilitasyon programı oluşturulmalıdır.

Anahtar Kelimeler: Disfaji; Yaşlı; Pnömoni; Yutma.

INTRODUCTION

Swallowing and chewing disorders are widely seen in the elderly and lead to severe consequences. Swallowing disorders are often asymptomatic, making early diagnosis challenging (1). Aspiration pneumonia is common as a result of the swallowing disorder. The mortality rate of aspiration pneumonia is between 20% and 65% (2). It is estimated that pneumonia due to aspiration is present in 10% of community-dwelling individuals and 30% of long-term care patients (3).

A reduction in the amount of connective tissue of tongue limits tongue movements and causes difficulties in controlling and pushing the bolus toward the posterior of the mouth (4). Increased eating duration (>30 min), fatigue while eating, food spillage, and drooling are the most commonly observed eating problems in the elderly. In addition, persistent coughing, suffocation, retching, or wet sounds while eating and drinking indicate swallowing difficulties and should not be ignored (5). Swallowing disorders lead to many severe complications in the elderly, including malnutrition, dehydration, decreased nutrition, and aspiration pneumonia (2). Aspiration is the entry of food from the oropharynx into the larynx, and problems in the pharyngeal stage of swallowing (i.e., delayed swallowing reflex and residue) may result in airway aspiration (6). Therefore, appropriate swallowing evaluation and management are crucial to prevent serious complications such as malnutrition, aspiration, and reduce the risk of malnutrition in the elderly. Several previous studies have used clinical and screening methods to evaluate the cough reflex and swallowing mechanisms in the elderly. However, a limited number of studies have evaluated the relationships among swallowing mechanisms, pneumonia, and its consequences (7-9). Thus, the current study aimed to (a) thoroughly examine the relationship between swallowing function and pneumonia in the elderly and (b) determine the relationships among swallowing function and malnutrition in elderly individuals with a history of pneumonia.

METHODS

Subjects

This study included 44 elderly who were treated in the Department of Geriatrics and Swallowing Disorders Research and Application Unit of Hacettepe University Faculty of Medicine between June and September 2014. The study was approved by Hacettepe University's Non-Interventional Clinical Research Ethics Committee with decision number GO 14/226-24 on 30/04/2014. Written informed consent was obtained from all the elderly participated in the study. All participants were informed, and they voluntarily participated in the study. Our study was conducted as a cross-sectional study. According to the SAFE test, it was calculated that a sample consisting of 44 subjects was needed to obtain 80% power, type 1 error at 5% (G*Power package, Version 3.1.9.2, Axel Buchner, Universitat Kiel, Germany). The study included two groups: the study group, 22 elderly participants with a history of recurrent aspiration pneumonia during one year and the control group, and 22 elderly participants without a history of recurrent aspiration pneumonia. Information on a history of recurrent aspiration pneumonia during one year was obtained from hospital files. Inclusion criteria for the study group were being >65 years old, having a history of recurrent aspiration pneumonia last 1 year, and a Mini-Mental Test (MMT) score >23. For the control group, the inclusion criteria were being >65 years old and MMT score of over >23; exclusion criteria for both groups were having a neurological or structural problem that causes swallowing disorder(s), non-oral feeding, dementia and lack of cooperation (10).

Measurements

Swallowing evaluation was performed using the water-swallowing test (WST) and Swallowing Ability and Functional Evaluation (SAFE).

Water Swallow Test

The water swallow test is a non-invasive method requiring no equipment, developed by Kubota et al., and previously established as valid and reliable in the elderly (11). In addition, the short application time of the test has increased the applicability of the test. Swallowing ability is evaluated with the

times required to drink water and the suspected areas in terms of the swallowing disorder. A cup containing 30 ml of water at room temperature is handed to the patient who is seated on a chair. The patient is told, "Please drink this water as you normally would." The chronometer was started when the water first touched the lips and was stopped, and then the larynx came to rest position. The time is taken to finish drinking the water, the profile, and any episodes are measured and observed. The profiles were "1: able to drink all the water in one gulp without choking," "2: able to drink all the water in two or more gulps without choking," "3: able to drink all the water in one gulp, but some choking occurs," "4: despite drinking the water in two or more gulps, some choking occurs, and "5: frequent choking, with difficulty drinking all the water." The examiner notes situations such as "Drinking carefully by holding water in the mouth and sipping," "Intense coughing," "Dripping water from the lips," and "Abnormal sounds and difficult respiration after drinking the water." The normal interval of swallowing ability is defined as 5 s. The diagnosis was a normal range (completed profile one within 5 s), suspected (completed profile one after >5 s, or Profile 2), and abnormal (profiles 3–59 (11,12).

Swallowing Ability and Functional Evaluation (SAFE) Test

The test evaluates swallowing in three phases. The first phase was the physical oromotor functions. In this phase, peripheral evaluation of oropharyngeal swallowing mechanism were performend and scores were given between the lips, tongue, palate, cheeks, teeth, chin, all movements of the larynx and oral reflexes between 0-3 (0: intense disorder; 1: medium level disorder; 2: slight disorder; 3: functional limits). In the SAFE oral phase evaluation, physiological data related to the oral phase such as closing the lips during swallowing, lip seal, bite packing, bolus transport, number of swallows per bite, chewing speed, and strength and nasal backflow were evaluated. In the SAFE pharyngeal phase evaluation, characteristics related to the pharyngeal phase such as delay in swallowing reflex, laryngeal elevation, the existence of coughing before/during/after swallowing, repetitive swallowing, feeling of sticking in the throat, changes which take place in sounds after swallowing and backflow were tested. In the second phase of the SAFE test, the evaluation was performend by giving scores between 0 and 3 to the expected function of the patients in both stages (0: severe disorder; 1: medium level disorder; 2: slight disorder; 3: functional limits). The third phase was sensory and cognitive characteristics. In order for the patient to pass to safe oral intake in the general information stage related to swallowing ability, the required cognitive and behavioral factors were evaluated. The scores given in the first and the second phases were calculated. The

Table 1: Study Participants' Physical Characteristics, Mini Mental Test Scores and Comorbidities.

Variables	Pneumonia (n=22)	Control (n=22)	p
	Median (IQR)	Median (IQR)	
Age (years)	73 (68-96)	70 (65-88)	**0.033*[1]**
Height (cm)	166.5 (120–185)	168 (154–180)	0.356[1]
Weight (kg)	70 (25–96)	78.5 (55–115)	0.086[1]
Body Mass Index (kg/m²)	26.55 (15.8–42.2)	27.5 (21.37–39.7)	0.162[1]
Mini Mental Test (0-30)	25 (24-26)	26 (24-28)	0.157[1]
Gender, M/F, n	11/11	11/11	1.000
Comorbidities[2]	**n (%)**	**n (%)**	
Diabetes	6 (27.27)	3 (13.63)	0.419
Hypertension	1 (4.5)	2 (9.09)	0.108
Cancer	2 (9.09)	8 (36.36)	0.427
Thyroid Disorder	2 (9.09)	1 (4.5)	0.249
Heart Diseases	7 (31.81)	0 (0)	0.365

*p<0.05. [1]Mann-Whitney U Test, [2]Chi-square test. IQR: interquartile range.

total scores were determined for both phases and associated with the corresponding values in the test booklet. The numbers corresponding to the total score received by the patients in the booklet allowed us to have information on the intensity of the swallowing difficulty. Since the answers received as present/not present were not crucial in determining the intensity of swallowing difficulty in SAFE's third Phase and were not reflected in the total score, they were not used in the statistical analysis. However, they were considered since they would be a suitable evaluation parameter. The intermediate values by the received score were graded between 1 and 9. The intermediate values corresponding to the total score received in the test, and their meanings were as follows: 1-2, intense disorder in swallowing, 3-4-5, medium level disorder in swallowing, 6-7, slight disorder in swallowing, and 8-9, swallowing function within normal limits (13).

Nutritional assessment was performed with the Turkish version of the Mini-Nutritional Assessment (MNA). The validity and reliability of MNA have been previously established in Turkish individuals (14). It is used to evaluate malnutrition risk and classify nutritional conditions in the elderly. The MNA (maximum score: 30 points) separates respondents into three categories: sufficient nutrition (≥24 points), risk of malnutrition (17–23.5 points), and malnutrition (<17 points). Permission to use the assessment has been obtained.

The Turkish version of the MMT was used for the evaluation of the cognitive state. The validity and reliability of MMT have been previously established in Turkish individuals with a slight dementia diagnosis (threshold value=23/24 points) (15). Scoring is as follows: cognitive disorder (0–9 points), medium-level cognitive disorders (10–23 points), and normal (24–30 points). This study included patients with MMT scores >23 points. Permission to use the assessment has been obtained.

Statistical Analysis

SPSS 21.0 (SPSS Inc., Chicago, IL, USA) for Windows software program was used in all statistical analyses. In the evaluation of data, mean±standard deviation, median, interquartile range, and minimum and maximum values were used for descriptive statistics. Whether measurements obtained from the study and control groups display normal distribution or not was tested with the Shapiro Wilk test. In the two-group comparisons of the numerical values, the Mann-Whitney u test and Student's t-test were performed. Spearman correlation analysis was performed. In the comparisons of the qualitative characteristics in the two groups, crosstab analysis of Chi-square analysis, Fisher exact test, and Fisher-Freeman-Halton test were used. A $p<0.05$ was accepted as statistical significance.

RESULTS

Table 1 displays the participants' physical characteristics, MMT scores, and comorbidities. A comparison of the WST scores by groups is shown in Table 2. Results indicated that 59.1% of participants of study group showed experienced decreased swallowing ability and 27.3% carried a risk in terms of swallowing function while 9.1% of participants of the control group showed experienced decreased swallowing ability and 9.1% carried a risk in terms of swallowing function ($p<0.001$). The two groups significantly differed in

Table 2: Comparison of Groups by Total Scores on the Water Swallowing Test.

Water Swallowing Test	Pneumonia (n=22)		Control (n=22)		p
	n	%	n	%	
Normal Swallowing Ability (Normal Range)	3	13.6	18	81.8	**<0.001*¹**
Possibility of Decrease in Swallowing Ability (Suspected)	6	27.3	2	9.1	**<0.001*¹**
Decrease in Swallowing Ability (Abnormal)	13	59.1	2	9.1	**<0.001*¹**
Time Taken to Drink 30 mL Water (s)$^{\phi}$	6.50±2.70		5.00±1.68		**<0.001*²**

*p<0.05. ¹Chi-square test, $^{\phi}$Student's t-test.

Table 3: Comparison of groups by the Swallowing Ability and Function Evaluation and Mini Nutritional Assessment.

Phases of SAFE		Pneumonia (n =22)		Control (n =22)		p
		n	%	n	%	
Physical Oromotor Function	Normal	1	4.5	8	36.4	0.001*
	Slight Disorder Level	5	22.7	9	40.9	0.001*
	Medium Disorder Level	12	54.5	5	22.7	0.001*
	Intense Disorder	4	18.2	0	0	0.001*
Oral Phase	Normal	1	4.5	10	45.5	<0.001*
	Slight Disorder Level	3	13.6	10	45.5	<0.001*
	Medium Disorder Level	13	59.1	2	9.1	<0.001*
	Intense Disorder	5	22.7	0	0	<0.001*
Pharyngeal Phase	Normal	1	4.5	16	72.7	<0.001*
	Slight Disorder	5	22.7	4	18.2	<0.001*
	Medium Disorder	9	40.9	2	9.1	<0.001*
	Intense Disorder	7	31.8	0	0	<0.001*
MNA	Normal Nutritional Status	4	18.2	18	81.8	<0.001*
	Risk of Malnutrition	8	36.4	3	13.6	<0.001*
	Malnutrition	10	45.5	1	4.5	<0.001*

*p<0.05, Chi-square test. SAFE: Swallowing Ability and Function Evaluation, MNA: Mini Nutritional Assessment.

terms of WST scores and drinking time (p<0.001). The participants' SAFE and MNA results are shown in Table 3. According to SAFE test results, the study group had an intense disorder in physical oromotor function 18.2%, in the oral phase 22.7%, in the pharyngeal phase 31.8%. However, no intense disorder was observed in the control group. (p<0.001). According to MNA results, malnutrition was seen in 45.5% of the study group and 4.5% of the control group (p<0.001).

Correlations between swallowing evaluations (SAFE, WST) and MNA and drinking time are shown in Table 4. A positive, strong correlation was found between the study group's MNA scores and SAFE pharyngeal phase values (r=0.622, p<0.002). Positive relationships were also determined between the study group's SAFE oral (r=0.565, p<0.006) and pharyngeal phase values (r=0.473, p=0.026) and between the control group's SAFE pharyngeal phase values and drinking time (r=0.654, p<0.001).

There was positive, significant correlation was found between drinking time and WST in the study group (r=0.471, p=0.027) and WST in the control group (r=0.427, p=0.048).

DISCUSSION

The results of our study, which examined the relationship between swallowing function and pneumonia in the elderly, show that individuals with a history of pneumonia should be evaluated in terms of swallowing function. However, our findings, which indicate swallowing dysfunction in individuals without a history of pneumonia, also reveal that aging is a risk factor for swallowing dysfunction and forms a basis for pneumonia. Therefore, the entire geriatric population should be evaluated in detail for the swallowing function.

A study that examined swallowing disorders in the elderly concluded that WST was a practical and straightforward method but must be used with the support of other tests (16). A study using WST reported that 34% of the elderly population had to swallow dysfunction (8). Similar studies showed that aging decreases tongue pressure and motor function in the lips, resulting in increased swallowing time and impaired swallowing function (9,17).

A study using video fluoroscopy, which is considered the gold standard for swallowing evaluation, found serious penetration and aspiration during

Table 4: Correlation between Evaluations of Swallowing Ability and Mini-Nutrition Assessment, and Time Taken to Drink 30 mL Water.

Groups		SAFE			WST
		Physical Evaluation	Oral Phase	Pharyngeal Phase	
Pneumonia (n=22)					
MNA (Study group)	**r**	0.374	0.498	0.622	0.394
	p	0.086	**0.018***	**0.002***	0.069
Time Taken to Drink 30 mL Water (s)	**r**	0.298	0.565	0.473	0.471
	p	0.178	**0.006***	**0.026***	**0.027***
Control (n=22)					
MNA	**r**	-0.045	0.076	0.292	0.408
	p	0.842	0.735	0.187	0.059
Time Taken to Drink 30 mL Water (s)	**r**	0.406	0.350	0.654	0.427
	p	0.061	0.111	**0.001***	**0.048***

*p <0.05. r: Spearman correlation analysis, MNA: Mini Nutritional Assessment, SAFE: Swallowing Ability and Function Evaluation, WST: Water Swallowing Test.

swallowing in 52.8% of individuals with pneumonia (aged ≥70 years) (18). Many other studies have shown that aging can affect swallowing function and cause aspiration, leading to a risk of vital. These studies also suggested that increased prevalence of pneumonia with age in dementia patients with and without a history of aspiration pneumonia is due to the weakening of the swallowing function and decreased the sensitivity of the cough reflex (7,19). Studies also suggest that swallowing phase is affected by age (8,16). In our study, similar results were obrained using the WST and SAFE tests. According to the results of the WST, Abnormal swallowing function was found in more than half of the study group. In the control group, only two subjects had abnormal swallowing function. We thought that the decrease in swallowing function in the study group leads to the development of frequent recurrent pneumonia by caused by aspiration. The relatively young age in the control group might be responsible for this. The prevalence of swallowing disorder increases with aging. In one study, the prevalence of swallowing disorders in elderly individuals has been found 16% in the 70-79 years-old group and 33% in the 80 years-old group (20). In addition, the 30 ml^2 of water drinking times of the study group were longer than the control group. We thought that the reason for the longer duration in the study group might be the water in order not to aspirate; carefully drinking and keeping it in the mouth.

According to the SAFE, swallowing dysfunction was found in the oral and pharyngeal phases of the study group. Over half of the participants with a history of pneumonia, medium-level swallowing disorders were found in terms of oropharyngeal function. We thought that the rate in patients with a history of pneumonia may reveal that swallowing disorders cause recurrent pneumonia. In addition, the rate of swallowing disorders among control group suggested that this group was also at serious risk of swallowing disorder, highlighting the importance of protective swallowing rehabilitation in geriatric patients. In addition, when physical oromotor evaluation results were examined, it is seen that older people with a history of pneumonia had more disorders. However, the disorder was also observed in individuals who did not have a history of pneumonia. The formation of changes in structures such as lips, tongue, palate, and teeth, which are essential in the formation of effective swallowing, and decrease in movements and reflexes that provide swallowing function with aging, might be responsible for the findings.

Swallowing dysfunction and malnutrition are reliable indicators of pneumonia in the elderly. Malnutrition, emerging in swallowing difficulties, leads to a weakened immune system, lack of energy, and decreased personal hygiene, work and socialization, mobility, and performance. Insufficient nutrition leads to weight loss and (21) decreased energy. A previous study reported a risk of malnutrition of 54.7% in individuals with a history of pneumonia, and 27.4% of them have malnutrition. The authors suggest a strong correlation between malnutrition and oropharyngeal swallowing dysfunction (21).

The risk of malnutrition was seen in one in third participants with a history of pneumonia, and malnutrition was observed in nearly half. The strong correlation was found between the MNA scores and SAFE oral and pharyngeal phase values among individuals with a history of pneumonia. We thought that the high malnutrition rate among individuals with a history of pneumonia might thus be due to decreased swallowing function. The close relationship between malnutrition and swallowing disorder is due to the difficulty in swallowing and especially the aspiration of people with pneumonia, stalling of food, and coughing after eating, leading to decreased desire to eat (21). Malnutrition, as a result of swallowing disorder, also leads to severe consequences such as aspiration pneumonia (22). The struggle against malnutrition also creates a severe economic burden (23). Improving swallowing efficiency in the elderly through swallow assessments, therefore, represents a way to reduce the risk of malnutrition.

In many studies, in the elderly who had previously had pneumonia, airway protection mechanisms and cough reflexes are more affected, and older people are more exposed to aspiration. This becomes a vicious circle, and the swallowing functions could be further impaired (20,24). We thought that the findings of our study are caused by physiological and musculoskeletal system changes due to aging. In addition, reduced connective tissue restricts bolus movement in the tongue, causing difficulty in pushing the bolus posteriorly. These changes that occur with age lead to a decrease in swallowing functions of individuals.

The strengths of our study were that the number of people indicated in the power analysis was reached, and that the physiotherapists conducting the study were experienced physiotherapists in the field of swallowing. One of the limitations of the study was the lack of methods such as videofluoroscopic imaging or fiberoptic endoscopic evaluation of swallowing. In addition, the lack of a more detailed assessment by gender and age could be considered as limitations. Another limitation of our study was that the ages of the study and control groups were different. Although they are relatively younger, there were subjects in this group having swallowing dysfunction. Our study was an initial study, and further studies are needed considering all these limitations.

In conclusion, anatomical and physiological changes that occur with age could lead to adverse effects for swallowing function. The most critical of these is aspiration pneumonia, which can be fatal. Therefore, to prevent the life threatening effects of malnutrition and swallowing disorders their risk factors need to be analyzed well. Aspiration and pneumonia could be prevented through the early diagnosis of swallowing disorders. Further, hospital expenses could be lowered, and the health quality of the elderly could be improved. Therefore, swallowing evaluations must be conducted regularly in, both elderly patients with and without pneumonia.

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RELATION OF VERTIGO, DIZZINESS, AND IMBALANCE WITH PHYSICAL ACTIVITY, EXERCISE CAPACITY, ACTIVITIES OF DAILY LIVING, AND QUALITY OF LIFE IN PERIPHERAL VESTIBULAR HYPOFUNCTION

ORIGINAL ARTICLE

ABSTRACT

Purpose: Vertigo (V), dizziness (D), and imbalance cause functional limitation and participation in peripheral vestibular hypofunction (PVH). The aim was to investigate the relation of V, D, imbalance, with physical activity, exercise capacity, activities of daily living (ADL), and quality of life (QoL) in patients with PVH.

