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Türkiye Fizyoterapistleri Derneği adına
(On Behalf of Turkish Physiotherapy Association)
Tülin DÜGER

Editör ve Yazı İşleri Müdürü
(Editor in Chief and Managing Editor)
H. Serap İNAL

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), Google Scholar, Türkiye Atıf Dizini ve Ulakbim Türk Tıp Dizini (TR Dizin)'nde yer almaktadır.

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

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YAZARLARIN DİKKATİNE
Genel Bilgiler

Genel Bilgiler

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

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

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

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

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

ETİK SORUMLULUK

Editör ve Alan Editörleri

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

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

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

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

Hakemler

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

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

Yazarlar

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

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

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

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

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

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

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

Yazım Kuralları

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

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

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

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

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

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

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

Dergide yayımlanmak üzere gönderilen makaleler;

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

Başlık Sayfası

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

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

Özetler

Her makale Türkçe ve İngilizce özet içermelidir.

Türkçe Özet ve Anahtar Kelimeler

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

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

İngilizce Özet (Abstract) ve Anahtar Kelimeler (Keywords)

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

Araştırma Makalesinin Bölümleri

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

Giriş

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

Yöntem

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

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

Sonuçlar

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

Tartışma

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

Aşağıdaki başlıklar tartışma kısmından sonra açıklamalarıyla beraber eklenmelidir:

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

Kaynaklar

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

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

Kaynak yazım örnekleri aşağıdaki gibidir:

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

Tablolar

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

Tablo 1. Grupların Bilgi Testi Sonuçları

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

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

Şekiller

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

Makale Gönderme Formatı

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

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

Telif Hakkı

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

Sorumluluk Reddi

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

Instructions for Authors

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

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

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

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

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

ETHICAL RESPONSIBILITY

Editorial Board

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

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

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

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

Reviewers

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

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

Authors

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

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

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

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

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

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

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

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

Instructions for Authors

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

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

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

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

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

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

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

Articles submitted for publication in the journal;

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

Title Page

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

Abstracts

Each manuscript should include both Turkish and English abstracts.

Turkish Abstract and Keywords

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

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

English Abstract and Keywords:

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

Sections of the Original Research Articles

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

Introduction

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

Methods

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

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

Results

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

Discussion

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

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

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

References

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

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

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

Reference writing examples are as follows:

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

Tables

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

Table 1. Knowledge Test Results of the Groups

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

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

Figures

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

Manuscript Submission

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

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

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EDİTÖRDEN

Değerli Okurlarımız,

Türk Fizyoterapi ve Rehabilitasyon Dergisi'nin 2023 yılı Ağustos sayısında 12 araştırma makalesi, iki sistematik derleme ve bir olgu sunumu ile karşınıza çıkıyoruz.

Araştırma makalelerinde COVID-19 pandemi döneminin hastalığı geçiren/geçirmeyen, egzersiz yapan/yapmayan ve skleroderma tanılı bireylerdeki etkileri; çoklu engele sahip çocukların motor performansları; fizyoterapistlerin kardiyopulmoner resüsitasyon bilgi düzeyleri; Dereceli Kronik Ağrı Ölçeği 2.0'nin Türkçe uyarlaması; stajyer fizyoterapistlerde spesifik olmayan bel ağrısının etkileri; spesifik olmayan bel ağrılı hastalarda terapötik egzersizlere uyum; güreşçilerde Q açısı ve esneklik; obstetrik brakiyal pleksus yaralanması olan çocuklarda postural salınım; uzaktan fizyoterapi ve rehabilitasyon eğitiminde e-öğrenme stilleri; fizyoterapi ve rehabilitasyon bölümü son sınıf öğrencilerinde tükenmişlik, umutsuzluk ve sosyal destek algısı ilişkisi incelenmiştir.

Sistematik derlemeler modifiye posterior omuz germe egzersizleri ile kas enerji tekniklerinin etkinliğine yönelik olup olgu sunumunda Shprintzen-Goldberg sendromunda çevresel zenginleştirme ve nörogelişimsel tedavi hakkında kıymetli veriler sunulmaktadır. Bu değerli çalışmalar ile fizyoterapi ve rehabilitasyon alanında güncel konuları sizlere sunmak editöryal ekip olarak bizlere kıvanç vermektedir.

Okuyucularımızın 8 Eylül Dünya Fizyoterapistler Gününü kutlar, 9. Ulusal Fizyoterapi ve Rehabilitasyon Kongresi'nin 26-28 Ekim 2023 tarihlerinde Pamukkale Üniversitesi Fizik Tedavi ve Rehabilitasyon Fakültesi tarafından düzenleneceğini bildirmek isteriz. Ulusal ve uluslararası iş birliklerini arttıracağını düşündüğümüz bu önemli toplantıda buluşabilmek umuduyla hepinize sağlık, başarı ve mutluluk dolu günler dileriz.

23-24 Eylül tarihleri arasında İstinye Üniversitesi'nde düzenlenecek olan SCOSYM 2023 Sempozyumu'nda sunulan bildirilerin Ekim ayında ek sayı olarak yayınlanacağını bildirmekten mutluluk duyarız.

Yayın Kurulu Adına,

Saygılarımla,

Prof. Dr. H. Serap İNAL

Baş Editör

EDİTÖRDEN

Dear Readers,

We present to you 12 research articles, two systematic reviews, and a case report in the August 2023 issue of the Turkish Journal of Physiotherapy and Rehabilitation.

In research articles, the effects of the COVID-19 Pandemic on convalescent and healthy individuals, on exerciser and non-exerciser adults, and patients with scleroderma; motor performance of children with multiple disabilities; cardiopulmonary resuscitation knowledge level of physiotherapists; Turkish version of Graded Chronic Pain Scale 2.0; effects of non-specific low back pain in trainee physiotherapists; adherence to therapeutic exercises in patients with non-specific low back pain; Q angle and flexibility in wrestlers; postural sway in children with obstetric brachial plexus injury; e-learning styles in distance physiotherapy and rehabilitation education; relationship of burnout, hopelessness and social support perception in senior physiotherapy and rehabilitation students were investigated.

Systematic reviews are focused on the effectiveness of modified posterior shoulder stretching exercises and muscle energy techniques, and in the case report, valuable data on environmental enrichment and neurodevelopmental therapy in Shprintzen-Goldberg syndrome are presented. As the editorial team, we are proud to present you these valuable studies and current issues in the field of physiotherapy and rehabilitation.

We congratulate the September 8 - World Physiotherapists Day of our readers and would like to inform you that the 9th National Physiotherapy and Rehabilitation Congress will be organized by Pamukkale University Faculty of Physical Therapy and Rehabilitation on October 26-28, 2023. We wish you all days full of health, success, and happiness with the hope of meeting at this important meeting, which we think will increase national and international cooperation.

We are pleased to announce that the abstracts presented at the SCOSYM 2023 Symposium, which will be held at Istinye University between September 23-24, will be published as an additional issue in October.

On behalf of the Editorial Board,

Kind Regards,

Editor-in-Chief

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FİZYOTERAPİ VE REHABİLİTASYON EĞİTİMİNDE E-ÖĞRENME STİLLERİ İLE AKADEMİK PERFORMANS VE ALGILANAN ÖĞRENME DÜZEYLERİ ARASINDAKİ İLİŞKİNİN İNCELENMESİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Araştırmamızda uzaktan eğitimle yürütülen fizyoterapi ve rehabilitasyon eğitiminde öğrencilerin baskın öğrenme stillerinin araştırılması, öğrenme stilleri ile akademik performans ve algılanan öğrenme düzeylerinin karşılaştırılmasını amaçlamıştır.

Yöntem: Çalışmamızın verileri 2020-2021 eğitim öğretim yılı bahar dönemi final sınavları haftasında çevrimiçi ortamda toplanmıştır. Kırşehir Ahi Evran Üniversitesi fizik tedavi ve rehabilitasyon bölümündeki 352 öğrenciye çevrimiçi ortamda ulaşılmıştır. Araştırmamızda demografik bilgiler ve akademik performansı değerlendirmek için ağırlıklı dönemsel not ortalaması bilgisine ek olarak Elektronik Ortamlar için E-Öğrenme Stilleri Ölçeği ve Algılanan Öğrenme Düzeyi Ölçeği ile veriler toplandı.

Sonuçlar: Çalışmamıza çevrimiçi ortamda uygulanan ankete tamamlayan ve çalışma kriterlerine uyan 300 öğrenci dahil edilmiştir. Dahil edilen öğrencilerin %75'i kadın, %25'i erkek öğrencilerden oluşmaktadır. Öğrencilerin çoğunluğunun mantıksal öğrenme stilini (%35,7) kullandığı bulunmuştur. Akademik performans 78,30 ± 19,20; algılanan öğrenme düzeyi ise 42,08 ± 7,96 olarak bulunmuştur. Aktif öğrenme ve sezgisel öğrenme stilleri ile akademik performans ve algılanan öğrenme düzeyleri arasında bir ilişki bulunmamıştır (p>0,05) ancak diğer öğrenme stilleri ile pozitif yönlü ilişki bulunmuştur. Sosyal öğrenme ve bağımsız öğrenme stilini baskın olarak kullanan öğrencilerin algılanan psikomotor öğrenme düzeyleri görsel-işitsel öğrenme stilini kullanan öğrencilere göre anlamlı olarak yüksek olduğu görülmüştür (p=0,02).

Tartışma: Uzaktan eğitim döneminde fizyoterapi öğrencilerinin yaygın olarak mantıksal öğrenme stilini tercih etmelerine rağmen görsel-işitsel ve sözel öğrenme stillerini tercih eden öğrencilerin daha yüksek akademik performans gösterdiği görülmüştür. Akademik açıdan daha başarılı olan görsel-işitsel öğrenme stilinde fizyoterapi eğitiminde önemli yere sahip olan algılanan psikomotor öğrenme puanları ise sosyal ve bağımsız öğrenme stilini tercih eden öğrencilere göre düşük olduğu görülmektedir. Fizyoterapi eğitiminde psikomotor öğrenme önemli bir yere sahiptir. Psikomotor öğrenmede yaşanan problemler fizyoterapistlik mesleğindeki uygulamaların gerçekleştirilmesinde problemlere yol açabilir.

Anahtar kelimeler: Akademik Başarı, Algılanan Öğrenme, Öğrenme, Uzaktan Eğitim

INVESTIGATION OF THE RELATIONSHIP BETWEEN E-LEARNING STYLES AND ACADEMIC PERFORMANCE AND PERCEIVED LEARNING LEVELS IN PHYSIOTHERAPY AND REHABILITATION EDUCATION

ORIGINAL ARTICLE

ABSTRACT

Purpose: In our research, we aimed to investigate the dominant learning styles of students in physiotherapy and rehabilitation education conducted with distance education, to compare learning styles with academic performance and perceived learning levels.

Methods: The data of our study were collected online during the spring semester final exams week of the 2020-2021 academic year. 352 students in the physical therapy and rehabilitation department of Kırşehir Ahi Evran University were reached online. E-Learning Styles Scale for Electronic Media, Perceived Learning Level Scale, and demographic information form were used in our research. In order to evaluate academic performance, weighted semester grade point average information was obtained. Results: 300 students who completed the online questionnaire and met the study criteria were included in our study. 75% of the included students are female and 25% are male. It was found that the majority of the students used the logical learning style (35.7%). Academic performance 78.30 ± 19.20; the perceived learning level was found to be 42.08 ± 7.96. There was no relationship between active learning and intuitive learning styles with academic performance and perceived learning levels (p>0.05), but a positive relationship was found with other learning styles. It was observed that the perceived psychomotor learning levels of the students using social learning and independent learning styles were significantly higher than the students using the audio-visual learning style (p=0.02).

Conclusion: Although physiotherapy students commonly prefer logical learning styles during the distance education period, it has been observed that students who prefer audio-visual and verbal learning styles have higher academic performance. Although it was observed that the academic performance levels of the students using the audio-visual learning style were higher, the perception of psychomotor learning was found to be low when compared with the students using the social and independent learning style. Psychomotor learning has an important place in physiotherapy education. Problems experienced in psychomotor learning may cause problems in the realization of practices in the physiotherapist profession.

Key words: Academic Success, Perceived Learning, Learning, Distance Education

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GİRİŞ

Öğrenme stilleri yeni bir bilgiyi ya da beceriyi algılama, işleme ve akılda tutmak için tercih edilen yöntemleri açıklayan genel bir terimdir. Öğrenme stili çevre ve alışkanlıklara göre şekillenmekte, kişiden kişiye farklılıklar göstermektedir (1). Öğrenme stillerinin temelinde öğrencinin ne öğrendiği değil nasıl öğrendiği yatmaktadır. Öğrenme stillerini tanımlamak için birçok model ve teori ortaya atılmıştır (2). Öğrenme stillerini tanımlamada sık tercih edilen modellerden biri Kolb'un deneyimsel öğrenme teorisidir (3). Kolb kitabında öğrenmeyi "deneyimin bilgiye dönüştürüldüğü" bir süreç olarak tanımlar. Bu teori dört farklı öğrenme stiline dayanmaktadır. Bunlar somut deneyim, yansıtıcı gözlem, soyut kavramlaştırma ve aktif deneyimdir. Somut deneyim, öğrenme sürecinde geri bildirim alma, hissetme gibi etkenleri; yansıtıcı gözlem, gözlemler, deneme-yanılma gibi etkenleri; soyut kavramlaştırma, olaylar arasındaki bağlantıları düşünme, neden-sonuç gibi etkenleri; aktif deneyim ise yaparak öğrenme gibi etkenleri kapsar. Kolb'un teorisine göre etkili öğrenme için bu dört modelin birlikteliği gerekmektedir (3). Bu modelin amacı, öğretimin en önemli parçalarından biri olan öğrencinin tercih ettiği öğrenme stilini saptamak ve öğrenme sürecinin daha verimli olmasını sağlamaktır. Sınıf ortamında gerçekleştirilen öğrenme sürecinde, öğrenci merkezli eğitimin kullanılması gerektiğini belirten birçok çalışma vardır (4). Bu doğrultuda eğiticilerin, öğrenme stillerine uygun bir şekilde eğitim vermesi, öğrenme stillerinin bilincinde olması öğrenme sürecinin kalitesini arttırmaktadır. Öğrenme süreci sınıftan çıkıp elektronik ortama geçtiği zaman, öğrencilerin de kendi öğrenme stilleri hakkında bilinçlenmesi, öğrenme sürecini daha verimli bir hale getirebilir (5).

Dijitalleşen dünya ile internet temelli araçların eğitimdeki yeri gittikçe artmaktadır. Bu araçlar herhangi bir zaman ve herhangi bir yerde kolayca bilgiye ulaşmayı mümkün kılmaktadır. E-öğrenme, uzaktan eğitimin bir parçası olup, öğrenme eylemini desteklemek amacıyla eğitim materyallerine dijital ortamdan erişmek olarak tanımlanmıştır (6). E-öğrenmede kullanılan materyaller içinde seslendirilen/okunan yazılar, hareketli/hareketsiz resimler, videolar, interaktif uygulamalar ve şemalar gibi birçok araç bulunmaktadır (7). Uzaktan eğitimin yaygınlaşmasıyla birlikte öğrenci memnuniyeti ve öğrenmede önemli rol oynayan faktörleri belirlemeye yönelik araştırma ihtiyacı da artmıştır (8). Algılanan öğrenme düzeyi, öğrenmenin ve ders değerlendirmenin bir göstergesi olarak kullanılmaktadır (9). Bu alanda yapılan bir çalışmada yazarlar algılanan öğrenmeyi, "öğrencinin öğrenme deneyiminden önce ve sonra beceri ve bilgi düzeylerine ilişkin algılarındaki değişiklikler" olarak tanımlamaktadırlar (8). Eğitmenlerin, eğitim tasarımı, sunumu ve değerlendirmesi gibi yönler açısından uzaktan eğitimin kalitesini artırmak ve sonuç olarak öğrencilerin öğrenme deneyimini geliştirmek için öğrencilerin öğrenme düzeylerini nasıl algıladıklarını değerlendirmesi önemlidir. Algılanan öğrenme düzeylerini nelerin arttırdığını öğrenmek, eğitmenlerin daha başarılı ve kaliteli uzaktan eğitim vermesini sağlayabilir (8).

Fizyoterapi eğitimi temel tıp eğitimleri üzerine inşa edilen klinik problem çözme ve uygulama eğitimlerinin yoğun olarak işlendiği 4 yıllık bir süreci içermektedir. Fizyoterapi eğitiminde öğrencilerin öğrenme stillerini değerlendiren bir sistematik derlemede öğrencilerin farklı öğrenme stilleri tercih ettiği belirtilmiştir. Bu çalışmaya göre fizyoterapi öğrencilerinin en çok tercih ettikleri öğrenme stili açık teorik kavramlarla desteklenen aktif katılımdır. Buna ek olarak başarılı bir fizyoterapi eğitimi için teorik bilgilerle birlikte yeterli uygulamalı eğitim verilmesi gerektiği bildirilmiştir. Uygulama odaklı eğitimlerde teorik dersleri minimal düzeyde tutup eğitimin problem çözme ve uygulamalı eğitimlerle harmanlanması gerektiğini ifade etmişlerdir (6). Ancak uzaktan eğitimle verilen fizyoterapi eğitimlerinde nasıl bir yol izleneceği ile ilgili literatürde yeterli bilgi bulunmamaktadır.

Geçmişte yapılan çalışmalar daha çok e-öğrenmede kullanılan teknoloji ile ilgiliyken, teknolojideki gelişmeler ve artan ulaşılabilirlikle birlikte günümüzdeki çalışmalar öğrenci ve eğitmenlerin e-öğrenmeye karşı yaklaşım ve etkileşimlerine, eğitimin kalitesi ve akademik başarıya yönelmiştir (10). Bu yüzden çalışmamızın amacı uzaktan eğitimin vazgeçilmez bir hal aldığı bu dönemde fizyoterapi ve rehabilitasyon öğrencilerinin uzaktan eğitim döneminde baskın öğrenme stillerini belirlemek, öğrenme stili

skorları ile akademik performans ve algılanan öğrenme düzeyleri arasındaki ilişkiyi incelemek, baskın kullanılan öğrenme stilleri ile akademik performans ve algılanan öğrenme düzeylerini karşılaştırmaktır.

YÖNTEM

Bu araştırma nicel yöntemlerden tarama modeli ile yapılmıştır. Araştırmanın evrenini Covid-19 salgını nedeniyle uzaktan eğitimin zorunlu olduğu 2020-2021 eğitim öğretim yılı güz döneminde Kırşehir Ahi Evran Üniversitesi Fizik Tedavi ve Rehabilitasyon Yüksekokulunda öğrenim gören 390 fizyoterapi öğrencisi oluşturmaktadır. G*Power 3.1 programı ile yapılan analizde %95 güven aralığında ve %80 güç ile örneklem büyüklüğünün minimum 68 kişiden oluşması gerektiği hesaplanmıştır. Katılımcılara e-posta, WhatsApp ve kısa mesaj yolları ile ulaşıldı. Dahil etme kriterleri arasında 18 veya üzeri yaşta olmak, 2020-2021 yılı bahar döneminde derslere katılmış olmak ve çalışmaya katılmaya gönüllü olmak bulunmaktadır. Dışlama kriterlerinde ise çalışmaya katılmaya gönüllü olmamak, ana dili Türkçe olmamak bulunmaktadır. Araştırmanın yapılmasında etik açıdan herhangi bir sakınca olmadığına yazarların görev yaptığı üniversiteye ait etik kurulun 2020-17/129 karar numaralı ve 24/11/2020 tarihli kararı ile onay verilmiştir. Çalışmaya katılmayı kabul eden gönüllü öğrencilerden online onam alınmış ve araştırma Helsinki Bildirgesine uygun şekilde yapılmıştır.

Katılımcılar 2020-2021 eğitim öğretim yılı güz ve bahar döneminde eğitimlerini elektronik ortamda uzaktan eğitim ile almışlardır. Derslerde kullanılan eğitim materyalleri de bir öğrenme yönetim sistemi olan Ahi Yeterliğe Dayalı Eğitim Projesi (AYDEP) üzerinden öğrencilere sunulmuştur. Kullanılan öğrenme yönetim sistemi canlı (senkron) ders ve sınavlara imkân sağlayan bir sistemdir. Derslerde kullanılan materyaller öğrenme yönetim sistemi üzerinden öğrencilere ulaştırılmıştır ve canlı derslerin tekrarlarına erişilebilmektedir. Derslerin değerlendirilmesinde videolu ödevler, performans ödevleri, ara sınavlar ve final sınavı kullanılmıştır.

Verilerin Toplanması

Çalışmada kullanılan bütün veriler internet üzerinden (Google Formlar; Google LLC, Mountain View, Kaliforniya ABD), bahar eğitim-öğretim döneminin final sınavları haftasında toplanmıştır. Katılımcılardan genel bilgiler, Elektronik Ortamlar için e-Öğrenme Stilleri Ölçeği ve Algılanan Öğrenme Düzeyi Ölçeği formlarını doldurmaları istendi.

Genel bilgiler formunda demografik bilgilerin yanında ağırlıklı not ortalaması (dönemsel performans) cevaplanması istendi. Demografik bilgiler içerisinde cinsiyet, yaş ve sınıf bilgileri toplanmıştır.

Öğrencilerin e-öğrenme stillerini belirlemek için Gülbahar vd. tarafından geliştirilen, geçerlilik ve güvenilirlik analizleri yapılmış olan "Elektronik Ortamlar için E-Öğrenme Stilleri Ölçeği" kullanılmıştır (11). Bu öğrenme stilleri ölçeği, öğrenme stillerini görsel-işitsel öğrenme, sözel öğrenme, aktif öğrenme, sosyal öğrenme, bağımsız öğrenme, mantıksal öğrenme ve sezgisel öğrenme olmak üzere toplam yedi alt gruba ayırmıştır. Bu alt boyutlar tablo 1'de açıklanmıştır. Ölçeğin cronbach alfa değeri 0,94 olarak tespit edilmiştir. E-Öğrenme Stilleri Ölçeğinde 38 madde bulunmaktadır. 1-Kesinlikle katılmıyorum, 2-Katılmıyorum, 3-Kararsızım, 4-Katılıyorum, 5-Kesinlikle katılıyorum gibi değerlere sahip beş dereceli likert tipi bir ölçektir (11).

Tablo 1. Elektronik Ortamlar için E-Öğrenme Stilleri, Açıklamaları ve İlişkili Olduğu Maddeler

Öğrenme Stili	Açıklaması	İlişkili Olduğu Maddeler
Görsel-işitsel öğrenme:	En iyi duyarak ve görerek öğrendiğini düşünür.	12,13,15,16,18,19,24,34
Sözel öğrenme:	En iyi okuyarak öğrendiğini düşünür.	25,26,27,28,29,30,31
Aktif öğrenme:	En iyi uygulayarak öğrendiğini düşünür.	11,14,20,21,22,23
Sosyal öğrenme:	En iyi etkileşimli grup etkinlikleri ile öğrendiğini düşünür.	5,6,7,8,9,10
Bağımsız öğrenme:	Kendi başına çalışmayı tercih eder.	1,2,3,4
Mantıksal öğrenme:	En iyi detaylı düşünerek öğrenir.	17,32,33
Sezgisel öğrenme:	En iyi duyguları ile ilişkilendirerek öğrendiğini düşünür.	35,36,37,38

Algılanan öğrenme düzeyini belirlemek için Rovai vd. tarafından geliştirilen, Albayrak vd. tarafından Türkçe formu uyarlanan "Algılanan Öğrenme Düzeyi Ölçeği" kullanılmıştır (12). Bilişsel (3 madde), duyuşsal (3 madde) ve psikomotor (3 madde) olmak üzere üç boyuttan oluşan yedili likert tipi ölçek toplamda 9 madde içermektedir. İlgili alt boyutların cronbach alfa değerleri sırasıyla 0,65, 0,66 ve 0,72'dir. İkinci ve yedinci maddeler ters kodlanmıştır. Alt boyutlar içinde alınabilecek en düşük puan 3 en yüksek puan 21'dir. Toplamda ise alınabilecek en düşük puan 9, en yüksek puan 63'tür (12). Ölçekten alınan yüksek puan, algılanan öğrenme düzeyinin yüksek olduğunu göstermektedir.

Çalışmamızda kullanılan ölçeklerin kullanımı için gerekli yazılı izinler alınmıştır.

İstatistiksel Analiz

Elde edilen verilerin analizinde "IBM SPSS Statistics for Windows, version 24.0 (IBM Corp., Armonk, N.Y., USA)" paket programı kullanılmıştır. Verilerin normal dağılıma uyup uymadığına Shapiro Wilk testi ile test edildi ve normal dağılıma uymadığı görüldü. Tanımlayıcı istatistikler ortalama ± standart sapma ve yüzde (%) değeri olarak hesaplandı. İncelenen değişkenler arasındaki korelasyon Spearman Korelasyon Analizi ile değerlendirildi. r değerleri 0-0,19 arası çok zayıf korelasyon, 0,20-0,39 arası zayıf korelasyon, 0,40-0,69 arası orta şiddette korelasyon, 0,70-0,89 arası kuvvetli korelasyon, 0,90 ve üzeri ise çok kuvvetli korelasyon olarak açıklandı (13). Öğrenme stili ile akademik performans ve algılanan öğrenme düzeyleri arasındaki ilişki Kruskal-Wallis testi ile değerlendirildi. İstatistiksel anlamlılık değeri $p<0,05$ olarak kabul edildi.