Methods: Thirty-nine subjects with and 32 without PVH were included. The V and D severity and frequency using Visual Analogue Scale (VAS), balance using Modified Clinical Test of Sensory Interaction and Balance (M-CTSIB), and Activity Specific Balance Confidence Scale (ABC) were assessed. Physical activity using the International Physical Activity Questionnaire (IPAQ) and functional exercise capacity using the 6-minute walk test (6MWT) were evaluated. ADL using the Vestibular Disorders ADL Scale (VADL) and QoL using the Dizziness Handicap Inventory (DHI) were determined.

Results: M-CTSIB, ABC, IPAQ, 6MWT, VADL, and DHI were lower in patients with PVH as compared to the control group ($p<0.05$). V-severity and -frequency were related to IPAQ ($r=-0.602$ and $r=-0.321$), VADL ($r=0.626$ and $r=0.492$), and DHI ($r=0.640$ and $r=0.578$, respectively, $p<0.05$). Both D-severity and -frequency was correlated with IPAQ ($r=-0.493$ and $r=-0.487$), VADL ($r=0.565$ and $r=0.408$), and DHI ($r=0.627$ and $r=0.566$, respectively, $p<0.05$). V- and D-severity was associated with 6MWT ($r=-0.339$ and $r=-0.336$, respectively, $p<0.05$). When somatosensory and visual sensations decreased, the balance was correlated with 6MWT ($r=-0.412$), VADL ($r=0.545$), and DHI ($r=0.422$, $p<0.05$).

Conclusion: The V, D, and imbalance are associated with physical activity level, functional exercise capacity, ADL, and QoL in PVH. Further study is needed to investigate the effects of vestibular rehabilitation programs to improve physical activity and functional exercise capacity.

Key Words: Dizziness; Physical Activity Level; Postural Balance; Vertigo; Vestibular Diseases.

PERİFERAL VESTİBÜLER HİPOFONKSİYONDA VERTİGO, DİZZİNESS VE DENGE BOZUKLUĞU İLE FİZİKSEL AKTİVİTE, EGZERSİZ KAPASİTESİ, GÜNLÜK YAŞAM AKTİVİTELERİ VE YAŞAM KALİTESİ ARASINDAKİ İLİŞKİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Periferik vestibüler hipofonksiyon'da (PVH) vertigo (V), dizziness (D) ve denge bozukluğu çeşitli fonksiyonel limitasyonlara ve inaktiviteye neden olur. Bu çalışmanın amacı, PVH'li hastalarda V, D, denge bozukluğu, fiziksel aktivite düzeyi, fonksiyonel egzersiz kapasitesi, günlük yaşam aktiviteleri (GYA) ve yaşam kalitesi (YK) arasındaki ilişkiyi araştırmaktı.

Yöntem: Otuz dokuz PVH hastası ve PVH hastası olmayan 32 birey çalışmaya dahil edildi. V/D şiddeti ve sıklığı Vizüel Analog Skalası (VAS) ve denge Modifiye Kliniğine Uyarlanmış Denge-Duyusal Etkileşim Testi (M-CTSIB) ve Aktiviteye Spesifik Denge Güvenlik Ölçeği (ABC) ile değerlendirildi. Fiziksel aktivite düzeyi Uluslararası Fiziksel Aktivite Anketi (UFAA) ve fonksiyonel egzersiz kapasitesi altı dakika yürüme testi (6DKYT) ile ölçüldü. GYA Vestibüler Bozukluklarda Günlük Yaşam Aktiviteleri Ölçeği (VGYA) ve YK Baş Dönmesi Engellilik Envanteri (BEE) ile değerlendirildi.

Sonuçlar: PVH'li hastalarda M-CTSIB, ABC, UFAA, 6DYT, VGYA ve BEE skorlarının kontrol grubuna göre daha düşük olduğu görüldü ($p<0,05$). V şiddeti ve frekansı UFAA ($r=-0,602$, $r=-0,321$), VGYA ($r=0,626$, $r=0,492$) ve BEE ($r=0,640$, $r=0,578$) ile ilişkili bulundu ($p<0,05$). D şiddet ve frekansı UFAA ($r=-0,493$ and $r=-0,487$), VGYA ($r=0,565$ and $r=0,408$) ve BEE ($r=0,627$ and $r=0,566$) ile korele idi ($p<0,05$). V ve D şiddeti 6DYT ile ilişkili idi (sırasıyla; $r=-0,339$ ve $r=-0,336$, $p<0,05$). Somatosensör ve görsel duyular azaldığı zaman; denge 6DYT ($r=-0,412$); VGYA ($r=0,545$) ve BEE ($r=0,422$) ile ilişkili bulundu ($p<0,05$).

Tartışma: PVH'de V, D ve denge bozukluğu fiziksel aktivite düzeyi, fonksiyonel egzersiz kapasitesi, GYA ve YK ile ilişkilidir. Vestibüler rehabilitasyon programlarının, fiziksel aktivite ve fonksiyonel egzersiz kapasitesinin iyileştirilmesine etkisini araştıran ileri çalışmalara ihtiyaç bulunmaktadır.

Anahtar Kelimeler: Dizziness; Fiziksel Aktivite Düzeyi; Postural Denge; Vertigo; Vestibüler Hastalıklar.

INTRODUCTION

Peripheral vestibular hypofunction (PVH) is a heterogeneous disorder that affects one or both sides of the vestibular system resulting from a complete or partial decrease of the vestibular function (1). Patients with PVH, due to vertigo, dizziness, and imbalance are faced with many problems in daily life. Because of these symptoms, patients are afraid of falling, and they especially avoid activities that require head movement, and physical activity level decreases (2,3). Physical inactivity is accepted as the most critical risk factor for numerous diseases, primarily for cardiovascular diseases (4).

There is not yet strong evidence to determine the specific exercises for people with PVH, and vestibular rehabilitation programs instead focus on vestibular adaptation and balance development (5-7). When vertigo, dizziness, and imbalance start decreasing, the patient needs to return to an active lifestyle and take up the habit of regular exercise. Physical activity protects patients from the risks of inactivity, which are hypertension, diabetes mellitus, low exercise capacity, obesity, and high mortality risk (8). American Physical Therapy Association, in the guide published in 2016, reported that vestibular rehabilitation should consist of exercises to improve gaze stability, habituation, balance-gait training, and walking endurance (9). Two studies showed that vertigo, dizziness or imbalance decrease physical activity levels in patients with PVH, but there is no study showing their relationship with exercise capacity (10,11).

Individuals with dizziness preferred lighter exercises such as light garden work, short walks, and doing light household chores (10). Therefore, there is a relationship between dizziness and physical activity level (10,11). In addition, both mild (i.e., going for walking) and heavy (i.e., working in the garden) physical activities are associated with reduced risk of the low quality of life, risk of falls, and depression in dizziness. Mild exercise may decrease the mortality rate in dizziness.

Although some studies showed that vertigo, dizziness and balance disorders decreased the independence of daily life and quality of life in patients with PVH, there was no study which investigating the relationship between these factors and physical activity level and exercise capacity in this population (12-14). Therefore, this study aimed to investigate the relationship of vertigo, dizziness, and imbalance with physical activity level, exercise capacity, activities of daily living and quality of life in patients with PVH and to compare balance, physical activity level, exercise capacity, activities of daily living and quality of life in individuals with and without PVH.

METHODS

Subjects

This study was conducted at the Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Gazi University. Patients who were referred to the vestibular rehabilitation program with the diagnosis of PVH from the Gazi University Department of Otorhinolaryngology were included in the study. The inclusion criteria were being 18-65 years old, experiencing vertigo or dizziness for at least two months, having no additional diseases of neurological, orthopedic, circulatory system, or vision that could cause vertigo, dizziness, and imbalance. Exclusion criteria were being in the acute phase of the vestibular disease and participating in the vestibular rehabilitation program in the last one month (1). Vestibular suppressant medications, if used, were discontinued at least seven days before participating in the study. The control group consisted of subjects without PVH with similar age and gender. Before the study was started, the approval of the Ethics Committee for Non-Interventional Clinical Investigations of Gazi University was received in 2015 (Approval Date: 29.12.2015 and Approval Number: 128). All the patients and the control group were informed about the study and written informed consent was obtained. The study was conducted between December 2015 and May 2016.

Measurements

Vertigo/Dizziness severity and frequency: Vertigo severity and frequency were assessed using a numeric Visual Analog Scale (VAS) (15). The same scale was also used to evaluate dizziness. According

to the scale, the severity of vertigo/dizziness within the last seven days is rated as 1 (no vertigo/ dizziness), 2-3 (slight), 4-5 (mild), 6-7 (severe), 8-9 (extreme) and 10 (not bearable). Vertigo/dizziness frequency in the last seven days is evaluated as 1 (no vertigo/ dizziness), 2-3 (1-5 times a week), 4-5 (1-3 times a day), 6-7 (4-10 times a day), 8-9 (>10 times a day) and 10 (all the time).

Modified Clinical Test of Sensory Interaction and Balance (M-CTSIB): The test was performed using the Biodex-BioSwayTM device (SD 950-340, Biodex Medical Systems, Inc., Shirley, NY, USA). The M-CTSIB evaluates the relationship of balance with the visual, somatosensory, and vestibular systems. The tests, which were performed twice, were carried out under four different conditions for 30 seconds: Condition 1-eyes open-firm surface; Condition 2-eyes closed-firm surface; Condition 3-eyes open-foam surface, and Condition-4 eyes closed-foam surface. At the end of the tests, body oscillations of the participants were calculated by the system, and the Sway Index scores, which show the standard deviation of the average position from center, were obtained. According to the Sway Index, higher scores indicate higher postural sway of the person (16).

Activities-specific Balance Confidence Scale (ABC): The scale, which involves 16 activities of daily living associated with balance, is used to determine how much individual confidence and the risk of falling there is when individuals perform these activities. Patients are asked to grade between 0 "completely unsafe" and 100% "completely safe." A score of close to 0 indicates that the patient has increased imbalance and risk of falling (17). The Turkish version of the scale was used in the study, and the author's permission to use the scale was obtained (18).

Six-Minute Walk Test (6MWT): It was used to assess the exercise capacity of the patients. The subjects were allowed to rest for 10 minutes before starting the test. The measurements (heart rate, blood pressure, fatigue, and dyspnea) before and after the test was taken. Heart rate using a Polar heart rate monitor (Polar FT1, Kempele, Finland), blood pressure using a blood pressure monitor (Perfect Aneroid sphygmomanometer, ERKA, Germany), and fatigue and dyspnea were using the Modified Borg Scale were assessed. Walking as fast as possible without running through a 30-meter distance for six minutes was asked from the subjects. The total distance walked by each subject was recorded in meters and used in analyses (19).

International Physical Activity Questionnaire-Long Form (IPAQ): The level of physical activity was assessed using the IPAQ. With this questionnaire, the duration, frequency, and severity of physical activities performed in different situations such as work, transportation, housework and caring for family, recreation, sport, and leisure-time and sitting time in the last seven days are examined in detail and calculated as a metabolic equivalent of task (MET). The smallest score of the questionnaire is 0 MET min/week, and the highest score is ≥3000 MET min/week. 0-600 MET min/week is inactive, 600-3000 MET min/week is minimally active, ≥3000 MET min/week is active (health-enhancing physical activity, HEPA) (20,21). For the study, evaluations were performed using the Turkish version of the scale, and the author's permission to use the questionnaire was obtained (21).

Vestibular Disorders Activities of Daily Living Scale (VADL): The scale measures the level of independence in a total of 28 daily life activities, 12 of which are (VADL-F), nine are (VADL-A), and seven are (VADL-I). The score of each question is between 1 and 10. Total score is between 28-280 points. If the total point is low, it means the individual is independent in daily life activities (22,23). The Turkish version of the scale was used in the study, and the author's permission to use the scale was obtained (23).

Dizziness Handicap Inventory (DHI): The scale assesses the disability and quality of life with the effects of dizziness over the past one month. It consists of 25 questions in total, and there are three subdivisions: functional (9), physical (7), and emotional (9). The scale consists of three options, including "yes," sometimes, and "no." The highest total score is 100, and the lowest is 0. The level of disability according to the scale is categorized as follows: 0-30 points=mild handicap; 31-60 points=moderate handicap; 61-100 points=severe handicap (24). For the study, evaluations were

performed using the Turkish version of the scale, and the author's permission to use the scale was obtained. (25).

Statistical Analysis

Statistical analyses of the study were conducted using the program Statistical Package for Social Sciences (SPSS) Version 22.0 (SPSS Inc. Chicago, USA). A chi-square test was used to analyze the gender differences between the patients with PVH and the control group. In order to determine the difference between the two groups, Student t-Test or a Mann Whitney U Test was used considering whether the data were distributed normally or not. Histogram, coefficient of variation, kurtosis/skewness, detrended plot, and Shapiro-Wilks/Kolmogorov–Smirnov tests were used to find out whether the data were normally distributed, or not. A Spearman correlation analysis was used for the relationship between the variables. The statistical significance level was $p<0.05$. Power analysis was performed with 80%, 85%, and 90% power and 5% type I error, the number of cases was calculated at least 24, 27, and 32 for each group. The study was completed with 39 patients with PVH and 32 controls with 90% power.

RESULTS

Forty-four patients with PVH were included in the study. Five patients were excluded because four did not meet the inclusion criteria (one patient had a lower extremity prosthesis, two patients had additional neurological diseases, and one patient had a sensory loss in the diabetic foot). One patient was unable to complete the assessments. The study was completed with 39 patients (mean age=42.36±12.56 years, 21-65 years, 29 females, 10 males) and 32 controls (mean age=38.96±10.29 years, 21-56 years, 23 females, nine males) (Figure 1). Thirty-three patients had unilateral, and six patients had bilateral PVH. Benign paroxysmal positional vertigo (BPPV) was present in 11 patients with unilateral PVH and three patients with bilateral PVH. The median duration of the diagnosis was 24 months (IQR=5-36 months).

At baseline, there was no difference between the groups regarding physical characteristics, including age, height, weight, body max index, and gender ($p>0.05$, Table 1).

According to VAS scores, it was seen that the median (range) severity of vertigo was 5 (3-7), and frequency was 4 (3-6) in patients with PVH. Similarly, median of severity and frequency of dizziness was 5 (3-7). These results suggested that the severity of vertigo and dizziness changed from slight to severe, and the majority of the patients had vertigo and/or dizziness for 4-5 times a day. Two patients had only dizziness, and 37 patients had both vertigo and dizziness.

The M-CTSIB scores were higher in patients with PVH than those of the controls ($p<0.05$), indicating higher postural sway in patients with PVH compared to the controls. Additionally, the ABC scores were lower in patients with PVH compared to the controls ($p<0.05$, Table 2). The IPAQ total scores and the 6MWT distance of the patients with PVH were significantly lower than those of the control

Table 1: Characteristics of the Patients with Peripheral Vestibular Hypofunction and Controls.

Parameters		PVH Group (n=39) Mean±SD	Control Group (n=32) Mean±SD	p
Age (years)		42.36±12.56	38.96±10.29	0.225[a]
Height (cm)		163.69±9.11	166.06±7.92	0.252[a]
Weight (kg)		72.05±14.05	68.19±15.15	0.270[a]
BMI (kg/m²)		26.99±5.31	24.61±4.54	0.051[a]
Gender, n (%)	**Females**	29 (74.4)	23 (71.9)	0.814[b]
	Males	10 (25.6)	9 (28.1)	

[a]Student t Test, [b]Chi-square Test. PVH: Peripheral Vestibular Hypofunction, BMI: Body Mass Index.

Table 2: Comparison of Balance, Physical Activity Level, Functional Exercise Capacity, Activities of Daily Living and Quality of Life in Patients with Peripheral Vestibular Hypofunction and Control Group.

Variables		PVH Group Median (IQR)	Control Group Median (IQR)	p
M-CTSIB (Point)	Condition-1	0.53 (0.39-0.71)	0.30 (0.26-0.42)	**<0.001*[a]**
	Condition-2	0.75 (0.55-1.06)	0.58 (0.39-0.74)	**0.023*[a]**
	Condition-3	0.91 (0.67-1.21)	0.62 (0.56-0.70)	**<0.001***
	Condition-4	2.21(1.73-3.00)	1.73 (1.61-1.90)	**<0.001***
ABC (0-100)		58.13 (36.25-73.13)	96.25 (91.88-98.75)	**<0.001***
IPAQ Total (MET-min/week)		510 (210.00-850.50)	2417.25 (1688.25-3883.50)	**<0.001***
VADL (28-280)	Functional (12-120)	43 (26-51)	12 (12-12)	**<0.001***
	Ambulation (9-90)	31 (20-41)	9 (9-9)	**<0.001***
	Instrumental (7-70)	23 (13-31)	7 (7-7)	**<0.001***
	Total (28-280)	102 (58-119)	28 (28-28)	**<0.001***
DHI (0-100)	Functional (0-36)	22 (16-30)	0 (0-0)	**<0.001***
	Physical (0-28)	18 (12-22)	0 (0-1.5)	**<0.001***
	Emotional (0-36)	12 (4-24)	0 (0-0)	**<0.001***
	Total (0-100)	50 (36-76)	0 (0-2)	**<0.001***
6MWT (m)[ϕ]		484.01±73.33	601.70±75.93	**<0.001***

*p<0.05. [ϕ]Mean±SD. [a]Mann Whitney U Test, [b]Student's t Test. PVH: Peripheral Vestibular Hypofunction, M-CTSIB: Modified Clinical Test of Sensory Interaction and Balance, Condition-1: Eyes Open, Firm Surface; Condition-2: Eyes Closed, Firm Surface; Condition-3: Eyes Open, Foam Surface; Condition-4: Eyes Closed, Foam Surface, ABC: The Activities-Specific Balance Confidence Scale, IPAQ: International Physical Activity Questionnaire-Long Form, 6MWT: Six-Minute Walk Test, VADL: Vestibular Disorders Activities of Daily Living Scale, DHI: Dizziness Handicap Inventory.

group (p<0.05, Table 2). All the scores of the VADL and DHI were higher in patients with PVH than the control group (p<0.05, Table 2).

There were negative and strong correlations between the severity of vertigo and the IPAQ total score (p<0.05), and there were a negative and low to moderate correlation between frequency of vertigo and the IPAQ total score (p<0.05, Table 3). In addition, negative and moderate correlations found between the severity and frequency of dizziness and IPAQ total score (p<0.05, Table 3). Negative moderate to strong associations were found between vertigo/dizziness severity and 6MWT distance (p<0.05). However, the frequency was not related to walking distance in 6MWT (p>0.05, Table 3).

There were singnificant correlations between severity and frequency of vertigo/dizziness and functional (p<0.05), ambulation (p<0.05), instrumental (p<0.05), and total scores of VADL (p<0.05) and functional (p<0.05), physical (p<0.05), emotional (p<0.05) and total scores of DHI (p<0.05) were found to have positive and moderate to strong correlations with severity and frequency of vertigo/dizziness (p<0.005) in patients with PVH (Table 3).

The M-CTSIB and ABC scores were not correlated with the IPAQ total score (p>0.05, Table 3). A moderate negative association was found between the Condition-4 score in M-CTSIB and 6MWT (p=0.009, Table 3). Additionally, positive and moderate to strong correlations were found between Condition-4 in M-CTSIB and functional (p= 0.002), ambulation (p<0.001), instrumental (p=0.002) and total scores of VADL (p<0,001) and functional (p=0.009), physical (p=0.007), emotional (p=0.013) and total scores of DHI (p=0.007) (Table 3). A positive and moderate to strong correlation was found between the condition-2 score in M-CTSIB and VADL-ambulation score (p=0.026, Table 3).

DISCUSSION

The findings of this study revealed that vertigo/dizziness was related to physical activity levels, functional exercise capacity, independence of daily living activities, and quality of life in patients with PVH. Moreover, balance measurements (decreased somatosensory and visual sensations) and

Table 3: Relationship between Vertigo, Dizziness, and Balance, and Physical Activity Level, Functional Exercise Capacity, Activities of Daily Living, and Quality of Life in Patients with Peripheral Vestibular Hypofunction.

Variables	IPAQ Total		6MWT		VADL								DHI							
					Functional		Ambulation		Instrumental		Total		Functional		Physical		Emotional		Total	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Vertigo																				
Severity	-0.602	**<0.001***	-0.339	**0.035***	0.582	**<0.001***	0.615	**<0.001***	0.592	**<0.001***	0.626	**<0.001***	0.681	**<0.001***	0.576	**<0.001***	0.494	**0.001***	0.640	**<0.001***
Frequency	-0.321	**0.046***	-0.219	0.181	0.518	**0.001***	0.482	**0.002***	0.454	**0.004***	0.492	**0.001***	0.558	**<0.001***	0.527	**0.001***	0.565	**<0.001***	0.578	**<0.001***
Dizziness																				
Severity	-0.493	**0.001***	-0.336	**0.037***	0.514	**0.001***	0.565	**<0.001***	0.545	**<0.001***	0.565	**<0.001***	0.647	**<0.001***	0.542	**<0.001***	0.453	**0.004***	0.627	**<0.001***
Frequency	-0.487	**0.002***	-0.281	0.083	0.446	**0.004***	0.448	**0.004***	0.327	**0.042***	0.408	**0.010***	0.591	**<0.001***	0.454	**0.004***	0.514	**0.001***	0.566	**<0.001***
M-CTSIB																				
Condition-1	-0.124	0.451	-0.296	0.067	0.213	0.193	0.266	0.102	0.252	0.121	0.270	0.097	0.101	0.541	0.260	0.109	0.175	0.287	0.175	0.287
Condition-2	-0.049	0.768	-0.358	**0.025***	0.197	0.229	0.356	**0.026***	0.315	0.051	0.312	0.530	0.195	0.233	0.292	0.071	0.285	0.079	0.278	0.086
Condition-3	-0.002	0.990	-0.101	0.540	0.261	0.109	0.271	0.095	0.217	0.184	0.291	0.720	0.153	0.353	0.298	0.065	0.007	0.964	0.125	0.450
Condition-4	-0.256	0.115	-0.412	**0.009***	0.491	**0.002***	0.572	**<0.001***	0.490	**0.002***	0.545	**<0.001***	0.414	**0.009***	0.427	**0.007***	0.395	**0.013***	0.422	**0.007***
ABC	0.312	0.053	0.448	**0.004***	-0.549	**<0.001***	-0.706	**<0.001***	-0.521	**0.001***	-0.601	**<0.001***	-0.704	**<0.001***	-0.596	**<0.001***	-0.698	**<0.001***	-0.706	**<0.001***
IPAQ Total	-	-	0.480	**0.002***	-0.378	**0.018***	-0.425	**0.007***	-0.276	0.089	-0.366	**0.022***	-0.407	**0.010***	-0.277	0.087	-0.345	**0.032***	-0.378	**0.018***
6MWT	0.477	**0.002***	-	-	-0.558	**<0.001***	-0.678	**<0.001***	-0.533	**<0.001***	-0.624	**<0.001***	-0.524	**0.001***	-0.415	**0.009***	-0.501	**0.001***	-0.528	**0.001***

*p<0.05. r: Spearman Correlation Coefficients PVH: Peripheral Vestibular Hypofunction, M-CTSIB: Modified Clinical Test of Sensory Interaction and Balance, Condition-1: Eyes Open, Firm Surface; Condition-2: Eyes Closed, Firm Surface; Condition-3: Eyes Open, Foam Surface; Condition-4: Eyes Closed, Foam Surface, ABC: Activities-Specific Balance Confidence Scale, IPAQ: International Physical Activity Questionnaire-Long Form, 6MWT: Six-Minute Walk Test, VADL: Vestibular Disorders Activities of Daily Living Scale, DHI: Dizziness Handicap. Inventory.

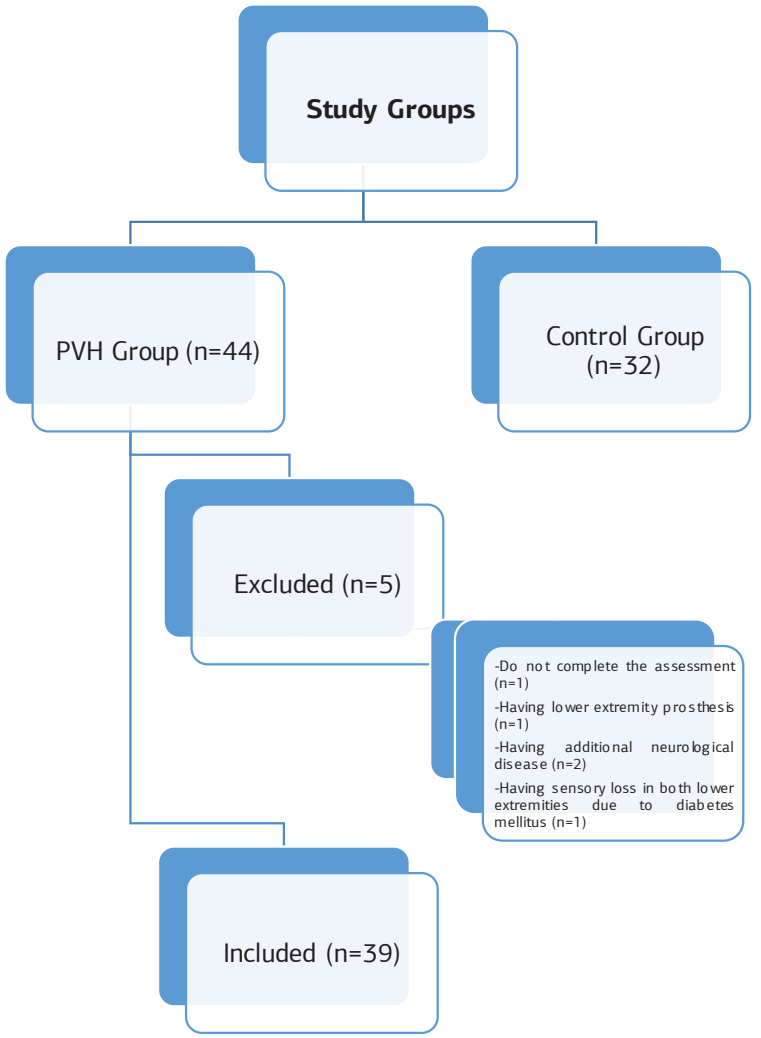

Figure 1: Flow Chart of the Participants.

balance confidence in performing daily activities were related to functional exercise capacity, independence of daily living activities, and quality of life.

Most peripheral vestibular lesions have a benign etiology and undergo spontaneous resolution due to the self-limiting nature of the condition and the process of central nervous system compensation (2). However, when this process is prolonged, or recovery is not fully achieved, patients avoid physical activities, especially these requiring head movement. Patients also move slowly, fear of falling, and restrict social life because of their handicaps. The reason for these limitations was vertigo/dizziness and imbalance symptoms that patients experience. In the literature, some studies observed that balance, physical activity level, independence of daily life activities, and quality of life have been affected in patients with vertigo or dizziness (10,26-28). Our findings were paralel in literature.

There are a limited number of studies investigating the relationship of vertigo or dizziness with physical activity levels (10,11). Ekwall et al. showed that dizziness affected the physical activity levels in older people with dizziness (10). Additionally, they observed that people with dizziness prefer lower intensity exercises, such as walking (10). Kollen et al. found that physical activity levels tend to decline as the dizziness severity increases in older people with dizziness (11). Although the participants of our study were not elderly, these studies that supported our study findings indicated a relationship between dizziness and physical activity level. Therefore, similar results were effective in the younger age group in addition to the literature.

No study investigated the relationship of vertigo or dizziness with functional exercise capacity. However, we knew that inactivity causes a decrease in functional exercise capacity (29). This issue is not generally taken into account in the rehabilitation of patients with vertigo or dizziness. Patients fear falling or losing their balance, and they believe that physical activities will increase their symptoms. Therefore, they do not prefer to do physical activity and exercise. Ekwall et al. suggested that even walking and garden activities decrease the risk of falling, and they improve the quality of life and mood in older people with dizziness (10). Although our patients were younger, and not having severe vertigo or dizziness, their physical activity level and exercise capacity were lower than the controls. We believed that these results were secondary complications of vertigo and dizziness. Therefore, we wanted to draw attention to this relationship, and we believe that aerobic exercises may be recommended to the patients.

Our study showed that objective balance test scores and perceived imbalance of PVH patients were lower compared to the control group. However, we were unable to find a relationship between balance and physical activity level, probably due to not severe vertigo or dizziness in our patients. Therefore, they had to maintain their physical activity even if they were in slow motion because minimal disability could not be an excuse for not to go to work or continue to housework in our country. Patients had to cope with vertigo or dizziness and continue their social roles. Therefore, a decrease in balance scores could not indicate a decrease in physical activity scores. The physical activity level of the controls was lower than expected, indicating that other factors may affect the level of physical activity. Although individuals in the control group had no balance disorder, they did not prefer to be physically active. It may be due to personal, cultural, and social habits. Another reason could be our assessment method because the IPAQ provides a subjective assessment of physical activity, and not specific for patients with PVH. If we had used objective assessments such as an accelerometer, we might have found a relationship.

In the current study, we reported that as vertigo/dizziness severity and frequency increased, patients became dependent on all of the dimensions of daily life activities. Neuhauser et al. showed that vigorous vertigo leads to severe disability, and a person could not perform daily living activities, and their activities were interrupted (30). Another study by Kollen et al. found that older people with dizziness feared to fall in ambulatory activities such as going up and down the stairs and talking on the phone, thus they were dependent on ambulatory daily living activities (11). Although these studies were not specific for PVH and the ages of the patients were not similar to ours, we thought that our results are parallel to their findings (11,30).

In terms of balance tests, we found that the independence of daily life activities was related to only Condition-4 test (eyes closed, foam surface) in the M-CTSIB, indicating vestibular system and its relationship with imbalance (31). Therefore, the independence of patients with PVH decreases in daily living activities when somatosensory and visual sensations decrease due to vestibular disorders. Patients' perceived imbalance could be correlated with the independence of daily life activities.

Our study showed that vertigo and dizziness severity was related to the quality of life in patients with PVH. Grigol et al. showed that vertigo severity was correlated with DHI score in patients with moderate vertigo (32). Another study showing similar results to ours reporting that vertigo was repeated in 88% of patients with vestibular vertigo, and they lived an unhealthy life and often had to go to the hospital (30).

When we investigated the relationship between balance and quality of life in patients with PVH, we found that only M-CTSIB Condition-4 and the ABC Scale were related to quality of life. These results showed that a decrease in visual and somatosensory sensations causes functional and physical limitations and emotional distress in patients with PVH. Finally, quality of life is affected. Gill-Body et al. investigated the effects of balance on functional performance and disability levels in patients with PVH (13). They found a relationship between the Sensory Organization Test with modified timed up and go test and DHI (13). Additionally, they suggested that the Sensory

Organization Test Condition-5 test was predictive for the disability level in patients who had bilateral PVH (13).

In addition to using a relatively subjective measure of physical activity level, we included both bilateral and unilateral PVH patients. Performing the study only with unilateral or only bilateral PVH patients might give different results. The other limitation of this study may be wide age range (21 to 65 years old). Although our study group is considered "young," according to the World Health Organization, it should be kept in mind that the imbalance that occurs as aging could affect all activities.

This study completed with 90% power. It is an important aspect that strengthens our study.

In conclusion, vertigo, dizziness, and balance disorders decreased physical activity levels, functional exercise capacity, independence of daily living activities, and quality of life in patients with PVH. Based on these findings, we thought that patients with PVH should get a vestibular rehabilitation. Vestibular rehabilitation should not only aim to reduce vertigo/dizziness or balance disorders, but it must also be given as training to increase the physical activity levels and functional exercise capacity. In this manner, it could prevent secondary complications of inactivity, reduce disability, and improve quality of life.

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Ethical Approval: Gazi University Ethics Committee of Non-Interventional Clinical Research approved the study (Approval Date: 29.12.2015 and Approval Number: 128).

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TEDAVİ GÖREN ERİŞKİN KANSER HASTALARINDA YAŞAM KALİTESİ VE KAS KUVVETİNİN DEĞERLENDİRİLMESİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Ayaktan tedavi gören kanser hastalarında kas kuvvetini değerlendiren çalışmalar sınırlıdır. Bu çalışmanın amacı, kanser tanısı almış ve kanser tedavisi gören erişkin hastalarında kas kuvveti ile yaşam kalitesi arasındaki ilişkiyi incelemekti.

Yöntem: Çalışmaya solid tümör tanısı ile ayaktan kemoterapi alan 17 (% 31,5) olgu (KT grup), kemoterapi ve cerrahi tedavi alan 20 (% 37,0) olgu (KT+C grup) ve kemoterapi, cerrahi tedavi ve radyoterapi alan 17 (% 31,5) olgu (KT+C+RT grup) olmak üzere, toplam 54 hasta (32 K, 22 E, yaş=49,74±12,00 yıl) dahil edildi. Bireylerin demografik bilgileri kaydedildi. Alt ekstremitede quadriceps femoris kas kuvveti ve üst ekstremitede el kavrama kuvveti değerlendirildi. Yaşam kalitesini değerlendirmek için Avrupa Kanser Araştırma ve Tedavi Organizasyonu Yaşam Kalitesi Anketi (EORTC-QLQ-C30-European) kullanıldı.

Sonuçlar: Yaşam kalitesi skorlarına göre, KT+C+RT grubun, KT+C gruba göre kognitif fonksiyon alt boyutunun etkilendiği belirlendi (p<0,05). KT grup hastaların, KT+C+RT grup hastalara göre; nefes darlığı ve uykusuzluk alt boyutu açısından yaşam kalitesinin olumsuz yönde etkilendiği saptandı (p<0,05). KT+C+RT grup hastaların, genel iyilik hali alt boyutu açısından diğer gruplardan daha iyi oldukları bulundu (p<0,05). Kadın hastaların fiziksel fonksiyon, rol fonksiyonu, ağrı ve semptom alt boyutları bakımından erkek hastalara göre anlamlı olarak daha fazla etkilendiği saptandı (p<0,05). El kavrama kuvveti ile yaşam kalitesi fonksiyonel skor (r=0,416, p=0,003), fiziksel fonksiyon (r=0,232, p=0,047) ve rol fonksiyonu (r=0,422, p=0,011) arasında istatistiksel olarak anlamlı ilişki olduğu belirlendi. Quadriceps kas kuvveti ile fiziksel fonksiyon (r=0,232 p=0,047), rol fonksiyonu (r=0,243, p=0,040) ve kognitif fonksiyon (r=0,259 p=0,030) arasında anlamlı ilişki olduğu bulundu.

Tartışma: Tedavi alan kanser hastalarında üst ve alt ekstremite kas kuvveti ile yaşam kalitesinin fiziksel, kognitif ve rol fonksiyonlarını içeren fonksiyonel skoru ile ilişkilidir. Kanser tedavisi gören tüm hastaların yaşam kalitesinin olumsuz yönde etkilenebileceği ve bu olumsuz etkilenimlerin kadın hastalarda erkeklere göre daha fazla olabileceği saptandı.

Anahtar Kelimeler: Erişkin; Kanser; Kanser Tedavisi; Yaşam Kalitesi.

AN EVALUATION OF QUALITY OF LIFE AND MUSCLE STRENGTH IN ADULT CANCER PATIENTS RECEIVING TREATMENT

ORIGINAL ARTICLE

ABSTRACT

Purpose: Studies investigating muscle strength in cancer patients treating in the outpatient setting are limited. The aim of this study was to investigate the quality of life and muscle strength of adult cancer patients in the treatment stage after cancer diagnosis.

Methods: A total of 54 patients (32 F, 22 M, age=49.74±12.00 years) with solid tumors, 17 (31.5%) patients receiving chemotherapy (CT Group), 20 (37.0%) treated with CT and surgery (CT+S Group), and 17 (31.5%) undergoing chemotherapy, surgery and radiotherapy (CT+S+RT) were included. Patient characteristics were recorded. Quadriceps femoris muscle strength and handgrip strength were measured. The European Cancer Research and Treatment Organization Quality of Life Questionnaire (EORTC-QLQ-C30-European) was used to assess quality of life.

Results: According to the quality of life scores, cognitive function was affected in the CT+S+RT Group compared to CT+S Group (p<0.05). Patients receiving CT, compared to patients receiving CT+S+RT Group in terms of shortness of breath and insomnia, quality of life was negatively affected, and patients receiving CT+S+RT Group were better in terms of general well-being (p<0.05). Female patients were significantly affected in terms of physical function, role function, pain and symptoms compared to male patients (p<0.05). Handgrip strength was correlated with quality of life functional score (r=0.416, p=0.003), phsical function (r=0,232, p=0.047), and occupational function (r=0,422, p=0.011). Score, physical function, and function. There was a relationship between quadriceps femoris muscle strength and functional socre (r=0,232, p=0,047), occupational function (r=0.243, p=0.040), and cognitive function (r=0.259, p=0.030)

Conclusion: Quality of life of the patients receiving cancer treatment had a negative effect and this negative effect was higher in female patients than in men. It was observed that the patients with high upper extremity muscle strength had better physical function, function and function in terms of quality of life.

Key Words: Adult; Cancer; Cancer Treatment; Quality of Life.

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GİRİŞ

Kanser, gelişmiş ülkelerde birinci, gelişmekte olan ülkelerde ise, ikinci en yaygın ölüm nedendir. Kanser prevelansını artıran risk faktörleri arasında nüfusun çoğalması ve yaşlanmanın yanı sıra, sigara içme, aşırı kilo, fiziksel inaktivite ve kentleşme gibi çevresel ve bireysel alışkanlıklar yer almaktadır (1). 2018'de dünyadaki tüm kanser vakalarında her iki cinsiyette ve her yaşta yapılan değerlendirmeler sonucu dünyada kanser vakalarının prevelansı arttığı görülmektedir. Globocan (Global Cancer Observatory) verilerine göre, akciğer kanseri görülme sıklığı % 11,6, meme kanseri % 11,6, kolorektal kanser % 10,2, prostat kanser, % 7,1, mide kanseri % 5,7, karaciğer kanseri % 4,7, özafagus kanseri % 3,2 ve diğer kanser türleri görülme sıklığı % 46 olarak bildirilmiştir (2).

Türkiye verilerine göre, akciğer kanseri görülme sıklığı % 16,5, meme kanseri % 10,6, kolorektal kanserler % 9,5, prostat kanseri % 8,2, tiroid kanseri % 6,2 ve diğer kanserlerin görülme sıklığı % 49'dur (2). Cinsiyet açısından incelendiğinde ülkemizde, erkek hastalarda akciğer kanseri % 24,7, prostat kanseri % 14,6, kolorektal % 9,7, mesane % 8,1, mide % 6,2 ve diğer kanserler % 36,7 oranında görülmektedir. Kadın hastalarda ise, meme kanseri % 24,4, tiroid kanseri % 11,5, kolorektal kanser % 9,3, korpus uteri % 6, akciğer kanseri % 5,8 ve diğer kanserler % 43,1 olarak belirtilmiştir (2).

Dünya Sağlık Örgütü yaşam kalitesini bireyin yaşamdaki konumlarını, içinde yaşadığı kültür ve değer sistemleri, hedefleri, beklentileri, standartları ve endişeleri bağlamında algılaması olarak tanımlar (3). Kişinin fiziksel sağlığı, psikolojik durumu, kişisel inançları, sosyal ilişkileri ve çevresi ile ilgili göze çarpan özellikleri ile karmaşık bir şekilde etkilenen geniş kapsamlı bir kavramdır (4).

Günümüzde kanser tedavisi gören hastalarda bireye bütüncül yaklaşımın en önemli değişkeni olarak araştırılan konu yaşam kalitesidir. Yaşam kalitesindeki olumsuz etkilenimler hastanın tedavi rejimlerine uyumunu zorlaştırır ve hastanede kalma sürelerini uzatabilir. Yapılan tedavilerin sonuçları göz önüne alınarak yaşam kalitesinde hangi parametrelerde etkilenim olduysa önlem alınarak hastanın hem günlük yaşamda hem de tedaviye devam etme noktasında fayda sağlanabilir (5).

Aaronson'a göre yaşam kalitesi birçok bölümden oluşmaktadır. Bunlar mental sağlık, semptomlar, tedavinin yan etkileri, aile ve sosyal ilişkilerde problemler, psikolojik problemleridir. Sosyal sağlık, iletişimin hem nicel hem de nitel yönlerini içerir. Fiziksel sağlık, öz bakım, hareketlilik, fiziksel aktivite düzeyi ve fiziksel bağımsızlığı içeren fonksiyonel sağlık bölümlerinden oluşur (6).