SONUÇLAR

Çalışmamıza 352 öğrenci davet edilmiştir. 52 öğrenci çalışmaya dahil edilme kriterlerine uymadığı için dışlanmıştır. 300 öğrenci araştırmaya dahil

Tablo 2. Çalışmaya Dahil Olan Öğrencilerin Genel Bilgileri ve Baskın Olarak Tercih Edilen Öğrenme Stilleri

n=300	**Ortalama**	**Standart Sapma**
Yaş	20,68	± 1,72
Cinsiyet	**n**	**%**
Kadın	225	75,00
Erkek	75	25,00
Sınıf		
1.	87	29,00
2.	86	28,70
3.	62	20,70
4.	65	21,70
Baskın Öğrenme Stili	**n**	**%**
Görsel-işitsel öğrenme	15	5,00
Sözel öğrenme	15	5,00
Aktif öğrenme	26	8,70
Sosyal öğrenme	26	8,70
Bağımsız öğrenme	76	25,30
Mantıksal öğrenme	107	35,70
Sezgisel öğrenme	35	11,70
Akademik Performans	**Ortalama**	**Standart Sapma**
Ağırlıklı Not Ortalaması	78,30	± 19,20
Algılanan Öğrenme Düzeyi	42,08	± 7,96
Algılanan Bilişsel Öğrenme Düzeyi	14,49	± 2,89
Algılanan Duyuşsal Öğrenme Düzeyi	14,63	± 3,01
Algılanan Psikomotor Öğrenme Düzeyi	12,95	± 3,74

Tablo 3. Elektronik Ortamlar için E-Öğrenme Stillerinin Skorları

Öğrenme Stili (n=300)	Ortalama ±SS	Minimum	Maksimum
Görsel-İşitsel öğrenme	3,62 ±0,40	2,37	4,37
Sözel öğrenme	3,33 ±0,58	2,00	5,00
Aktif öğrenme	3,33 ±0,64	1,50	5,00
Sosyal öğrenme	3,37 ±0,70	1,16	5,00
Bağımsız öğrenme	3,75 ±0,62	1,00	5,00
Mantıksal öğrenme	3,85 ±0,81	1,66	5,00
Sezgisel öğrenme	3,46 ±0,66	1,25	5,00

Tablo 4. E-Öğrenme Stilleri Alt Grup Skorları ile Akademik Performans Arasındaki Korelasyon

		Görsel-İşitsel Öğrenme	Sözel Öğrenme	Aktif Öğrenme	Sosyal Öğrenme	Bağımsız Öğrenme	Mantıksal Öğrenme	Sezgisel Öğrenme
Akademik Performans	r	0,564	0,219	0,063	-0,013	0,035	-0,095	-0,023
	p	0,024*	0,002*	0,381	0,860	0,631	0,190	0,752
AÖD	r	0,168	0,320	0,063	0,266	0,297	0,168	0,080
	p	0,004*	<0,001*	0,275	<0,001*	<0,001*	0,004*	0,164
ABÖD	r	0,222	0,313	0,100	0,265	0,245	0,198	0,075
	p	0,002*	<0,001*	0,162	<0,001*	0,001*	0,006*	0,296
ADÖD	r	0,213	0,259	0,030	0,217	0,215	0,085	0,069
	p	0,003*	<0,001*	0,677	0,002*	0,002*	0,238	0,339
APÖD	r	0,064	0,208	0,024	0,209	0,174	0,150	0,117
	p	0,372	0,003*	0,733	0,003*	0,015*	0,036*	0,101

AÖD: Algılanan Öğrenme Düzeyi, ABÖD: Algılanan Bilişsel Öğrenme Düzeyi, ADÖD: Algılanan Duyuşsal Öğrenme Düzeyi, APÖD: Algılanan Psikomotor Öğrenme Düzeyi, *Spearman korelasyon analizi: p<0,05

edilmiştir ve genel yanıt oranı %85,22'dir. Çalışmaya dahil edilen öğrencilerin genel bilgileri ve baskın öğrenme stilleri tablo 2'de görülmektedir. Çalışmaya dahil edilen öğrencilerin çoğunluğunu kadın öğrenciler oluşturmaktadır (%75) ve öğrencilerin yaş ortalaması 20,68 ± 1,72 olarak bulunmuştur. Sınıflar arasındaki öğrenci dağılımları birinci sınıf (%29) ile ikinci sınıf (%28,7) arasında ve üçüncü sınıf (%20,7) ile dördüncü sınıf (%21,7) olarak bulunmuştur. Ağırlıklı not ortalaması dönem içerisinde alınan bütün dersleri kapsamakla birlikte ortalama olarak 78,3'tür. Elektronik Ortamlar için E-Öğrenme stilleri ölçeğine verilen cevaplara bakıldığında ilk 3 sırada sırasıyla mantıksal öğrenme (%35,7), bağımsız öğrenme (%25,3) ve sezgisel öğrenme (%11,7) olduğu görülmektedir (Tablo 2).

Elektronik Ortamlar için E-Öğrenme Stilleri alt boyutlarının skorları tablo 3'te gösterilmiştir. Elektronik Ortamlar için E-Öğrenme Stilleri alt boyutlarına bakıldığı zaman en yüksek skor mantıksal öğrenme alt grubunda (3,85±0,81), en düşük skor ise sözel öğrenme (3,33±0,58) ve aktif öğrenme (3,33±0,64) alt boyutlarında gözlenmiştir (Tablo 3).

Akademik performans ile görsel-işitsel öğrenme skoru ve sözel öğrenme skoru arasında pozitif yönlü korelasyon olduğu bulunmuştur (sırasıyla r=0,564, p=0,024 ve r=0,219, p=0,002). Algılanan öğrenme düzeyleri ile öğrenme stili skorları arasındaki korelasyon tablo 4'te verilmiştir.

Öğrenciler öğrenme stillerine göre gruplandırıldıklarında (Tablo 5), gruplar arasında akademik performans açısından istatistiksel olarak bir fark bulunmamıştır (p=0,436). Algılanan öğrenme düzeyleri alt boyutları arasında ise yalnızca psikomotor alt boyutunda anlamlı bir fark bulunmuştur (p=0,02). Sosyal öğrenme ve bağımsız öğrenme stilini kullanan öğrencilerin algılanan psikomotor öğrenme düzeylerinin, görsel-işitsel öğrenme stilini kullanan öğrencilerden anlamlı olarak yüksek olduğu görülmüştür. Diğer gruplar arasında istatistiksel

Tablo 5. Akademik Performans ve Algılanan Öğrenme Düzeylerinin E-Öğrenme Stilleri Alt Boyutlar Arasında Karşılaştırılması

	Görsel-İşitsel Öğrenme (Grup 1) n=15 *Medyan (Min-Maks)*	Sözel Öğrenme (Grup 2) n=15 *Medyan (Min-Maks)*	Aktif Öğrenme (Grup 3) n=26 *Medyan (Min-Maks)*	Sosyal Öğrenme (Grup 4) n=26 *Medyan (Min-Maks)*	Bağımsız Öğrenme (Grup 5) n=76 *Medyan (Min-Maks)*	Mantıksal Öğrenme (Grup 6) n=107 *Medyan (Min-Maks)*	Sezgisel Öğrenme (Grup 7) n=35 *Medyan (Min-Maks)*	Kruskal-Wallis p-değeri
Akademik Performans	75,03 53,33-89,26	79,46 70,83-92,30	72 43,30-93	78,53 61,50-91,60	75,5 47,03-93,46	74,56 20,94-92,76	74,33 60,46-88,33	0,436
AÖD	39 31-50	42 27-53	41 27-54	43 25-58	43 13-58	43 21-61	40 21-54	0,114
ABÖD	14 9-19	15 6-20	15 9-20	15 8-21	14 5-21	15 9-21	14 8-19	0,684
ADÖD	14 12-18	15 8-19	16 10-20	15 8-21	16 5-21	15 5-21	15 6-20	0,343
APÖD	9 5-15	13 3-17	12 3-18	13 6-19	13 3-19	12 3-20	12 3-18	0,02* 1<4 1<5

AÖD: Algılanan Öğrenme Düzeyi, ABÖD: Algılanan Bilişsel Öğrenme Düzeyi, ADÖD: Algılanan Duyuşsal Öğrenme Düzeyi, APÖD: Algılanan Psikomotor Öğrenme Düzeyi, *Kruskal-Wallis Testi: p<0,05

bir farklılık gözlenmemiştir.

TARTIŞMA

Yaptığımız çalışma uzaktan eğitim döneminde fizyoterapi ve rehabilitasyon öğrencileri arasında en çok tercih edilen öğrenme stilinin "detaylı düşünerek öğrenme" olarak tanımlanan (11) mantıksal öğrenme stili olduğunu göstermektedir. Buna ek olarak görsel-işitsel öğrenme stili alt boyutu skorları ile akademik performans arasında pozitif yönlü bir korelasyon bulunmasına rağmen algılanan psikomotor öğrenme düzeyinin bu öğrenme stilini baskın olarak tercih eden öğrencilerde daha düşük olduğu görülmüştür. Türkiye'de fizyoterapi ve rehabilitasyon öğrencileri arasında öğrenme stillerini araştıran bir çalışma işbirlikçi öğrenme stillerinin yaygın olarak kullanıldığını göstermektedir (14). Aynı alanda yapılan başka bir çalışmada fizyoterapi lisans eğitimi birinci sınıf, son sınıf ve yüksek lisans eğitiminde daha çok dikkatlilik kavramının öne çıktığını göstermiştir (15). Bu öğrenme stili kavramı çalışmamızda kullandığımız ölçekte mantıksal öğrenme stiline karşılık gelmektedir. Farklı sağlık eğitimlerindeki öğrenme stillerini araştıran başka bir çalışmada ise fizyoterapi öğrencileri arasında özümseyici ve ayrıştırıcı öğrenme stillerinin öne çıktığı görülmektedir (16). Özümseyici öğrenme stili kavramsal modeller yaratmayı, okumayı, bağımsız araştırmalar yapmayı baskın olarak kullanırken ayrıştırıcı öğrenme stilinde problem çözme, karar verme, fikirlerin mantıksal analizini baskın olarak kullanılmaktadır. Çalışmamızın bulguları ile benzer alanda yapılan çalışmalar arasında farklılıklar bulunmaktadır (14-16). Bunun başlıca sebebi yüz yüze eğitim ile uzaktan eğitim arasındaki farklılıktan kaynaklanıyor olabilir. Eğitim ortamındaki değişimle birlikte öğrencilerin sınıf ortamından uzaklaşması, eski alışkanlıklarının ve öğrenme stili tercihlerinin uzaktan eğitime uyum sağlayacak şekilde farklılaşmış olması olasıdır.

İlçin ve ark. 2018 yılında fizyoterapi öğrencilerinin öğrenme stilleri ve akademik performans arasındaki ilişkiyi araştırdıkları çalışmalarında katılımcı öğrenme skorunun akademik performansı olumlu yönde etkilediğini belirtirken pasif öğrenme skorunun akademik performansı olumsuz yönde etkilediğini belirtmişlerdir (14). Fizyoterapi ve rehabilitasyon öğrencilerinde akademik performansı etkileyen faktörleri araştıran bir çalışmada ise tercih edilen öğrenme stili ile akademik performans arasında bir ilişki bulunamamıştır (17). Başka bir çalışmada ise birden fazla öğrenme stilini kullanan öğrencilerin tek bir öğrenme stilini baskın olarak kullanan öğrencilere kıyasla istatistiksel olarak daha yüksek akademik performansa sahip oldukları ancak tercih edilen öğrenme stilinin istatistiksel olarak bir

etkisinin olmadığını göstermiştir (18). Yaptığımız çalışmada ise görsel-işitsel öğrenme stili ve sözel öğrenme stili skorları yüksek olan öğrencilerin akademik olarak daha başarılı olduğu saptanmıştır. Bu durum uzaktan eğitimin uygulanış şekli ile ilişkili olabilir. Uzaktan eğitimde sınıf ve uygulama ortamından uzaklaşan öğrencilerin okuyarak, duyarak ve izleyerek öğrenme alışkanlığı elde etmeleri sonucunda bu öğrencilerin akademik olarak daha başarılı olmalarına sebep olmuş olabilir. Ancak baskın olarak kullanılan öğrenme stili ile akademik performans arasında istatistiksel bir ilişki bulunmamıştır. Farklı öğrenme stillerine sahip öğrencilerin uzaktan yürütülen fizyoterapi ve rehabilitasyon eğitiminde akademik başarı açısından birbirine üstünlükleri olmadığı söylenebilir.

Araştırmamızda öğrenme düzeyi sadece akademik performans (ağırlıklı dönemsel not ortalaması) ile değil öğrencinin bilgiyi nasıl algıladığını ölçen Algılanan Öğrenme Düzeyi Ölçeği ile de değerlendirilmiştir. Algılanan öğrenme düzeyi uzaktan eğitim uygulamalarında önemli bir yere sahiptir (19, 20). Rovai ve ark. yaptıkları çalışmada okullarda yapılan sınavların öğrenmeyi tam olarak değerlendiremeyeceğini, daha çok bilişsel öğrenme düzeyini test edeceğini bildirmiştir. Algılanan öğrenme düzeyinin bilişsel, duyuşsal ve psikomotor alt boyutlarıyla ölçülmesinin eğitim çıktıları açısından faydalı olacağını savunmuştur (21). Uzaktan eğitim, eğitimin bilişsel ve duyuşsal alanlarını başarıyla ele alırken psikomotor alanda geri kalabilmektedir (22). Literatür tarandığında uzaktan fizyoterapi eğitiminde öğrencinin öğrenme algısı ile öğrenme stilleri arasındaki ilişkiyi inceleyen çalışma bulunamamıştır. Bu da çalışmamızın sonuçlarını tartışmayı güçleştirmektedir. Araştırmamızda sezgisel öğrenme ve aktif öğrenme stilleri skoru ile algılanan öğrenme düzeyi ve alt boyutları arasında; görsel-işitsel öğrenme stili skoru ile algılanan psikomotor öğrenme düzeyi arasında da bir ilişki bulunmamıştır. Araştırmamız "en iyi uygulayarak öğrendiğini düşünen" aktif öğrenme stilinde ve "en iyi duygularıyla ilişkilendirerek öğrendiğini düşünen" sezgisel öğrenme stilinde yüksek puan alan öğrencilerin öğrenme algısı arasında ilişki bulmamıştır. Aktif öğrenme stili puanları ile algılanan öğrenme düzeyleri arasında pozitif yönlü bir ilişki bulunmaması, öğrencilerin uzaktan eğitimde yeterli uygulama alanına sahip olmaması ile açıklanabilir. Sezgisel öğrenme stilinde diğer öğrenme stillerinde olduğu gibi pozitif yönlü korelasyon görülmemesinin sebebi öğretim ve eğitim ile ilgili algılarının uzaktan eğitimde azalması sonucu olarak görülebilir (23).

Baskın olarak kullanılan öğrenme stilleri ile algılanan öğrenme düzeylerini karşılaştırdığımız zaman ise sosyal öğrenme ve bağımsız öğrenme stilini kullanan öğrencilerde algılanan psikomotor öğrenme düzeyi açısından görsel-işitsel öğrenme stilini kullanan öğrencilere göre anlamlı olarak yüksek olduğu görülmektedir. Bağımsız öğrenme stili "kendi başına çalışmayı tercih eden" öğrencileri tanımlamaktadır. Uzaktan eğitimde bu öğrenme stiline sahip öğrencilerin psikomotor öğrenme algısı açısından yüksek sonuçlar vermesi tahmin edilebilir bir durumdur. Her ne kadar uzaktan eğitimde sosyal öğrenmenin azalacağı düşünülse de çalışmamızda sosyal öğrenme stilini baskın olarak kullanan öğrencilerin görsel-işitsel öğrenme stiline göre algılanan psikomotor öğrenme düzeyi açısından yüksek skora sahip olması, sosyal öğrenme stilinin uzaktan eğitimde kullanılabilir olduğunu göstermektedir. Fredericksen ve ark. ders içeriğini iyi öğrendiklerine inanan öğrencilerin uzaktan eğitimlere aktif olarak katılmaları daha olası olacağını belirtmiştir (20). Ancak bunun gerekçeleri daha detaylı olarak çalışmalarla araştırılabilir.

Yüz yüze fizyoterapi ve rehabilitasyon eğitiminde teorik sınavlara ek olarak vaka örnekleri ve uygulamalı sınavlar kullanılmaktadır. Teorik sınavlar ile bilişsel öğrenmenin değerlendirilmesi; vaka örnekleri ve klinik problem çözme yöntemleri ile duyuşsal öğrenmenin değerlendirilmesi, uygulamalı sınavlar ile psikomotor öğrenmenin değerlendirilmesi hedeflenmektedir. Eğitimin uzaktan eğitimle yürütülmesi sonucu ve eğitim çıktılarının alışılmışın dışındaki yöntemlerle değerlendirilmeye başlanmasıyla psikomotor öğrenmenin değerlendirmesinde eksiklikler meydana gelmiş olabilir. Bu yüzden uzaktan eğitimde eğitimin ve akademik başarının değerlendirilmesinde görsel testler ve video ödevler gibi birden fazla yöntemin kullanılması akademik başarının ve psikomotor öğrenme algısının artırılmasına yardımcı olabilir.

Çalışmamızın limitasyonları bulunmaktadır. Çalışmanın tek bir okuldaki öğrencilerle gerçekleştirilmiş

olması genellenebilirliği azaltan bir faktördür. Buna ek olarak akademik performansı uzaktan eğitimin gerçekleştirildiği dönemdeki ağırlıklı not ortalamasını (dönemsel) kullanmamız, teorik ve uygulama ağırlıklı dersleri ayırmamamız bu iki tür dersin ayrımını yapmamızı zorlaştırmaktadır.

Sonuç olarak yaptığımız çalışma fizyoterapi ve rehabilitasyon uzaktan eğitiminde öğrencilerin öğrenme stili olarak mantıksal öğrenme stilini benimsediğini göstermiştir. Psikomotor öğrenme fizyoterapistlik mesleğinin doğasında bulunan uygulamalar için olmazsa olmaz bir ön şart olarak görülebilir. Uzaktan eğitimde psikomotor öğrenmeyi geliştirmek ve öğrenme aşamalarını tamamlamak için uzaktan eğitim ile sunulan uygulama derslerinin sınıf ortamında tekrarlanması faydalı olabilir.

Destekleyen Kuruluş: Yok.

Çıkar Çatışması: Yazarların çıkar çatışması bulunmamaktadır.

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COMPARISON OF MOTOR PERFORMANCE BETWEEN CHILDREN WITH MULTIPLE DISABILITIES AND TYPICAL DEVELOPMENT

ORIGINAL ARTICLE

ABSTRACT

Purpose: Individuals with multiple disabilities have two or more disabilities at the same time, and these impairments can cause qualitatively and quantitatively insufficient motor performance. This study aimed to compare the motor performance of children with multiple disabilities to children with typical development.

Methods: This prospective study included 26 children with multiple disabilities who had visual impairment according to the International Statistical Classification of Diseases and Related Health Problems: 11th Revision, and 20 children with typical development. The Bruininks-Oseretsky Test of Motor Proficiency Second Edition Short Form was used to examine motor proficiency. A standard hand dynamometer and pinchmeter were used to assess hand and finger grip strength. The Nine-Hole Peg Test was used to evaluate performance-based hand functions.

Results: Children with multiple disabilities had lower scores for balance control ($p<0.001$), running speed agility ($p<0.001$), shoulder and arm strength ($p=0.042$), and abdominal strength ($p=0.007$). Hand grip strength scores for the dominant ($p=0.006$) and non-dominant hands ($p=0.008$) were significantly lower compared to children with typical development. Dominant hand placing ($p=0.026$) and removing ($p=0.035$) times were longer for children with multiple disabilities compared to the corresponding times for the children with typical development.

Conclusion: Data obtained from the current study reveal that children with multiple disabilities have poorer motor proficiency, grip strength, and hand functions compared to children with typical development. Inadequacy of visual input in addition to their existing disabilities may cause insufficient motor performance in children with multiple disabilities.

Key Words: Children, Hand Strength, Motor Skills, Vision Disorders

ÇOKLU ENGELE SAHİP ÇOCUKLAR İLE TİPİK GELİŞİM GÖSTEREN YAŞITLARI ARASINDA MOTOR PERFORMANSIN KARŞILAŞTIRILMASI

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Çoklu engele sahip bireyler aynı anda iki ya da daha fazla engele sahiptir ve bu durum niteliksel ve niceliksel olarak yetersiz motor performansa neden olabilir. Bu çalışma, çoklu engele sahip çocukların motor performansını tipik gelişim gösteren yaşıtlarıyla karşılaştırmayı amaçlamaktadır.

Yöntem: Bu prospektif çalışmaya, Hastalıkların ve İlgili Sağlık Sorunlarının Uluslararası İstatistiksel Sınıflaması: 11. Revizyon'una göre görme bozukluğu tanısı almış çoklu engele sahip 26 çocuk ve tipik gelişim gösteren 20 çocuk dahil edilmiştir. Motor yeterliliğin değerlendirilmesinde Bruininks-Oseretsky Motor Yeterlilik Testi İkinci Versiyon Kısa Formu kullanılmıştır. El ve parmak kavrama kuvvetlerinin değerlendirilmesinde el dinamometresi ve pinçmetre kullanılmıştır. Performansa dayalı el becerilerinin değerlendirilmesi için Dokuz Delikli Peg Testi uygulanmıştır.

Sonuçlar: Çoklu engele sahip çocuklar daha düşük denge kontrolü ($p<0,001$), hareket hızı ve çeviklik ($p<0,001$), omuz ve kol kuvvet ($p=0,042$) ve abdominal kuvvet ($p=0,007$) skorlarına sahipti. Tipik gelişim gösteren çocuklar ile karşılaştırıldığında, dominant ($p=0,006$) ve non-dominant ($p=0,008$) el kavrama kuvvetleri önemli derecede daha zayıftı. Çoklu engele sahip çocukların peg testi takma ($p=0,026$) ve çıkarma ($p=0,035$) süreleri tipik gelişim gösteren çocuklara göre daha uzundu.

Tartışma: Çalışmadan elde edilen bilgiler çoklu engele sahip çocukların tipik gelişim gösteren çocuklara göre daha zayıf motor yeterlilik, kavrama kuvveti ve el fonksiyonlarına sahip olduklarını ortaya koymaktadır. Mevcut engellerine ek olarak görsel girdilerin yetersizliği, çoklu engele sahip çocuklarda yetersiz motor performansa neden olabilir.

Anahtar Kelimeler: Çocuklar, El Kuvveti, Motor Beceriler, Görme Bozuklukları

INTRODUCTION

Motor and sensory developments are closely related processes; once peripheral sensory stimuli are perceived in the brain, the appropriate motor responses are generated. When considered from this point of view, vision plays an important role in a child's developmental process because it provides feedback to the vestibular and proprioceptive system (1) and helps to coordinate and improve movement (2). In addition, the visual ability of a child facilitates awareness of objects and motions in the environment (3) and enables the execution of voluntary goal-directed movements (4). Vision is therefore important to be able to plan and perform the child's motor skills.

Visual impairment is a general term that includes both low vision and blindness (5). According to the International Statistical Classification of Diseases and Related Health Problems: 11th Revision (ICD-11) published by the World Health Organization (WHO), those individuals whose visual acuity is equal to or better than 20/400 but worse than 20/70 can be identified as having low vision, while those with visual acuity worse than 20/400 can be identified as blind (5). The vision of children with visual impairment may be partially or completely limited owing to different factors, including pre/postnatal conditions, structural impairments, refractive errors, or cortical visual impairment (6).

Visual impairment negatively affects motor performance and leads to a delay in the development of motor skills (7). Gross motor milestones like head control, sitting, crawling, and typically emerge within the first year of a child's life (1), but visually impaired children tend to acquire motor skills later in their life compared to children with typical development (8, 9). Furthermore, visual information is required for specifying body position and maintaining balance, and the static balance of the visually impaired children is worse than it is for children without visual impairment (7). It has also been suggested that individuals with visual impairment are less proficient in performing various movements under different conditions, such as those involving variations in amplitude and orientation, or those that involve the identification of a target location (10).

To be considered person with multiple disabilities, one must have two or more disabilities at the same time; these individuals generally have a combination of various impairments, such as hearing impairment, visual impairment, mental retardation, or physical impairments (6). It has been shown that there are deficiencies in motor development as well as in all other developmental areas among children with multiple disabilities, and their motor development has been shown to be qualitatively and quantitatively different in comparison with the children with typical development (4, 11, 12). Although suitable motor skills are required for independence in terms of function, motor skills are severely limited in these children (13).

Due to the multiple impairments and poor motor skills, children with multiple disabilities limit their participation in functional motor activities, and community-based sports and physical activities (14, 15). Limited functional performance can lead to less opportunities to learn from movement experience and exploration, and hinder the development of other skills and functional activities (16). Thus, these individuals experience limitations and obstacles in daily functioning, such as unsafe movements and limited participation (2, 17). Therefore, these children are at an increased risk of progressive motor impairments, inactivity, and preventable health conditions throughout their life. By means of therapeutic interventions, these children have the potential to (a) increase competency of motor skills, (b) increase function, (c) increase self-efficacy of participating in recreational activities, and (d) decrease secondary conditions and unhealthy body compositions (13). However, to our knowledge, no study has examined the motor performance of children with multiple disabilities besides visual impairment. Therefore, the purpose of the present study was to compare the motor performance and skills of children with multiple disabilities to children with typical development by focusing specifically on motor proficiency, hand and finger grip strength, and performance-based hand dexterity.