Kanser tedavisinde kullanılan yöntemlerin iyileştirilmesi, tedavi etkinliğinin artması ve hastaların uzun süreli sağ kalımı sonuçlanmaktadır. Hastalarda ortaya çıkan pek çok semptomun yaşam kalitesini etkilediği görülmektedir. Uygulanan tedaviler ile yaşam kalitesini etkileyen faktörler, tedavi şekline ve kişisel özelliklere göre değişebilir. Yorgunluk, kusma ve bulantı, ağrı, bilişsel problemler, kilo kaybı, fiziksel inaktivite, yetersiz beslenme, elektrolit bozukluğu ve konstipasyon bulguları yaygındır ve bu bulgular hastanın yaşam kalitesinde önemli bir rol oynar (7,8).

Kilgour ve ark. el kavrama kuvvetinin kanser hastalarında sağ kalım ile bağımsız olarak ilişkili olduğunu göstermiştir (9). Bu durum kas kuvveti ve fiziksel fonksiyonlara odaklanmanın önemini göstermektedir. Kanser hastalarında tedavi sürecinde kas kuvveti azalabilir. Uygulanan tedaviler, kas protein yapısını bozarak kas kütlesinin azalmasına neden olurlar. Bu sonuca, anabolik ve katabolik metabolizma arasındaki dengenin, katabolik metabolizma lehine bozulması yol açmaktadır (10). Her ne kadar kas kuvveti ve fiziksel fonksiyonların bozulmasında çeşitli faktörlerin rol oynadığı düşülse de, kesin mekanizma açık değildir. Etkileyen etmenleri araştıran çalışmalar devam etmektedir.

Kanserde kas kuvveti kaybı genellikle yatan hastalarda değerlendirilmiştir (11). Fakat ayaktan gelen hastaların günlük yaşamlarına devam ederken kas kuvvetinde meydana gelen değişiklerin yaşam kalitesine etkisi göz ardı edilmiştir. Ayaktan tedavi gören hastalarda yaşam kalitesi ve kas kuvvetinin birlikte değerlendirilmesi, bu konuda fizyoterapi ve rehabilitasyon açısından önemli bilgiler sağlayabilir. Bu nedenle çalışmamızda, kanser tedavisi sürecinde hastaların aldığı tedavilerin yaşam kalitesini ne ölçüde etkilediği, ayrıca kas kuvvetinin yaşam

kalitesi ile ilişkisini belirlemek amaçlandı.

YÖNTEM

Bu çalışma, kesitsel bir çalışma olarak planlandı. Bu amaç doğrultusunda, Mart 2018-Eylül 2018 tarihleri arasında Hacettepe Üniversitesi Onkoloji Hastanesi ve Hacettepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Fakültesi Onkoloji Ünitesi'nde tedavi gören 54 hasta çalışmaya dahil edildi. Çalışmanın yürütülebilmesi için, Hacettepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu'ndan GO 18-169-24 karar numarası ile etik onay alındı (Onay Tarihi: 20.03.2018). Çalışma Helsinki Bildirgesi'nde tanımlanan ilkelere uygun şekilde yürütüldü. Bireyler çalışma hakkında bilgilendirilerek, yazılı aydınlatılmış onam formu imzalatıldı.

Çalışmaya, 18-65 yıl yaş aralığında, solid tümör tanısı alan, kanser tedavisi gören ve çalışmaya katılmaya gönüllü olan bireyler dahil edildi. Diabetes mellitusu olan hastalar ile ileri düzeyde görme ve işitme problemi olan hastalar çalışmaya dâhil edilmedi. Hastaların yaş, cinsiyet, boy ve vücut ağırlığı değerleri, sigara öyküsü, kanser türü ve aldığı tedaviler kaydedildi.

Yaşam kalitesini değerlendirmek için kanser hastalarına özgü geliştirilen Avrupa Kanser Araştırma ve Tedavi Organizasyonu Yaşam Kalitesi Anketi (AKTAO-YK-Ç 30) kullanıldı. Bu anket Aaronson ve

Tablo 1: Kanser Olgularının Fiziksel ve Demografik Özellikleri.

Parametre		Kanser (n=54)	
		X̄±SS	Min-maks
Yaş (yıl)		49,74±12,00	23-65
Cinsiyet (E/K), n %		22/32	40,7/59,3
Boy (cm)		167,31±9,07	153-187
Vücut Ağırlığı (kg)		70,52±13,22	48-110
Tanı		n	%
Meme Kanseri		11	20,4
Akciğer Kanseri		10	18,5
Kolon Kanseri		13	24,1
Diğer		20	37,0
Eğitim			
İlkokul		18	33,3
Ortaokul		8	14,8
Lise		10	18,5
Üniversite		12	22,2
Lisansüstü		1	1,9
Okur-Yazar Değil		5	9,3
Tanı Süresi			
0-6 ay		20	37
7-12 ay		16	29
13-23 ay		10	19
≥24 ay		8	15
Tedavi Sayısı			
Cerrahi		33	61,1
Radyoterapi		17	31,5
Kemoterapi	İlk 3 Kür	26	48,1
	4-7 Kür	19	35,1
	8-14 Kür	5	16,8

Tablo 2: Olguların Yaşam Kalitesi ve Kas Kuvveti Değerleri.

Parametre	Kanser (n=54)	
	X̄±SS	Min-Maks
AKTAO-YK-Ç 30		
Genel Sağlık Durumu	54,01±26,68	0-100
Fonksiyonel Ölçekler		
Fiziksel Fonksiyon	62,92±23,00	0-100
Rol Fonksiyonu	69,44±30,32	0-100
Kognitif Fonksiyon	70,67±27,83	0-100
Duygusal Fonksiyon	66,20±26,32	0-100
Sosyal Fonksiyon	67,59±27,74	0-100
Fonksiyonel skor	66,33±18,13	2,22-93,33
Semptom Ölçeği		
Yorgunluk	59,25±26,34	0-100
Bulantı ve Kusma	33,02±28,12	0-100
Ağrı	45,98±34,40	0-100
Nefes Darlığı	41,45±38,81	0-100
Uykusuzluk	55,55±41,96	0-100
İştah Kaybı	51,23±32,83	0-100
Konstipasyon	43,82±34,15	0-100
Diyare	20,37±28,53	0-100
Mali Zorluklar	35,80±39,30	0-100
Semptom Skor	44,91±20,12	7,69-84,62
El Kavrama Kuvveti (kg-kuvvet)		
Sağ	24,01±8,97	10-44,80
Sol	22,52±9,50	10-43,00
Quadriceps Kas Kuvveti (0-5)		
Sağ	4,60±0,59	3-5
Sol	4,58±0,60	3-5

AKTAO-YK-Ç 30: Avrupa Kanser Tedavileri Araştırma Organizasyonu-Yaşam Kalitesi-Çekirdek Anketi-30

ark. tarafından geliştirilmiştir ve toplam 30 sorudan oluşmaktadır. Genel sağlık durumunu değerlendiren bir ve yaşam kalitesini değerlendiren beş fonksiyonel ölçek (fiziksel fonksiyon, rol fonksiyonu, kognitif fonksiyon, emosyonel fonksiyon, sosyal fonksiyon) ve semptom ölçeğinden oluşan çok boyutlu bir ankettir (12). Fonksiyonel bölümlerde alınan puanların düşük olması, yaşam kalitesinin düşük olduğunu göstermektedir. Semptom ölçeğinde ise, yorgunluk, ağrı, bulantı-kusma, nefes darlığı, uykusuzluk, iştah kaybı, konstipasyon, diyare ve maddi zorluk değerlendirilmektedir. Bu bölümden alınan puanların düşük olması, yaşam kalitesinin yüksek olduğunu göstermektedir. İlk 28 soru dörtlü Likert tipi ölçektir ve maddeler "Hiç: 1 puan," "Biraz: 2 puan," "Oldukça: 3 puan" ve "Çok: 4 puan" olarak değerlendirilmektedir. Ankete yer alan 29. ve 30. sorular genel iyilik hali alanını oluşturan sorulardır. Ölçeğin 29. sorusunda hastadan 1'den 7'ye kadar olan puan aralığında (1: Çok kötü ve 7: Mükemmel) sağlığını ve 30. soruda genel iyilik halinin değerlendirmesi istenmektedir (13). Türkçe geçerlik ve güvenirlik çalışması yapılan ölçek için kullanım izni alındı (14).

Hastaların el kavrama kuvveti, Jamar marka el dinamometresi (Sammons Preston, Bolingbrook, IL, ABD) ile ölçüldü (15). Hasta oturtularak omuz adduksiyonda, dirsek 90 derece fleksiyonda, el bileği ve önkol nötral pozisyonda iken ölçüm yapıldı; ölçüm sağ ve sol el kavrama kuvveti ayrı olarak üç kez tekrarlanıp aritmetik ortalaması alındı.

Quadriceps femoris kas kuvveti manuel kas testi

Tablo 3: Yaşam Kalitesinin Uygulanan Tedavi Açısından Dağılımının İncelenmesi.

AKTAO-YK-Ç 30	KT Grup (n=17)	KT+C Grup (n=20)	KT+C+RT Grup (n=17)	p
	X̄±SS	X̄±SS	X̄±SS	
Fonksiyonel Ölçek				
Fiziksel Fonksiyon	59,21±25,59	64,66±16,05	64,70±27,76	0,727
Rol Fonksiyonu	61,76±30,48	73,33±28,30	72,54±32,77	0,458
Emosyonel Fonksiyon	56,86±29,79	71,24±20,49	69,60±27,78	0,209
Kognitif Fonksiyon	65,60±30,18	61,76±25,29$^{\varphi}$	59,16±26,85	**0,043***
Sosyal Fonksiyon	67,64±23,91	69,16±29,75	65,68±30,31	0,933
Fonksiyonel Skor	61,43±17,94	70,11±15,35	66,79±21,05	0,353
Genel Sağlık Skoru	43,13±26,22$^{\varphi}$	55,41±27,47	63,23±23,58	**0,042***
Semptom Ölçeği				
Yorgunluk	67,32±27,63	56,11±25,61	54,90±25,60	0,316
Bulantı ve Kusma	38,23±28,72	32,49±27,82	28,43±28,72	0,602
Ağrı	53,92±37,04	39,16±33,01	46,07±33,60	0,438
Nefes Darlığı	62,74±42,29$^{\Psi}$	31,66±35,00	31,37±32,21	**0,020***
Uykusuzluk	84,31±20,80$^{\Psi}$	53,33±42,44	29,41±40,62	**<0,001***
İştah Kaybı	49,01±35,58	51,66±27,52	52,94±37,37	0,941
Konstipasyon	47,05±37,37	48,33±31,48	35,29±34,30	0,467
Diyare	19,60±23,74	20,00±27,36	21,56±35,24	0,978
Mali Zorluklar	33,33±39,08	28,33±37,89	47,05±40,92	0,342
Semptom Skor	52,48±21,37	41,92±18,13	40,87±20,11	0,172

$^{\Psi}$p<0,05. $^{\varphi}$p<0.05 KT+C Grup>KT+C+RT Grup, $^{\varphi}$p<0.05 KT Grup<KT+C+RT Grup, AKTAO-YK-Ç 30: Avrupa Kanser Tedavileri Araştırma Organizasyonu-Yaşam Kalitesi-Çekirdek Anketi-30, KT Grup>KT+C ve KT+C+RT Grup.

ile değerlendirildi. Dr. Lowet tarafından geliştirilen ve yerçekimi pozisyonuna ve uygulanan kuvvete göre kasa 0-5 arasında değerler verilerek yapıldı. "0 puan (tam paralizi): kasta hiç kontraksiyon alınmaz," "1 puan (Eser): eklemde hareket açığa çıkmadan kontraksiyon hissedilir," "2 puan (Zayıf): kas yerçekimi elimine edilmiş pozisyonda normal eklem hareketini tamamlar," "3 puan (Orta): kas yerçekimine karşı normal eklem hareketini tamamlar," "4 puan (İyi): kas yerçekimine karşı maksimum dirençten daha az bir dirençle normal eklem hareketini tamamlar" ve "5 puan (Normal): kas yerçekimine karşı maksimum dirençle normal eklem hareketini tamamlar" olarak değerlendirildi (16).

İstatistiksel Analiz

Verilerin analizi SPSS 22 (SPSS Inc. Chicago IL, ABD) programı ile yapıldı ve % 95 güven aralığında çalışıldı. Sayımla belirlenen değişkenler için frekans ve yüzde değeri; ölçümle belirlenen değişkenler için ortalama±standart sapma değerleri hesaplandı. Yaşam kalitesi anketinin ölçek puanlarının cinsiyete göre karşılaştırılması için Student t testi kullanıldı. Gruplar arası karşılaştırma tek yönlü ANOVA ile yapıldı. Posthoc analiz yöntemi olarak Turkey kullanıldı. Kas kuvveti değerleri ile yaşam kalitesi alt başlıkları arasındaki ilişki Spearman korelasyon analizi yöntemi ile değerlendirildi. Spearman koreasyon katsayısına göre, r=0,60-0,75 kuvvetli ilişki, r=0,35-0,59 orta derece ilişki, r=0,25-0,34 zayıf ilişki ve r≤0,24 çok zayıf ilişki olarak belirlendi. Yanılma olasılığı p<0,05 olarak kabul edildi. Araştırmanın post-hoc güç analizi G* Power programı (Versiyon 3.0.10 Universität Düsseldorf, Düsseldorf, Almanya) kullanılarak yapıldı; % 80 güç ve yanılma olasılığı α=0,05 alındı. Primer değişkenin yaşam kalitesi skoru olduğu güç analizi sonucunda, çalışmanın 34 hasta ile tamamlanması uygun bulundu.

Tablo 4: Yaşam Kalitesinin Cinsiyetler Arasında Dağılımının İncelenmesi.

AKTAO-YK-Ç 30	Erkek (n=22)	Kadın (n=32)	p
	X̄±SS	X̄±SS	
Fonksiyonel Ölçek			
Fiziksel Fonksiyon	73,63±16,13	55,62±24,33	**0,004***
Rol Fonksiyonu	81,81±19,18	60,93±33,76	**0,012***
Emosyonel Fonksiyon	70,83±25,03	63,02±27,10	0,288
Kognitif Fonksiyon	75,75±25,57	67,18±29,17	0,270
Sosyal Fonksiyon	68,93±25,35	66,66±29,63	0,770
Fonksiyonel Skor	73,63±11,82	55,62±20,09	**0,013***
Semptom Ölçeği			
Yorgunluk	51,00±21,59	64,93±28,09	0,056
Bulantı ve Kusma	25,00±27,57	38,54±27,57	0,082
Ağrı	33,33±31,70	54,68±33,92	**0,024***
Nefes Darlığı	42,42±38,73	40,62±39,47	0,869
Uykusuzluk	45,45±40,55	62,49±42,12	0,144
İştah Kaybı	43,93±29,79	56,24±34,32	0,178
Konstipasyon	33,33±35,63	51,04±31,66	0,061
Diyare	24,24±34,39	17,70±23,92	0,414
Mali Zorluklar	39,39±35,09	33,33±42,33	0,583
Semptom Skor	38,34±17,94	49,43±20,55	**0,042***

*p<0.05. AKTAO-YK-Ç 30: Avrupa Kanser Tedavileri Araştırma Organizasyonu-Yaşam Kalitesi-Çekirdek Anketi-30.

SONUÇLAR

Çalışmaya 32 (% 59,3) kadın ve 22 (% 40,7) erkek olmak üzere 54 hasta dahil edildi. Olguların yaş, boy, vücut ağırlığı ve demografik özellikleri Tablo 1'de verilmiştir.

Üst ekstremite kas kuvvetinin belirlenmesi için ölçülen sol el kavrama kuvveti ortalaması 22,52±9,50 kg-kuvvet ve sağ el kavrama kuvveti ortalaması 24,01±8,97 kg-kuvvet idi. Alt ekstremite kas kuvveti için ölçülen quadriceps femoris kas kuvveti ortalaması sağ için 4,60±0,59 (ortanca değeri 5) ve sol için kas kuvveti ortalaması 4,58±0,60 (ortanca değeri 5) olarak bulundu. AKTAO-YK-Ç 30 yaşam kalitesi anketi alt parametreleri ve kas kuvveti değerleri Tablo 2'de gösterilmiştir.

Olguların 17'si (% 31,5) (KT Grup) solid tümör tanısı ile ayaktan kemoterapi almaktaydı. Kemoterapi ve cerrahi tedavisi alan 20 (% 37,0) olgu KT+C grubunu oluşturdu. Kemoterapi, cerrahi tedavi ve radyoterapi alan hastalardan oluşan KT+C+RT grubu, 17 (% 31,5) olgudan oluştu.

KT+C+RT Grubu olguların AKTAO-YK-Ç 30 ile belirlenen genel iyilik hali, KT grup hastalardan anlamlı olarak daha iyiydi (p<0,05, Tablo 3). KT grup ile KT+C grup arasında AKTAO-YK-Ç 30 yaşam kalitesi anketi alt boyutları açısından istatistiksel olarak anlamlı farklılık bulunmadı (p>0,05). KT+C+RT grup olguların AKTAO-YK-Ç 30 anketi kognitif fonksiyon alt boyutu, KT+C grup olgulardan anlamlı olarak daha fazla etkilenmişti (p<0,05). Nefes darlığı ve uykusuzluk bakımından sadece KT alan hastalarda anlamlı farklılık bulundu (p<0,05). Bu hastaların daha fazla etkilendiği belirlendi (Tablo 3) .

AKTAO-YK-Ç 30 ile ölçülen yaşam kalitesi düzeyi cinsiyetler arasında karşılaştırıldığında, kadın hastaların yaşam kalitesi anketi alt basamaklarından daha kötü değerler aldığı; kadın ve erkek hastalar arasında fiziksel fonksiyon, rol fonksiyonu, fonksiyonel skor ve semptom kontrolü açısından istatistiksel olarak anlamlı farklılık olduğu gözlendi (p<0,05, Tablo 4).

El kavrama kuvvetinin, yaşam kalitesi parametrelerinden fiziksel fonksiyon (r=0,357, p=0,022), rol fonksiyonu (r=0,422, p=0,011) ve

Tablo 5: Kanser Tedavisi gören Olgularda Kas Kuvveti İle Yaşam Kalitesi Arasındaki İlişki.

AKTAO-YK-Ç 30		El Kavrama Kuvveti		Quadriceps Kas Kuvveti	
		Sol	Sağ	Sol	Sağ
Fonksiyonel Ölçek					
Fiziksel Fonksiyon	**r**	0,357	0,466	0,206	0,232
	p	**0,022***	**0,005***	0,069	**0,047***
Rol Fonksiyonu	**r**	0,261	0,422	0,279	0,243
	p	0,100	**0,011***	**0,021***	**0,040***
Fonksiyonel Skor	**r**	0,261	0,416	0,172	0,170
	p	0,100	**0,013***	0,109	0,112
Semptom Skoru	**r**	-0,050	-0,243	-0,131	-0,130
	p	0,376	0,077	0,176	0,177
Genel Sağlık Skoru	**r**	0,268	0,102	0,032	0,057
	p	**0,043***	0,277	0,411	0,344
Sosyal Fonksiyon	**r**	0,082	0,270	-0,033	-0,015
	p	0,303	0,056	0,406	0,456
Kavrama Fonksiyonu	**r**	0,016	0,169	0,263	0,259
	p	0,459	0,163	**0,029***	**0,030***
Emosyonel Fonksiyon	**r**	0,093	0,100	-0,061	-0,081
	p	0,280	0,281	0,332	0,283
Semptom Ölçeği					
Yorgunluk	**r**	-0,188	0,294	-0,216	-0,195
	p	0,233	0,082	0,121	0,163
Bulantı ve Kusma	**r**	-0,107	-0,106	-0,124	0,102
	p	0,446	0,450	0,471	0,520
Ağrı	**r**	-0,144	-0,315	-0,199	-0,212
	p	0,363	0,061	0,153	0,127
Nefes Darlığı	**r**	0,054	0,002	0,038	0,031
	p	0,732	0,990	0,787	0,823
Uykusuzluk	**r**	-0,147	-0,194	-0,093	-0,060
	p	0,352	0,257	0,508	0,608
İştah Kaybı	**r**	0,127	-0,090	-0,192	-0,178
	p	0,424	0,601	0,168	0,202
Konstipasyon	**r**	-0,282	-0,183	-0,017	-0,027
	p	0,070	0,285	0,906	0,846
Diyare	**r**	0,300	0,020	0,137	0,115
	p	0,054	0,908	0,327	0,413
Mali Zorluklar	**r**	0,158	0,048	0,205	0,177
	p	0,316	0,780	0,140	0,204
Semptom Skoru	**r**	-0,050	-0,243	-0,131	-0,130
	p	0,376	0,077	0,176	0,177

*p<0,05. AKTAO-YK-Ç 30: Avrupa Kanser Tedavileri Araştırma Organizasyonu-Yaşam Kalitesi-Çekirdek Anketi-30.

fonksiyonel skor (r=0,416, p=0,013) ile arasında pozitif yönlü ilişki olduğu bulundu. Quadriceps kas kuvveti ile yaşam kalitesi parametrelerinden fiziksel fonksiyon (r=0,232, p=0,047), rol fonksiyonu (r=0,279, p=0,021) ve kognitif fonksiyon (r=0,263, p=0,029) arasında ilişki olduğu belirlendi (Tablo 5).