METHODS

Participants and Recruitment

Children with multiple disabilities attending Ankara Goreneller Visually Impaired School were included in this study. Individuals with multiple disabilities between the ages of 9 and 18 years who had visual impairment according to the ICD-11 were included in this study. Information on disability status was obtained from medical reports of each child with multiple disabilities. Individuals were excluded if they had severe cardiological or pulmonary problems, were diagnosed with epilepsy, were non-ambulant, had severe communication problems that could affect study participation, or had undergone eye surgery or another important operation with general anesthesia in the last six months. In addition, children with typical development were included as a control group. Children with typical development between the ages of 9 and 18 years who volunteered to participate in this study were included.

This project was designed as a prospective study and was conducted between March 2018 and June 2018. Children with multiple disabilities were evaluated in an empty class of Ankara Göreneller Visually Impaired School. Children with typical development were evaluated in an examination room at Hacettepe University Faculty of Physical Therapy and Rehabilitation. Evaluation of each child took forty minutes and was completed on the same day. The protocol of this study was approved by Hacettepe University Non-Interventional Clinical Researches Ethics Board with GO 18/753 registration number. Informed written consent was obtained from both the children and their parents to the research and to participate in the research and to be included in the publication of the results.

Procedure

Demographic information of the children was obtained from the participants or their parents. The Bruininks-Oseretsky Test of Motor Proficiency Second Edition Short Form (BOT-2 SF) was used for evaluating motor proficiency, and a standard hand dynamometer (Jamar® Plus + Digital Hand Dynamometer from Patterson Medical by Sammons Preston, Bolingbrook, USA) and a pinchmeter (Jamar® Pinch Gauge, TEC, Clifton, New Jersey, USA) were used for measuring hand grip strength and pinch grip strength, respectively. The Nine-Hole Peg Test for evaluating performance-based hand functions was also used.

The BOT-2 SF is a common measurement tool used for evaluating motor proficiency. The short form of the longer test consists of 14 items chosen from the 53 items of the complete form. This measurement tool is suitable to use in children between the ages of 4 and 21 years (18, 19). The "Balance," "Running Speed Agility," and "Strength" subtests were used in the present study. The duration of standing on one leg on a balance beam was measured for the balance subtest, the number of one-legged stationary hops over 15 seconds was measured for the running speed agility subtest, and the number of knee push-ups and sit-ups over 20 seconds was measured for the strength subtest.

The Jamar hydraulic hand dynamometer was used to measure hand grip strength by following the guidelines of the American Society of Hand Therapists (ASHT) (20). The Jamar hydraulic pinch gauge was used to measure pinch grip strength. Each measurement was repeated three times, and the children rested for approximately one minute between each measurement. The test was repeated for the other hand in the same way.

The Nine-Hole Peg Test (9-HPT) was used to evaluate performance-based hand functions and finger dexterity. Before starting, information about the test was given to the children by the researchers. The peg board was centered in front of the child, and nine pegs were placed near the board on the same side as the hand being tested. The children who are blind used tactile sense when they were placing the pegs into the holes and removing them. The test was repeated for the other hand in the same way.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistical Software (IBM Corporation, Armonk, New York) version 23. Measured outcomes were tested for normality. Descriptive statistics were given as median and interquartile range for the non-parametric data. The Mann–Whitney U

Test was used to compare two non-parametric data sets. The significance level was set at 0.05. When describing the level of evidence-based on the size of a p-value, the preferred terminology is as follows: a p-value around 0.05 shows "weak evidence", while a p-value less than 0.01 shows "strong evidence" and a p-value less than 0.001 shows "very strong evidence". The power of study was calculated according to dominant hand grip results. As a result of power analysis, the power of the study was calculated as 0.97 with alpha of 0.05 (21).

RESULTS

In the present study, 59 individuals with multiple disabilities were assessed, and 33 children who did not meet the criteria were excluded. In total, 26 children with multiple disabilities (mean age: 13.96±3.14 years) were included in the study. In addition, 20 children with typical development (mean age: 12.90±2.79 years) were included in the control group. The study flowchart was shown in Figure 1. There was no significant difference in terms of age between the groups (p=0.293). None of the children

Table 1. Comparison of the BOT2-SF, Grip Strength, and 9-HPT Results between the Groups

	Children with Multiple Disabilities (n=26)	Children with Typical Development (n=20)	p
BOT-2 SF Scores			
Balance (0-4 points)			
Standing on One Leg on a Balance Beam – Eyes Open	0 (0-0)	4 (3-4)	<0.001*
Running Speed Agility (0-10 points)			
One-legged Stationary Hop	0 (0-0)	8 (8-8)	<0.001*
Strength (0-9 points)			
Knee Push-Ups	2 (0-2)	2 (2-2)	0.042*
Sit-Ups	2 (0-2)	2 (2-2)	0.007*
Hand and Finger Grip Strength (Kilogram-Force)			
Dominant Hand			
Hand Grip	12.39 (8.66-14.84)	17.78 (12.33-21.49)	0.006*
Palmar Grip	3.33 (2.00-3.50)	3.33 (2.62-4.33)	0.169
Pinch Grip	1.83 (1.16-2.75)	2.13 (1.83-2.46)	0.317
Lateral Grip	3.88 (2.75-5.25)	4.29 (3.66-5.75)	0.166
Non-Dominant Hand			
Hand Grip	10.77 (7.18-14.46)	16.63 (11.18-18.32)	0.008*
Palmar Grip	2.75 (2.00-4.10)	3.38 (2.33-3.92)	0.471
Pinch Grip	1.66 (1.00-2.16)	1.67 (1.00-2.58)	0.748
Lateral Grip	3.00 (2.16-5.00)	3.80 (3.42-4.33)	0.074
9-HPT (Second)			
Dominant Hand			
Placing Time	33.22 (0-62.00)	14.26 (12.70-16.15)	0.026*
Removing Time	11.11 (0-19.00)	7.14 (6.10-8.00)	0.035*
Non-Dominant Hand			
Placing Time	36.32 (0-70.72)	14.45 (12.9-18.11)	0.196
Removing Time	10.95 (0-14.00)	6.98 (6.40-8.72)	0.201

Abbreviation: BOT-2 SF: The Bruininks-Oseretsky Test of Motor Proficiency Second Edition Short Form, 9-HPT: The Nine-Hole Peg Test. Data were expressed as median (interquartile range). Mann-Whitney U test, *p <0.05

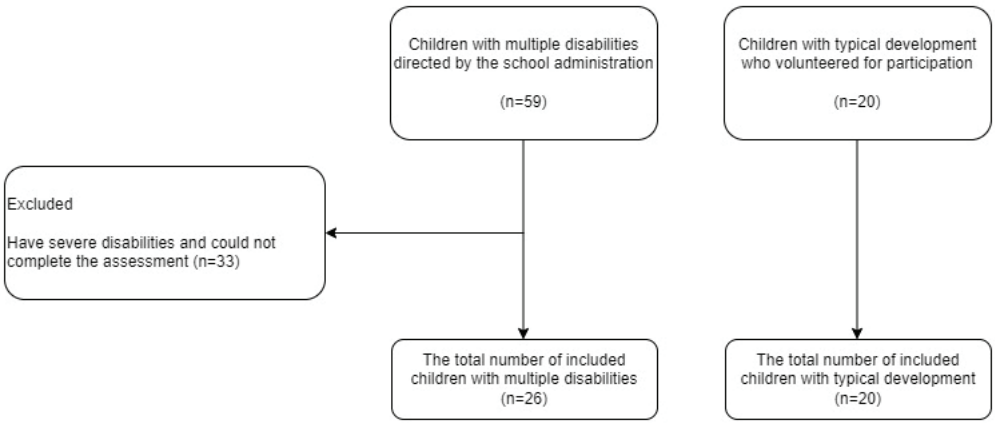

Figure 1. Flowchart of the Study Sample

had any difficulty during the motor performance measurements. The measured outcomes are shown in Table 1 in terms of medians and interquartile ranges.

Analysis of the motor proficiency indicated that there was very strong evidence of lower balance and running speed agility scores ($p<0.001$); strong evidence of lower abdominal strength scores ($p=0.007$); and weak evidence of lower shoulder and arm strength scores ($p=0.042$) for the children with multiple disabilities in comparison with the scores of children with typical development.

According to the results of the hand and finger grip strength tests, there was strong evidence that the children with multiple disabilities had lower hand grip strength scores for both the dominant ($p=0.006$) and non-dominant hand ($p=0.008$) when compared to the corresponding scores of the children with typical development. There was no evidence of any significant differences with respect to dominant palmar grip ($p=0.169$), pinch grip ($p=0.317$), and lateral grip ($p=0.166$) as well as non-dominant palmar grip ($p=0.471$), pinch grip ($p=0.748$), and lateral grip strength ($p=0.074$) scores for the children with multiple disabilities in comparison with those of the children with typical development.

When comparing the 9-HPT durations of the groups, there was weak evidence that the dominant hand placing ($p=0.026$) and removing times ($p=0.035$) were longer for the individuals with multiple disabilities. There was no evidence indicative of longer placing ($p=0.196$) and removing times ($p=0.201$) for the non-dominant hand.

DISCUSSION

This study aimed to exhibit the motor performance of the children with multiple disabilities who had visual impairment and compare with children with typical development in different areas. To our knowledge, this is the first study comparing the motor performance of children with multiple disabilities who have visual impairment to children with typical development. In this study, motor performance was assessed with respect to various movements, such as motor proficiency, grip strength, and performance-based hand functions. The results confirmed that children with multiple disabilities had poorer motor performance, including decreased motor proficiency, hand and finger grip strength, and performance-based hand dexterity, in comparison with the corresponding performance of children with typical development.

Visually impaired children face difficulties in performing various activities in their daily lives because of their motor and sensorial impairments (22, 23). Previous studies have indicated that there are specific differences in motor performance and sensorimotor control between children with visual impairment and children with typical development (7-10); visually impaired children have also been found to exhibit delayed motor development (6, 22). These limitations, which have been observed in children with visual impairment, are similar to those demonstrated by children with multiple dis-

abilities who had visual impairment in the present study. The present study showed that the individuals with multiple disabilities had lower scores on activities assessed for balance, running speed agility, shoulder and arm strength, and abdominal strength compared to individuals with typical development.

It has been indicated that children with visual impairment have lower balance scores (3, 24). In the present study, children with multiple disabilities had poorer balance performance compared to children with typical development. Thus, inadequacy or absence of visual input in addition to their existing disabilities may cause decreased balance performance in children with multiple disabilities.

Agility is one of the most important performance-based physical fitness parameters and affects the quality and efficiency of motor performance; it also requires a combination of parameters such as balance, coordination, speed, reflexes, strength, and endurance (25). It has been found that children who are blind have performed worse on agility performance tests than children with typical development (3). In a similar manner, the present study has shown that the children with multiple disabilities had lower scores for agility performance.

As with the previous parameters, children with visual impairment had poorer muscle strength compared to children with typical development (3, 7). Both children with low vision and children who are blind had lower strength scores when tested for hip and knee extension compared with the scores of children with typical development, and individuals who are blind had the lowest strength scores among these three groups (26). In this study, the results have shown that the individuals with multiple disabilities had lower strength scores for the shoulder, arm, and abdominal muscles in comparison with children with typical development.

In the present study, the hand grip strength scores of the children with multiple disabilities were lower than children with typical development for both the dominant and non-dominant hands. A study that compared the grip strength of judokas with and without visual impairment indicated that the individuals with visual impairment had lower hand grip strength scores (27). This difference between the groups may be due to the individuals with visual impairment were not being able to use their hands for active exploration and manipulation because of decreased or inexistent visual knowledge (28).

Fine motor skills require more effort and time for children with multiple disabilities, and there are generally performance differences between the dominant and non-dominant sides (4). In the present study, it was found that both placing and removing times were longer for the dominant hand, but there was no evidence of longer times for the non-dominant hand. Previous studies have indicated that upper extremity speed and dexterity were decreased for children with visual impairment in comparison with the performance of children with typical development (4, 28). It has been demonstrated that inadequate eye-hand coordination, decreased visual perception, and compensatory mechanisms such as increased tactile stimuli and reduced distance of vision influence activity performance (10, 28).

Implications for Practice

The results of the study make it clear that children with multiple disabilities besides visual impairment had poorer motor performance when compared to children with typical development. In addition, another main purpose of the authors was to draw the attention of politicians and authorities to the development of health policies and practices for supporting children with multiple disabilities. There is a specific need to develop health policies that will increase the number of healthcare professionals and physiotherapists working with these children (29-31). Because all children with multiple disabilities have different abilities, disabilities, and therapeutic goals, there is a specific need for the therapist's experience of the child's motor abilities (29). Besides, the success of this process depends on knowledge about limiting factors affecting the participation of each child in order that intervention to change limiting factors should be guided appropriately (29, 31). By means of training programs conducted by physiotherapists, the motor proficiency of children with multiple disabilities can increase. Although the lack of internal motivation of children with multiple disabilities, stimulation of motor abilities will help

them to participate in daily life activities and provide control over their own life (15). In light of the results of this study, the authors recommend that the treatment program of children should include vestibular stimulation training, upper extremity muscle strengthening, functional fine motor activities to improve motor skills. Besides, group aquatic aerobic exercise programs can help these children to improve cardiorespiratory endurance (14). It is expected that the findings of the present study will contribute to the development of clinical approaches for children with multiple disabilities who have visual impairment.

Study Limitations and Future Perspective

The present study had some limitations to be taken into account. The "multiple disabilities" is an umbrella term used for individuals who have a combination of various impairments at the same time. However, it should be considered that the participant heterogeneity in this study makes the findings generalizable for individuals with multiple disabilities. Besides, this study cannot give information about the developmental and/or cognitive stages, sex norms, and reference to age. Because the measurement tools which were used in this study do not contain norm values for children with multiple disabilities.

Another issue was the lack of reliable measurement tools for students with multiple disabilities. Reliability and validity studies of the used measurement tools have not been conducted for children with multiple disabilities. The measurement tools used in this study have been designed and standardized for individuals with typical development. However, The BOT-2 SF and a hand dynamometer have been used in previous studies in individuals with visual impairment (27, 32). Due to the lack of reliable measurement tools, it is necessary to develop and use specific test batteries for children with multiple disabilities.

It should also be noted that sensory integration problems and decreased physical activity might also affect the motor skill performance of these children, but these factors were not examined in this study. Future studies are needed to investigate the relationship between sensory integration, physical activity level, and motor performance in children with multiple disabilities.

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INVESTIGATION OF PHYSICAL ACTIVITY, SLEEP QUALITY, ANXIETY AND DEPRESSION LEVELS AMONG EXERCISER AND NON-EXERCISER ADULTS IN THE COVID-19 PANDEMIC

ORIGINAL ARTICLE

ABSTRACT

Purpose: To assess physical activity (PA), perceived exercise benefits, perceived sleep quality, anxiety and depression levels of adults who exercised and did not exercise during the pandemic.

Methods: 1226 voluntary participants who lived in the community (age range 18-55 years) were included in this cross-sectional study. Demographic information was recorded, and exercise motivators and barriers were evaluated through questions prepared by the researchers. PA levels [International Physical Activity Questionnaire-Short Form (IPAQ-SF)], perception about the benefits of exercise [Exercise Benefits and Barriers Scale-Benefits Subscale (EBBS-BS)], sleep quality [Pittsburgh Sleep Quality Index (PSQI)], and anxiety and depression levels [Hospital Anxiety and Depression Scale (HADS)] were assessed.

Results: There were statistically significant differences in scores of IPAQ-SF, PSQI, EBBS-BS, and HADS between those who did and did not exercise ($p<0.001$). Fifty-two percent of the participants had low PA levels during the pandemic. It was found that the main motivating factor of exercise was to improve performance and/or strength (81.54%), and the main barrier was preferring to do other things (lack of motivation) (84.8%).

Conclusion: Those with low PA levels have worse anxiety, depression, and poor sleep quality. Knowing the motivators and barriers of PA can guide the determination of intervention and prevention strategies.

Keywords: Anxiety, Covid-19, Depression, Physical Activity, Sleep

COVID-19 PANDEMİSİNDE EGZERSİZ YAPAN VE YAPMAYAN YETİŞKİNLERİN FİZİKSEL AKTİVİTE, YAŞAM KALİTESİ, ANKSİYETE VE DEPRESYON DÜZEYLERİNİN İNCELENMESİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Pandemi sırasında egzersiz yapan ve yapmayan yetişkinlerin fiziksel aktivite (FA), algılanan egzersiz yararları, uyku kalitesi, anksiyete ve depresyon düzeylerini değerlendirmektir.

Yöntem: Kesitsel tipteki bu çalışmaya, toplumda yaşayan (18-55 yaş aralığı) 1226 gönüllü katılımcı dahil edildi. Demografik bilgiler kaydedildi ve araştırmacılar tarafından hazırlanan sorularla egzersiz motivatörleri ve bariyerleri değerlendirildi. FA seviyeleri [Uluslararası Fiziksel Aktivite Anketi-Kısa Form UFAA-KF)], egzersizin yararları hakkında algı [Egzersiz Faydaları ve Engeller Ölçeği-Faydalar Alt Ölçeği (EFEÖ-FÖ)], uyku kalitesi [Pittsburgh Uyku Kalitesi İndeksi (PUKİ)], anksiyete ve depresyon düzeyleri [Hastane Anksiyete ve Depresyon Ölçeği (HAD)] değerlendirildi.

Sonuçlar: Egzersiz yapan ve yapmayanlar arasında UFAA-KF, PUKİ, EFEÖ-FÖ ve HAD skorlarında istatistiksel olarak anlamlı fark vardı ($p<0,001$). Katılımcıların %52'si pandemi sırasında düşük FA seviyelerine sahipti. Egzersizin ana motive edici faktörünün performansı-gücü artırmak (%81,54) ve ana bariyerinin ise başka şeyler yapmayı tercih etmek (motivasyon eksikliği) (%84,8) olduğu bulundu.

Tartışma: Düşük FA seviyelerine sahip yetişkinlerin anksiyete, depresyon ve uyku kalitesi skorları daha kötüydü. FA'nın motive eden faktörlerini ve bariyerlerini bilmek, müdahale ve önleme stratejilerinin belirlenmesine rehberlik edebilir.

Anahtar kelimeler: Anksiyete, Covid-19, Depresyon, Fiziksel Aktivite, Uyku

INTRODUCTION

Coronavirus disease 2019 (COVID-19) spread rapidly among countries and was declared a pandemic by the World Health Organization in March 2020 (1). Due to the high transmission rate of COVID-19, the general population has become anxious and fearful, and positively diagnosed people have experienced physical and emotional isolation in addition to stress or insomnia (2). The current extraordinary situation of the world, changing the daily routines of people, and being away from social life, negatively affected the mental health such as sleep quality, anxiety and depression levels of individuals (3).

The health benefits of adequate or more physical activity (PA) have irrefutable evidence for improving physical, psychological, and social conditions (4). PA has beneficial effects on sleep quality and contributes to the prevention of chronic diseases, reduces anxiety, and depressive symptoms (5, 6). Thus, factors affecting PA such as exercise habits, attitudes toward exercise, and current motivational conditions may change the perception of exercise benefits, sleep quality, anxiety, and depression levels of individuals in the COVID-19 pandemic.

Various motivators and barriers were reported in different populations for the participation of PA because the age of the individual is an important factor to consider when developing programs to promote PA (7). Losing or maintaining weight was reported as the main motivator for physically active adults, and a lack of time was reported as the most frequently barrier for inactive adults (7). These motivators and barriers vary according to sociodemographic characteristics, perception of exercise, and general health status (8). The pandemic brings a new and extraordinary lifestyle for every individual, and the question of how motivators and barriers have changed due to factors such as social isolation, and health-related concerns comes to mind. The pandemic primarily affected individuals' lifestyles, such as participation in PA and sedentary behavior (1, 9). Many motivators and barriers may have caused this lifestyle. Although lack of motivation and lack of appropriate facilities/equipment/space are shown as barriers to the emergence of these behaviors, studies evaluating both motivators and barriers for adults are limited in the literature. In addition, although there are some studies investigating PA, sleep quality, anxiety, and depression levels during the pandemic period, there is no study revealing their findings among exerciser and non-exerciser adults.

The primary aim of this study was to assess the perception of exercise benefits, sleep quality, and anxiety and depression level of individuals who did and did not do exercise during pandemic. Another aim was to evaluate PA levels and to determine motivators and barriers to PA of adults who were isolated due to COVID-19.

METHODS

Study Design

This cross-sectional study was conducted between April 2020 and May 2020 via an online form created by the researchers. The voluntary participants answered the questions regarding motivator and barrier factors about their exercise habits and continuousness of exercise, perception of exercise benefits, PA level, sleep quality, and emotional status. The research protocol was conducted in accordance with the Declaration of Helsinki. Informed consent was received from all participants before their enrollment into the study. The protocol of this study was registered to a clinical trials database (clinicaltrials.gov) (NCT04339491) and this study was granted by the Istanbul Bilgi University Human Research Ethics Committee (2020-40030-52).

Sample

The calculation of the sample size was carried out with a 95% confidence level and a 5% of precision, the expected proportion of the change in population was 0.5. Since Turkey's population is more than 100.000, according to these values, as the sample size should be at least 400 people (10).

The sample selection was made using the convenience sampling strategy method. The study sample consisted of people living in urban areas and who have internet access, who were respondents of posting invitations through social media and e-mail during the early period of coronavirus restrictions imposed in the country. The lockdown

measures were enforced by the government for the entire country starting from March 11th 2021 (11).

Participants reached the self-administered questionnaires online. Before proceeding to the questionnaires, in the first part of the study, the participants were given information about the research. Individuals who lived in the community with an age range of 18-55 years were included. Participants were excluded if they self-reported the following conditions; visual or auditory impairment, cardiorespiratory insufficiency, orthopedic, rheumatologic and neurological disease that prevented the participation of exercise; or if they could not communicate in the native language.

Participants were asked to confirm that they met these criteria and voluntarily participated in the study. Two thousand eleven people were reached during initial contact, and 39.2% of these people refused to participate in the study. One thousand two hundred twenty-two participants completed the questionnaire. Sixteen individuals' data were excluded because of missing data.

Outcomes

To collect the data, a survey was administered with questions about several demographic variables such as age, sex, education, smoking habits, chronic diseases, and working status in the pandemic period and motivators of and barriers to PA. The participants were questioned about their exercise habits during the pandemic and were separated into two groups as those who exercised during the pandemic (group 1) and those who did not (group 2). Also, they were questioned about whether they exercised regularly before the pandemic (defined as exercising for 30 min or longer, twice per week or more frequently for at least 1 year) (12).

PA Level: International Physical Activity Questionnaire-Short Form (IPAQ-SF) which was developed by Craig et al. (2003) (13), was used to assess the PA level of participants. The IPAQ-SF includes seven items and assesses the activity type, frequency (days), and duration (h) of various activities. PA scores are estimated using the calculated total metabolic equivalent task (MET). After the calculation of total MET scores, PA level of participants was divided into three categories as low (0-600 MET-minutes/week), moderate (600-3000 MET-minutes/week) and high (3000 MET MET-minutes/week and above) (13). The Turkish version of IPAQ-SF has shown to be a reliable and valid questionnaire by Sağlam et al. (2010) (14).

Perception of Exercise Benefits: The Exercise Benefits and Barriers Scale-Benefits Subscale (EBBS-BS) was used to assess the perception of exercise benefits in this study. The EBBS-BS consists of 29 items. Higher scores indicate the individual's feelings of stronger positive benefits of exercise. The Turkish adaptation and reliability of EBBS-BS, which was developed by Sechrist et al. (1987), have been reported by Ortabağ et al (15, 16).

Sleep Quality: The Pittsburgh Sleep Quality Index (PSQI), developed by Buysse et al. (1989), was used to evaluate sleep quality (17). The Turkish validity and reliability of the PSQI has been studied by Ağargün et al. (1996) (18). The PSQI consists of 19 questions or items. A global score ≥5 indicates clinically impaired sleep quality.

Anxiety and Depression: The Hospital Anxiety and Depression Scale (HADS) was developed by Zigmond and Snait (1983) (19). The Turkish version of HADS, which, 14-item descriptive and self-report questionnaire. HADS is divided into an anxiety subscale (HADS-A) and a depression subscale (HADS-D). Higher scores indicating greater frequency and severity of symptoms of anxiety and depression (20).

Motivators and Barriers: The motivators and barriers to PA were evaluated with items that have already been investigated and shown to significantly affect PA levels in previous studies (8, 21-23). The items, having been used to investigate motivators and barriers to exercise of the participants, were provided as Appendix A.

The permissions were obtained for using Turkish versions of all questionnaires.

Statistical Analysis

The Statistical Package for the Social Sciences 22.0 (SPSS Inc., Chicago, IL, USA) program was used for all statistical analyses. The descriptive statistics (mean, standard deviation, skewness, kurtosis) and Shapiro–Wilk's test were used for testing the assumption of normality. The data

were not normally distributed, thus nonparametric tests were used for statistical analysis. Descriptive statistics (mean, frequency, and percentage) were used to describe the demographic characteristics of the participants. Variables were compared between the groups using the Mann-Whitney U test for continuous variables and the Chi-square test for categorical data. The significance level was set at $p<0.05$.

RESULTS

A total of 1206 participants were included in the study (group 1: n=428; group 2: n=778). The demographic and clinical features and comparisons of the groups are presented in Table 1. No differences were found in terms of education, chronic disease, days of isolation, and the working status between the groups (p=0.166, p=0.163, p=0.06, p=0.115 respectively). There were differences in terms of age, sex, body mass index (BMI), smoking status, and doing regular exercise before the pandemic between the groups (p<0.001) (Table 1).

There were statistically significant differences in the scores of IPAQ-SF, PSQI, EBBS-BS, HADS depression (p<0.001) and HADS anxiety (p=0.004) between group 1 and group 2. All parameters were found to be higher in group 2, except for the score of IPAQ-SF (Table 2).

The most prevalent motivator for exercisers (group 1) was to improve performance and/or strength (81.5%) and the most prevalent barrier for non-exercisers (group 2) was to prefer to do other things (lack of motivation) (84.8%). The exercise motivators of group 1 and exercise barriers of group 2 are presented in Table 3.

The participants in both groups were investigated according to their exercise habits during and before the pandemic (Table 1). In group 1, 54.7% (n=234) of the participants were found to already have regular exercise habits and continued to exercise during the pandemic, and 45.3% of the participants (n=194) had not exercised before and started exercising during the pandemic restrictions (at least for 4 weeks). In group 2, 22% of the participants (n=171) stopped exercising during the pandemic

Table 1. Demographic and Clinical Features of the Participants

	Total (n=1206)	Group I (n=428)	Group II (n=778)	p
Age (years) Mean (SD)	27.23 (6.89)	26.19 (6.14)	27.80 (7.22)	**<0.001***
BMI (kg/m^2) Mean (SD)	23.41 (3.89)	22.78 (3.67)	23.74 (4.05)	**<0.001***
Sex n (%)				
Female	759 (62.9)	300 (70.1)	459 (59.0)	**<0.001****
Male	447 (37.1)	128 (29.9)	319 (41.0)	
Education, (≤ High school / > High school) n (%)	384 (31.8)/822 (68.2)	147 (34.3)/281 (65.7)	237 (30.5)/541 (69.5)	0.166**
Smoking Status (Y/N) n (%)	300 (24.9)/906 (75.1)	82 (19.2)/346 (80.8)	218 (28.0)/560 (72.0)	**<0.001****
Chronic Disease (Y/N) n (%)	115 (9.5)/1091 (90.5)	34 (7.9)/394 (92.1)	81 (10.4)/697 (89.6)	0.163**
Isolation (days) Mean (SD)	20.60 (7.93)	21.29 (7.13)	20.22 (8.32)	0.06*
Work Status During the Pandemic n (%)				
No change	110 (9.1)	35 (8.2)	75 (9.6)	
Work at home	422 (35.0)	163 (38.1)	259 (33.3)	
Less than before the pandemic	152 (12.6)	43 (10.0)	109 (14.0)	0.115**
e-Learning	522 (43.3)	187 (43.7)	335 (43.1)	
Regular Exercise Before the Pandemic, n (%)	405 (33.6)	234 (54.7)	171 (22.0)	**<0.001****
Frequency (days), Mean (SD)	3.71 (1.33)	3.81 (1.38)	3.57 (1.24)	
Time (minutes), Mean (SD)	62.37 (27.98)	59.70 (28.61)	66.02 (26.74)	
Duration (months), Mean (SD)	15.11 (26.47)	14.81 (24.13)	15.53 (29.44)	

***p*<0.05,** SD: Standard Deviation, n (%): Number (Percent), Y/N: Yes/No, BMI: Body Mass Index, *: Mann-Whitney U Test, **: χ^2 Test

Table 2. Physical Activity, Sleep Quality, Perception of Exercise Benefits, Anxiety and Depression Scores of the Participants

	Group I (n=428)	Group II (n=778)	p
IPAQ-SF (total MET), Mean (95% CI)	1793.75 (1654-1933)	773.97 (661-886)	**<0.001***
IPAQ-SF (category), n (%)			
Low-active	86 (20.1)	547 (70.3)	**<0.001****
Moderate	168 (39.3)	176 (22.6)	
High-active	174 (40.7)	55 (7.1)	
EBBS-BS (total score), Mean (95% CI)	48.12 (47-49)	55.54 (54-56)	**<0.001***
PSQI (total score), Mean (95% CI)	4.23 (3.99-4.47)	5.14 (4.94-5.34)	**<0.001***
HADS (anxiety score), Mean (95% CI)	7.85 (7.45-8.24)	8.67 (8.35-8.99)	**0.004***
HADS (depression score), Mean (95% CI)	6.26 (5.93-6.59)	7.94 (7.66-8.21)	**<0.001***

***p*<0.05,** IPAQ-SF: International Physical Activity Questionnaire Short Form, MET: Metabolic Equivalent Threshold, PSQI: Pittsburgh Sleep Quality Index, EBBS-BS: Exercise Benefits and Barriers Scale-Benefits Subscale, HADS: Hospital Anxiety and Depression Scale, *: Mann-Whitney U Test, **: χ^2 Test

Table 3. Exercise Motivators/Barriers of the Groups

Group I Exercise motivators	n (%)	Group II Exercise barriers	n (%)
improve performance and/or strength	349 (81.5)	prefer to do other things (lack of motivation)	660 (84.8)
lose or maintain weight	315 (73.6)	lack of money	225 (28.9)
avoid or manage a health condition	286 (66.8)	lack of enjoyment	147 (18.9)
improve mood	132 (30.8)	nobody to exercise with	134 (17.2)
improve appearance	72 (16.9)	lack of confidence	130 (16.7)
		lack of time	98 (12.5)
other	13 (3.0)	other	32 (4.1)

%: percent, n: Number of participants

restrictions (at least for 4 weeks) although they had a habit of exercising regularly before the pandemic, while the 78% (n=607) had not exercised before and or during the pandemic. The most essential motivators for participants who had exercise habits and continued to exercise were to improve performance and/or strength (82.1%), lose or maintain weight (66.2%), and improve mood (64.9%). The most essential motivators for participants who did not exercise before but started exercising with the pandemic restrictions were as follows: to lose or maintain weight (82.5%), avoid or manage health conditions (76.2%), and improve performance and/or strength (66%). The most common barriers for the participants who stopped exercising were the preference to do other things (lack of motivation) (79.5%), lack of money (57.3%), and lack of confidence (24%). The common barriers for participants who did not exercise before or during the pandemic were as follows: the preference to do other things (lack of motivation) (86.3%), lack of time (22.8%), and lack of money (20.9%).

DISCUSSION

The findings of the current study indicated that PA levels and sleep quality were higher, and anxiety and depression levels were lower in individuals who exercised. It was found that about half of the participants had low PA levels in the pandemic. The most prevalent motivator for individuals who exercised even during the pandemic was to improve performance and/or strength, and the most prevalent barrier was the preference to do other things (lack of motivation) for individuals who did not do

exercise in this period.

In this research, although age and BMI were significantly different between the groups, it was observed that the participants in both groups were similar age range and were in the normal weight range in terms of BMI. In a systematic analysis investigating smoking prevalence (22), it was reported that the majority of the smokers were men. Similarly, the difference in smoking status between the groups may be due to the larger male population of group 2 (41.0%) than in group 1 (29.9%). Also, a high rate of 'avoiding or managing health condition' motivators in participants who exercised (group 1) may have related to low smoking behavior. The work status of participants in the two groups was found to be similar. It could be suggested that there was no association between working status and PA levels. In addition, because the participants were young adults, the percentage of chronic diseases was low in both groups.

It was shown that PA levels decreased during the COVID-19 outbreak period (24). In this study, 52% of the participants were found to have low PA levels. The majority of those who did not exercise during the pandemic stated that they did not exercise regularly before the pandemic (78%), and 22% of the participants stopped exercising during the pandemic restrictions. Therefore, in line with other studies (1, 9, 24), it can be concluded that besides the sociodemographic and lifestyle characteristics of the population, the COVID-19 outbreak negatively affected the PA levels of healthy adults. As expected, the PA level of participants who exercised was found to be significantly higher than in the non-exercising group. Moreover, most of the participants who exercised were in the high-active category, and most of the non-exercising participants were in the low-active category. This is probably a consequence of the fact that exercises performed regularly were included in moderate-vigorous PA.

Interestingly, when we looked at our findings, we found that those who did not exercise had higher EBSS scores than those who did. In other words, although they knew the benefits of exercise, they did not do exercise, and their PA levels were low. Although the opposite was expected, finding such a result led us to conclude that knowing the benefits of exercise might not be sufficient for exercise behavior. As Williams and French concluded, exercise habits can be acquired using behavioral models that include a specific goal, motivation, and time management (25).

Regardless of other factors that may affect sleep, exercise has been proved to have a positive effect on sleep in the short and long term (5). The current study showed that individuals who exercised had higher sleep quality scores. We also found that participants who exercised had lower anxiety and depression scores. The difference in sleep quality, anxiety and depression scores between the "exerciser group" and "non-exerciser group" may have resulted from the positive effects of doing exercise or the negative effects of stopping exercising. In the non-exerciser group, there were individuals who stopped exercising even though they had exercise habits, at a rate of almost one fourth. It was stated that the measures taken during the pandemic had a significant differential effect, particularly on participants who were physically active before and experienced a significant decline in their PA levels, sleep quality, and well-being; there were no significant changes in physically inactive participants (24). Although our study is unable to determine causality of the significant difference due to its design, this finding is important in terms of emphasizing the relationship between exercise and these mental health-related factors, whether it is due to the positive effect of doing exercise or the negative effect of stopping exercising.

According to our findings, for participants who continued to exercise during the pandemic and for participants who started exercising, the most prevalent motivators were related to physical performance and body weight. Differently, the other motivator was to improve mood for participants who continued, and motivators about health conditions were some of the essential motivators for participants who started exercising. Marashi et al. (2021) reported that participants who stayed active during the pandemic were more motivated by mental health outcomes and less motivated by physical health outcomes (23). In line with this finding, individuals in our study who seemed motivated for PA were also intrinsically motivated for well-be-

ing during COVID-19 restrictions.

Barriers to participation in PA are affected by the inter-relations between the individuals and their social and physical environments. Our findings show that it is possible to define the preference to do other things (lack of motivation) and lack of money as the most prevalent barriers to PA during the pandemic. Hoare et al. (2017) found that lack of time was the most frequent reported barrier to PA in the adult population before the pandemic (8). Based on our results, the lack of time for exercise was the sixth most reported barrier during the pandemic. In this period, working from home or continuing education as e-Learning may have enabled more time for people and may have lessened the lack-of-time barrier. Barriers, such as lack of motivation are related to an individual's psychological factors. Stults-Kolehmainen and Sinha (2014) reported that people try to engage in less strenuous activities and avoid exercising during stressful times (26). Therefore, psychological support could help people to overcome perceived barriers to be physically active during stressful times such as the pandemic.

The lack of motivation was the most prevalent barrier for participants who did not do exercise before or now and who stopped exercising, but the second-ranked barrier varied. For the participants who stopped exercising, the second main barrier was lack of money. Lack of appropriate facilities or equipment at home may create a cost problem for these people. This study did not question the participants' exercise environment preferences or how they exercised before the pandemic. To eliminate this barrier, it may be beneficial to gain awareness that exercise can also be properly done at home with simple and inexpensive equipment. On the contrary, for the participants who did not do exercise before or now, the second main barrier was lack of time. For these physically inactive participants, as mentioned above, because there were no significant changes in PA levels, lack of time was one of the main barriers, in line with pre-pandemic research (8).

Despite the strength of the study, the large population size, and its timely assessment of PA and mental health behaviors, the evaluation of PA levels with a self-reported method, statistical difference in mean age between the groups although very similar, and the inability to determine causality due to the cross-sectional nature of the design can be taken as a limitation. The assessment of intensity and volume of PA was not considered in the pre-pandemic period, and the subjective measurement of the motivators of and barriers to PA also places a limitation.

The present study demonstrated that although our participants belonged to a younger population, their PA levels were low both before and during the pandemic. Also, our results suggest that those with low PA levels have significantly worse anxiety, depression, and poor sleep quality. Despite the presence of several factors associated with PA, the major motivator and barrier of PA during the pandemic were improved performance and/or strength and lack of exercise motivation, respectively.

The findings of this study are important in terms of showing that exercising is associated with less exposure to these negative mental health disturbances during the COVID-19 pandemic. Accordingly, exercise can be considered as part of strategies to cope with factors (such as poor sleep, higher anxiety, and depression scores) that occur during the pandemic. Adherence to PA can be affected due to changes in living conditions, so individuals' exercise motivators and barriers must be questioned by healthcare professionals for increasing PA.

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TÜRKİYE'DEKİ FİZYOTERAPİSTLERİN KARDİYOPULMONER RESÜSİTASYON BİLGİ DÜZEYLERİNİN DEĞERLENDİRİLMESİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı, Türkiye'de çalışmakta olan fizyoterapistlerin Kardiyopulmoner Resüsitasyon (KPR) hakkındaki bilgi düzeylerini değerlendirmekti.

Yöntem: Ağustos-Ekim 2021 tarihleri arasında yürütülen kesitsel bir araştırmadır. Çalışmaya katılmayı kabul eden 164'ü (%59,63) erkek, 111'i (%40,37) kadın olmak üzere toplam 275 fizyoterapiste online anket formu gönderilerek veriler toplandı. KPR bilgi düzeyini değerlendirmek amacıyla 2010 Amerikan Kalp Cemiyeti-Avrupa Resüsitasyon Konseyi KPR kılavuzu rehber alınarak hazırlanan anket toplam 26 sorudan oluşmakta ve kendi kendine uygulanmaktadır. Anketin ilk bölümünde kişisel bilgileri içeren 5 soru (yaş, cinsiyet, çalıştıkları kurum, çalışma süresi vb.); ikinci bölümde KPR eğitimi ve değerinin algılanmasına yönelik 12 soru , üçüncü bölümde ise KPR ile ilgili bilgi düzeylerini ölçmeyi hedefleyen 10 soru yer almaktadır. KPR bilgi puanında 0-5 puan aralığı düşük, 6-10 puan aralığı ise yüksek olarak değerlendirildi.

Sonuçlar: En çok çalışılan kurum hastane (%41,50) ve çalışma alanı ise kas-iskelet sistemi (%37,80) idi. Herhangi bir yerde kardiyak arrest (KA) vakası ile karşılaşanların oranı %28,40 iken çalışma ortamında bu oran %20,70 idi. Katılımcıların çoğu (%67,30) KPR eğitimi almıştı ancak eğitim alanlar KPR uygulama konusunda %59,50'si eğitimi, %71,90'u da kendisini yetersiz buldu. Çalışma alanı, yaş, cinsiyet ve deneyim yılına göre KPR sertifikasına sahip olma durumu ilişkili değildi(p>0,05).Hastanede çalışanların KPR sertifikası sahip olma oranı üniversitede çalışanlara göre daha yüksekti(p=0,014).Teorik KPR bilgi puanı ortalaması 5±0,12 idi, bu sonuç KPR bilgi düzeylerinin düşük olduğunu gösterdi. KPR bilgi puanı; KPR eğitimi alanlarda almayanlara göre, KPR uygulamasında kendini yeterli görenlerde de yeterli görmeyenlere göre daha yüksekti (p=0,001).

Tartışma: Sonuçlarımız fizyoterapistlerin çoğunluğunun, KPR sertifikasının olduğunu fakat KPR sertifikası olanların çoğunluğunun da KPR bilgi düzeylerinin yetersiz olduğunu ve kendilerini bu konuda yetersiz hissettiklerini göstermiştir. KPR uygulamasını daha iyi değerlendirmek isteyen gelecekteki araştırmalar fizyoterapistlerin gerçek KPR yeterliliğini teorik bir değerlendirmeden ziyade uygulamalı yöntemlerle değerlendirmelidir.

Anahtar kelimeler: Bilgi, Fizyoterapist, Kardiyopulmoner Resüsitasyon

EVALUATION OF CARDIOPULMONARY RESUSCITATION KNOWLEDGE LEVELS OF PHYSIOTHERAPISTS IN TURKEY

ORIGINAL ARTICLE

ABSTRACT

Purpose: The aim of this study was to evaluate the knowledge level of physiotherapists working in Turkey about Cardiopulmonary Resuscitation (CPR).

Methods: It is a cross-sectional study conducted between August and October 2021. Data were collected by sending an online questionnaire form to a total of 275 physiotherapists, 164 (59.63%) male and 111 (40.37%) female, who agreed to participate in the study. In order to evaluate the level of CPR knowledge, the questionnaire prepared by taking the 2010 American Heart Association-European Resuscitation Council CPR guideline as a guide, consists of 26 questions and is self-administered.In the first part of the questionnaire, 5 questions containing personal information (age, gender, institution of employment, duration of employment, etc.); in the second part, there are 12 questions on the perception of CPR training and its value, and in the third part, 10 questions aiming to measure the current knowledge level about CPR. In the CPR knowledge score, 0-5 points range was evaluated as low, 6-10 point range was evaluated as high.

Results: The most work setting was the hospital (41.50%) and the main scope of work was the musculoskeletal system (37.80%). While the rate of those who encountered a CA case anywhere was 28.40%, this rate was 20.70% in the work setting. Most of the participants (67.30%) had received CPR training.While 59.50% of those who received training found the training incompetent in CPR practice, 71.90% found themselves. CPR certificate was not related to field of study, age, gender and years of experience (p>0.005). The rate of CPR certification among those working at the hospital was higher than those working at the university(p=0.014). The mean theoretical CPR knowledge score was 5±0.12, which showed that CPR knowledge levels were low.CPR knowledge score; It was higher in those who received CPR training than those who did not, and those who considered themselves competent in CPR practice compared to those who did not see it as sufficient (p=0.001).

Conclusion: Our results showed that the majority of physiotherapists have CPR certification, but the majority of those with CPR certification have insufficient knowledge of CPR and feel incompetent in this regard.Future research that wishes to better evaluate the practice of CPR should evaluate physical therapists' actual CPR competence with hands-on methods rather than a theoretical assessment.

Keywords : Knowledge, Physiotherapist, Cardiopulmonary Resuscitation

GİRİŞ

Kardiyak arrestin pratik, operasyonel tanımı, bir kişinin solunum yokluğu veya anormal solunum ile tepkisiz kalmasıdır (1). Kardiyorespiratuar arrest (KA) son derece önemli tıbbi acil bir durumdur ve birkaç dakika içinde kardiyopulmoner resüsitasyon (KPR) başlatılmazsa ölüm veya kalıcı beyin hasarına neden olur. Toplu olarak hayatta kalma zinciri olarak bilinen; kardiyak arrestin erken tanınması, yüksek kaliteli KPR, hızlı defibrilasyon ve etkili resüsitasyon sonrası bakımı içeren dört anahtar müdahale, sonuçları iyileştirir (2). KPR'nin hemen başlatılması, KA sonrası sağ kalımı iki veya dört katına çıkarabilir (3). Kardiyopulmoner arrestten hastaların sağkalımını artırmanın KPR uygulayan sağlık profesyonellerinin tutum ve becerilerinin yeterliliğine bağlı olduğu bilinmektedir (4).

COVID-19 pandemisinde HDKA hastane dışı kardiyak arrest (HDKA), insidansının arttığına yönelik çalışmalar mevcuttur. On çalışmadan (35.379 katılımcıyla) elde edilen bilgileri özetleyen sistematik bir derleme, ilk COVID-19 dalgası sırasında HDKA insidansında bir artış olduğunu bildirmiştir (5). KA'in çoğunlukla evde meydana geldiği, ambulans müdahale sürelerinin arttığı ve ambulans ekipleri tarafından daha az resüsitasyon girişimi başlatıldığı görülmüştür (6) . Hastane dışı ve hastane içi ortamlarda COVID-19'un KA epidemiyolojisi ve sağlık sonuçları üzerinde önemli bir etkisi olduğu açıktır (7). Avrupa Resüsitasyon Konseyi (ERC) COVID-19 kılavuzları, hem hastane dışı hem de hastane içi KA için KPR girişimlerinin sürdürülmesini tedavi sağlayan kişi(ler) için riskin azaltılarak uygulanmasını teşvik etmektedir (7).

Kardiyak arresti tanıma ve suni teneffüs yapma becerisi, tüm sağlık profesyonelleri için temel bir beceridir. Bu alandaki bilgi ve beceriler, eğitimden sonra üç ile altı ay içinde gerileyebilir/bozulabilir. Bilgi ve becerileri sürdürmek için sık değerlendirmeler ve gerektiğinde refresher eğitimler önerilir (2). Refresher eğitimleri bilginin yanısıra KPR uygulama becerilerine odaklananır ve kaliteli bir KPR uygulaması refresher eğitimlerinin düzenli olarak yapılmasına bağlıdır (8). Daha önceki çalışmalarda hekimlerde ve farklı sağlık profesyonellerinde KPR bilgi düzeyi değerlendirilmiştir (9–12). Pepera ve diğ. Yunan fizyoterapistlerde KPR bilgi düzeyini değerlendirdiği çalışmada, fizyoterapistlerin ERC kılavuzlarına göre resüsitasyon konusunda bilgi eksikliklerinin olduğunu bildirmiştir. Bu çalışmada KPR sertifikası olanların yüzdesinin düşük olduğu ve bu nedenle KPR eğitiminin çalışan tüm fizyoterapistler için zorunlu olması gerektiği sonucuna ulaşılmıştır (13). Yeni Zelenda fizyoterapistlerinin KPR bilgisinin değerlendirildiği bir başka çalışmada ise fizyoterapistlerin KPR eğitimine katılım oranlarının düşük olduğu ve çalışma ortamının özellikle özel muayenehane, kamu hastaneleri ve toplum ortamlarında çalışan fizyoterapistlerin diğer ortamlara kıyasla KPR sertifikasına sahip olma oranının daha yüksek olduğu saptanmıştır (14). Fizyoterapistlerin KPR bilgi düzeyinin değerlendirildiği çalışma sayısı sınırlıdır. Fizyoterapistler akut bakım ortamında bilgisi, klinik karar verme becerisi ile önemli bir rol üstlenmektedir (15). Hem akut bakım ve rehabilitasyon sürecindeki önemli sorumluluklarından dolayı hem de COVID-19'un KA vaka görülme oranının artırmasından dolayı fizyoterapistlerin KPR bilgi düzeylerinin değerlendirilmesi önem taşımaktadır. Bu nedenle çalışmamızın amacı, Türk fizyoterapistlerinin KPR eğitimi hakkındaki bilgi düzeylerini değerlendirmektir.

YÖNTEM

Çalışma Tasarımı ve Veri Toplama

Bu çalışma, kesitsel bir araştırmadır. Veriler, internet tabanlı anonim bir anket kullanılarak Ağustos 2021 ile Ekim 2021 tarihleri arasında toplandı. Veri toplama işlemine başlamadan önce X Üniversitesi Etik Kurulu'ndan etik onay (Tarih/Karar No:08.10.2020/35) alınmıştır. Çalışmaya katılmak isteyenlerden online olarak bilgilendirildi ve aydınlatılmış onam formu alındı. Anket çalışmalarında en küçük örnek büyüklüğünün madde sayısının beş ila on katı civarında olması gerektiği bilgisine dayanılarak 10 maddelik bu anket için madde sayısının en fazla on katı olan en az 100 kişilik örnek büyüklüğüne ulaşılması hedeflendi (16).

KPR bilgi düzeyini değerlendirmek amacıyla hazırlanan sorular 2010 Amerikan Kalp Cemiyeti (AHA) - ERC KPR kılavuzu rehber alınarak hazırlandı. Anket iki bölüme ayrılmış 26 kapalı sorudan oluşmakta ve kendi kendine uygulanmaktadır. Birinci bölümde ki-

şisel bilgileri içeren 5 soru (yaş, cinsiyet, çalıştıkları kurum, çalışma süresi, temel çalışma alanı); ikinci bölümde katılımcıların KPR eğitimi ve değerinin algılanmasına yönelik 12 soru , üçüncü bölümde ise KPR ile ilgili bilgi düzeylerini ölçmeyi hedefleyen 10 soru yer almaktadır. Bilgi soruları ikili değişkenler olarak puanlandı; doğru yanıtlara '1' puan, yanlış yanıtlara ve bilmiyorum yanıtlarına '0' puan verilmiştir. Bu nedenle, toplam bilgi puanı potansiyel olarak 0 ile 10 puan arasında değişmekteydi (13). Toplam puana göre bilgi düzeyini sınıflandırmak için daha önceki bir çalışmadaki kesme değerleri dikkate alınarak; KPR bilgi puanında 0-5 puan aralığı düşük, 6-10 puan aralığında puan alanlar ise yüksek olarak sınıflandırıldı ve gruplar arasında KPR eğitimi alıp almama durumu karşılaştırıldı (17).

Taslak anketin pilot testi, mevcut araştırmadan bağımsız olan Türkiye'de çalışan 10 fizyoterapist tarafından uygun bir örneği kullanılarak yapıldı. Anketi doldurmaları ve soruların anlaşılabilirliği hakkında geri bildirimde bulunmaları istendi. Bu incelemenin ardından soruların yapısını ve akışını iyileştirmek için ankette küçük değişiklikler yapıldı. Araştırmaya katılması uygun olan potansiyel katılımcılara fizyoterapi ve rehabilitasyon lisans eğitimi sonrasında aktif olarak kullanılan ortak mail grupları yoluyla ulaşıldı. Anket formları Türkiye genelinde çalışmakta olan ve çalışmaya katılmayı kabul eden fizyoterapistlerin e-posta adreslerine Google anketlere yüklenen 'Fizyoterapistlerin Kardiyopulmoner Resüsitasyon Bilgi Düzeylerinin Değerlendirilmesi' başlıklı anket formu gönderildi ve bu anketler aracılığıyla veriler toplandı.