TARTIŞMA

Kanser tanısı sonrası tedavi aşamasında olan erişkin kanser hastalarının yaşam kalitesi ve kas kuvvetini incelediğimiz çalışmamız sonucunda; hastaların yaşam kalitesi bakımından kadın hastaların daha fazla etkilendiği; KT grup hastaların uykusuzluk ve nefes darlığı bakımından; KT+C+RT grup hastaların

ise, kognitif fonksiyonun etkilendiği ve genel iyilik açısından kendilerini daha iyi hissettikleri sonucuna varıldı. El kavrama kuvveti etkilenen hastaların yaşam kalitesi bakımından fonksiyonel yönden etkilendiği; bu etkilenimin fiziksel fonksiyon ve rol fonksiyonu açısından belirgin olduğu sonucuna varıldı. Alt ekstremite kas kuvvetinin fiziksel fonksiyon, rol fonksiyonu ve kognitif fonksiyonu ile ilişkili olduğu bulundu.

Chan ve ark. yaptıkları çalışmada, neoadjuvant kemoterapi tedavisi görmekte olan hastaları kemoterapi ve cerrahi dönemi olarak iki kısma ayırdıklarında kemoterapi döneminde yaşam kalitesinin daha fazla etkilendiğini fakat anlamlı bir farklılık olmadığını ileri sürmüşlerdir (17). Sawada ve ark. yaptıkları çalışmada, tedavi başlangıcından 15 gün sonra ve tedavinin sonunda yapılan değerlendirmelerde radyasyon sırasında depresyon ve yorgunluk belirtileri artarken, yaşam kalitesinin azaldığını bulmuşlardır (18). Çalışmamızda bu çalışmaya paralel olarak tedavide kemoterapi, cerrahi ve radyoterapinin birlikte olduğu grup, rol fonksiyonu, emosyonel fonksiyon ve kognitif fonksiyon açısından tek başına kemoterapi alan olgular veya kemoterapi ile alan olgulardan daha fazla etkilenmişti. Sadece kognitif fonksiyonda belirgin farklılık bulundu. Bu sonuçlar da yaşam kalitesinin negatif olarak etkilediğini göstermektedir. Yapılan bir başka çalışmada, radyoterapinin bilişsel fonksiyonları anlamlı derecede etkilemesinin altında yatan neden olarak yapılan çalışmalar sonucu radyoterapi ile hafıza fonksiyon bozukluğu arasındaki ilişkinin kısmen plazma interlökin-6 seviyelerinin yükselmesinin neden olduğu hipokampal inflamasyon ile açıklanabileceği ileri sürülmüştür (19). AKTAO-YK-Ç 30 ile ölçülen kognitif fonksiyonun KT+C+RT grup olgularda daha fazla etkilenmesinin nedeni olarak kombine tedavide her bir tedavi ajanının bilişsel fonksiyonu olumsuz yönde etkilediğini düşünmekteyiz .

Tedavi şekli kemoterapi, cerrahi ve radyoterapi olan hastaların genel iyilik hali belirgin olarak farklılık göstermektedir. Safieddine ve ark.'nın yaptıkları çalışmada beyin tümörü olan hastalarda kemoterapi, cerrahi ve radyoterapinin, yaşam kalitesini uzun dönemde etkilendiği belirlenmiştir. Aynı hasta grubu içinde cerrahi öncesi kemoterapi dönemi ve radyoterapi ile biten sürecin sonunda yaptıkları incelemede, sağkalımın cerrahi olan grubun daha iyi sonuçlandığını ve kombine tedavi grubunun başlangıçtaki kemoterapi ile karşılaştırıldığında daha yüksek skorlar elde ettiklerini ifade edilmiştir (20). Dahiya ve ark. kemoradyoterapi alan ileri evre servikal kanseri olan hastalarda, tedavi öncesi ve sonrası yaptıkları yaşam kalitesi değerlendirmesi sonucunda, altı aylık takip ile tedavi öncesi genel sağlık skorunun belirgin olarak yükseldiğini (tedavi öncesi 50,15 puan ve tedavi sonrası 59,52 puan) saptamıştır (21). Genel sağlık durumu açısından skorun yükselmesinin, tedavinin olumlu etkisi ile birlikte hastanın tedaviye adapte olması, kendini iyi hissetmesi yerine: tedaviye devam etme gücünü artırmasından kaynaklandığını düşünmekteyiz.

Geve ve ark. 18–39 yaşlarında olan ve akut tedavisini tamamlamış genç erişkin kanser hastalarda yaptıkları çalışmada, cinsiyet arasında analiz sonucunda kadın hastaların fiziksel fonksiyon, duygusal fonksiyon ve bilişsel fonksiyon ölçeklerinde erkek hastalardan daha fazla etkilendiğini belirlemiştir. Semptom ölçeğinden ise, yorgunluk, uykusuzluk, kabızlık ve mali zorluklar bakımından yine kadın bireylerin erkeklere oranla daha fazla etkilendiklerini bildirmişlerdir (22). Üstündağ ve Zencirli yaptıkları çalışmada, kemoterapi alan hastaların yaşam kalitesini değerlendirmişler ve sonucunda kadın hastaların fiziksel ve sosyal fonksiyonlarının erkek hastalara göre daha fazla etkilendiğini saptamışlardır (23). Derogor ve ark. AKTAO-YK-Ç 30 ile yaşam kalitesini değerlendikleri çalışmada; kadın hastaların fiziksel fonksiyon, emosyonel fonksiyon, ağrı, yorgunluk ve uykusuzluk ile ilgili olarak erkek hastalardan daha fazla sorun yaşadığını bildirmişlerdir (24). Çalışmamızda, yaşam kalitesi açısından erkek ve kadınlar arasında yapılan incelemelerde, kadınların fiziksel fonksiyon, rol fonksiyonu ve semptom açısından erkek hastalara göre daha fazla etkilendiği gözlendi. Yaşam kalitesinin birçok alt parametresinin etkilenmesi, kadın hastalarda kanser tedavisinin daha yıkıcı sonuçlar doğurduğunu ifade etmektedir. Bu veriler ışığında, çalışmamız literatür ile paralel sonuçlar göstermektedir.

Kemoterapi aldıktan sonra meydana gelen bulantı ve kusmanın bu süreçte fazla nedeniyle uykusuzluğu tetiklediğini düşünmekteyiz. Literatürde ağrı, uykusuzluk, nefes darlığı ve bulantı kusma ilişkilendirilmiştir (25). Aynı zamanda Nikbakhsh ve ark. yaptığı çalışmada ise, tanı konulduktan sonra sadece kemoterapi tedavisi yapılan kanser

hastalarında depresyon ve anksiyete görüldüğünü ve bazı hastaların bu duygularını bastırdıklarını ilerleyen dönemlerde ise bu durumun daha kötü sonuçlar doğurduğunu belirtmişler (26).

Kas kuvveti ile yaşam kalitesi arasındaki ilişki ele alındığında sağ el kavrama kuvveti ile rol fonksiyonu ve fiziksel fonksiyon arasındaki ilişkinin de etkilendiği görüldü. Ekinci ve Düger yaptığı bir çalışmada, yatan hastalarda kas kuvveti ile yaşam kalitesi arasındaki ilişkide fiziksel fonksiyonun etkilendiğini göstermiştir (27). Moon ve ark. kolorektal kanser tedavisi gören hastalarda, azalan fiziksel aktivite ile proinflamatuar sitokin seviyesinde oluşan artışın kas katabolizmasını tetiklediğini ve kas kütlesinin azaldığını tespit etmişlerdir (28). Bilişsel işlev ile iskelet kas kuvveti arasında ilişki olduğunu belirten çalışmalar da mevcuttur (29,30). İskelet kasından salgılanan interlökinler ile beyin türevli nörotrofik faktörün bilişsel işlevi etkileyerek, beyin fonksiyonlarını etkilediği bildirilmiştir (29). Lidoriki ve ark., kas kuvveti düşük olan kanser hastalarında; postoperatif komplikasyon riskinin artığını, kemoterapinin neden olduğu toksiditenin yüksek olması ile ve kötü sağ kalım riski ile ilişkili olduğunu ileri sürmüşler (30). Azalmış kas kütlesi birçok kanser türünde yaşam kalitesindeki düşüş için önemli bir prognostik faktör olarak ortaya çıkmıştır. Yapılan çalışmalarda teknolojik cihazlar ile ölçümler yapılmıştır. Fakat klinikte bu ölçüm yöntemleri pahalı (29,30) ve erişimi zor olan tekniklerdir. Daha basit ve erişimi kolay olan dinamometreler yardımı ile fizyoterapistler kanser tedavisi gören hastaların kas kuvvetini ölçebilirler. Fiziksel fonksiyon ve yaşam kalitesi ile ilgili olarak kas kuvveti kaynaklı durumu erken dönemde belirleyebilirler.

Klassen ve ark, farklı tedavi rejimleri alan meme kanseri hastalarında yaptıkları çalışmada, quadriceps kuvveti ve el kavrama kuvvetinin, tedavi alan hasta grubunda sağlıklı kadın grubuna göre % 25 daha düşük olduğu bildirilmişlerdir. Kas kuvvetini yaş, yorgunluk, ağrı, depresyon, yapılan cerrahi ve cerrahiden sonra geçen süre gibi birçok faktör göz önüne alındığında, en çok hastaları kemoterapi almış olmasının etkilediğini bildirmişlerdir (31). Günümüzde fizyoterapistler egzersizi kanser tedavisi alan hastalarda yaşam kalitesini artırmak için kullanmaktadırlar (32). Kas fonksiyonun farklı kanser tedavilerinden etkilendiği düşünüldüğünde, hastaya özel egzersiz uygulamaları ile daha iyi kas performansı, kanser toksiditidesi, operasyona bağlı olan kısıtlılıkları ve fiziksel inaktivitenin getirdiği olumsuzlukları azaltarak hastanın mortalite riskini azaltabilir. Bu konuda farklı kanser türlerini ve farklı tedavi kombinasyonlarını içeren ileri çalışmalara ihtiyaç vardır.

Kanser tedavisi geniş özellikler gösteren hasta kitlesini kapsamaktadır. Klinikte çalışan fizyoterapistler yaşam kalitesini değerlendirmeli ve hastanın ihtiyaçları için tedavi programına ilgili eğitimleri eklemelidirler. Bu konudaki ileri araştırmalar ile hastaların farklı özellikleri göz önüne alınarak yaşam kalitesi ve kas kuvveti yerine: erken dönemde belirlenecek hastaların olumsuz yönde etkilenmelerinin önüne geçilebilmeli ve gerekli önlemler alınabilmelidir.

Hastaların aldıkları farklı tedaviler göz önüne alındığında kanser türüne göre tedavi süreleri, kür sayıları, cerrahi, radyoterapi ve kemoterapi türlerinin farklı olması çalışma için limitasyondur. Alt ekstremite kas kuvvetinin manuel kas testi yerine objektif yöntemler ile ölçülmesi geniş bir değer aralığında değerlendirme yapılmasını sağlayabilirdi.

Sonuç olarak, bu çalışmada kanser tedavisi gören hastaların yaşam kalitesinin aldıkları tedaviye ve tanıya göre farklılık gösterdiği; kadın hastaların erkeklere göre daha fazla etkilendiği bulundu. Ayaktan tedavi gören, kas kuvveti kaybı olan hastalarda yaşam kalitesinin fiziksel rol fonksiyonu ve kognitif fonksiyonlarının olumsuz etkilendiği görüldü. Hasta tarafından bildirilen yaşam kalitesi düzeyi kanser tedavisinin olumsuz etkilerinin fizyoterapistlerin uyguladıkları tedavi programında yönlendirmede yardımcı olabilir.

Destekleyen Kuruluş: Yok.

Çıkar Çatışması: Yok.

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Hakem Değerlendirmesi: Dış bağımsız hakemler tarafından değerlendirilmiştir.

Yazar Katkıları: Konsept – AA, TD; Dizayn – AA, TD; Süpervizyon - TD; Kaynaklar – AA, TD; Materyaller –

AA, TD; Veri toplama ve/veya İşleme - AA; Analiz ve/veya Yorumlama – AA, TD; Literatür Tarama - AA; Makale Yazımı – AA, TD; Eleştirel İnceleme - TD.

Açıklamalar: Yok.

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AN INVESTIGATION OF QUALITY OF LIFE RELATED TO PROSTHESIS IN SYRIAN REFUGEE LOWER EXTREMITY AMPUTEES

ORIGINAL ARTICLE

ABSTRACT

Purpose: The use of prosthesis and an individual's perception of the prosthesis are associated with the quality of life. The study aimed to evaluate the quality of life related to prosthesis in Syrian refugees with lower extremity amputees.

Methods: The study was conducted at three different prosthetic-orthotic centers managed by the Alliance of International Doctors. Seventy-six male (age=37.76±12.83 years) and 12 females (age=37.16±16.07 years) Syrian refugees with unilateral lower extremity (transtibial and transfemoral/knee disarticulation) amputation were evaluated. Demographic and amputation and prostheses-related characteristics were recorded. Quality of life related to the prosthesis was evaluated using the Prosthetic Evaluation Questionnaire (PEQ).

Results: All PEQ scores of the transtibial and transfemoral/knee disarticulation amputees were similar (p>0.05). The PEQ-Appearance score of the single amputees was observed to be significantly lower than the married amputees (p=0.013). The PEQ-Ambulation score of participants using prosthesis over one year was significantly higher (p=0.038). The PEQ-Sound score of participants using prosthesis less than one year was found significantly higher (p=0.048). The PEQ-sound scores of chronic disease group were significantly higher than those of accident and war associated amputees (p=0.020).

Conclusion: Quality of life of the refugee amputees regarding prosthesis and living with a prosthesis were similar regardless of the level of amputation. Expectations change with the increase in the duration of prosthesis use, and in single amputees, the expectation of cosmetic appearance becomes a concern.

Key Words: Amputees; Prosthesis; Quality of Life.

SURİYELİ MÜLTECİ ALT EKSTREMİTE AMPUTELERİNDE PROTEZE BAĞLI YAŞAM KALİTESİNİN ARAŞTIRILMASI

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Protez kullanımı ve bireyin protez algısı yaşam kalitesi ile yakından ilişkilidir. Bu çalışmanın amacı, Suriyeli mülteci alt ekstremite amputelerinde proteze bağlı yaşam kalitesini araştırmaktı.

Yöntem: Çalışma, Uluslararası Doktorlar Derneği tarafından yönetilen üç farklı protez-ortez merkezinde yapıldı. Tek taraf alt ekstremite amputasyonu (transtibial ve transfemoral/diz dezartikülasyonu) geçirmiş 76 erkek (yaş=37,76±12,83 yıl) ve 12 kadın (yaş=37,16±16,07 yıl) Suriyeli mülteci ampute dahil edildi. Demografik veriler, amputasyon ve protez ile ilgili özellikler kaydedildi. Proteze bağlı yaşam kalitesini değerlendirmek için Protez Değerlendirme Anketi (PDA) kullanıldı.

Sonuçlar: Transtibial ve transfemoral/diz dezartikülasyonu olan amputelerin tüm PDA puanları benzer bulundu (p>0,05). Bekar olan bireylerin PDA-Görünüş puanının evlilere göre anlamlı derecede düşük olduğu gözlendi (p=0,013). Bir yıldan uzun süredir protez kullananlarda PDA-Ambulasyon puanının anlamlı derecede yüksek olduğu bulundu (p=0,038). Bir yıldan kısa süredir protez kullananların ise, PDA-Ses puanı anlamlı derecede yüksekti (p=0,048). PDA-Ses puanı kronik hastalık nedenli amputasyonlarda, kaza ve savaş nedenli amputasyonlara göre anlamlı olarak daha yüksekti (p=0,020).

Tartışma: Mülteci amputelerin, protezleri ve yaşam kalitesi ile ilgili algılarının, amputasyon seviyesinden bağımsız olarak, birbirine benzediği bulundu. Protez kullanım süresinin artışı ile beklentilerde değişim görülmekte ve bekar bireylerde görsellik beklentisi ön plana çıkmaktadır.

Anahtar Kelimeler: Ampute; Protez; Yaşam Kalitesi.

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INTRODUCTION

Quality of life is defined as a person's perceived position concerning his/her aims, expectations, conditions, and concerns within the scope of the values and culture of the person's habitat (1). Physical health is influenced by the level of independence, psychological condition, social relationships, individual beliefs, and the living environment. Amputation causes substantial changes in a person's daily life and function levels (2). The amputee faces many challenges to return the pre-operative functional levels, and the limitations in maintaining physical function affect the quality of life adversely (3). Therefore, one of the aims of the rehabilitation programs in lower limb amputees with prosthesis is to maintain the quality of life (4).

The use of prosthesis and the individual's perception of the prosthesis are associated with the quality of life (5). Prosthesis usage restores the body image, gives a cosmetically acceptable appearance, and improves function (6). In addition, the type and quality of prosthesis plays a vital role in the individual's perception of life and his/her quality of life (2,4)

In Arabic-speaking countries, the incidence of diabetes-related amputation is the highest (7,8). In addition to this, other causes such as terror incidents and wars have been steadily increasing (9,10). A substantial number of amputees reside in Arabic-speaking countries, and some of them were forced to leave their homes and live as refugees in other countries. It is crucial to investigate how the amputation level, cause, and other descriptive variables efect quality of life in the refugees with amputees. The present study aimed to investigate the quality of life as well as their perceptions related to prosthesis using the Prosthesis Evaluation Questionnaire (PEQ) in Syrian refugees with lower extremity amputees.

METHODS

The study was a cross-sectional multi-centered study. The study was conducted on three different prosthesis-orthosis centers (Istanbul, Sanliurfa, and Reyhanli) operating by the Alliance of International Doctors, an international non-governmental organization, between February 2, 2019, and December 7, 2019. The study included 88 Syrian refugees with unilateral lower extremity (transfemoral/knee disarticulation, TFA/KD, and transtibial, TTA) amputees in an age range of 18-74 years, wearing prostheses at least 8 hours/day, and with perception and mental competence to understand and answer Arabic questions. The sample size was calculated using Power and Sample Size Program (Version 3.1.2, Tennessee, USA) based on a previous study and determined as 24 amputees for each group (TTA-TFA/KD) (95% power and α=0.05 Type I error probability) (11). Upper extremity, Chopart, ankle/hip disarticulation, and bilateral/multiple lower extremity amputees were not included in the study. All amputees participated in a similar prosthetic rehabilitation program planned by the same physician and physiotherapist, on average, 6-8 sessions.

Marmara University Faculty of Medicine Ethics Committee of Non-Interventional Clinical Research approved the study (Approval Number: 09.2019.004 and Approval Date: 04.01.2019). After obtaining written consent from the amputees, data collection was started. During the evaluation, a native Arabic speaking interpreter and was familiar with prosthesis terminology provided communication with the participants.

Demographic and descriptive data, such as the cause/level of amputation, kind of prosthetic components, the duration of the prosthesis use, marital status, education status, and employment status of the subjects were collected.

The PEQ was used to assess the quality of life-related to the prosthesis. The PEQ, developed by the Prosthetics Research Study (PRS) group, is a comprehensive self-report measurement tool to assess the functional level and prosthesis-related quality of life in lower extremity amputees (4,12). Day and Buis conducted the validity study of the Arabic version of the scale (13). Permission was obtained from Day and Buis for the use of the scale in the present study. The PEQ is composed of 82 questions with nine subgroups, including Frustration, Perceived Response, Social Burden, Ambulation, Utility, Residual Limb Health (RLH),

Table 1: Socio-Demographic and Amputation-Related Characteristics of the Amputees.

Characteristics	Amputation Level		Marital Status		Duration of Prosthesis		Cause of Amputation			Gender		Employment Status	
	TTA (n=48)	TFA/KD (n=40)	Married (n=69)	Single (n=19)	<1 Year (n=32)	≥1 Year (n=56)	Accident (n=15)	War (n=61)	Chronic Disease (n=12)	Female (n=12)	Male (n=76)	Unemployed (n=68)	Employed (n=20)
Age (years), Mean±SD	40.23±14.45	34.63±10.98	41.01±12.49	25.57±7.60	38.62±14.88	37.14±12.27	36.46±10.23	33.96±10.82	58.08±8.79	37.16±16.07	37.63±12.83	38.54±14.36	34.75±7.82

Amputation level-mean age p=0.048*; Marital Status *p<0.001; Cause of Amputation *p<0.001, TTA: Transtibial Amputee, TFA/KD: Transfemoral Amputee/Knee Disarticulation.

Table 2: Prostheses-Related Characteristics of the Amputees.

Components	Suspension n (%)				Foot n (%)				Knee n (%)			
	Active Vacuum	Passive Vacuum	Pin Lock	Suction	Sach	Single Axis	Dynamic	Carbon	Monocentric Friction	Hydraulic	Pneumatic	Micro Processor
TTA	7 (14.6)	8 (16.7)	33 (68.8)	0	3 (6.3)	23 (47.9)	14 (29.2)	8 (16.7)	0	0	0	0
TFA/KD	0	0	24 (60)	16 (40)	4 (10)	16 (40)	16 (40)	4 (10)	15 (37.5)	4 (10)	20 (50)	1 (2.5)

TTA: Transtibial amputee, TFA/KD: Transfemoral/knee disarticulation amputee.

Table 3: Prosthesis Evaluation Questionnaire Scores by the Amputation Levels.

Prosthesis Evaluation Questionaire	TTA (n=48)	TFA/Knee Disarticulation (n=40)	p
Ambulation	6.12±2.55	5.94±2.52	0.741
Transfer	7.29±2.36	6.96±2.21	0.489
Utility	7.46±1.85	7.10±2.28	0.407
Satisfaction	7.50±2.20	7.33±2.46	0.738
Prosthetic Care	8.15±2.04	8.20±1.70	0.918
Appearance	7.59±2.09	7.50±2.14	0.846
Sounds	7.16±2.80	7.36±2.44	0.726
Residual Limb Health	6.95±2.02	6.56±1.96	0.365
PEQ-PF	7.29±1.79	7.13±1.87	0.681
PEQ-MS	6.71±2.21	6.45±2.14	0.577

Student t Test. TTA: Transtibial Amputee, TFA: Transfemoral Amputee, PEQ-PF: Prosthesis Evaluation Questionnaire- Prosthetics Function, PEQ-MS: Prosthesis Evaluation Questionnaire-Mobility Scores.

Appearance, Sounds, and Well-being. There are also specific questions in the PEQ related to satisfaction, pain, transfer, prosthetic care, self-efficacy, and importance questions (14). In the present study, PEQ-Ambulation, PEQ-Appearance, PEQ-RLH, PEQ-Sounds, and PEQ-Utility and the questions related to transfer, prosthetic care, and satisfaction were evaluated. All questions use a Visual Analogue Scale (VAS, ranging from 0-the lowest score to 10-the highest score) and refer to four weeks preceding the administration of the instrument (12). The scores for each subgroup were generated by computing the arithmetic mean of all questions, and at least half of the questions of a single group should be answered with a number score (14). Furthermore, PEQ-Prosthetics Function Score (PEQ-PF) and PEQ-Mobility Score (PEQ-MS) were calculated. The PEQ-PF Score was calculated as the mean score of the values obtained in PEQ-Appearance, PEQ-RLH, PEQ-Sounds, and PEQ-Utility. The PEQ-MS combined the PEQ-Ambulation and Transfers subgroups (4).

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows (Version 21.0. IBM Corp., Armonk, NY, USA). Descriptive statistics were used to categorize the amputees. Student t-test was used binary comparisons. Kruskal Wallis test was used for the multi-group comparisons, and Mann-Whitney-U test was used as post hoc. In this study, the significance level was determined as $p<0.05$ for all evaluations.

RESULTS

The mean age of the amputees (12 females, 76 males) was 37.68±13.22 years. Socio-demographic and amputation-related characteristics of the amputees are shown in Table 1. According to age outcomes, amputation level, marital status, cause of amputation showed difference between intra-classification of the related parameters ($p=0.048$, $p<0.001$, $p<0.001$ respectively). The gender, duration of prothesis and employment status were similar between the groups ($p=0.884$, $p=0.616$, $p=0.262$ respectively). The prostheses-related characteristics of the amputees are presented in

Table 4: Comparison of Prosthesis Evaluation Questionnaire Scores by Educational Status.

PEQ	Illiterate (n=11)	Elementary (n=19)	Secondary (n=29)	High School (n=22)	Undergraduate/ Graduate (n=7)	p$^{\phi}$
PEQ-PF	7.57±2.29	2.29±2.17	7.32±1.42	7.15±1.71	6.23±1.98	0.416
PEQ-MS	6.84±2.59	7.12±2.32	6.62±1.81	6.25±2.26	5.76±2.41	0.462

$^{\phi}$Kruskal Wallis Test. PEQ-PF: Prosthesis Evaluation Questionnaire-Prosthetics Function, PEQ-MS: Prosthesis Evaluation Questionnaire-Mobility Scores.

Table 5: Comparison of Prosthesis Evaluation Questionnaire Scores by Gender.

Prosthesis Evaluation Questionnaire	Total (n=88)	Female (n=12)	Male (n=76)	p
Ambulation	6.04±2.53	6.08±3.04	6.03±2.46	0.951
Transfer	7.14±2.29	6.25±2.95	7.28±2.16	0.146
Utility	7.30±2.05	7.58±1.62	7.25±2.12	0.606
Satisfaction	7.42±2.31	7.51±2.09	7.41±2.36	0.895
Prosthetic Care	8.17±1.88	7.75±1.90	8.24±1.88	0.403
Appearance	7.55±2.10	7.37±2.12	7.58±2.11	0.747
Sound	7.25±2.62	6.89±2.46	7.31±2.67	0.618
Residual Limb Health	6.77±1.99	6.33±2.62	6.85±1.88	0.402
PEQ-PF	7.22±1.82	7.04±1.94	7.24±1.81	0.721
PEQ-MS	6.59±2.17	6.17±2.87	6.66±2.06	0.467

Student t Test. PEQ-PF: Prosthesis Evaluation Questionnaire-Prosthetics Function. PEQ-MS: Prosthesis Evaluation Questionnaire-Mobility Scores.

Table 2.

The PEQ-PF and PEQ-MS scores were found to be similar in all subgroups in terms of TTA and TFA/KD. In the PEQ subgroups, even though statistically insignificant, scores of the TFA/KD group were trended to be lower (p>0.05) (Table 3). The PEQ-PF and PEQ-MS values of the amputees with various educational status were found to be similar (p>0.05) (Table 4). All PEQ scores of the male and female amputees were found to be similar (p>0.05) (Table 5).

In terms of all PEQ subgroup scores, except for PEQ-Appearance (p=0.013) and PEQ-PF (p=0.031), there was no difference between single and married amputees (p>0.05) (Table 6).

It was observed that the mean PEQ-Ambulation scores of amputees using prosthesis for more than one year were found to be significantly higher (p=0.038). On the other hand, the mean PEQ-Sounds scores of those with prosthesis for less than one year were significantly higher (p=0.048) (Table 6). Even though no difference was observed in multiple comparisons of the groups, the difference between an accident, war, and chronic disease groups was found to be significant in terms of the PEQ-Sounds scores (p=0.020). In terms of the employment status, all subgroups showed similar PEQ scores (p>0.05) (Table 6).

DISCUSSION

In the study, PEQ scores were found to be above average. The satisfaction level was excellent in terms of the characteristics evaluated. All PEQ subgroups, PEQ-PF, and PEQ-MS scores of the TTA and TFA/KD amputees were found to be similar. We found that the amputation level did not affect the quality of life. The quality of life was similar according to gender and education level. Expectations change with the increase in the duration of prosthesis use, and in single amputees, and the expectation of cosmetic appearance becomes a concern.

In previous studies, quality of life, prosthesis compatibility, and duration of daily prosthesis use the TFA have been reported to be lower (15,16). The PEQ scores of the amputees with different levels of amputations were similar. The scores of the TTA were tended to be higher than those of the TFA (3,17,18). The lower scores of the TFA/KD overlap with previous studies.

Despite difficulties associated with transfemoral prosthesis production and with meeting the prosthesis expectation of TFA/KD, the similarities of PEQ scores of TFA/KD and TTA showed that the prosthesis for TFA/KD reached a level similar to TTA in meeting the expectations of the amputees.

A meaningful relationship between prosthesis mobility and satisfaction with life has been shown (17). The PEQ-MS scores of the present study were found to be similar to the results reported by Franchignoni et al. (12) but lower than those reported by the other studies (4,5,16,19). The PEQ-

Table 6: Comparison of Prosthesis Evaluation Questionnaire Scores by the Descriptive Characteristics.

Prosthesis Evaluation Questionnaire	Marital Status			Duration of Prosthesis			Cause of Amputation				Employment Status		
	Married (n=69)	Single (n=19)	p[δ]	<1 year (n=32)	≥1 year (n=56)	p[δ]	Accident (n=15)	War(n=61)	Chronic Disease (n=12)	p[ϕ]	Unemployed (n=68)	Employed (n=20)	p[δ]
Ambulation	6.14±2.53	5.86±2.53	0.491	5.30±2.90	6.46±2.20	**0.038***	6.50±2.20	5.97±2.41	5.85±3.52	0.754	6.05±2.57	5.98±2.44	0.910
Transfer	7.27±2.34	6.67±2.48	0.313	6.91±2.40	7.27±2.32	0.479	6.33±2.36	7.36±2.21	7.04±2.59	0.242	6.99±2.33	7.66±2.13	0.253
Utility	7.50±2.05	6.57±1.97	0.083	7.07±2.09	7.42±2.03	0.449	6.80±2.34	7.39±1.82	7.44±2.83	0.468	7.37±2.04	7.04±2.13	0.533
Satisfaction	7.56±2.35	6.94±2.16	0.303	6.87±2.60	7.73±2.08	0.093	7.40±2.16	7.50±2.22	7.07±3.03	0.863	7.50±2.35	7.16±2.19	0.563
Prosthetic Care	8.18±2.00	8.14±1.37	0.929	7.94±2.00	8.30±1.80	0.387	7.31±2.66	8.38±1.56	8.21±2.08	0.167	8.30±1.72	7.55±2.34	0.255
Appearance	7.84±1.97	6.50±2.29	**0.013***	7.66±1.95	7.48±2.19	0.709	6.93±2.77	7.49±2.01	8.62±1.20	0.153	7.57±2.04	7.48±2.34	0.857
Sounds	7.50±2.55	6.33±7.77	0.086	7.89±1.78	6.88±2.95	**0.048***	6.50±3.13	7.16±2.55	8.62±1.94	**0.020***	7.37±2.55	6.83±2.90	0.425
Residual Limb Health	6.91±1.91	6.29±2.22	0231	6.94±2.07	6.67±1.95	0.547	6.43±2.77	6.65±1.97	7.86±1.89	0.131	6.80±2.10	6.69±1.61	0.830
PEQ-PF	7.44±1.74	6.42±1.89	**0.031***	7.39±1.63	7.12±1.92	0.499	6.67±2.35	7.17±1.64	8.13±1.75	0.104	7.28±1.78	7.01±1.97	0.565
PEQ-MS	6.71±2.11	6.18±2.40	0.351	6.10±2.50	6.86±1.93	0.115	6.41±2.15	6.66±2.04	6.45±2.94	0.908	6.52±2.21	6.82±2.08	0.593

*p<0.05. [δ]Student t Test. [ϕ]Kruskal Wallis Test. PEQ-PF: Prosthesis Evaluation Questionnaire- Prosthetics Function. PEQ-MS: Prosthesis Evaluation Questionnaire-Mobility Scores.

MS scores vary in relation to the amputation level, cause of amputation, mobility level, or mobility device use status (3,18,19). In the present study, amputation levels and causes did not significantly affect PEQ-MS scores.

Amputation limits opportunities in educational and vocational improvement (2). The majority of the amputees in the present study were found to be young. The cause of amputation was mainly the war (69%) for these amputees. In the present study, no difference was found between amputees with different education levels in terms of PEQ scores. Getting an education and qualified jobs would be one of the main issues in short. Being an amputee, in addition to being a refugee, would multiply the challenges they would need to face in the future.

In previous studies, the number of male participants has been reported to be in large quantities (71-94%) (4,5,19,20). The overwhelming majority of the male amputees in the present study were similar to the previous studies. The role of the males is vital in societies in which males have the primary responsibility for maintaining family standards. Amputation may prevent this responsibility. Therefore, functional aspects of the prosthesis are very crucial, especially for the males to maintain the financial sufficiency of the family and to overcome strenuous activities (21,22). On the other hand, aesthetic or cosmetic aspects of the prosthesis and its realistic appearance are crucial, especially for the females to be able to wear feminine outfits (6,21,23). In previous studies, only functionality and body image satisfaction are correlated in males. However, in females, along with functionality, aesthetics, and weight are correlated with body image (23). In another study, the success rate of prosthetic applications in females was reported to be lower. In the same study, although it was highlighted that females live alone more than males, it was argued that the gender is an independent and essential factor for the success of prosthesis (22). The females' PEQ-PF scores in general and the ambulation parameter score in the PEQ-MS were found to be significantly lower (4). In another study, no difference was found between genders in terms of prosthesis satisfaction, comfort, appearance, ease-of-use, or weight (24). The mean age of the participants was low and close to each other, and it could be a factor that would eliminate the gender difference in terms of mobility scores in the study.

The rate of married amputees in the present study (78.40%) was lower than those reported in studies by Legro et al. and Asano et al (4,5). Although mean PEQ-MS values in both single and married groups were similar, PEQ-PF mean values of the married group are significantly higher, which indicated that the expectations for the prosthesis were met in married participants.

Except for appearance, in all PEQ subgroups, single and married amputees showed similar results. In the present study, the mean age of the single amputees was lower. Their higher aesthetic expectation may have influenced the PEQ-Appearance score.

The mean PEQ scores were similar in terms of the duration of prosthesis use. However, mean PEQ-Ambulation scores were lower in those using the prosthesis for less than one year. In the first year of prosthesis use, habitual use of prosthesis is not established yet, problems such as volume changes of the stump are seen, and socket-stump compatibility is not established (25).

The PEQ-Sounds scores of those with prosthesis for more than one year were found to be lower. Prosthesis use focuses on ambulation and socket compatibility in early periods. With the experience in prosthesis use gained in time, expectations from prostheses increase, and mechanical sounds coming from the prosthesis may disturb the amputee. In the present study, similar models/types of products were selected for prosthetic feet and joints.

In the present study, we found that only the chronic disease group's satisfaction was higher in terms of the PEQ-Sounds parameter. The higher mean age in the chronic disease group may have resulted in higher prosthesis functionality satisfaction despite decreased mobility. The low number of amputees in the injury and chronic disease groups should also be considered when interpreting the results.

Amputation has a direct effect on employment status. In a previous study, 82% of the amputees became unemployed after amputation (2). Amputees have been reported to be generally unemployed (48-87.1%) (2,4,5,20). The unemployment rate

(68%) found in the present study was close to the those reported in the literature. The importance of social support after amputation in increasing the quality of life has been shown. Socialization is positively affected by social support and the increase in mobility (5). Those amputees receiving their prosthesis from a foundation were more satisfied with the look of their prosthesis (24). Our findings revealed that all subgroups had similar satisfaction levels, probably stating that providing the prosthesis free of charge increases the level of satisfaction (4,24). The selection of components was based on the mobility levels of amputees. However, novel products that provide high-level functionalities, such as carbon feet/microprocessor knees, have been used in few amputees. However, it was observed that the expectations of the unemployed/employed group were met at a similar level.

The limitation was that the present study was not able to form groups that were equal in terms of group size.

In conclusion, it was found that perceptions of refugee amputees, whose basic needs were fulfilled and who were living under similar conditions, regarding the prosthesis in general and living with prosthesis were generally similar to each other. Cause and level of amputation is not a factor, even though there were some differences in the subgroups. Despite the difficulties caused by being a refugee, providing functional prostheses free of charge might be a determining factor in this perception. With the increase in the duration of time in prosthesis use, expectations might change. Aesthetic expectations are of importance for single amputees. The increase in the number of refugee amputees in neighboring countries due to the civil war results in the necessity of taking new approaches and measures in the rehabilitation of these groups carrying cultural differences. It is essential to investigate how the cause/level of amputation and other descriptive variables affect prosthesis in these groups.

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FİZYOTERAPİ VE REHABİLİTASYON EĞİTİMİNDE SİMÜLE HASTA KULLANIMININ ÖĞRENME MOTİVASYONU VE ÖĞRENCİ GERİ BİLDİRİMLERİNE ETKİSİ: RANDOMİZE KONTROLLÜ ÇALIŞMA

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Çalışmamızın amacı, fizyoterapi ve rehabilitasyon (FTR) lisans eğitiminde servikal bölge değerlendirmesi için simüle hasta (SH) kullanımının öğrenme motivasyonuna ve öğrenci geribildirimlerine olan etkisini araştırmaktı.

Yöntem: Çalışmaya, FTR Ölçme ve Değerlendirme dersini alan 46'sı kadın, 60 gönüllü ikinci sınıf öğrencisi dahil edildi. Öğrenciler, teorik-uygulama (TU) dersi alan, SH oturumuna katılan ve hem TU dersi alıp hem de SH oturumuna katılan (TU-SH) olarak randomize edildi. Tüm öğrencilere eğitim aşamalarının öncesinde ve hemen sonrasında, konu içeriğinden oluşan 10 test sorusu içeren bilgi ön-son testi uygulandı. Eğitim sonrasında bir kez Öğretim Materyaline İlişkin Motivasyon Ölçeği (ÖMMÖ) yapıldı. Eğitim aşamalarının öncesinde, hemen sonrasında ve bir hafta sonrasında öğrenci geribildirim (endişe-stres-motivasyon-fayda) skorları kaydedildi.

Sonuçlar: TU ve TU-SH gruplarının ön-son test sonuçları, SH grubuna göre anlamlı olarak daha yüksekti ($p<0,001$). SH ve TU-SH gruplarında ders öncesi endişe düzeyleri, TU grubunun ders öncesi endişe düzeyine göre yüksekti (SH $p=0,002$ ve TU-SH $p=0,004$). Eğitimler sona erdikten hemen sonra SH grubunun endişe düzeyi, TU grubuna göre halen yüksekti ($p=0,002$). TU-SH ve TU gruplarının ders sonrası motivasyon düzeyi SH grubuna göre yüksekti ($p<0,001$). TU-SH grubunun bir hafta sonraki motivasyon düzeyi ise, TU grubuna göre yüksekti ($p=0,004$). TU-SH grubunun, ÖMMÖ puanları diğer gruplara göre daha yüksekti ($p=0,005$).