İstatistiksel analiz

Çalışmada elde edilen verilerin istatiksel analizi IBM SPSS 24.0 (SPSS Inc, Chicago, ABD) programı kullanılarak yapıldı. Tanımlayıcı istatistik olarak sayısal değişkenlerde ortalama, standart sapma, minimum maksimum değerler, sayı ve yüzdeler kullanıldı. Katılımcılar yaş, cinsiyet, çalışma alanı, KPR eğitimi, deneyim süresi ve KPR uygulama ve uygulamama açısından gruplandırıldı. KPR ile ilgili sorulardaki doğru cevaplar ile KPR eğitimi alıp almama gibi kategorik değişkenler arasındaki ilişkiyi incelemek için ki-kare testi kullanıldı. İstatistiksel anlamlılık $p < 0,05$ olarak belirlendi.

SONUÇLAR

Çalışmaya 164'ü erkek, 111'i kadın olmak üzere toplam 275 fizyoterapist katıldı. Katılımcıların %38,90'ı 26-35 yaş aralığında ve %35,60'ı 10 yıldan daha fazla deneyim süresine sahipti. Fizyoterapistler, %41,50 oranında en çok hastanede çalışmaktaydı ve en sık bildirilen çalışma alanı kas-iskelet sistemi uygulamalarıydı (%37,80) (Tablo 1).

Kardiyopulmoner resüsitasyon eğitimi ve değerinin algılanması ile ilgili yöneltilen sorular ve yanıtları Tablo 2'de sunulmuştur. Herhangi bir yerde kardiyak arrest vakası ile karşılaşanların oranı %28,40 iken çalışma ortamında bu oran %20,70 idi. 'Kardiyak arrest geçiren bir kişiyi nasıl değerlendireceğinizi biliyor musunuz?' sorusuna %47,60 oranında verilen cevap 'hayır' , %31,60 oranında verilen cevap ise 'evet' oldu.

Ankete katılanların çoğu (%67,30), lisans öğrenimi eğitim müfredatı içinde ya da sonrasında bir KPR eğitimi aldığını bildirdi. KPR eğitimi alanların; %60'ı eğitimin mankenler üzerinde verildiğini, yaklaşık üçte biri (%30,80) acil bir durumda KPR uyguladığını ifade etti. Eğitim alanların yarısından fazlası (%59,50) eğitimi yetersiz bulurken, %71,90'ı da KPR uygulama konusunda kendisini yetersiz buldu. 'Sizce fizyoterapistler KPR'yi bilmeli mi?' sorusuna %92,00 oranında 'evet' cevabı verildi (Tablo 2).

Çalışma alanı, yaş, cinsiyet ve deneyim yılına göre mevcut KPR eğitimi almış olma durumu arasında anlamlı bir farklılık yoktu (sırasıyla; p=0,875, p=0,725, p=0,932, p=0,880). KPR eğitimi alma durumunun çalışma ortamına göre ilişkisi incelendiğinde ise anlamlı bir farklılık bulundu. KPR eğitimi alma oranı spor takımlarında çalışan fizyoterapistlerde (%87,50) en yüksekken, bunu toplum ortamlarında (%72,90), özel muayenehanede (%71,40), hastanede (%70,20), üniversitede (%51,60) çalışan fizyoterapistler izledi ($x2 (4) = 9,985$, $p = 0,041$). Hastanede çalışan fizyoterapistlerin KPR sertifikasına sahip olma oranı üniversitede çalışanlara göre anlamlı olarak daha yüksekti ($x2 (2)= 5,980$ $p=0,014$).

KPR uygulama konusunda kendini yeterli görenlerin KPR bilgi puanı, yeterli görmeyenlere göre anlamlı olarak daha yüksekti ($p=0,001$, $z= -3,175$). KPR uygulama konusunda kendini yeterli görmenin (evet/

Tablo 1. Katılımcıların Özellikleri

	n	%
Yaş (yıl)		
18 – 25	77	28,00
26 – 35	107	38,90
,36 – 45	79	28,70
46 – 54	10	3,60
≥ 55	2	0,70
Cinsiyet		
Erkek	164	59,60
Kadın	111	40,40
Klinik Deneyim Süresi (yıl)		
1	71	25,80
2 – 5	61	22,20
6 – 10	45	16,40
11 – 15	34	12,40
16 – 20	46	16,70
≥ 21	18	6,50
Temel çalışma ortamı		
Özel muayenehane	21	7,60
Hastane	114	41,50
Toplum	70	25,50
Spor takımı	8	2,90
Üniversite	62	22,50
Temel çalışma alanı		
Muskuloskeletal	104	37,80
Kardiyorespiratuar	26	9,50
Nöroloji	52	18,90
Pediatri	47	17,10
Geriatri	5	1,80
Diğer (kadın sağlığı, el rehabilitasyonu, mental sağlık vb.)	41	14,90

hayır) KPR uygulama/uygulamama üzerindeki etkisi anlamlı idi (x2 (1) = 15,419, p < 0,001).

Katılımcıların sadece %6,20'si (n=17) daha önce damar yolu açma girişiminde bulunduğunu bildirdi. Acil bir durumda damar yolu açabileceğini düşünenlerin oranı %16,70 (n=46) iken, %66,50'si (n=183) açamayacağını, %16,70'si (n=46) ise bu konuda kararsız olduğunu belirtti. Gerekli hallerde balon-maske tekniğiyle ventilasyon sağlayabileceğinizi düşünüyor musunuz? sorusuna %29,50 (n=81) evet, %53,10 (n=146) hayır, %17,50 (n=48) karasızım yanıtı verildi.

Katılımcılara KPR ile ilgili yöneltilen sorular ve yanıtları Tablo 3'te sunulmaktadır. Soru #3 'Solunum nasıl kontrol edilir?' en yüksek başarı oranına sahipti; katılımcı fizyoterapistlerin %86,90'ı doğru yanıt verdi ve "Kalp masajı, kalp hızı dakikada kaç olacak şekilde uygulanmalıdır?" sorusu en düşük başarı oranına sahipti; katılan fizyoterapistlerin %21,80'i doğru yanıt verdi.

Katılımcıların teorik bilgi sorularına ilişkin toplam puan ortalaması 5±0,12'dir. Ankete katılanların %67,30'u (n=185) 10 üzerinden 5'in altında puan aldı. Bu sonuç katılımcıların çoğunluğunun KPR bilgi düzeylerinin düşük olduğunu gösterdi. KPR eğitimi almış olan ve almayan katılımcılar arasında

Tablo 2. KPR Eğitimi ve KPR Eğitiminin Değerinin Algılanmasına Yönelik Sorulara Verilen Cevaplar

	n	%
Herhangi bir yerde kardiyak arrest vakası ile karşılaştınız mı?		
Evet	78	28,40
Hayır	195	70,90
Kararsızım	2	0,70
Çalışma ortamınızda kardiyak arrest vakası ile karşılaştınız mı?		
Evet	57	20,70
Hayır	217	78,90
Kararsızım	1	0,40
Kardiyak arrest olmuş bir kişiyi değerlendirmeyi biliyor musunuz?		
Evet	87	31,60
Hayır	131	47,60
Kararsızım	57	20,70
Daha önce KPR eğitimi aldınız mı?		
Evet	185	67,30
Hayır	90	32,70
Cevabını evet ise, aldığınız eğitim sizce yeterli miydi?		
Evet	40	21,60
Hayır	110	59,50
Kararsızım	35	18,90
Cevabınız evet ise, eğitiminiz mankenler üzerinde uygulamalı mıydı?		
Evet	111	60,00
Hayır	74	40,00
Daha önce kendiniz KPR uyguladınız mı?		
Evet	57	30,80
Hayır	128	69,20
Sizce bir fizyoterapist KPR bilmeli midir?		
Evet	253	92,00
Hayır	10	3,60
Kararsızım	12	4,40
Kendinizi KPR konusunda yeterli görüyor musunuz?		
Evet	20	10,80
Hayır	133	71,90
Kararsızım	32	17,30
Daha önce damar yolu açma girişiminde bulundunuz mu?	17	6,20
Evet	258	93,80
Hayır		
Acil bir durumda damar yolu açabileceğinizi düşünüyor musunuz?	46	16,70
Evet	183	66,50
Hayır	46	16,70
Kararsızım		
Gerekli hallerde balon-maske tekniğiyle ventilasyon sağlayabileceğinizi düşünüyor musunuz?	81	29,50
Evet	146	53,00
Hayır	48	17,50
Kararsızım		

KPR: Kardiyopulmoner Resüsitasyon

Tablo 3. Fizyoterapistlerin On KPR Bilgi Sorusu için Doğru Cevaplarının Yüzdesi.

Sorular	Doğru	Yanlış
Bilinç durumu nasıl kontrol edilmelidir?	133 (48,40%)	142 (51,60%)
Bilinç kapalı ancak nefes alabilen ve nabzı olan hastaya hangi pozisyon verilmelidir?	133 (48,40%)	142 (51,60%)
Solunum nasıl kontrol edilir?	239 (86,90%)	36 (13,10%)
Erişkin hastada kalp masajı/suni solunum oranı kaç olmalıdır?	217 (78,90%)	58 (21,10%)
Çocuk hastada (1-8 yaş) kalp masajı/suni solunum oranı kaç olmalıdır?	79 (28,70%)	196 (71,30%)
Bebek hastada (0-12 ay) kalp masajı/suni solunum oranı kaç olmalıdır?	70 (25,50%)	205 (74,50%)
Kalp masajı, kalp hızı dakikada kaç olacak şekilde uygulanmalıdır?	60 (21,80%)	215 (78,20%)
KPR sırasında vücutta en kolay nabız alınabilecek 3 bölge hangileridir?	120 (43,60%)	155 (56,40%)
Nabız kontrolü için en fazla ne kadar zaman ayırılmalıdır?	149 (54,20%)	126 (45,80%)
Kardiyak arrest sırasında damar yolu açık olan hastaya ilk uygulanması gerekli ilaç hangisidir?	176 (64,00 %)	99 (36,00 %)

KPR: Kardiyopulmoner Resüsitasyon

KPR bilgi puanlarında istatistiksel olarak anlamlı fark vardı (sırasıyla 5,30 ± 2 ve 4,30 ± 1,60 puan; p<0,001). KPR eğitimi almamış olanların KPR anketindeki bilgi puanları, eğitim alan yanıtlayıcılardan istatistiksel olarak daha düşüktü (x2 (1, n=275) = 11,63; p<0,001).

TARTIŞMA

Çalışmamız, Türkiye'de çalışan fizyoterapistlerin KPR bilgi düzeylerini ve KPR'ye yaklaşımlarını araştıran ilk çalışmadır. Çalışmanın sonucunda araştırmamıza katılan fizyoterapistlerin çoğunluğunun, KPR sertifikasının olduğunu fakat KPR sertifikası olanların çoğunluğunun da KPR bilgi düzeylerinin yetersiz olduğu ve kendilerini bu konuda yetersiz hissettikleri sonucuna ulaşıldı. Fizyoterapistlerin KPR bilgisine sahip olması gerektiği konusunda da katılımcıların hemfikir olduğu görüldü.

Çalışmamızdaki fizyoterapistlerin kardiyak arrest ile karşılaşma oranı %28,40'tı. Az görülemeyecek bu oran COVID-19 pandemisi sonrası kardiyak arrest risklerinin artması gerçeği ile birlikte fizyoterapistlerin de bu durum ile daha sık karşılaşabileceği ihtimalini doğurmaktadır. Hastane dışı ve hastane içi ortamlarda COVID-19'un KA epidemiyolojisi ve sağlık sonuçları üzerinde önemli bir etkisi olması ve ERC COVID-19 kılavuzlarının, hem hastane dışı hem de hastane içi KA için resüsitasyon girişimlerinin sürdürülmesini tedavi sağlayan kişiler için riskin azaltılarak uygulanmasını teşvik etmesi (7) fizyoterapistlerin KPR uygulamalarına hakim olmaları durumunu kaçınılmaz kılmaktadır. Fizyoterapistler çok disiplinli sağlık bakım sisteminin ayrılmaz bir parçasıdır ve KPR yapmak için gerekli olan temel beceri ve bilgilere sahip oldukları düşünülür. Çoğu zaman, fizyoterapistlerin görevlerini yerine getirirken KPR gerektiren diğer durumlarda bir doktorun yanında veya yokluğunda acil bakım sağlamaları beklenebilir (18) .Türkiye'de fizyoterapistler KPR eğitimini ilk olarak lisans dönemindeki ilkyardım derslerinde almaktadır. Ancak lisans sonrası zorunlu bir KPR

eğitimi de yoktur. Sonuçlarımız, Türkiye'deki fizyoterapistlerin büyük bir çoğunluğunun (%92), literatür ile benzerlik gösterecek şekilde (14,18) KPR sertifikasının zorunlu olması gerektiğine inandıklarını göstermekteydi. Türkiye'de fizyoterapistler için KPR sertifikası zorunluluğu olmamasına rağmen fizyoterapistlerin yarısından fazlası (%67,30), KPR sertifikası almıştı. Fakat çalışmamız eğitim ve sertifika alan kişilerin çoğunluğunun da (%59,50) eğitimlerin yeterli olmadığını düşündüklerini göstermekteydi. Yine eğitim alanlardan geriye kalanların neredeyse yarısı da (%18,90) bu eğitimlerin yeterliliği konusunda kararsız kalmışlardı.

KPR sertifikasına sahip olma durumunun çalışma ortamına göre ilişkisi incelendiğinde; spor takımlarında çalışan fizyoterapistlerin en yüksek düzeyde sertifikaya sahip olan grup olması, takımlarda KPR sertifikasının zorunlu olmasından veya buralarda çalışan fizyoterapistlerin acil durumlarla karşılaşma ihtimalinin daha çok farkında olmalarından kaynaklanıyor olabilir. Çalışmamızdaki fizyoterapistlerin çoğunluğunun KPR sertifikasına sahip olmasına rağmen kendilerini yetersiz hissetmeleri, pratik olarak uygulama fırsatının olmaması, yeterli bilgi eksikliği veya fizyoterapistlerin kaza ve acil servis, yoğun bakım gibi KPR konusundaki yeterliliklerinin olabileceği ortamlarda değil, büyük ölçüde ayakta tedavi bölümlerinde çalıştıkları fizyoterapi uygulama ortamıyla da ilişkilendirilebilir. Ayrıca bu yetersizlik hissini eğitimlerin belli bir zaman aralığında güncellenmemesinin etkilediğini düşünmekteyiz. Son kılavuz, KPR tekrar eğitimi için optimum bir aralık önermek adına kanıtların yetersiz olduğunu bildirmiştir (19). KPR becerileri, ilk KPR eğitiminden sonra 3-12 ay içinde azalır, ancak kanıtlar, yapılan tekrar eğitimlerinin KPR becerilerini, kurtarıcının kendine güvenini ve KPR yapma isteğini geliştirdiğini göstermektedir (19).

KPR sertifikası zorunlu olmasa da Türkiye'de yaptığımız çalışmamıza benzer şekilde Yeni Zelanda araştırmasına katılan fizyoeterapistlerin %81'inin KPR sertifikasına ve %31'inin temel yaşam desteğinin üzerinde ek niteliklere sahip olduğu görülmüştür (14). Bu sonuç da bize, durumun zorunlu koşulmasından ziyade farkındalığının arttırılmasının önemini vurgulamaktadır. Olumlu bir tutuma sahip olup KPR prosedürü hakkında yetersiz bilgiye sahip olmak yanlış uygulamalara yol açabilir ve bu da hayat kurtarmak yerine tehlikeli bir sonuca neden olabilir.

Çalışmamızın önemli sonuçlarından biri de fizyoterapistlerin yetersiz KPR bilgi düzeyine sahip olduklarını göstermesiydi. Katılımcıların sadece %32,70'i KPR ile ilgili teorik bilgi sorularına doğru cevap vermişti. Bu bulgu literatürdeki çalışmalar ile benzerlik göstermekteydi (13,18). Bu, Türkiye'deki fizyoterapistlerde olduğu gibi çalışmaların yapıldığı ülkelerdeki fizyoterapistler için KPR akreditasyonunun ve güncelleme eğitimlerinin bir zorunluluk olmasıyla veya pratikte sık sık kullanılmamasıyla açıklanabilir. Bu ülkelerdeki suni teneffüs uygulamasının hala bir tıp doktorunun alanına girdiği görülmektedir (13,18). Benzer durumun Türkiye için de geçerli olduğu söylenebilir. Tersine Yeni Zelandalı fizyoterapistlerin KPR bilgi düzeyinin değerlendirildiği çalışmada katılımcılar sorulara %62 ile %94 oranında doğru cevap vermiş ve fizyoterapistlerin beşte biri acil durumlarda KPR kullanmış ve uygulamaların çoğunda başarılı oldukları görülmüştür. Her beş Yeni Zelandalı fizyoterapistten birinin kariyerleri boyunca suni teneffüs uyguladıklarını ve acil bir durumda ambulans gelmeden önce mevcut olan tek sağlık profesyoneli olabilecekleri bildirilmiştir (14).

Katılımcılarımızın KPR sertifikası olmasının literatürle benzer şekilde KPR bilgi puanlarını pozitif yönde etkilediği görüldü (13). KPR eğitimi almış olan ve KPR uygulama konusunda kendini yeterli görenler, KPR ile ilgili sorulara, eğitim almamış ve/veya kendini yetersiz görenlere kıyasla daha iyi yanıt verdi. KPR uygulama konusunda kendini yeterli görmenin KPR uygulama üzerindeki etkisi de anlamlı idi. Bu gerçek, KPR'de sağlam bir teorik bilgiyi elde etme ve sürdürmede eğitimin önemini ortaya koymaktadır. Özellikle son kılavuzlarda vurgulandığı gibi, hastanın hayatta kalması erken defibrilasyon süresine ve KPR uygulamasının kalitesine bağlı olduğundan KPR bilgi düzeyi, bilginin sürdürülebilirliği ve uygulama konusundaki yeterliliği önem taşımaktadır (1,7,19).

Çalışmamızın sınırlılıkları mevcuttur. İlk olarak, çalışmanın kesitsel doğası gereği nedensellikten ziyade sadece ilişkiler belirlenebilmiştir. İkinci olarak, KPR ile ilgili olarak kişinin bildirdiği verilerin kullanılması, gerçek davranışı yansıtmayabilecek yanlılığı ortaya çıkarmış olabilir. Üçüncüsü, Türkiye'deki

toplam fizyoterapistlerin sadece küçük bir oranı ankete cevap verdiğinden çalışma nispeten küçük örneklem boyutunu içermekteydi. Çalışmanın demografik özellikleri genelleştirilebilir görünse de anket yanıtlarının Türkiye fizyoterapi popülasyonunu temsil edip etmediği bilinmemektedir. Ayrıca katılımcıların lisansüstü eğitim düzeyleri sorgulanmamıştır, eğitim düzeyi de KPR bilgi düzeyini etkileyebilir. Bu eksikliği gidermek için, daha ileri çalışmaların, yüksek yanıt oranı oluşturabilen temsili bir örneklemi olan spesifik alanlarda çalışan fizyoterapistlere yönelik olacak şekilde bir popülasyon üzerinde yapılması önerilir. Son olarak KPR eğitimi sonrası geçen sürenin sorgulanmamış olması ve yazılı yanıtlardaki KPR protokolleri bilgisi, KPR bilgi düzeyinin bir ifadesi olarak kullanılması herhangi bir pratik yeterlilik değerlendirmesi yapılmaması çalışmanın diğer bir limitasyonunu oluşturmaktaydı.

Çalışmamızın sonuçları fizyoterapistlerin yarısından fazlasının, KPR sertifikasına sahip olduğunu fakat KPR sertifikasına sahip olanların çoğunluğun da KPR bilgi düzeylerinin yetersiz olduğunu ve kendilerini bu konuda yetersiz hissettiklerini göstermiştir. Fizyoterapistlerin KPR uygulaması için başarı oranlarını güçlendirmek ve ayrıca ihtiyaç duyan hastaların sonuçlarını iyileştirmek için, Türkiye'de KPR eğitiminin farkındalığının arttırılması ve/veya zorunlu hale getirilmesi ile sürekli mesleki gelişim önerilmektedir. Türkiye fizyoterapistleri için KPR sertifikasının zorunlu hale gelmesi durumunun hastalar için sağlanacak potansiyel faydalar ile maliyet, eğitim için çalışma süresi, durumun takibi için gerekli sistem ve yeniden sertifikalandırma sıklığı durumlarıyla kıyaslanıp tartılması gerekecektir. Türkiye fizyoterapistlerinin KPR uygulamasını daha iyi değerlendirmek isteyen gelecekteki araştırmalar fizyoterapistlerin gerçek KPR yeterliliğini teorik bir değerlendirmeden ziyade bir manken üzerinde pratik bir değerlendirme ile incelemelidir. Bu çalışmanın bulgularını doğrulamak için fizyoterapistler arasında KPR bilgisi, tutumu ve uygulaması hakkında ulusal düzeyde teorik ve pratik düzeyde değerlendirme yapan çalışmalara ihtiyaç vardır. Ayrıca, sağlık sistemi içinde fizyoterapinin profesyonel özerkliğine yönelik uluslararası gerekliliği daha da artırabileceğinden, fizyoterapistlerin acil durumlara yönelik bilgi, beceri ve yetkinliği hakkında daha fazla çalışmaya ihtiyaç vardır.

Destekleyen Kuruluş: Destekleyen kuruluş bulunmamaktadır.

Çıkar Çatışması: Çıkar çatışması bulunmamaktadır.

Yazar Katkıları: Fikir/kavram – RTK ; tasarım – RTK, HBY; denetleme/danışmanlık – RTK,HBY; kaynaklar ve fon sağlama RTK; veri toplama ve/veya işleme – RTK, MM; analiz ve/ veya yorumlama – RTK, MM, HBY; literatür taraması – RTK, MM, HBY; makale yazımı – RTK, MM, HBY; eleştirel inceleme - RTK, MM, HBY.

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FUNCTIONS, SLEEP, FATIGUE AND QUALITY OF LIFE IN PATIENTS WITH SCLERODERMA DURING COVID-19: CROSS - SECTIONAL STUDY

ORIGINAL ARTICLE

ABSTRACT

Purpose: COVID-19, which has affected people in various ways, has also shown to cause various limitations on the lives of Scleroderma patients. The current study aims at evaluating the upper extremity functions, sleep quality, fatigue, and health-related quality of life in Scleroderma patients and to determine the factors affecting upper extremity functions.

Methods: A total of 83 participants were recruited in this study. Of the participants, 39 were Scleroderma patients (mean age 43.28±9.96 years) and 44 were healthy controls (mean age 40.05±8.89 years). The Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH) and Michigan Hand Outcomes Questionnaire (MHQ) were applied to evaluate upper extremity functions of the participants. Pittsburgh Sleep Quality Index (PSQI), Fatigue Severity Scale (FSS), and the Scleroderma Health Assessment Questionnaire (SHAQ) were used to evaluate the sleep quality, fatigue, and health-related quality of life, respectively.

Results: Scleroderma patients had significantly lower scores in hand functions, sleep quality, fatigue, and health-related quality than the healthy group (p=0.001). The correlations between DASH and PSQI (r=0.559, p=0.001), FSS (r=0.496, p=0.001), SHAQ scores (r=0.754, p=0.001) were highly positive. Similarly, a high correlation was found between MHQ and SHAQ scores (r=-0.679, p=0.001).

Conclusion: Upper extremity functions and health-related quality of life were found to be affected in patients with Scleroderma. It was revealed that upper extremity functions were affected by sleep quality, fatigue, and health-related quality of life. Therefore, knowing all these effects and their relationships with each other allows to draw a systematic treatment plan on Scleroderma patients.

Key Words: Activities of Daily Living, Hand, Quality of Life, Systemic Sclerosis

COVID-19 PANDEMİSİ SIRASINDA SKLERODERMALI HASTALARDA FONKSİYON, UYKU, YORGUNLUK VE YAŞAM KALİTESİ: KESİTSEL ÇALIŞMA

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: İnsan sağlığını çeşitli şekillerde etkileyen COVID-19, Skleroderma hastalarının yaşamlarında da çeşitli etkilere ve kısıtlamalara neden olmuştur. Bu çalışmada Skleroderma hastalarında üst ekstremite fonksiyonları, uyku kalitesi, yorgunluk ve sağlıkla ilgili yaşam kalitesinin değerlendirilmesi ve üst ekstremite fonksiyonlarını etkileyen faktörlerin belirlenmesi amaçlandı.

Yöntem: Çalışmaya toplam 83 katılımcı dahil edildi. Katılımcıların 39'u Skleroderma hastası (ortalama yaş 43,28±9,96 yıl) ve 44'ü sağlıklı kontrol (ortalama yaş 40,05±8,89 yıl) idi. Katılımcıların üst ekstremite fonksiyonlarını değerlendirmede Kol, Omuz ve El Sorunları Anketi ve Michigan El Sonuç Anketi uygulandı. Pittsburgh Uyku Kalitesi İndeksi, Yorgunluk Şiddet Ölçeği ve Skleroderma Sağlık Değerlendirme Anketi sırasıyla uyku kalitesini, yorgunluğu ve sağlıkla ilişkili yaşam kalitesini değerlendirmek için kullanıldı.