Tartışma: Servikal bölge değerlendirmesinin öğrenim sürecinde TU dersi ile SH oturumunun beraber verilmesinin bu eğitimlerin ayrı ayrı verilmesinden daha uygun olacağını ve SH etkileşiminin FTR lisans eğitiminde kullanılmasının yarar getireceğini öngörmekteyiz.

Anahtar Kelimeler: Fizyoterapist; Geribildirim; Motivasyon; Simüle Hasta.

EFFECT OF SIMULATED PATIENT USE ON LEARNING MOTIVATION AND STUDENT FEEDBACK IN PHYSIOTHERAPY AND REHABILITATION EDUCATION: A RANDOMIZED CONTROLLED TRIAL

ORIGINAL ARTICLE

ABSTRACT

Purpose: This study aimed to investigate the effect of simulated patient (SP) use for cervical region assessment on learning motivation and student feedback in undergraduate physiotherapy and rehabilitation (PTR) education.

Methods: Sixty volunteered second grade students (46 females) participating in PTR Measurement and Evaluation course were included. Students were randomly divided into three groups: theoretical-practical (TP) course, SP interaction course and TP-SP taking both courses. Pre-post knowledge test including 10 multiple-choice questions was applied before and immediately after the lessons. Instructional Materials Motivation Survey (IMMS) was applied after the lessons. Student feedback (anxiety-stress-motivation-usefulness) scores were recorded before, immediately after, and one week after the lessons.

Results: The post knowledge test scores of the TP and TP-SP groups were significantly higher than the SP group ($p<0.001$). The pre-lesson anxiety of the SP and TP-SP groups was higher than the TP group (SP $p=0,002$ and TP-SP $p=0,004$). After the completion of the lessons, anxiety levels of the SP group were still higher than the TP group ($p=0.002$). Motivation level of the SP and TU group were increased after the training ($p=0.001$). Motivation level of the TP-SP was still higher than the TP group one week later ($p=0.004$). The TP-SP group's IMMS findings were statistically higher than the other groups ($p=0.005$).

Conclusion: We suggest that cervical region assessment should be combined with the TP course and SP interaction in the learning process and that it is beneficial to use the SP interaction in PTR undergraduate education.

Key Words: Physical Therapists; Feedback; Motivation; Simulated Patient.

GİRİŞ

Sağlık hizmetlerinin iyi düzeyde verilebilmesi için, sağlık profesyonellerinin iyi eğitilmesi ve mümkün olduğunca iş yaşamına hazır olmaları gerekmektedir. Bu nedenle sağlık profesyonellerinin eğitiminde, çalışma ortamlarına benzer durumlar ve mekanlar oluşturularak kişilerin eğitim programları ve öğretim yöntemleri yeniden oluşturulmalıdır. Dünya'da simülasyon (benzetim) temelli klinik beceri eğitimlerinin son yıllarda sıklıkla kullanılması ve yaygınlaşması önerilmektedir. Simülasyon temelli öğrenme; güvenli ve yeterli şekilde klinik uygulama ortamının taklit edilmesi için uygulanır. Öğrenme ortamı gerçeğe ne kadar yakınsa, bireyin öğrenme ve gerçek yaşam arasında ilişki kurmasının o kadar kolay olduğu belirtilmektedir. Simülasyon sağlık eğitimde ilk defa 1960'lı yıllarda Los Angeles'da Dr. Howard Barrows tarafından kullanılmaya başlanmış ve Dr. Barrows gerçek hastayı taklit eden simüle hasta (SH) kavramını ortaya koymuştur. SH, eğitimin hedeflerine göre öncesinden eğitilen, yönlendirilen ve birden fazla senaryoda farklı rolleri oynayabilen kişi ve oyuncudur (1-3).

Geleneksel olarak fizyoterapi ve rehabilitasyon (FTR) eğitimi, uygulama sırasında öğrencilerin becerilerini akranlar üzerinde kazanmasına güvenir. Simülasyon kavramı bu bağlamda FTR lisans eğitimine uzak değildir. Fakat öğrencilerin birbiri ile olan pratik uygulamaları, düşük gerçeklik simülasyonu olarak adlandırılır. Çünkü öğrencilerin beceri veya prosedürün sadece bir bölümünü uygulamalarını sağlayan durumdur ve deneyimli gerçeklik seviyesi sınırlıdır (2). Sabus ve Macauley ise, en etkili öğrenme için öğrencilerin aktif olması gerektiğini belirtir. Yapılan simülasyon belli bir düzeyde strese, gerginliğe neden olursa, öğrencilerin uyanık ve heyecanlı olmasına yol açarak, öğrenmeye aktif olarak katılmalarını sağlar (4). Geleneksel pratik uygulama yöntemleri ile bunu başarmak pek mümkün değildir (5). Çünkü öğrenciler, akranları ile çalışırken daha az tehdit altında hissettiklerini belirtmişlerdir (6). Bu durumda birbirleri ile aynı düzeyde aktif katılım sağlayabilmeleri zor olabilmektedir. Anekdotal olarak, öğrencilerin birbirleri ile becerilerini pekiştirirken, becerilerini geliştirme gerekliliklerini yerine getirme zorunluluğu hissetmedikleri için kolayca konsantrasyonlarını kaybettikleri ve dikkatlerinin dağıldığı bildirilmektedir (7). Bu nedenlerle, Amerikan Fizik Tedavi Derneği, lisans eğitimlerinde SH kullanılmasını stratejik planının bir parçası olarak kabul etmiştir (1,2,8).

SH, öğrencilerin anamnez almaları, fiziksel muayene yapmaları, iletişim becerilerini geliştirmelerinin yanı sıra, sağlık bakım programlarındaki klinik yeterliliği değerlendirmek için de yoğun olarak kullanılmaktadır (9). SH kullanımı, özellikle tıp eğitiminde iyi bir şekilde belgelenmesine rağmen, diğer sağlık mesleklerinin eğitim ile ilgili literatüründe bu konu daha az belirgindir (10,11). Literatürde kanıt düzeyi yüksek olmayan sınırlı sayıda çalışma, FTR bölümü lisans öğrencileri üzerinde SH eğitimlerinin etkisini araştırırken, çok az sayıda randomize kontrollü çalışma bulunmaktadır (10,11). Roberts ve Cooper, 2019 yılında yayınladıkları derlemelerinde, yüksek gerçeklik simülasyonunun faydası hakkında daha fazla araştırmaya ihtiyaç olduğunu belirtmişlerdir (2).

Türkiye'de SH kullanımı ile yapılan çalışmalar, daha çok hemşirelik ve tıp öğrencileri ile yapılmıştır. Tıp öğrencileri ile yapılan bir çalışmada öğrencilerin büyük çoğunluğu SH eğitimlerinin eğitim boyunca sürmesini istemiş ve eğitimin kendilerini hekim olarak hissetmelerine yardımcı olduğunu belirtmişlerdir (12). Hemşirelik öğrencileri ile yapılan bir çalışmada, SH ile gerçekleştirilen beceri eğitimlerinin öğrencilerin kendilerini rahatsız ve güvensiz hissetmelerine neden olabildiği, ancak daha sonraki uygulamalarda öğrencilerin kaygılarının azalmasına, kendilerine olan güvenlerinin artmasına ve mesleki sorumlulukların öğrenilmesine olumlu katkı sağladığı belirlenmiştir (13). Türkiye'de FTR Bölümü öğrencilerinde SH kullanımı ile ilgili yapılmış bir çalışma bulunmamaktadır. Bu nedenle bu randomize kontrollü çalışmada, FTR lisans eğitiminde servikal bölge değerlendirmesi için SH kullanımının öğrenme motivasyonuna ve öğrenci geribildirimlerine olan etkisinin araştırılması amaçlandı.

YÖNTEM

Çalışma randomize, kontrollü ve prospektif bir tasarımla oluşturuldu. Çalışma için Acıbadem Üniversitesi Tıbbi Araştırma Etik Kurulu tarafından

etik kurul onayı alındı (Onay Tarihi: 12.09.2019 ve Onay Numarası: 2019/14/3). Çalışma Eylül 2019 ve Ekim 2019 tarihleri arasında tamamlandı ve çalışmanın yapılacağı kurumdan izin alındı. GPower V.3.1.7 (Kiel Üniversitesi, Kiel, Almanya) programı kullanılarak, % 95 güven sınırında, 0,05 hata payı ile çalışmanın güç oranını % 95 olarak elde etmek için örneklem büyüklüğü 54 olarak hesaplandı (14). Çalışmadan çıkabilecek öğrenci olabileceğini varsayarak toplam öğrenci sayısı 60 olarak kabul edildi.

Çalışmaya Acıbadem Mehmet Ali Aydınlar Üniversitesi Sağlık Bilimleri Fakültesi FTR Bölümü Ölçme ve Değerlendirme II dersini alan ve çalışmaya katılmayı gönüllü olarak kabul eden 60 ikinci sınıf lisans öğrencisi alındı. Katılmak isteyen öğrencilerden Ölçme ve Değerlendirme I dersinden başarılı olamayanlar çalışmaya alınmadı. Öğrencilere çalışma sözlü olarak açıklandı ve onam formunu imzalayan 60 öğrenci (yaş = 20,27±1,89 yıl; 46 kadın, 27 erkek), blok randomizasyon yöntemini kullanan bilgisayar programı (Random Allocation Software® 2.0, Windows, Isfahan, İran) yardımı ile randomize olarak TU Grubu (n=20), SH Grubu (n=20) ve TU-SH Grubu (n=20) olmak üzere üç gruba ayrıldı (Şekil 1). Bütün gruplara dersten/simülasyondan dokuz gün önce uygulamalara ait video ve resimlerinin bulunduğu, içeriği Gross ve ark.'nın kas iskelet sistemi değerlendirmesi kitabından hazırlanan, power point sunumu, e-posta ise gönderildi ve konuya çalışmaları istendi (15). Servikal bölge değerlendirmesi olan konu, hasta ile iletişim, anamnez, inspeksiyon, palpasyon ve diğer değerlendirme yöntemlerini içermekteydi. E-posta atıldıktan iki gün sonra, SH gruplarına dahil olan tüm öğrencilere, uygulama sırasında onlardan ne beklenildiğine dair bir açıklama ve SH oyuncuları ile tanışma toplantısı yapıldı. Teorik ders grubuna alınan öğrencilere de beklentiler konusunda gerekli açıklamalar yapıldı. Bir hafta sonra katılımcılar derslere alındı. Gruplar sırası ile aşağıdaki gibi oluşturuldu:

• TU Grubu (n=20): Sadece TU grubuna giren öğrencilerden oluşmaktaydı. Bu ders; 50 dk teorik, 30 dk tartışma ve akranları üzerinde uygulama dersi olarak işlendi.

• SH Grubu (n=20): Sadece SH dersine (20 dk) giren öğrencilerden oluşmaktaydı. SH oturumu 10-15 dk öğrencinin anamnez alması ve değerlendirme yapmasını içermekte ve 5-10 dk öğretim elemanının öğrenciye olan öneri ve doğru uygulamaları içeren geri bildirim zamanından oluşmaktaydı.

• TU-SH Grubu (n=20): Öncelikle TU dersi alan bir hafta sonra da SH (20 dk) dersine giren öğrencilerden oluşmaktaydı.

Çalışmaya katılan öğrencilerin hepsi uygulamalara dahil oldu. Bir hafta sonra tekrar yapılan memnuniyet, endişe, stres, ders motivasyonu ve gelecekteki faydası bölümleri değerlendirmesine TU grubundan 15 öğrenci, SH grubundan 16 öğrenci ve TU–SH grubundan ise, 16 öğrenci katıldı. Bazı öğrencilerin katılmama nedeni, o gün okulda olmamaları veya çalışmanın yapılacağı toplantı salonuna gelmemeleri idi. Çalışmanın akış şeması Şekil 1'de verilmiştir.

Eğiticilerin Özellikleri

Teorik dersi anlatan öğretim üyesi sekiz yıldır servikal bölge değerlendirmesi dersini veren deneyimli bir eğitici idi. SH deneyimini yöneten öğretim elemanları ise, iki senedir bu modülü yöneten üç eğiticiden oluşturuldu. Dördüncü öğretim elemanı ise, öğrencileri ve SH uygulamasını koordine etti.

Simüle Hastaların Özellikleri

SH'ler iki senedir aynı modüle gelen oyunculardan (konservatuar öğrencisi) oluşmaktaydı. Ayrıca bu oyuncular benzer şekilde üç yıldır Tıp Fakültesi'nde Fiziksel Tıp ve Rehabilitasyon Anabilim Dalı'nın yürüttüğü kas iskelet sistemi değerlendirmesi modülüne giren deneyimli oyunculardı. Eğitimlerde birden fazla SH tek vakayı canlandırıyorsa, hastaların öğrenci üzerindeki etkisi ve öğrenci sorularına verilen yanıtların standardize edilmesi gerektiğinden, SH'lere sunacakları klinik belirti ve semptomları tanımalarını sağlamak için, standart bir vaka çalışması ve oyunculuk senaryosu verildi (3). Her SH ile, bireysel olarak subjektif sorulara standartlaştırılmış cevapları verme ve nesnel testlerdeki davranışları tekrarlaması için öğrencilerle etkileşime geçmeden önce 30 dk'lık bir toplantı yapıldı. Bu yaklaşımın SH'lerin öğrencilere olan davranış ve uygulama cevaplarındaki güvenirliğini ve geçerliğini artırdığı gösterilmiştir (16). Üç adet SH aktörü vardı. SH aktörlerin her biri

sırasıyla toplam 14, 13 ve 13 öğrenci ile etkileşime geçti. Her öğrenci SH ile tek başına değerlendirme ve anamnez görüşmesi yaptı. Toplam SH oturumu beş saate (13:00-18:00) yakın sürdü.

Simüle Vaka Senaryosu

Senaryo C5-C6 protrüze disk herniasyonu olan 40 yaşında akademisyen hasta olarak oluşturuldu. Bir hafta önce iki saat ağır alışveriş torbası taşıyan hastanın şu anki şikayeti sabah kalktığında; boyun ve sol kola yayılan ağrı, ön kol dış yüzünden baş parmağa vuran uyuşma ve karıncalanma olarak tanımladı. Hastanın hikayesinde, birkaç yıldır ara ara boyun ağrıları yaşadığı; ama birkaç gün içinde geçtiği, özellikle bilgisayarda çok iş yaptığı zaman bu ağrıları daha fazla ortaya çıktığı bilgisi yer almaktaydı. Hasta fazla kiloluydu ve ailesinde tip 2 diyabet öyküsü bulunmaktaydı.

Standardize Kontrol Listesi

Öğrencilerin detaylı anamnez almaları, hasta ile olan iletişimleri ve fizyoterapiye ait değerlendirme yöntemlerini nasıl uyguladıkları, SH oturumları sırasında, standardize kontrol listesi (25 maddelik) yardımı ile değerlendirildi. Standardize kontrol listesi her öğrenciye her öğretim elemanının aynı şekilde geri bildirim vermesi için oluşturuldu. Yirmi beş maddenin her biri anamnez ve değerlendirme yöntemlerinin başlıklarını içermekteydi. Kontrol listesi, öğrencinin yapıp, yapmadığını öğretim elemanın kolaylıkla işaretleyerek yapması için oluşturulan iki bölümden ve üçüncü bölümünde öğrencinin uygulamayı yapsa bile eksiği varsa onun yazılabileceği bir bölümden oluşmaktaydı. Uygulama sonrasında eğitmenler tarafından öğrencilere geri bildirim (5-10 dk) verilerek, doğruları ve hataları anlatıldı ve doğru yöntemler öğrencilere tekrar gösterildi.

Bilgi Ön ve Son Testi

Tüm gruplara dersin slayt içeriğinden oluşturulan 10 adet çoktan seçmeli soru, bilgi ön testi ve son testi olarak soruldu. Bu sorular servikal bölge değerlendirmesindeki önemli noktaları ve uygulama yöntemlerinin yapılışı ile bilgileri içermekteydi. Tüm sorular (15 adet) teorik dersi anlatan sekiz yıldır servikal bölge değerlendirmesi ve teorik dersi veren dersin sorumlu öğretim elemanı tarafından oluşturuldu ve diğer araştırıcı öğretim elemanları ile birlikte yapılan toplantıda her soru değerlendirildi. Her soruya araştırmacılar 0-100 arası puan verdi ve düzeltme yapmaları istendi. Düzeltme sonunda 90-100 puan arası en yüksek puanı alan 10 soru test sorusu belirlendi ve Etik Komite başvurusuna eklenerek onay alındı. Öğrencilerin test sonucu, her soru 10 puan olmak üzere 0 ile 100 puan arasında puanlanarak verildi.

Endişe, Stres, Ders Motivasyonu ve Gelecekteki Faydasının Değerlendirilmesi

Dersin öncesi, hemen sonrası ve bir hafta sonrası endişe, stres ve ders motivasyonu değerlendirmeleri için 0 ile 10 puanlık Görsel Analog Skalası kullanıldı. Ders bitimi ve bir hafta sonrasında dersin gelecekteki faydası konusunda değerlendirme de aynı şekilde yapıldı. Sıfır "hiç yok", 10 ise, "maksimum derecede" var olarak belirlenmiştir (14). Klinik bir ortamda stresi değerlendirmek için Görsel Analog Skalası'nın kullanılmasının, anketler ile yapılan değerlendirmelerle eşit derecede güvenilir ve geçerli olduğu gösterilmiştir (17).

Öğretim Materyaline İlişkin Motivasyon Ölçeği (ÖMMÖ)

Keller; dikkat boyutunda, materyallerin öğrenenin dikkatini çektiği zaman, öğrenen kişinin motivasyonunun artırdığını belirtmiştir (18). Öğrenenlerin dikkatini çekebilmek için algısal uyarılma, sorgulama ve değişebilirlik içeren stratejilerin belirlenmesi gerekmektedir. Ölçek, öğretim metotlarının öğrencinin dikkatini ne kadar çektiğini ve bu şekilde motivasyonunun ne kadar

Tablo 1: Olguların Özellikleri.

Özellik	TU Grubu (n=20)	SH Grubu (n=20)	TU-SH Grubu (n=20)	p
Yaş (yıl), X̄±SS	20,15±0,81	20,70±3,07	19,95±1,09	0,670
Cinsiyet (E/K), n	6/14	7/13	4/16	0,560

TU: Teorik/uygulamalı ders grubu, SH: Simüle hasta grubu, TU-SH: Teorik/uygulamalı ders ve simüle hasta grubu.

Tablo 2: Grupların Bilgi Testi (Ön Test ve Son Test) Sonuçları.

Bilgi Testi	TU Grubu (n=20)	SH Grubu (n=20)	TU-SH Grubu (n=20)	p§
Ön Test	60,50±13,17	69,05±14,11	67,14±14,54	0,051
Son Test	83,00±14,18	73,50±9,33	83,33±10,17	**0,001***
Grup içi p değeriϕ	**<0,001***	0,900	**<0,001***	

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

artığını göstermektedir. Dikkat, uygunluk, güven ve memnuniyet alt bölümleri olan ölçeğin toplam değeri de motivasyonu vermektedir. Çalışmamızda kullandığımız ölçek, Dinçer ve Doğanay'ın Türkçe'ye çevirdiği her uygulama sonunda öğrencilere doldurtulan ÖMMÖ'deki 33 maddeyi bulunduran ankettir (19). Ölçekte dört alt bölüm bulunmaktadır. Bunlar, dikkat (2, 8, 11, 14, 16, 19, 21, 23, 26, 27. sorular), uygunluk (6, 9, 10, 15, 17, 22, 28, 30. sorular), güven (1, 3, 4, 7, 12, 18, 24, 31, 32. sorular) ve memnuniyet (5, 13, 20, 25, 29, 33. sorular) alt ölçek başlıklarıdır. Ölçekteki 3, 7, 12, 15, 19, 22, 26, 29, 31 ve 34. maddeler olumsuz ifade taşımakta ve ters puanlamayı gerektirmektedir. Orta noktası 108,00 olan ölçekten alınabilecek en düşük puan 36,00, en yüksek puan ise, 180,00'dir (19). Ölçek eğitimlerin bitişinin hemen sonrasında sadece bir kez öğrencilere uygulandı. Çalışmaya başlamadan önce Dinçer ve Doğanay'ın ÖMMÖ anketini kullanmak için e-posta yolu ile izin alındı.

İstatistiksel Analiz

Elde edilen verilerin analizinde SPSS paket istatistik programının 21.0 (Statistical Package for Social Sciences Inc, Chicago, IL, ABD) sürümü kullanıldı. Verilerin normal dağılıma uygunluğunun tespiti için Shapiro Wilk Testi uygulandı. Veriler, ortalama ve standart sapma olarak ifade edildi. Grupların birbiri ile karşılaştırılması için Kruskal Wallis ile post-analizi kullanıldı. Uygulama öncesi ve sonrası farkların analizi için Wilcoxon İşaretli Sıralar Analizi yapıldı. Tüm analizlerde p<0,05 (iki yönlü) değeri yanılma olasılığı kabul edildi.

SONUÇLAR

Çalışmaya katılan öğrencilerin yaş ortalaması ve cinsiyet dağılımı gruplar arasında benzerdi (p>0,05, Tablo 1). TU ve TU-SH gruplarının ön-son test sonuçları, grup içinde anlamlı olarak arttı (p<0,001). SH grubunda ise ön-son test sonuçları açısından istatistiksel olarak anlamlı bir fark yoktu (p=0,900). Gruplar arası ön-son test sonuçları arasında anlamlı bir farklılık bulunmadı (p>0,05, Tablo 2). SH grubu (15,38±2,78) ve TU-SH (15,71±4,11) gruplarında kullanılan standardize edilmiş değerlendirme formlarının sonuçları arasında istatistiksel anlamlı fark saptanmadı (p=0,990).

Öğrencilerin Görsel Analog Skalası ile ölçülen, ders öncesi ve sonrası endişe ve stres düzeylerine bakıldığında, grup içinde endişe ve stres düzeyleri ders öncesi yüksek iken, ders sonrası bu düzeyler istatiksel olarak SH grubu dışında anlamlı biçimde azaldı (p<0,001, Tablo 3). Bir hafta sonra grup içindeki endişe ve stres düzeyleri TU ve TU-SH

Tablo 3: Grupların Görsel Analog Skala ile Değerlendirilen Endişe, Stres, Ders Motivasyonu ve Fayda Değerleri.

Görsel Analog Skalası	TU Grubu (n=20)			SH Grubu (n=20)			TU-SH Grubu (n=20)			p
	Ders Öncesi	Ders Sonrası	1 Hafta Sonrası	Ders Öncesi	Ders Sonrası	1 Hafta Sonrası	Ders Öncesi	Ders Sonrası	1 Hafta Sonrası	
	$\bar{X}$±SS	$\bar{X}$±SS	$\bar{X}$±SS	$\bar{X}$±SS	$\bar{X}$±SS	$\bar{X}$±SS	$\bar{X}$±SS	$\bar{X}$±SS	$\bar{X}$±SS	
Endişe	3,38±2,68	1,85±1,72[a]	1,50±1,60[b]	5,26±3,33[¥]	4,34±2,55[¥]	3,05±2,27	5,27±3,37	3,40±3,02[a]	2,21±2,34[b]	**0,001***
Stres	3,17±3,04	1,95±2,41[a]	1,64±1,73[b]	5,15±3,68	4,47±3,2[§]	2,88±2,31	5,00±3,74	3,60±2,50	2,85±0,67[b]	**0,001***
Ders Motivasyonu	6,47±2,33	7,55±1,98[a]	7,28±1,77[b]	6,40±2,37	6,38±2,31[§,§§]	8,17±2,12[b]	7,55±1,98	8,78±2,55[a]	9,27±1,27[b]	**0,001***
Gelecekteki Fayda	0	9,50±1,20	8,88±1,40	0	9,37±0,88	9,75±0,70	0	9,70±1,10	10,00±0,00	0,130

*p<0,05, SH>TU; §p<0,05, SH<TU; §§p<0,05, SH<TU-SH, [a]Grup içi ders öncesi, ders sonrasına göre anlamlı fark, [b]Grup içi ders öncesi, 1 hafta sonrasına göre anlamlı fark Wilcoxon İşaretli Sıralar Analizi. Kruskal Wallis Analizi, TU: Teorik/uygulamalı, SH: Simüle hasta.

Tablo 4. Öğretim Materyaline İlişkin Motivasyon Ölçeği Sonuçları.

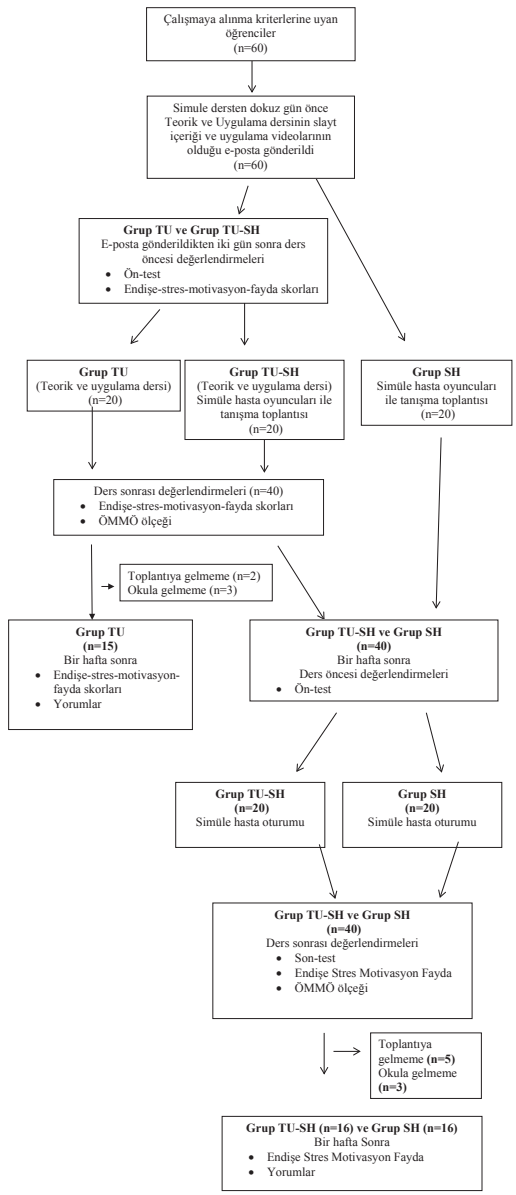
Öğretim Materyaline İlişkin Motivasyon Ölçeği	TU Grubu (n=20)	SH Grubu (n=20)	TU-SH Grubu (n=20)	p
	X̄±SS	X̄±SS	X̄±SS	
Dikkat	39,90±5,58	41,00±7,40	44,95±5,60$^{\phi}$	**0,004***
Uygunluk	34,40±2,92	34,55±4,76	37,58±2,88$^{\phi}$	**0,004***
Güven	37,90±3,81	35,45±5,15	39,45±4,88$^{\xi}$	**0,005***
Memnuniyet	24,30±3,38	25,80±5,52	27,77±2,22$^{\phi}$	**0,004***
Toplam	136,50±14,98	136,80±21,73	149,50±17,07$^{\phi}$	**0,004***

*p<0,05. $^{\phi}$TU-SH>TU; $^{\xi}$TU-SH>SH. Kruskal Wallis Analizi. TU: Teorik/uygulamalı ders, SH: Simüle hasta, TU-SH: Teorik/uygulamalı ve simüle hasta.

grupların ders öncesine göre anlamlı şekilde halen düşüktü (p<0,001, Tablo 3). SH grubunda değişiklik bulunmamaktaydı (p>0,05, Tablo 3). Öğrencilerin ders öncesi endişe düzeyine bakıldığında, TU grubuna göre, SH ve TU-SH gruplarının değerleri istatistiksel olarak anlamlı derecede yüksekti (p<0,001, Tablo 3). Ders sonrasında, TU grubunun SH grubuna göre endişe ve stres düzeyleri istatistiksel olarak anlamlı derecede düşüktü (p<0,05, Tablo 3). TU ve TU-SH grubunda bulunan öğrencilerin ders sonrası motivasyon düzeyleri ders öncesine göre istatistiksel olarak yüksekti (p<0,05, Tablo 3). SH grubunda ders sonrası motivasyon düzeyleri açısından değişiklik görülmedi (p=0,900, Tablo 3). Bir hafta sonraki motivasyon düzeyleri incelendiğinde, TU-SH grubunun TU grubuna göre motivasyon düzeyi halen yüksek olduğu bulundu (p<0,05, Tablo 3). Öğrencilerin gelecekteki fayda düzeylerine verdiği cevaplara göre, gruplar arasında fark bulunmadı (p=0,05, Tablo 3). İstatistiksel olarak bir anlamlılık bulunmamakla birlikte TU-SH grubunun tüm öğrencileri bir hafta sonraki değerlendirmede, dersin gelecekteki fayda düzeyine 10-tam puan verdiler.

ÖMMÖ'nün toplam değeri ile alt ölçütlerinden dikkat ve uygunluk değerleri, TU-SH grubunda, TU grubuna göre istatistiksel olarak yüksek bulunurken (p<0,05, Tablo 4); güven alt bölümü SH grubuna göre daha yüksekti (p<0,05, Tablo 4).

Öğrencilerimiz yorumlarında her üç grup da dersi beğendiğini belirtmekle birlikte, özellikle SH oturumuna "çok geliştirici, yararlı, staj öncesi pratiklik kazandırıyor, bütüncül olarak düşünmemi sağladı, hasta ile olan iletişimimi daha iyi artırabileceğine inanıyorum" gibi olumlu yanıtlar verdiler. Dersler hakkında olumsuz yorum yapan



Şekil 1: Çalışmanın Akış Şeması. TU: teorik/uygulamalı ders. ÖMMÖ: Öğretim Materyaline İlişkin Motivasyon Ölçeği

öğrencimiz yoktu.

TARTIŞMA

Çalışmanın sonuçlarında, SH uygulamasının motivasyonu artırdığı görüldü. SH uygulamalarında, başlangıçta endişe ve stres seviyesi yüksekte olsa zamanla azaldı. Ancak ön-son test sonuçları ve standardize form sonuçlarına göre bilgi düzeyinde önemli bir fark sağlamadı. ÖMMÖ'de ise, iki uygulamanın birlikte kullanıldığı TU-SH grubu; dikkat, uygunluk, memnuniyet ve toplam skorlarında sadece TU grubuna göre daha iyi sonuç alırken; güven skorunda sadece SH grubu düşük sonuçlar gösterdi.

Türkiye'de SH kullanımı ile yapılan çalışmaların daha çok hemşirelik ve tıp fakültesi öğrencilerinde yapıldığı görülmektedir. Yarış ve ark., tıp fakültesi ikinci ve üçüncü sınıf öğrencilerinin SH kullanımına yönelik görüşlerini almışlardır. Sonuçta öğrenciler; SH kullanımına tüm eğitim boyunca devam etmelerini istediklerini ve uygulamanın kendilerini hekim olarak hissetmelerini sağladığını belirtmişlerdir (12). Sarikoç ve ark. ise, psikiyatri hemşireliği eğitiminde SH kullanımın eğitimin niteliğini, öğrenenlerin öğrenmeye yönelik güdülenmelerini artıracağı ve olumlu öğrenme deneyimleri yaşamalarına katkıda bulunacağını çalışmalarında göstermişlerdir (20). Mevcut çalışmada ise; literatürdeki çalışmalara benzer şekilde öğrencilerimiz yorumlarında, SH oturumunu yararlı, geliştirici ve hasta ile olan iletişimi olumlu yönde etkileyebilecek bir uygulama olarak gördüklerini belirttiler.

FTR eğitiminden sorumlu akademisyenlerin, geleceğin fizyoterapistlerine çekirdek eğitim programını nasıl vereceklerini düşünmeleri gerekmektedir. Bunu başarmak için, yeni ve farklı öğrenme metotlarını oluşturma, paylaşma ve kullanma kültürü geliştirilmelidir (21). Literatürde FTR eğitiminde kullanılan SH metodu kas-iskelet sistemi, kardiyorespiratuar ve nörolojik FTR eğitiminde, tedavi ve değerlendirmelere katkıda bulunmuştur (10-15, 17). Mevcut çalışma ise, kas iskelet sistemi değerlendirmesi için planlandı ve öğrenciler, servikal bölge problemi olan bir SH'nin değerlendirmesini yaptılar. Öğrencilere ders öncesi ve sonrasında servikal bölge değerlendirmesindeki önemli noktaları ve uygulama yöntemlerinin yapılışı ile bilgileri değerlendiren ön ve son test yapıldı. Sonuçta, TU ve TU-SH gruplarının bilgi düzeyi eğitim sonrasında arttı. SH oturumuna giren öğrencilerin ise eğitim öncesi ve sonrası bilgi düzeyleri arasında fark bulunmadı. Bununla birlikte standardize değerlendirme formu sonuçlarında, hem SH hem de TU-SH grupları benzer şekilde uygulamaları yaptığı için aynı puanları aldılar. Yani, her iki grup da (TU-SH ve SH grupları) SH oturumuna teorik-uygulama bilgilerini aynı şekilde aktarabildiler. Huhn ve ark.'nın yaptığı randomize bir kontrollü çalışmada, TU veya SH dersi sonrasında klinik problem testine girdiklerinde bizim çalışmamıza benzer şekilde bilgi transferi açısından anlamlı bir fark saptanmıştır (22). Boissonnault ve ark.'nın, çalışmasında ise, SH grubunun bilgi transferinin daha iyi olduğu bulunmuştur (23). Fakat çalışmaların modelleri ve sonuç ölçümleri bizim çalışmamızdan ve birbirlerinden farklı olduğu için tam olarak karşılaştırma yapılması zordur. Bu konuda daha standardize edilmiş çalışmalara ihtiyaç bulunmaktadır.

Sabus ve Macauley, simülasyonun strese, gerginliğe neden olarak öğrencileri uyanık ve heyecanlı tutacağını ve bu sayede aktif öğrenmenin gerçekleşeceğini rapor etmiştir (4). Hekimlerde yapılan bir çalışmada simülasyonun, geleneksel eğitim metoduna göre stres seviyelerini artırdığı belirlenmiştir (24). Tıp öğrencilerinde yapılan başka bir çalışmada ise, halkla doğrudan iletişim kurmaya kıyasla, simülasyon ortamında stresin daha az olduğu belirtilmiştir (25). FTR öğrencileri ile yapılan çalışmalarda, SH oturumu öncesi stres ve endişe seviyelerinin yükseldiği gözlenmiştir (15,26). Bu çalışmada ise, benzer şekilde stres seviyeleri, SH oturumları öncesi, TU ders öncesine göre daha yüksek görülürken, dersin bir hafta sonrasında ise, TU-SH grubunun endişe seviyesi düşmüştü. Bu durum, SH gruplarının TU dersi ile desteklenmesinin endişe düzeylerinde azalmaya neden olabileceğini bize göstermektedir.

Motivasyon, insanları etkinlikleri öğrenmeye teşvik etmektedir. Eğer öğrenciler istekli ise, motivasyonu ve çabayı artırarak öğrenmeyi geliştirme ve böylece yetkinliği geliştirme potansiyeli oluşturabilirler (27,28). Feickert ve ark.'nın üçüncü ve dördüncü sınıf tıp öğrencileri ile yaptıkları çalışmalarında, SH eğitimlerinin öğrencilerin motivasyonlarını

artırdığını ve daha fazla akademik fayda sağladıkları belirtmiştir (29). Çalışmamızda da tüm ders oturumlarının hemen sonrasında (SH grubu hariç) öğrencilerin motivasyonu artarken, bir hafta sonrasında Feickert ve ark.'nın çalışmasına benzer şekilde (29) TU-SH grubunun motivasyonları, TU grubuna göre yüksekti.

Öğrenenlerin dikkatini çekebilmek için algısal uyarılma, sorgulama ve değişebilirlik içeren stratejilerin belirlenmesi gerekmektedir. Bu nedenle öğrencilerin dersler hakkındaki algıları ÖMMÖ kullanılarak değerlendirilebilir (18,19). Bu ölçek öğretim metotlarının öğrencinin dikkatini ne kadar çektiğini ve bu şekilde motivasyonunun ne kadar arttığını göstermektedir. Dikkat, uygunluk, güven ve memnuniyet alt birimi olan ölçeği toplam değeri de motivasyonu vermektedir (19). Mevcut çalışmada, TU-SH grubunun dikkat, uygunluk, memnuniyet ve toplam skorlarda TU grubuna göre yüksek iken, SH grubunun güven değeri TU-SH grubuna göre düşüktü. Dolayısıyla öğrenciler en çok TU-SH grubuna yüksek değerler verirken, sadece SH grubuna alınmış öğrenciler bu uygulamanın güven anlamında diğer gruplara göre daha problemli olabileceğini bildirdiler. Dennis ve ark.'nın FTR birinci ve ikinci sınıf öğrencilerine yaptıkları simülasyon oturumlarını karşılaştırdıkları çalışmalarında (30), her iki sınıfın da bizim çalışmamıza benzer şekilde ÖMMÖ puanları verdiği rapor edilmiştir (30). Ancak, birinci sınıfların daha yüksek değerler verdikleri gözlenmiştir (30). Bu nedenle FTR eğitiminin erken dönemindeki simülasyon uygulamalarının öğrencileri motive etmede daha başarılı olabileceğini belirtmişlerdir (30). TU-SH grubundaki öğrencilerin diğer gruplara göre dikkat, uygunluk ve memnuniyete verdiği yüksek puanların özellikle müfredatın ilk yıllarında hasta senaryolarını, teorikten-pratiğe ve gerçeğe döndürme fırsatlarının kısıtlı olmasından kaynaklandığını düşünmekteyiz. Bu grubun bunu yapma fırsatını daha güvenli bir şekilde yerine getirebilmesinin öğrencilerin motivasyonlarını da artırabildiğini düşünmekteyiz (30). TU-SH grubundaki öğrencilerin tamamının, bu motivasyonla birlikte bir hafta sonrasındaki anketlerde uygulamanın gelecekteki faydasına da tam puan vermiş olmaları, bu düşüncemizi güçlendirmektedir.

Çalışmamızda sadece bir SH senaryosu değerlendirildi ve bu durumun klinik uygulama davranışına etkisi araştırılmadı. Bu durum çalışmamızın limitasyonlarından biridir. Fakat öğrencileri, SH görmeden klinik uygulama için görevlendirmek müfredat programımıza uymadığı için, çalışma sonrasında SH görmeyen gruba da bu eğitimler verildi. Bütün gruplara klinik uygulamaya gidene kadar SH uygulamaları yapıldığı için, SH eğitiminin klinik uygulama davranışına etkisi değerlendirilemedi. İleri ki çalışmalarda SH müfredatına sahip olmayan bir bölüm ile karşılaştırma yapılması amaçlanmaktadır. Diğer bir limitasyon ise, FTR eğitiminde eğitim sonuçlarını ve SH eğitimini değerlendirebileceğimiz geçerliği ve güvenirliği olan objektif yöntemlere sahip olunmamasıdır. Bu nedenle sonuçlar literatürdeki çalışmalara benzer şekilde daha çok öğrencilerin algıları göz önüne alınarak yürütüldü. Ek olarak, SH oturumunun kendine ait bazı zorlukları bulunmaktadır. Bunlar, maddi problemler, zaman ve öğretim elemanı kısıtlılığıdır. Bu nedenle yararlarının bilinmesi, araştırılması ve buna bağlı olarak ders müfredatlarına gerekirse eklenmesi önem taşımaktadır (2).

Sonuç olarak, FTR lisans eğitiminde SH kullanımının etkisini değerlendiren çalışmamızda öğrenciler, SH oturumundan bir hafta sonrasında motivasyonlarını yüksek olduğunu belirtilmiş. TU ile SH uygulamasının birlikteliğine uygunluk, dikkat ve gelecek faydası yönünden daha olumlu sonuçlar vermişlerdir. Servikal bölge değerlendirmesi öğrenim sürecinde; TU dersi ile SH etkileşiminin beraber verilmesinin bu eğitimlerin ayrı ayrı verilmesinden daha etkili olacağını ve SH etkileşiminin FTR lisans eğitiminde kullanılmasının yarar getireceğini öngörmekteyiz.

Destekleyen Kuruluş: Yok.

Çıkar Çatışması: Yok.

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