Sonuçlar: Skleroderma hastaları, el fonksiyonları, uyku kalitesi, yorgunluk ve sağlıkla ilgili kalite açısından sağlıklı gruba göre anlamlı olarak daha düşük puanlara sahipti (p=0,001). Kol, Omuz ve El Sorunları Anketi puanı ile Pittsburgh Uyku Kalitesi İndeksi puanı (r=0,559, p=0,001), Yorgunluk Şiddet Ölçeği puanı (r=0,496, p=0,001), Skleroderma Sağlık Değerlendirme Anketi puanı (r=0,754, p=0,001) arasında pozitif yönde yüksek korelasyon vardı. Benzer şekilde Michigan El Sonuç Anketi puanı ile Skleroderma Sağlık Değerlendirme Anketi puanı arasında da yüksek korelasyon bulundu (r=-0,679, p=0,001).

Tartışma: Sklerodermalı hastalarda üst ekstremite fonksiyonlarının ve sağlıkla ilgili yaşam kalitesinin etkilendiği bulundu. Üst ekstremite fonksiyonlarının uyku kalitesi, yorgunluk ve sağlıkla ilgili yaşam kalitesinden etkilendiği ortaya kondu. Dolayısıyla tüm bu etkileri ve birbirleriyle olan ilişkilerini bilmek Skleroderma hastalarında sistematik bir tedavi planı çizmeye olanak sağlar.

Anahtar Kelimeler: Günlük Yaşam Aktiviteleri, El, Yaşam Kalitesi, Sistemik Skleroz

INTRODUCTION

Coronavirus Disease 2019 (COVID-19) was first detected in December 2019, with several cases of pneumonia in China (1). Dyspnea and pneumonia developed in a lot of the cases in the following days. In severe cases, acute respiratory distress syndrome developed rapidly (1-3). COVID-19, which affects the respiratory tract in various ways, has also caused various influences and limitations in the lives of Scleroderma (SSc) patients. Even the fear of contracting COVID-19 has affected the lives of individuals.

More than 25 million people in North America and more than 30 million people in Europe are affected by SSc which is a rare disease. In the only study conducted in Turkey, the prevalence of scleroderma 23.2/100.000, incidence was determined as 2.1/100.000 and it was found to be similar to Europe and the United States (4). Although the etiology is not fully known, it is chronic, progressive, autoimmune, connective tissue disease known to cause excessive collagen deposition and widespread microvascular damage in the internal organs and skin (5). In SSc patients, especially pulmonary arterial hypertension and interstitial lung disease are especially seen with lung involvement (6). Hypoxemia and limitation of exercise capacity are observed in patients. Lung involvement seriously affects the prognosis in scleroderma and is closely related to morbidity and mortality (7).

Since SSc is a multisystem disease, clinical manifestations and prognosis vary. The presence of joint, muscle, and bone involvement may cause a decrease in functional capacity and hindrance of activities of daily living (ADL) (8). Because of all these reasons, SSc draws attention with high levels of disability, severe disruptions to impaired health-related quality of life (HRQOL), and ADL (9). Sleep efficiency and rapid-eye movement sleep of the SSc patients decrease, and arousal index and slow-wave sleep increase. Despite this, the risk of sleep-diseased breathing does not increase (10). In the literature, the importance of limitation of hand functions as well as decrease in the ability to perform ADL, increase in fatigue and pain in SSc patients are emphasized. Accordingly, fatigue is considered to be a very important symptom in most SSc patients (11).

There are some similarities between COVID-19 and SSc in terms of the pattern of organ involvement, the presence of significant vasculopathy, and cardiorespiratory complications (12). These similarities suggest that SSc patients may experience more severe symptoms if they are likely to have COVID-19. The current study aimed to evaluate the upper extremity functions and HRQOL of SSc patients and to compare them to the healthy controls (HC). In addition, we sought to clarify the factors associated with the influence of upper extremity functions and HRQOL. On the other hand, The COVID-19 process also affects healthy individuals. In terms of health status, we also aimed to investigate the differences between healthy individuals and individuals with SSc in this process.

METHODS

Design

The ethical approval for the research project has been granted by Cerrahpasa Medical Faculty Ethics Committee of Istanbul University-Cerrahpasa (A-18 05.01.2021). All procedures of the study are carried out in accordance with the Helsinki Declaration. All patients were clarified and they signed the informed consent form.

Participants

A total of 83 participants (39 patients with SSc and 44 age- and sex-matched healthy controls) were recruited to the cross-sectional study conducted between March 2020 and February 2021, during COVID-19 pandemic. The patients were diagnosed with diffuse cutaneous SSc according to 2013 ACR/EULAR Classification Criteria for SSc, by a rheumatologist at Clinic of Cerrahpasa Medical Faculty. Patients aged 20-60 years who received routine medical treatment were included in the study. Patients diagnosed with juvenile onset SSc, and those with a history of neurological disease or trauma that may affect hand functions were excluded from the study.

Outcome Measures

The participants were questioned about gender, age, body mass index, employment, presence of

rheumatic diseases in the family, smoking status and the disease duration. The disease duration was defined from the date of diagnosis.

Primary Outcome Measurements

The Scleroderma Health Assessment Questionnaire (SHAQ)

SSc-related quality of life assessed with valid and reliable Turkish version of the SHAQ tool. SHAQ consists of five scleroderma specific items (Raynaud's phenomenon, overall disease severity, digital ulcers, respiratory and intestinal involvement). The effects of digital ulcers, Raynaud's phenomenon, lung respiratory symptoms, gastrointestinal symptoms and general SSc symptoms on ADL were questioned. The score ranges from 0 (minimum limitation) to 3 (max limitation). In addition, the functional ability level of the participants on the scale was questioned with Health Assessment Questionnaire-Disability Index (HAQ-DI). The higher SHAQ score [(5VAS scores+8HAQ-DI domains)/13] meant worse situation (13).

The Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH)

The upper extremity functions and musculoskeletal conditions were assessed with the Turkish version of DASH. The participants were asked to answer the questions assessing difficulties during ADL, symptoms, social function, working, sleeping and self-confidence. Scores from 0 to 100 can be obtained for each module in DASH, and a high DASH score indicates severe disability (14).

Secondary Outcome Measurements

Michigan Hand Outcomes Questionnaire (MHQ)

The MHQ is a standardized method for assessing patients with all types of hand disorders. The patients were asked to evaluate herself/himself with the MHQ containing six domains (pain, hand function, satisfaction with hand function, work performance, ADL, and aesthetics). A higher score [right hand score+left hand score)/2] indicates a better hand function (15,16).

Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) is a self-rated questionnaire and assesses sleep disturbances and sleep quality over 1-month time period. The participants were asked nine questions evaluating sleep quality, latency, duration, efficiency and disturbances, daytime dysfunction and usage of sleeping medication. Each component is evaluated over 0-3 points, and the total score of the scale is obtained with the total score of the 7 components. A global PSQI score equal to or greater than five means that sleep quality and patterns have worsened (17).

Fatigue Severity Scale (FSS)

The FSS is a nine-item self-report measure that assesses the effect of fatigue on functioning. The severity of fatigue symptoms during the past week were evaluated with FSS. Each item scored from 1 to 7. "1" indicates strong disagreement with the statement, while "7" indicates strong agreement. The total score is calculated by taking an arithmetic mean. A score of 4 or higher indicates severe fatigue. As the total score increases, the severity of fatigue symptom increases (18).

Statistical Analysis

All variables showed normal distribution according to the Kolmogorov-Smirnov test ($p=0.160$) and, therefore, a parametric analysis was conducted. The groups were compared using the Independent samples-t test in the case of numerical variables and Chi-square test when the variables were categorical. Pearson correlation coefficient was used to evaluate the associations between variables (r). The data analysis was performed using IBM SPSS (Statistical Package for Social Sciences) version 21.00 software (IBM Corp., Armonk, NY, USA). Differences were considered statistically significant at $p<0.05$. Post-hoc power analyzes were calculated for SHAQ using the final sample size, at an alpha level of 0.05 and based on Independent samples-t test (G*Power 3.1 software) and were found as 0.99.

RESULTS

Demographic and clinical characteristics of the SSc patients and HC are presented in Table 1. There were no significant differences between groups ($p>0.05$). The SSc group had a mean of disease duration over six years.

Comparison of SSc and HC in terms of upper ex-

Table 1. Descriptive Variables of SSc Patients and HC

	SSc (n = 39)	HC (n = 44)	p	t
Age (years) mean ± SD	43.28 ± 9.96	40.05 ± 8.89	0.122	-1.404
BMI (kg/cm²) mean ± SD	23.71 ± 5.23	24.83 ± 4.10	0.279	-1.089
Disease duration (month) mean ± SD	83.08 ± 64.31			
Gender-Female n (%)	34 (%87.2)	33 (%75.0)	0.160	
Employment n (%)	15 (%38.5)	33 (%75.0)	*0.001*	
Family history n (%)	18 (%46.2)	8 (%18.2)	*0.006*	
Smoking status - *Nonsmoker* n (%)	26 (%66.7)	21 (%47.7)	0.158	
Smoking status - *Smoker* n (%)	6 (%15.4)	14 (%31.8)		

SSc: Scleroderma, HC: Health Control, SD: Standard Deviation, BMI: Body mass index, kg: kilogram, cm: centimeter, Family history: Rheumatic diseases in family

*p<0.05 (Independent samples t test, Chi-square test)

tremity functions, sleep quality, fatigue and HRQOL were specified in Table 2. The SSc group had significantly lower scores than the HC group in terms of DASH, MHQ-pain, MHQ-total, SHAQ and HAQ-DI. The differences between the two groups were significantly reflected in the statistics (p<0.001). However, there were no significant differences between the two groups in terms of PSQI (p=0.155) and FSS (p=0.152) scores.

Correlations between upper extremity functions and HRQOL for all patients were presented in Table 3. There was highly positive correlation between DASH and SHAQ, HAQ-DI, FSS, PSQI (p<0.001). While there was a moderate correlation between MHQ - Overall hand function and SHAQ, HAQ-DI, low correlation was found between MHQ - Overall hand function and FSS. Similarly, high correlation was found between MHQ-Total and SHAQ, HAQ-DI.

Table 2. Comparison of SSc and HC Groups in Terms of Upper Extremity Functions, Sleep Quality, Fatigue and Health-Related Quality of Life

	SSc (n = 39)		HC (n = 44)			
	min-max	**mean ± SD**	**min-max**	**mean ± SD**	**t**	**p**
DASH	0.83 - 86.67	36.43 ± 22.98	0 - 48.33	6.83 ± 10.35	7.708	**0.001***
MHQ - Pain	10.00 - 125.00	53.07 ± 31.30	5.00 - 125.00	75.45 ± 53.64	-2.282	**0.025***
MHQ - Total	27.92 - 96.94	56.61 ± 15.63	50.07-104.17	87.96 ± 13.60	-9.769	**0.001***
PSQI	0 - 13.00	6.25 ± 3.17	0 - 16.00	5.18 ± 3.59	1.436	0.155
FSS	0 - 6.90	4.54 ± 1.95	1.00 - 6.70	3.97 ± 1.65	1.447	0.152
SHAQ	0 - 2.30	1.07 ± 0.56	0 - 1.00	0.25 ± 0.25	8.675	**0.001***
HAQ-DI	0 - 3.00	1.05 ± 0.71	0 - 1.50	0.21 ± 0.35	6.841	**0.001***

SSc: Scleroderma, HC: Health Control, DASH: Disabilities of the Arm, Shoulder and Hand Questionnaire, MHQ: Michigan Hand Outcomes Questionnaire, PSQI: Pittsburgh Sleep Quality Index, FSS: Fatigue Severity Scale, SHAQ: Scleroderma Health Assessment Questionnaire, HAQ-DI: Health Assessment Questionnaire Disability Index

*p<0.05 (Independent samples t test)

Table 3. Relationship Between Upper Extremity Functions and Sleep Quality, Fatigue, Health-Related Quality of Life in Patients with SSc

	PSQI		FSS		SHAQ		HAQ-DI	
	r	p	r	p	r	p	r	p
DASH	0.559	**0.001***	0.496	**0.001***	0.754	**0.001***	0.793	**0.001***
MHQ - Overall hand function	-0.266	**0.101***	-0.362	**0.024***	-0.643	**0.001***	-0.598	**0.001***
MHQ - ADL	-0.148	0.368	-0.271	0.095	-0.721	**0.001***	-0.711	**0.001***
MHQ - ADL Both hands	-0.335	**0.037**	-0.306	0.058	-0.730	**0.001***	-0.734	**0.001***
MHQ - ADL Total	-0.255	0.117	-0.302	0.062	-0.758	**0.001***	-0.755	**0.001***
MHQ - Work performance	-0.362	**0.024***	-0.335	**0.037***	-0.596	**0.001***	-0.597	**0.001***
MHQ - Pain	0.264	0.104	0.158	0.337	0.128	0.436	0.194	0.235
MHQ - Aesthetics	-0.071	0.669	-0.119	0.471	-0.205	0.211	-0.167	0.309
MHQ - Patient satisfaction	-0.222	0.174	-0.290	**0.073***	-0.536	**0.001***	-0.517	**0.001***
MHQ - Total	-0.200	0.223	-0.315	0.223	-0.679	**0.001***	-0.628	**0.001***

SSc: Scleroderma, HC: Health Control, DASH: Disabilities of the Arm, Shoulder and Hand Questionnaire, MHQ: Michigan Hand Outcomes Questionnaire, PSQI: Pittsburgh Sleep Quality Index, FSS: Fatigue Severity Scale, SHAQ: Scleroderma Health Assessment Questionnaire, HAQ-DI: Health Assessment Questionnaire Disability Index, ADL: Activities of daily living.

*p<0.05 (Pearson correlation analysis)

Sleep quality and fatigue scores were not found to be highly correlated with other variables except for DASH.

DISCUSSION

In this study, the SSc group had significantly lower scores in terms of DASH, MHQ-pain, MHQ-total, SHAQ and HAQ-DI compared to the healthy group. To our knowledge, this is the first study in the literature evaluating upper extremity functions and HRQOL together in patients with SSc during COVID-19 pandemic. The COVID-19 pandemic has had a huge impact on the health situation worldwide. This led to an increase in the usual disease burden in individuals with SSc as well, with unexpected results (12). However, severe outcomes are observed more frequently in individuals with SSc, especially those with cardiopulmonary involvement, than in the general population. On the other hand, one of the things that complicates the situation of individuals with SSc is the restriction of access to health institutions. This may prevent patients from receiving quality care during the COVID-19 period and affect their health status (19).

It has been reported in the literature that the most important risk factors complicating ADL are decreased grip strength and dexterity, stiffness and Raynaud's phenomenon (20). There is also a relationship between hand mobility and skin score and difficulty in ADL. Similarly, in our study, we examined the relationship between upper extremity functions and HRQOL. There were highly positive correlations between upper extremity functions and HRQOL, sleep quality, and fatigue. We could also classify our patients according to the Rodnan skin scoring. On the other hand, Peytrignet et al. reported that pain, fatigue and impaired hand function are important contributors to overall disability in diffuse cutaneous SSc in their study with an average disease duration of 11.9 months (11). Being in the early period of the disease may have not affected the function much and may have even made it difficult to demonstrate its effects. SSc patients in our study were diagnosed more than six years ago on average. We think that this period is a suitable time to reveal the effects of the disease on function and HRQOL. Yakut et al., in their study with SSc patients and healthy control subjects, emphasize that the increase in fatigue may occur due to decrease in both respiratory and peripheral muscle strength, decrease in diffusion capacity, increase in dyspnea, and deterioration of functional

capacity (21). In addition, they reported that fatigue affected the ADL and HRQOL of the patient. On the other hand, Liem et al. compared the activity level of SSc patients with the general population (22). They noted that the total minutes of physical activity per week was markedly lower in SSc. In addition, according to this study, male gender, functional inability and lack of energy are factors that reduce physical activity level. Unlike the method of this study, we did not evaluate physical activity level. But in a similar vein, we compared SSc with HC in our study. Only the diffuse cutaneous SSc patients were included in the study. Because we thought that parameters such as pain, function, sleep quality, and fatigue could be affected more in these patients due to their involvement.

Nokes et al. reported that about a third of patients had sleep-disordered breathing in the study which they investigated the risk of sleep-disordered breathing in patients with SSc (10). Furthermore, this rate is approximately the same as the rate of interstitial lung disease, and the rate of pulmonary hypertension is half of this rate. Similarly, in Bassel et al.'s study to identify symptoms that make it difficult for SSc patients to perform ADL, they confirmed that symptoms such as pain, fatigue and limitations in hand function were the most important symptoms affecting HRQOL in SSc (23). In this study, it was emphasized that the number of studies focusing on the sleep problem, which has a very important role in limiting the ADL in SSc patients, should be increased. PSQI is a widely used scale for evaluating the sleep quality. According to the PSQI, a global score of five or more is defined as a poor sleeper (24). We also concluded that sleep quality was poor in both SSc patients and healthy individuals. Although SSc patients have more sleep problems as the mean value, there is no statistically significant difference when compared with healthy individuals. We think that, this result may be due to the fact that the COVID-19 pandemic may have caused changes in the sleep patterns of healthy people also.

As Odonwodo et al. wrote in their reviews, hardening of the skin and involvement of the musculoskeletal system in patients with SSc may affect their ability to use their hands functionally, especially (25). Similarly, in a study on 62 patients, 63% of which were diffuse cutaneous SSc by Kallen et al., it was reported that 89% of SSc patients had problems with hand function and so that it could be said that the skin and tendon involvement of the hand was a generalizable problem in SSc patients (26). In another review article Thombs et al. emphasized that the level of pain in SSc was similar to other chronic pain and rheumatic diseases (5). It has been noted that the source of pain in SSc may be Raynaud's phenomenon, musculoskeletal, tightness, calcinosis, ulcers, gastrointestinal problems or depressive symptoms. Additionally, it has been stated that the association between pain and sleep disorder was strong. While the sleep-pain relationship was emphasized in this study, the relationship of many different parameters was revealed in our study. It can be said that sleep quality, fatigue and HRQOL are among the parameters that affect the functions of SSc patients. Similarly, most of the studies in the literature have focused on the hand problems. The superior aspect of our study is that we evaluated the overall upper extremity involvement.

Limitations

In this study, we compared diffuse cutaneous SSc patients with healthy individuals. We did not make a classification according to the Rodnan skin scoring. However, this is the first study to evaluate upper extremity functions, sleep quality, fatigue and HRQOL together in SSc patients and to identify an association between these parameters. Our study is also limited by the fact that we did not evaluate physical activity level, although our results could be beneficial in the future studies that evaluate these factors.

Conclusions

Since SSc is a multisystem disease, it is very important to know its effects on upper extremity functions and HRQOL, especially in pandemic conditions. Because the most important factors affecting the upper extremity functions in patients with SSc are fatigue, sleep quality, and health-related quality of life. Knowing all these influences and their interrelationships on SSc patients enables a systematic treatment plan. This study continues as a randomized controlled trial. Knowing these results will have an important place in the rehabil-

itation plans.

Sources of Support: None.

Conflict of Interest: There is no conflict of interest.

Ethical Approval: The ethical approval for the research project has been granted by Cerrahpasa Medical Faculty Ethics Committee of Istanbul University-Cerrahpasa (A-18 05.01.2021). All procedures of the study are carried out in accordance with the Helsinki Declaration.

Informed Consent: All patients were clarified and they signed the informed consent form.

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THE COMPARISON OF THE PHYSICAL AND SOCIAL INFLUENCES OF THE COVID-19 PANDEMIC IN CONVALESCENTS AND CONTROLS: A CASE-CONTROL STUDY

ORIGINAL ARTICLE

ABSTRACT

Purpose: To compare the fatigue and dyspnea level, respiratory function, mental fatigue, sleep quality, and social influence of the COVID-19 pandemic in convalescent and controls and to explore the relationship between these characteristics in both groups.

Methods: A total of 352 participants, including COVID-19 convalescent (n=176) and controls (n=176), participated in this study. The following instruments were used by online technologies: Visual Analog Scale (VAS) to investigate fatigue and dyspnea level, Single Breath Counting (SBC) test to measure respiratory function, Wood Mental Fatigue Inventory (WMFI) to evaluate mental fatigue, Pittsburg Sleep Quality Index (PSQI) to assess the sleep quality and Social Influences Survey Questionnaire (SISQ) to investigate social influences of the pandemic.

Results: COVID-19 convalescents reported higher levels of tiredness, dyspnea, and mental fatigue than controls ($p<0.05$). In both groups, there was a moderate-low positive relationship between fatigue and dyspnea levels. The respiratory functions and sleep quality of COVID-19 convalescents were lower than controls. There was a positive correlation between mental fatigue and sleep quality for the COVID-19 convalescents ($p<0.05$). Furthermore, the social influences of the pandemic were comparable in COVID-19 convalescents and controls ($p>0.05$).

Conclusion: Even after long-term COVID-19 recovery, symptoms like increased fatigue and dyspnea, mental fatigue, poor respiratory function, and sleep disturbances persist. Therefore, it is necessary to develop treatment strategies in order to alleviate these problems.

Keywords: COVID-19, Dyspnea, Fatigue, Sleep, Social Factors

COVID-19 GEÇİRİP İYİLEŞMİŞ KİŞİLER VE KONTROLLERDE COVID-19 PANDEMİSİNİN FİZİKSEL VE SOSYAL ETKİLERİNİN KARŞILAŞTIRILMASI: BİR VAKA KONTROL ÇALIŞMASI

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: COVID-19 pandemisinin hastalığı geçirip iyileşmiş kişiler ve kontrollerde yorgunluk ve dispne düzeyi, solunum fonksiyonu, zihinsel yorgunluk, uyku kalitesi ve sosyal etkilerini karşılaştırmak ve her iki grupta bu özellikler arasındaki ilişkiyi araştırmaktır.

Yöntem: Bu çalışmaya COVID-19 hastalığı geçirip iyileşmiş kişiler (n=176) ve kontroller (n=176) olmak üzere toplam 352 katılımcı katıldı. Aşağıdaki ölçekler çevirim-içi olarak kullanıldı: Yorgunluk ve dispne düzeyini araştırmak için Görsel Analog Skalası (GAS), solunum fonksiyonunu ölçmek için Tek Nefes Sayımı (TNS) testi, zihinsel yorgunluğu değerlendirmek için Wood Mental Yorgunluk Envanteri (WMYE), bireylerin uyku kalitesini değerlendirmek için Pittsburg Uyku Kalitesi İndeksi (PUKİ) ve pandeminin sosyal etkilerini araştırmak için Sosyal Etkiler Anketi (SEA).

Sonuçlar: COVID-19 hastalığı geçirip iyileşmiş kişilerde kontrollere göre daha yüksek düzeyde yorgunluk, dispne ve zihinsel yorgunluk bildirildi ($p<0,05$). Her iki grupta da yorgunluk ve dispne düzeyleri arasında orta-düşük düzeyde pozitif ilişki tespit edildi. COVID-19 hastalığı geçirip iyileşmiş kişilerde solunum fonksiyonları ve uyku kalitesinin kontrollerden daha düşük olduğu görüldü. COVID-19 hastalığı geçirip iyileşmiş kişilerde zihinsel yorgunluk ile uyku kalitesi arasında pozitif bir ilişki mevcuttu ($p<0,05$). Ayrıca, pandeminin sosyal etkilerinin COVID-19 hastalığı geçirip iyileşmiş kişilerde ve kontrollerde benzer olduğu bulundu ($p>0,05$).

Tartışma: Uzun süreli COVID-19 iyileşme süresinden sonra bile yorgunluk ve nefes darlığı, zihinsel yorgunluk, zayıf solunum fonksiyonu ve uyku bozuklukları gibi semptomlar devam etmektedir. Bu nedenle, COVID-19 hastalığı geçirip iyileşmiş kişilerde bu sorunları azaltabilmek amacıyla tedavi stratejileri geliştirilmesi gereklidir.

Anahtar Kelimeler: COVID-19, Nefes Darlığı, Yorgunluk, Uyku, Sosyal Faktörler

INTRODUCTION

The World Health Organization (WHO), has declared the new coronavirus (COVID-19) outbreak a global pandemic on March 11, 2020 (1). COVID-19 has an impact on the immune (cytokine storm) and respiratory systems (pneumonia), as well as the hematological (blood clotting), cardiovascular (myocardial hypertrophy), musculoskeletal (myalgia, rhabdomyolysis), nervous (loss of senses, confusion), and mental health (stress, depression, anxiety) (2,3). While many patients exposed to COVID-19 have recovered completely, prolonged symptoms such as dyspnea, weariness, cough, and dysosmia may last for more than 120 days in COVID-19 convalescents, those who recover from COVID-19 (4,5). According to a recent study, the most common delayed symptom was fatigue, followed by dyspnea, weakness, anxiety, and exercise intolerance (6). The long-term consequences of COVID-19 are a major and significant concern for public health.

Infectious disease outbreaks have a negative influence on patients' physical health as well as their psychological health and well-being (7). Patients diagnosed with COVID-19 should be treated in isolation, and research shows this isolation causes anxiety, depression, panic attacks, mood swings, and sleep disorders (8,9). Although these physical and psychological health issues have been studied in COVID-19 convalescents, no comprehensive studies have been conducted comparing them with healthy people. Therefore, the primary aim of this study was to compare fatigue and dyspnea level, respiratory functions, mental fatigue, sleep quality, and social influence in COVID-19 convalescents and controls. The secondary aim of this study was to investigate the relationship between fatigue and dyspnea level, respiratory functions, mental fatigue, sleep quality, and social influence in both groups.

METHODS

Study design and participants

The sample size was calculated by using the G*Power 3.0 program. Cohen's d was used to calculate the effect size value because no reference data from a similar study were available. Assuming a value for the medium effect size as d=0.4, α= 0.05, β=0.05, and 95% power based on the two-legged Wilcoxon-Mann-Whitney U test, the sample size was calculated to be a minimum of 172 participants in each group. Therefore, a total of 352 international volunteers have been recruited for this study, including COVID-19 convalescents (n=176) and controls (n=176).

Individuals between the ages of 40 and 65 and those who volunteered were included in the study. A confirmed case of COVID-19 was characterized by a positive real-time reverse-transcription polymerase chain reaction (PCR) result on throat swab materials. And persons whose PCR test results were positive but turned negative within the last 14 days were included in the COVID-19 convalescents. Those who had never tested positive on a PCR test were included in the control group. Participants with recurrent COVID-19 infections were excluded from the study. Additionally, lack of internet and mobile phone access, inability to complete the questionnaire list, and neurological, respiratory, or musculoskeletal problems influencing physical activities were among the exclusion criteria for all individuals. The authors assert that all procedures used in this study correspond to the Helsinki Declaration and the ethical norms of all relevant national and institutional authorities. This study was approved by the Eastern Mediterranean University Board of Scientific Research and Publication Ethics (ETK00-2021-0092).

A case-control study was carried out, including COVID-19 convalescent and controls. Those who have had a history of COVID-19 and are currently recovered were assigned to the study group, while those who had never been diagnosed with COVID-19 were assigned to the control group. A convenient sampling method was used to recruit control participants. The aim of the study was described to the participants, and signed informed permission was acquired prior to recruitment. The interviews were conducted using online technologies such as WhatsApp and phone calls. Initially, each participant received a phone call in which the goal of the research was described. Step-by-step instructions were given to those who volunteered to participate in the research. All participants were

then instructed to complete the questionnaires and submit them through WhatsApp. All data were collected between October 2021 and January 2022.

Outcome measures

The socio-demographic [age, gender, weight, height] and physical [chronic diseases, time since diagnosis, intensive care unit stay (ICU) stay, ICU length of stay] characteristics of the participants were documented. The presence of fatigue and dyspnea was also recorded. In this study, Visual Analogue Scale (VAS) and Single-Breath Counting (SBC) were the primary outcomes. Wood Mental Fatigue Inventory (WMFI), Pittsburgh Sleep Quality Index (PSQI), and Societal Influences Survey Questionnaire (SISQ) were the secondary outcomes.

Primary Outcomes

Visual Analogue Scale (VAS)

The VAS for fatigue (VAS-fatigue) was used to measure the fatigue level and the VAS (VAS-dyspnea) was used to measure dyspnea. The VAS is a 100-mm horizontal line that is used to quantify symptoms from 0 to 100. The minimum score obtained from the visual analog scale is 0 and the maximum score is 100 mm. The participants were asked to rate their fatigue level (10) and the intensity of their breathlessness (11) "at rest" and "at activity" (12).

Single-Breath Counting (SBC)

The participants were instructed to perform a maximal inhalation and count numbers in ascending order in a single exhalation. This was repeated three times and the best attempt was chosen for analysis (11). Most adults with normal respiratory function are able to count to 50 in a single breath. A single breath count of less than 15 is typically correlated with low forced vital capacity (FVC) and respiratory muscle weakness (13). This valid method can be used to assess the lung function of the individuals in the absence of equipment with a sensitivity (94.44%), specificity (76.62%), and excellent intra-rater reliability (Intraclass Correlation Coefficient 0.976) (14).

Secondary Outcomes

Wood Mental Fatigue Inventory (WMFI)

The participants were asked to rate the frequency of 9 mental fatigue symptoms in the past month. This questionnaire ranges from 0 (not at all) to 4 (very much). Scores range from 0–36, and higher scores indicate greater mental fatigue. WMFI has excellent internal consistency (Cronbach's alpha 0.85) and high test-retest reliability 0.887 (15).

Pittsburgh Sleep Quality Index (PSQI)

The PSQI is a self-reported questionnaire intended to evaluate sleep quality and disturbances during the previous month. It contains 19 items and 7 dimensions each scored 0 (no difficulty) to 3 (severe difficulty), which are summed to produce a global score. The higher the score, the more severe the sleep disturbance (16). The PSQI was developed to discriminate between "good" and "poor" sleepers. The scores range from 0 to 21 and a score >5 is considered a significant sleep disturbance (17,18). This valid and reliable (Cronbach's alpha of 0.85) test which has a high sensitivity (98.7) and specificity (84.4), has been reported to be a good index to distinguish between good sleepers and sleep-disturbed patients (18).

Societal Influences Survey Questionnaire (SISQ)

The SISQ is a self-rated questionnaire to assess the implications of COVID-19. It consists of 15 questions and 5 categories related to their social life during the pandemic. The SISQ comprises a 4-point Likert scale, with scores ranging from 1 (never) to 4 (often). A higher score indicates a greater influence in each category. The SISQ has good validity and reliability (Cronbach's alphas range from 0.57 to 0.76) (13).

Statistical Analysis

The Statistical Package for Social Science (SPSS) 26.0 statistical data analysis package software was used to analyze the data. Scale data such as age, height, and weight were given as median, and interquartile ranges (IQR), which represent the 25th to 75th percentiles of the distribution of data, and categorical data such as gender and diagnosis with COVID-19 were given as percentages (%). The data distribution was examined with histograms, plots, and analytical methods using the Kolmogorov-Smirnov test for normality. The Mann-Whitney

U test was used to compare the non-normally distributed parameters, and the Pearson and Fisher's Exact Chi-Square test was used to compare the categorical parameters. In addition, the Spearman Correlation Test was used in the correlation analysis of the clinical findings. The correlation coefficient was classified as r=0.00-0.30: negligible, r=0.30-0.50: low, r=0.50-0.70: moderate, r=0.70-0.90: high and r=0.90-1.00: very high correlation. P-value<0.05 was accepted as a statistically significant level (19).

RESULTS

Table 1 shows participant distributions, which reveal that the two groups were similar in terms of socio-demographic and physical characteristics.

Findings on the Visual Analogue Scale

On the VAS-fatigue scale [at rest COVID-19 convalescents: 97.2% and Controls: 84.7% and at activity COVID-19 convalescents: 90.3% and Controls: 77.8%] reported the presence of fatigue. On the VAS-dyspnea scale [at rest COVID-19 convalescents: 77.8% and Controls: 58% and at activity COVID-19 convalescents: 90.9% and Controls: 80.1%] reported the presence of dyspnea.

There was a statistically significant difference in VAS-fatigue at rest, VAS-fatigue at activity, VAS-dyspnea at rest, and VAS-dyspnea at activity between COVID-19 convalescents and controls (p<0.001). The controls had lower levels of fatigue and dyspnea level during both rest and activity compared to COVID-19 convalescents (Table 2).

There was a statistically significant difference in VAS-fatigue at rest, VAS-fatigue at activity, VAS-dyspnea at rest, and VAS-dyspnea at activity between COVID-19 convalescents and controls (p<0.001). The controls had lower levels of fatigue and dyspnea level during both rest and activity compared to COVID-19 convalescents (p<0.05) (Table 2).

There was a high-low positive relationship between VAS-fatigue and VAS-dyspnea in both groups. In the COVID-19 convalescents, there was a high positive correlation between VAS-fatigue at rest and VAS-fatigue at activity, and a low positive correlation with VAS-dyspnea at rest, and VAS-dyspnea at activity (p<0.001). Also, there was a moderate

Table 1. Socio-demographic and Physical Characteristics of the Participants

	COVID-19 convalescents (n= 176)	**Controls (n= 176)**	***P value***
Age (years), median (IQR)	49 (44-54)	49 (44-54)	0.994[a]
Height (cm), median (IQR)	170 (163-178)	170 (163-178)	0.466[a]
Weight (kg), median (IQR)	75.5 (67-85)	75 (65-85)	0.429[a]
Gender, % (n)			
Female	50 (88)	50.6 (89)	1.000[b]
Male	50 (88)	49.4 (87)	
Chronic Diseases, % (n)			
Yes	36.9 (65)	28.4 (50)	0.111[b]
No	63.1 (111)	71.6 (126)	
Chronic Disease type, % (n)			
Diabetes	40.0 (26)	46.0 (23)	0.356[c]
Hypertension	44.6 (29)	32.0 (16)	
Others	15.4 (10)	22.0 (11)	
Time since diagnosis (days), median (IQR)	90 (56-150)	N/A	-
ICU stay (days), % (n)			
Yes	19.3 (34)	N/A	-
No	80.7 (142)		
ICU length of stay (days), Median (IQR)	7 (2-30)	N/A	-

IQR: Interquartile range; n: sample size; %: Percentage; ICU: Intensive care unit, [a]Mann – Whitney U Test; [b]Fisher's Exact Chi – Square Test, [c]Pearson Chi – Square Test.

Table 2. Comparison of Fatigue Level, Dyspnea Level, Respiratory Functions, Mental Fatigue, Sleep Quality, and Societal Influences of the Participants

	COVID-19 convalescents (n= 176) Median (IQR)	Controls (n= 176) Median (IQR)	P value[a]
VAS-fatigue (cm)			
At rest	5(3-8)	2 (1-8)	<0.001*
At activity	4 (2-8)	2 (1-7)	<0.001*
VAS-dyspnea (cm)			
At rest	2 (1-7)	1 (0-6)	<0.001*
At activity	5 (2-8)	3 (1-7)	<0.001*
SBC	39.5 (30-57.13)	43 (38-65)	<0.001*
WMFI	6 (3-21)	4 (1-20)	0.020*
PSQI	7 (5-16)	5 (3-14)	<0.001*
SISQ			
Social Distance	12 (11-16)	12 (10-16)	0.318
Social Anxiety	13 (11-16)	13 (11-16)	0.594
Social Desirability	10 (8- 12)	10 (8.5-12)	0.929
Social Information	6 (5-8)	6 (5-8)	0.568
Social Adaptation	7 (6-8)	7 (6-8)	0.136

IQR: Interquartile range; n: sample size; *p <0.05; VAS: Visual Analogue Scale; SBC: Single Breath Counting; WMFI: Wood Mental Fatigue Inventory; PSQI: Pittsburgh Sleep Quality Index; SISQ: Societal Influences Survey Questionnaires; [a] Mann – Whitney U Test.

positive correlation between VAS-fatigue at activity and VAS-dyspnea at rest and a low positive correlation with VAS-dyspnea at activity. A moderate positive correlation was also found between VAS-dyspnea at rest and VAS-dyspnea at activity (p<0.001) (Table 3).

For the controls, there was a high positive correlation between VAS-fatigue at rest and VAS-fatigue at activity, a moderate positive correlation with VAS-dyspnea at activity, and a low positive correlation with VAS-dyspnea at rest (p<0.001). There was also a moderate positive correlation between VAS-fatigue at activity and VAS-dyspnea at activity and a low positive correlation with VAS-dyspnea at rest (p<0.001). Additionally, a moderate positive correlation was found between VAS-dyspnea at rest and VAS-dyspnea at activity (p<0.001) (Table 3).

Findings on the Single Breath Counting

Although both groups scored within the normal range of SBC (30-50 counts), there was a statistically significant difference between COVID-19 convalescents and controls (p<0.001). The number of breaths per minute was greater among controls than among COVID-19 convalescents (Table 2).

There was no notable relationship between SBC and other outcome measures in both groups. In the COVID-19 convalescents, there was a low negative correlation between SBC and VAS-dyspnea at activity, and a negligible negative correlation with VAS-fatigue at rest, VAS-fatigue at activity, VAS-dyspnea at rest, mental fatigue and sleep quality (p< 0.05) (Table 3).

For controls, there was a negligible negative correlation between SBC and VAS-fatigue at rest, VAS-fatigue at activity, VAS-dyspnea at rest, mental fatigue, and sleep quality (p< 0.05). There was no relationship between SBC and VAS-dyspnea at rest (p> 0.05) (Table 3).

Findings on the Wood Mental Fatigue Inventory

The overall score of the WMFT between COVID-19 convalescents and controls was statistically significant implying that COVID-19 convalescents reported higher levels of mental fatigue than controls (p< 0.05) (Table 2).

Although there was a low-negligible relationship between mental fatigue and other outcome measures, the relationship between mental fatigue and sleep quality was remarkable in COVID-19

Table 3. Relationship of Clinical Findings between COVID-19 Convalescents and Controls

			CONTROLS						
	CLINICAL FINDINGS		VAS-fatigue At rest	VAS-fatigue At activity	VAS-dyspnea At rest	VAS-dyspnea At activity	SBC	WMFI	PSQI
COVID -19 CONVALSCENTS	VAS-fatigue At rest	r		0.812**	0.405**	0.520**	-0.280**	0.349**	0.249**
		p		<0.001	<0.001	<0.001	<0.001	<0.001	0.001
	VAS-fatigue At activity	r	0.714**		0.492**	0.544**	-0.160*	0.376**	0.260**
		p	<0.001		<0.001	<0.001	0.034	<0.001	<0.001
	VAS-dyspnea At rest	r	0.465**	0.530**		0.564**	-0.053	0.281**	0.294**
		p	<0.001	<0.001		<0.001	0.494	<0.001	<0.001
	VAS-dyspnea At activity	r	0.353**	0.425**	0.650**		-0.157*	0.378**	0.247**
		p	<0.001	<0.001	<0.001		0.037	<0.001	0.001
	SBC	r	-0.220**	-0.255**	-0.250**	-0.339**		-0.115	-0.162*
		p	0.003	0.001	0.001	<0.001		0.130	0.032
	WMFI	r	0.263**	0.171*	0.220**	0.194**	-0.179*		0.282**
		p	<0.001	0.023	0.004	0.010	0.018		<0.001
	PSQI	r	0.270**	0.283**	0.263**	0.287**	-0.178*	0.427**	
		p	<0.001	<0.001	0.001	<0.001	0.018	<0.001	

r: Spearmen correlation test; *p <0.05. **p <0.01; VAS: Visual Analogue Scale; SBC: Single Breath Counting; WMFI: Wood Mental Fatigue Inventory; PSQI: Pittsburgh Sleep Quality Index.

convalescents. There was a low positive correlation between mental fatigue and sleep quality, a negligible positive correlation with VAS-fatigue at rest, VAS-fatigue at activity, VAS-dyspnea at rest, VAS-dyspnea at activity, and a negligible negative correlation with SBC (p< 0.05) (Table 3).

In controls, there was a low positive correlation between mental fatigue and VAS-fatigue at rest, VAS-fatigue at activity, VAS-dyspnea at activity, and a negligible positive correlation with VAS-dyspnea at rest and sleep quality (p<0.001). There was no correlation between mental fatigue and SBC (p< 0.05) (Table 3).

Findings on the Pittsburgh Sleep Quality Index

Both groups scored below the cut-off of 5 for sleep quality, suggesting that they were both poor sleepers. The PSQI global score showed a statistically significant difference between the groups (p<0.001). COVID-19 convalescents had more sleep disturbances than controls (Table 2).

Except for the relationship between mental fatigue and sleep quality in COVID-19 convalescents, there was a low-negligible relationship between sleep quality and other parameters in both groups. In COVID-19 convalescents, there was a low positive correlation between sleep quality and mental fatigue, a negligible positive correlation with VAS-fatigue at rest, VAS-fatigue at activity, VAS-dyspnea at rest, VAS-dyspnea at activity, and a negligible positive correlation with SBC (p< 0.05) (Table 3).

In controls, there was a negligible positive correlation between sleep quality and VAS-fatigue at rest, VAS-fatigue at activity, VAS-dyspnea at rest, VAS-dyspnea at activity, and mental fatigue, and a negligible positive correlation with SBC (p< 0.05) (Table 3).

Findings on the Societal Influences Survey Questionnaires

According to the SISQ, no significant difference was found in "social distance", "social anxiety", "social desirability", "social information" and "social adaptation" sub-parameters of SISQ between the groups (p>0.05). (Table 2).

DISCUSSION

The primary aim of this study was to compare fatigue and dyspnea level, respiratory functions, mental fatigue, sleep quality, and social influence in COVID-19 convalescents and controls. This study revealed that fatigue and dyspnea levels and mental fatigue were higher, whereas respiratory functions and sleep quality were lower in COVID-19 convalescents than in controls. On the other hand, the pandemic had a stronger influence on social adaption in the controls compared to COVID-19 convalescents. In addition, a moderate-low positive relationship between fatigue and dyspnea in both groups and a low positive relationship between mental fatigue and sleep quality in COVID-19 convalescents were found.

According to a previous study, fatigue and dyspnea were the most common symptoms during infection and follow-up (fatigue: 95% vs. 87%; dyspnea: 90% vs. 71%) (20). Similarly, in our study, 97% of patients reported fatigue, and the intensity of fatigue was moderate. Although the prevalence of fatigue and the level of fatigue in COVID-19 convalescents were significantly higher than in controls, it was observed that 85% of controls also reported fatigue. This shows that the fatigue experienced during the pandemic is not only caused by infection. Although our study was conducted in individuals without any neurological disease, the study performed in individuals with multiple sclerosis supports our view. In the study of Özkeskin et al., the fatigue level of individuals with multiple sclerosis with and without Covid-19 was found to be similar, so it was concluded that the level of fatigue in this population may be due to quarantine rather than the virus (21). There is evidence that fatigue and dyspnea in COVID-19 convalescents may result from prolonged cardiovascular disorders during recovery and negative effects on oxygen transport mechanisms, muscle function, and exercise capacity. Long-term physical inactivity during quarantine or COVID-19 infection affects most of these factors adversely (22). A "lock-down fatigue" phenomenon has developed due to the COVID-19 pandemic due to preventive restrictions on movement and fear, and anxiety (23). In a cross-sectional study, dyspnea was reported in 71% of the patients an average of 79 days after COVID-19 (20). The current study found that 77.8% of the patients had dyspnea at rest and 90.9% during activity. The mean level of dyspnea at rest and during activity was moderate. A respiratory disorder, which is clinically manifested as dyspnea in post-COVID-19 syndrome, not only reduces the patient's ability to exercise but also further impairs the muscular energetic state (24). This, in turn, may lead to increased fatigue, increasing physical inactivity, and causing the situation to enter a vicious cycle. The moderate-low correlation found between dyspnea and fatigue levels in our study can be explained by this mechanism.

Lewis et al. showed no difference in pulmonary function tests before and after COVID-19 infection in non-critically ill classified patients whereas patients with lung diseases and increasing age had decreased lung functions (25). In this study, however, SBC revealed a significant reduction in respiratory functioning when COVID-19 convalescents were compared to controls. Furthermore, there was a low negative correlation between dyspnea levels at activity and SBC. This was similar to a study by Liang et al., which revealed that three months after discharge, more than half of the survivors exhibited dyspnea, despite the lung lesions being resolved completely (26).

COVID-19 pandemic lockdown possibly has an influence on mental fatigue (27,28). Torrente et al. found that mental fatigue was not correlated with lock-down adherence but positively correlated with depression and anxiety, implying mental fatigue is closely related to the difficulties of lock-down (27). According to the findings of the current paper, COVID-19 convalescents showed higher mental fatigue than healthy participants. Furthermore, there was a low correlation between mental fatigue and sleep quality in COVID-19 convalescents.

COVID-19 outbreak-related events are associat-

ed with reduced sleep quality and an increase in a negative mood. According to the study by Pinto et al., most patients (69.6%) suffered at least one sleep disruption, associated with nonworking house confinement, female gender, and sleep-disordered breathing (29). Zhang et al. reported that 90% of patients with COVID-19 have worse sleep quality after infection than before infection. Although several studies investigated the impact of the COVID-19 outbreak on sleep quality (29–31), no study has been conducted to the best of our knowledge comparing sleep disturbances in COVID-19 convalescents and healthy people. According to the findings of this study, both groups had poor sleep quality, with COVID-19 convalescents having poorer sleep quality than controls.

Although physical distancing slows the transmission of the virus, it also restricts people's face-to-face social interactions, perhaps reducing their feeling of social connectedness (32). In addition to social isolation, the pandemic's uncertainty and threat cause people to experience mental health issues like anxiety (13). Li et al. found that older age was associated with higher scores on the SISQ's "social distance," "social desirability," and "social information," with females scoring higher than males on "social distance" (13). In the current study, the SISQ scores of COVID-19 convalescents and controls were comparable in all sub-parameters. Higher SISQ scores indicate a greater social impact of the pandemic on social activities, hence the outcomes of our research were unexpected since no difference was revealed across the groups, suggesting that COVID-19 convalescents reported equal social sufficiency as controls. Due to the lack of a cutoff value for the SISQ, the effects of COVID-19 on the social dimension cannot be discussed further.

Limitations

There are also some limitations of this study that should be noted when interpreting the results. Firstly self-selection bias may have influenced the subjects. A subset of participants may have a bias toward following and being interested in COVID-19, making them more likely to be knowledgeable about the topic and/or eager to cooperate. As a result, the sampled participants may not accurately reflect the target population. Furthermore, the evaluations were completed online due to the difficulty of conducting face-to-face evaluations during the pandemic. This study focused on internet users and was not intended to collect data from people who did not use such technology resulting in a bias towards representativeness, particularly among the elderly. Lower education and income level have been linked to a decreased chance of being vaccinated against COVID-19 (33). Even though the demographic characteristics of our participants were identical in both groups, we were unable to adjust the sampling procedure according to the education and income level. These limitations can serve as an important opportunity for possible improvements in future studies.

CONCLUSION

When compared to controls, COVID-19 convalescents had greater degrees of fatigue and dyspnea, and mental fatigue, as well as reduced respiratory functioning and sleep quality. The social influences of the pandemic were comparable in COVID-19 convalescents and controls indicating that COVID-19 convalescents reported equal social sufficiency as controls. In both groups, there was a moderate-low positive relationship between fatigue and dyspnea levels. Furthermore, sleep disturbances are associated with mental fatigue in COVID-19 convalescents. The results indicate that COVID-19 convalescents continue to experience symptoms such as fatigue and dyspnea, mental fatigue, poor respiratory functions, and sleep disturbances even after long-term recovery. To address these concerns, treatment strategies for post-COVID-19 conditions must be developed.

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An oral presentation titled "Comparison of the Levels of Fatigue and Dyspnea, Pulmonary Function, Life Satisfaction, Cognitive Symptoms and Sleep Quality of Post-COVID-19 Individuals and Healthy Individuals" was delivered at an online conference "4th International Conference on COVID-19 Studies", 17-19th April 2021. This presentation was published in the proceedings book.

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RELIABILITY AND VALIDITY OF THE TURKISH VERSION OF THE GRADED CHRONIC PAIN SCALE 2.0

ORIGINAL ARTICLE

ABSTRACT

Purpose: To investigate the translation and cultural adaptation, the reliability and validity of the Turkish version of the Graded Chronic Pain Scale (GCPS) 2.0.

Methods: The study was an observational and cross-sectional study translated and adapted into Turkish according to the Beaton protocol. Data was collected from eighty participants diagnosed with chronic low back pain (LBP) by a physician. Due to the pandemic, the scales were sent to patients via online form. Reliability was assessed using the test-retest method, parallel form method, and internal consistency. Validity was assessed using face, content, and construct validity analyses.

Results: Cronbach's alpha was calculated as 0.89 to determine internal consistency. The intraclass correlation coefficient (ICC) was found to be 0.92 for the GCPS 2.0 total. Statistically significant correlation was found betweeen the GCPS 2.0 and the Oswestry Low Back Pain Disability Index (ODI) (r = 0.759 p = 0.001) and between the GCPS 2.0 and the Roland-Morris Disability Questionnaire (RMDQ) (r = 0.777 p = 0.001). Factor analysis revealed a 2-factor structure.

Conclusion: The Turkish version of the GCPS 2.0 is a valid and reliable measurement tool for patients with chronic LBP.

Keywords: Chronic Pain, Disability, Low Back Pain, Pain Intensity, Reliability and Validity

DERECELİ KRONİK AĞRI ÖLÇEĞİ 2.0`NİN TÜRKÇE VERSİYONUNUN GÜVENİRLİK VE GEÇERLİLİĞİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Dereceli Kronik Ağrı Ölçeği 2.0'nin Türkçe versiyonunun çeviri ve kültürel uyarlaması, güvenirlik ve geçerliliğinin incelenmesi.

Yöntem: Bu çalışma, Beaton protokolüne göre Türkçe'ye çevrilmiş ve uyarlanmış gözlemsel ve kesitsel bir çalışmadır. Veriler, doktor tarafından kronik bel ağrısı teşhisi konan 80 katılımcıdan toplandı. Pandemi nedeniyle ölçekler hastalara online form aracılığıyla gönderilmiştir. Güvenirlik; test-tekrar test yöntemi, paralel form yöntemi ve iç tutarlılık kullanılarak değerlendirildi. Geçerlilik; yüz, içerik ve yapı geçerliliği analizleri kullanılarak değerlendirildi.

Sonuçlar: İç tutarlılığı belirlemek için Cronbach's alpha 0,89 olarak hesaplandı. Dereceli Kronik Ağrı Ölçeği 2.0 toplamı için sınıf içi korelasyon katsayısı 0,92 olarak bulunmuştur. Dereceli Kronik Ağrı Ölçeği 2.0 ile Oswestry Bel Ağrısı Engellilik İndeksi arasında (r = 0,759 p = 0,001) ve Dereceli Kronik Ağrı Ölçeği 2.0 ile Roland-Morris Engellilik Anketi arasında (r = 0,777 p = 0,001) istatistiksel olarak anlamlı korelasyon bulunmuştur. Faktör analizi 2 faktörlü bir yapı ortaya çıkarmıştır.

Tartışma: Dereceli Kronik Ağrı Ölçeği 2.0'nin Türkçe versiyonu kronik bel ağrılı hastalar için güvenilir ve geçerli bir ölçüm aracıdır.

Anahtar Kelimeler: Kronik Ağrı, Engellilik, Bel Ağrısı, Ağrı Yoğunluğu, Güvenirlik ve Geçerlilik

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INTRODUCTION

Pain is a subjective, multidimensional sensory and emotional experience that varies from person to person, and a message that the body wants to convey to the person (1). The International Association for the Study of Pain has defined pain as; 'An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.' (2).

Chronic pain affects 20% of the world's adult population (3). It lasts longer than 3 months and being independent of tissue healing. It can be cured with well-diagnosed. When the patients treated with multidisciplinary approaches, it was determined that there were major changes in their chronic pain (4,5). For this reason, the use of the biopsychosocial approach has been increased in the field of rehabilitation (6). GCPS measures the extent of which the patient is affected biologically and socially due to pain and provides us with valuable information on this subject. The 7-item chronic pain scale developed in 1992 by Von Korff et al (7) was revised to an 8-item GCPS 2.0 in 2010. The scoring and classification in the revised scale was simplified (8).

In the original scale, each item asks about pain intensity over a 6-month period. Von Korff, considering studies conducted after 1992, concluded that reports of retrospective mean pain recall should not exceed 3 months when assessing chronic pain. For this reason, the 6-month period during which pain was assessed in the new scale was reduced to 3 months. (8). When assessing pain intensity, only one value was reported by averaging the values of Question (Q)2, Q3, Q4. Chronic pain was defined as persistent or recurrent pain lasting longer than 3 months (9). For this reason, the scale was expanded to include the first item (Q1), which measures the persistence of pain and whether it is chronic pain, and asks about pain days within 6 months. The disability score (DS) was averaged from questions Q5, Q6, Q7, and Q8, which measure the patient's limitation due to chronic pain. As a result, a revised scale was developed (8).

The GCPS 2.0 is a multidimensional measurement instrument that can provide information about the persistence of pain while determining both pain intensity and disability level. The items in the scale are short and simple, and the scale is very easy to answer and score. In addition, the scale does not only measure the pain of a single body region, but is suitable for measuring pain in entire body regions. When a patient with chronic pain is examined, instead of using many different scales to determine pain intensity and degree of disability, results are obtained easily and quickly with this single scale.

When evaluating patients before and after treatment, the existing measurement methods and scales should be considered. Assessment should be done with instruments whose validity and reliability have been demonstrated in the literature. In this way, discrepancies between different data are minimized. Until standardization of the scale is achieved, each element of the scale should be analyzed and reviewed in detail, and the scoring and interpretation of the scale should be clearly stated (10,11).

The aim of this study was to evaluate the validity and reliability of the Turkish version of the GCPS 2.0, which was adapted to many languages and was mainly used in the USA and European countries and less frequently in Asian countries.

METHODS

Participants

The ethical approval was obtained from the Yeditepe University Clinical Trials Ethics Committee for the study, which was dated 24/09/2020 and numbered 37068608-6100-15- 1965. Eighty participants were recruited for the 8-item GCPS 2.0. The sample size was calculated considering the 10:1 item ratio (10 participants per item) proposed by Kline P (12). To ensure homogeneity of participants, these eighty participants consisted of people with chronic LBP. The study data was collected between October 2020 and November 2020 by emailing the scales to participants living in Turkey who signed the informed written consent in the study. Figure 1 shows the inclusion criteria. Participants who had a psychiatric disorder, a cognitive disorder, a history of disease such as dementia or Alzheimer's disease, LBP requiring immediate treatment, inflammatory LBP, and LBP due to a vascular cause were not included in the study (13).

Data Collection Instruments

The data collection instruments used in this study were: Clinic and Demographic Assessment Form, ODI, RMDQ and GCPS 2.0 (8). Turkish versions of the ODI and RMDQ were used as parallel forms to our scale.

Clinical and Demographic Evaluation Form

The clinical section contains questions about inclusion and exclusion criteria. If the patient meets the study criteria, the demographic portion of the form and other forms can be completed.

ODI

The ODI is a questionnaire that measures the impact of LBP on daily life and the degree of disability caused by this pain. It consists of a total of 10 questions. At the end of the survey, a minimum score of 0 and a maximum score of 50 can be obtained (14).

RMDQ

The RMDQ is a sensitive instrument for measuring functional loss and disability due to LBP. It is a questionnaire that consists of 24 questions and is easy to answer. "0" means no disability, and "24" means the highest disability (15).

GCPS 2.0

The Chronic Pain Grade Scale was developed by M. Von Korff as a 7-item scale to measure pain intensity and disability due to chronic pain (7). The scale asks about pain intensity for a period of the last 6 months. In 2010, Von Korff converted the scale to query pain intensity for the last 3 months (8) and transformed it into GCPS 2.0. To measure the persistence of pain, the first item was added, which asks about the pain days experienced in the last 6 months. Other items ask about the situation in the quarterly period. In the converted form, there are 8 items. Items 2, 3, 4 measure pain intensity and items 5, 6, 7, 8 measure disability level. As pain intensity, the sum of pain at the moment (Q2) and worst pain in 3 months (Q3) and usual pain intensity (Q4) in 3 months are asked. The degree of disability asked is the extent of usual (Q5) and daily activities (Q6), recreational, social, and family activities (Q7) in the last 3 months, and finally the degree of limitation in the ability to work (Q8). It is an 11-point Likert scale, except for the first item.

In addition, there is a short 3-question scale in this scale to determine the chronic pain of patients in primary care: Graded Chronic Pain-Primary Care Scale. One of these three items is usual pain intensity (Q4) for pain intensity, the other two are the sum of impairment of daily activities (Q6), the score for days kept from usual activities (Q5) to assess the DS.

Statistical Analysis

The IBM Statistical Package for the Social Sciences Statistics Version 22 software (IBM Corp. Armonk, NY, USA) was used for the statistical analysis of the results obtained in the study. The variables from the clinical and demographic data of the study group were tabulated as mean, standard deviation, minimum and maximum values. Other variables are presented in tables as numbers and percentages. The suitability of the research variables for normal distribution was determined by Kolmogorov-Smirnov / Shapiro-Wilk tests and visual inspection of histograms.

Reliability of the Scale

Reliability was assessed using the test-retest method, the parallel forms method, and internal consistency. For the internal consistency method, we used the Cronbach's alpha coefficient. The higher the alpha coefficient, the more the items of the scale agree with each other (16). In the study, test-retest reliability was investigated using the ICC method, which was preferred by the researchers and which they considered more reliable (17). In this study, the test-retest method was applied to 30 participants with an interval of 10 days (18,19). The study used the RMDQ and the ODI as parallel forms of the scale.

Transcultural Adaptation and Translation Process

The Beaton protocol was followed in translating the scale (20). First, the scale was translated from English to Turkish by two individuals whose native language is Turkish and who are fluent in English. The translated examples were converted into a single draft. This draft was then translated into English by two individuals whose native language is English and who are fluent in Turkish. The two

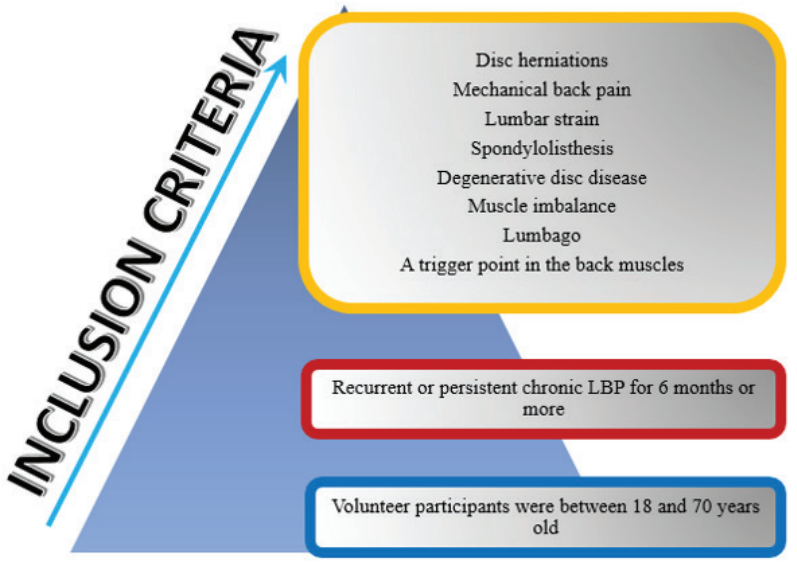

Figure 1. Inclusion Criteria

translations were compared with the original and it was found that they did not differ significantly in terms of integrity of meaning. Incomprehensible items were translated more clearly and the second draft was prepared for expert opinion. The scale was examined by physicians, nurses, and 3 specialized physical therapists. Their opinions were taken and we thought that the word 'recreation' would not be understood by participants of all sociocultural groups only in the 7th item. We decided to replace the word 'recreation' with the word 'entertainment', which is more understandable in Turkish. Apart from this, other expressions were found to be understandable and appropriate. With the last draft, a pilot test was conducted with 30 people who suffered from chronic pain. After the pilot test, we received reports that the phrase "daily activities" in item 6 was confusing. As a result, we considered it would be better to include examples of daily activities in parentheses to eliminate the confusion caused by the phrase "daily activity" in item 6. The scale was finalized taking into account the participants' comments.

Validity of the Scale

The validity of the scale was assessed using face, content, and construct validity analyses. The Beaton protocol was used to translate the scale (20). Content validity, i.e. logical validity, was assessed by interviewing experts. For construct validity, we used exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). With EFA, we determined how many factors constituted the basic components. In CFA, the model created was tested using the information we obtained from the EFA (16,21,22).

RESULTS

Description of the Sample

Eighty participants with chronic LBP were included in the study. 62.5% (n=50) of the participants were women. 50% of the women were unemployed. 50% of the participants were overweight and 12.5% were obese. In addition, 60% had been suffering from pain for more than 2 years. The mean age of the participants was 36.99 ± 12.03 years. 26.2% were taking pain medication. The 36% of the women were housewives, 12% physical therapists, and 12% students. The 26.7% of the men were workers, 23.3% engineers, and 16.7% technicians. 68.8% of the participants had a herniated disc. 52.5% of participants had LBP with radiating leg pain. The sociodemographic and clinical characteristics of the participants are shown in Table 1.

Reliability Analysis of the GCPS 2.0

The Cronbach's alpha was found to be 0.89. The Cronbach's alpha of the subscale for characteristic pain intensity (CPI) was 0.88, and the Cronbach's alpha of the subscale for DS was 0.87. Thus, it

Table 1. Distribution of Sociodemographic and Clinical Characteristics by Gender.

	Female		Male		Total	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)	Number (n)	Percentage (%)
Gender	50	62.50	30	37.5	80	100
Education Level						
Pre-University	24	48	14	46.70	38	47.50
High Education	26	52	16	53.30	42	52.50
Employment Status						
Employed	22	44	24	80	46	57.50
Unemployed	28	56	6	20	34	42.50
BMI Group						
Thinness and Normal	22	44	8	26.60	30	37.50
Overweight	20	40	20	66.70	40	50
Obese	8	16	2	6.70	10	12.50
Profession						
Housewife	18	36	0	0	18	22.50
Worker	2	4	8	26.70	10	12.50
Other Professions*	30	60	22	73.30	52	65
Pain Durations						
6-12 months	11	22	6	20	17	21.20
1-2 years	7	14	8	26.70	15	18.80
More than 2 years	32	64	16	53.30	48	60
Use of Pain Medication						
Yes	13	26	8	26.70	21	26.20
No	37	74	22	73.30	59	73.80
Age (year) (Mean ± SD)	36.18±12.15		38.33±11.90		36.99±12.03	

SD: Standard Deviation, Other Professions*: Engineer (n:8, %10), Student (n:7, %8.8), Physiotherapist (n:6, %7.4), Teacher (n:5, %6.2), Technician (n:7, %8.8), Government official (n:4, %5), Dietician (n:2, %2.5), Retired (n:2, %2.5), Finance (n:2, %2.5), Tradespeople(n:2, %2.5), Others (n:7, %8.8)

shows that the internal consistency of the scale and its subscales was reliable. At the same time, the decreases in the Cronbach's alpha value when the item was deleted show that the items were consistent and contributed highly.

The ICC values (95% CI) for test-retest reliability were found to be within the range of 0.87 to 0.96. Test-retest correlation of the total score of the scale was found as 0.92. Factor structure, item analysis and ICC values are shown in Tables 2 and 4.

RMDQ between GCPS 2.0 (r=0.717 p=0.001) and ODI between GCPS 2.0 (r=0.759 p=0.001) was found a high correlation (Table 3).

Table 2. Test-Retest Reliability of GCPS 2.0 and Its Subscales.

	Test (n=30) (Mean±SD)	Re-Test (n=30) (Mean±SD)	ICC	p
Number of Days with Pain	76.03±69.00	71.53±72.35	0.96	**0.001****
CPI	16.60±6.34	17.03±7.14	0.87	**0.001****
DS	12.96±10.38	12.36±9.29	0.90	**0.001****
GCPS Total	29.56±14.92	29.40±15.15	0.92	**0.001****

SD: Standard Deviation, n: Number, ICC: Intraclass Correlation Coefficient, DS: Disability Score, CPI: Characteristic Pain Intensity

Table 3. Correlation Test Results Related of GCPS 2.0 Total and Subscale Scores with "RMDQ" and "ODI" Scores.

	GCPS-CPI		GCPS-DS		GCPS	
	r	p	r	p	r	p
RMDQ	0.621	**0.001****	0.605	**0.001****	0.717	**0.001****
ODI	0.777	**0.001****	0.571	**0.001****	0.759	**0.001****

RMDQ: Roland-Morris Disability Questionnaire, ODI: Oswestry Low Back Pain Disability Index, GCPS-CPI: Graded Chronic Pain Scale - Characteristic Pain Intensity, GCPS-DS: Graded Chronic Pain Scale – Disability Score, GCPS: Graded Chronic Pain Scale

Validity Analysis of the GCPS 2.0

The KMO value was found to be fairly good at 0.81 (0.80-0.89), and the sample size was considered adequate. The result of Bartlett's test was $p < 0.05$ (chi-square=447.917 df=28 p=0.001), and the data were found suitable for factor analysis.

In applying factor analysis, direct oblimin rotation was selected as the rotation method and principal component analysis was selected as the extraction method to keep the structure of the relationship between factors the same, and factor components were formed. As a result of the factor analysis, the variables were grouped under 2 factors with a total explained variance of 74.833%. The resulting factor structure of the scale is shown in Table 4.

The original scale, consisting of 7 items, has two subscales; one with three items and one with four items. We included item 1 in the analysis, which was not included in the original and adaptation studies, and validated these two subscales that appeared in the EFA in the CFA as well. The fit indices we obtained in the CFA are shown in Table 5.

The First Item

The first item asks on how many days the patient had pain in the last 6 months. The response to item 1 consisted of days. The Cronbach's alpha of the entire inventory decreased to 0.22 when this item was analyzed in the usual way because it was incompatible with the other questions. When the item was removed from the analysis, the Cronbach's alpha of the inventory increased to 0.89. The fifth item, consisting of days and presented as an 11-point Likert, gave us an idea. For this reason, we applied a similar transformation to Item 1 to Item 5 to make Item 1 fit the Likert type. When we

Table 4. Factor Structure, Item Analysis and ICC Analysis Results of GCPS 2.0.

Items	Mean	SD	Factor Loads		Total Factor Load	Explained Variance (%)	Cumulative Explained Variance (%)	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	ICC
Item 1	5.91	3.01		0.66				0.59	0.89	0.96
Item 2	4.30	2.57	**Factor 1**	0.92	4.66	58.28	58.28	0.68	0.88	0.87
Item 3	6.00	2.48		0.86				0.72	0.87	0.81
Item 4	5.12	2.54		0.93				0.74	0.87	0.89
Item 5	2.06	2.32		0.87				0.40	0.90	0.90
Item 6	3.18	2.77	**Factor 2**	0.79	1.32	16.54	74.83	0.75	0.87	0.86
Item 7	2.81	2.72		0.73				0.73	0.87	0.85
Item 8	3.47	2.83		0.69				0.75	0.87	0.92

SD: Standard Deviation, %: Percentage, ICC: Intraclass Correlation Coefficient

Table 5. Fit Indices of Confirmatory Factor Analysis.

The Criterion of Model Fit	Good Fit	Acceptable Fit	Fit in this Study
CMIN/DF	χ2/df ≤3	χ2/df ≤5	1.34
GFI	GFI≥0.90	GFI≥0.85	0.94
AGFI	AGFI≥0.90	AGFI≥0.85	0.87
CFI	CFI≥0.97	CFI≥0.95	0.99
RMSEA	RMSEA≤0.05	RMSEA≤0.08	0.04
IFI	IFI≥0.95	IFI≥0.90	0.99
NFI	NFI≥0.95	NFI≥0.90	0.94

CMIN/DF (x2/df): Chi-Square Fit Test (Minimum Discrepancy (chi-square) / Degrees of Freedom), GFI: Goodness of Fit Index, RMSEA: Root Mean Square Error of Approximation, AGFI: Adjusted Goodness of Fit Index, IFI: Incremental Fit Index, CFI: Comparative Fit Index, NFI: Normed Fit Index

analyzed item 1 in this way, the Cronbach's alpha of the whole scale increased to 0.89 and the correlation with the other items became consistent. In all previous studies, item 1 was excluded from the analysis because it was not compatible, but in our study, item 1 was included in the analysis, giving a new perspective to the analysis.

DISCUSSION

The aim of this study was to conduct a Turkish and cross-cultural adaptation, and a validity and reliability of the GCPS 2.0 to make it available for Turkish patients with chronic pain. According to the results of our study, GCPS 2.0 is a valid and reliable instrument for Turkish patients with chronic LBP.

The GCPS 2.0 has been adapted to many languages. It has been used in many studies in the Americas and in European countries. In recent years, it has also been used in Asian countries. The GCPS 2.0 scale is a short, simple, multidimensional, useful instrument with high validity and reliability that can be used in all patients with chronic pain (7,8).

To be used in international and national settings, the scale must meet certain criteria and norms. In developing the scale, it was also important to ensure its reliability and validity. Scales developed without adherence to standards may have high error rates and bias. In addition, scale adaptation was an easier, more reliable, and less expensive method than developing a scale from scratch. To ensure that our scale was reliable and valid, we followed the criteria and standards set forth in the scale adaptation (23).

When we looked at the internal consistency of the Turkish adaptation of the scale, the GCPS 2.0 total score was 0.89, and the internal consistency of the subscales was found to be GCPS-CPI 0.88 and GCPS-DS 0.87. If the alpha coefficient is between $0.80 \leq \alpha < 1.00$, it means that the scale is very reliable (24). According to this classification, our scale was very reliable in terms of internal consistency. If we look at other studies that have been done so far, the lowest value found for internal consistency was 0.70 (DS in the Brazilian version) (25) and the highest value was 0.95 (DS in the Greek version) (26). Internal consistency was 0.916 for CPI and 0.815 for DS in Arabic version (27).

We thought it appropriate to consider item 1 in calculating the internal consistency of our scale. Converting the first item into a Likert form and including it in the analysis ensured the integrity of the scale. In this way, the first item was not excluded from the analysis and the internal consistency of the scale was increased. If the Likert form of Item 1 had been included in the scale in GCPS 2.0, the scale would have been more powerful and simpler, as well as more useful. If this new idea we found is reevaluated and considered, and if the GCPS 2.0

is revised with this form, its use in clinical and research settings could be easier and more useful.

Item Q2 gave us the idea not to make the interval of test retest too long. This is because immediate pain is a symptom that changes rapidly depending on time and other factors. For this reason, we set our test-retest interval at 10 days. The test-retest reliability was 0.92 for ICC GCPS 2.0 overall. The ICC value of the original scale was 0.88 (7). In the Spanish version (28) (n=75) of the study, they enrolled 46 patients at 10-day intervals and found an ICC of 0.81. In the Brazilian version (n=283) (25), they enrolled 131 patients at 6-10-day intervals and found an ICC of 0.76 for GCPS-CPI and 0.72 for GCPS-DS. In the Indonesian version (n=202) (29), 45 participants completed the test 2 weeks later and found an ICC of 0.78 for CPI and 0.70 for DS. Reviewing all this information, we can conclude the following: The repeatability and temporal invariance of the Turkish GCPS 2.0 were found to be highly reliable.

In designing the study, we chose 2 scales, such as the GCPS 2.0, that can classify participants with a disability and whose reliability and validity were conducted in Turkish. When we examined the correlation between these 2 forms and the GCPS 2.0, there was a high correlation between the ODI and the GCPS 2.0 ($r = 0.759$ $p = 0.001$) and between the RMDQ and the GCPS 2.0 ($r = 0.777$ $p = 0.001$). The relationship between the RMDQ and the GCPS 2.0 was examined in the Spanish version and a correlation of $r = 0.509$ was found (28).

In assessing the validity of the scale, we examined the scale using content, face, and construct validity methods. Before we began adapting the scale, we obtained permission from the owner of the scale. Then, the scale was translated according to the language adaptation instructions (17,30). As the International Testing Commission (ITC) explains, words that were not culturally adaptable can be changed without distorting the whole, and words with similar meanings can replace them(31). For this reason, it was decided to use the word 'Entertainment' instead of the word 'Recreation' in order to increase cultural harmony. In the Spanish version, they chose the word leisure activities rather than recreation, similar to our version (28). In the comments of the participants of the pilot test, it was written that the word "daily activities" in item 6 was not understood. To explain the daily activities in Item 6, we put short examples in parentheses (taking a bath, eating, going shopping, etc.). In the German version, they added a description for the same item. In our estimation, they may have received negative feedback for this item (32).

When it could be applied EFA to our scale, the scale appeared with 2 factors. Unlike other studies, we included the 1st item in the analysis when calculating the factor loading. Then, we observed whether the structure of our two-factor scale that emerged in the EFA was appropriate with the CFA. We confirmed our two-factor structure formed in the EFA using the goodness-of-fit results (33).

There are many single and multidimensional scales that measure pain or limitation (RMDQ, ODI, Brief Pain Inventor). However, a short and simple-to-use scale that measures both pain intensity and the long term effect of pain on movement together, such as GCPS 2.0, has not yet been translated into Turkish. After the scale is being brought to the literature, it will provide convenience to users in academic studies or clinics and will simultaneously provide information about the dimensions of pain (8,14,15,34)

There are some limitations in the study. This study was done online instead of face to face, which made it difficult to reach every segment of society that is in some way not related to technology. For example, this was a barrier for older people who did not know how to fill out online forms on the Internet. Apart from this, only participants with chronic LBP patients were included in this study. For this reason, we suggest further studies for other types of chronic pain. Additionally, when the 1st question of the scale is a Likert-type question, ıt might facilitate both scoring and use of the scale. Furtermore, Since patients with chronic pain are at risk of depression, we think that using a depression scale along with the GCPS 2.0 could be useful in diagnosing chronic pain.

According to the results of this study, which deals with the process of cross-cultural adaptation and translation of the scale into Turkish, GCPS 2.0 is a valid and reliable instrument, as well as being short

and easy to use in patients with chronic low back pain.

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STAJYER FİZYOTERAPİSTLERDE NONSPESİFİK BEL AĞRISININ POSTÜR, KOR ENDURANS VE LUMBOPELVİK STABİLİTE İLE İLİŞKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Çalışmamızda nonspesifik bel ağrısı (NSBA) olan ve olmayan stajyer fizyoterapistlerin postür, kor endurans ve lumbopelvik stabilitelerinin karşılaştırılması amaçlanmıştır.

Yöntem: Çalışmaya 2021-2022 eğitim ve öğretim yılında Süleyman Demirel Üniversitesi Sağlık Bilimleri Fakültesi Fizyoterapi ve Rehabilitasyon Bölümü'nde öğrenim gören 97 öğrenci dahil edildi. Katılımcıların fiziksel aktivite düzeyleri Uluslararası Fiziksel Aktivite Anketi-Kısa Formu (UFAA-KF) ile belirlendi. Bel ağrısı şiddeti Sayısal Ağrı Derecelendirme Ölçeği (SADÖ) ile değerlendirildi. Postür analizi için New York Postür Analizi Skalası (NYPAS) ve bel ağrısına bağlı yetersizliklerin değerlendirilmesi amacıyla da Oswestry Bel Özürlülük İndeksi (OÖİ) kullanıldı. Katılımcıların kor endurans ve lumbopelvik stabilitelerinin değerlendirmesi için McGill Torso Endurans Test Bataryası ile Lumbopelvik Stabilite Manşon Testi (LPSMT) yapıldı.

Sonuçlar: Çalışma, bel ağrısı olan (GrupAğrılı, n=46, %51,1) ve olmayan (GrupAğrısız, n=44, %48,9) toplam 90 stajyer fizyoterapist ile tamamlandı. Gruplar, postür özellikleri bakımından benzerlik gösterse de (p>0,05) fiziksel aktivite düzeyinin ve bel ağrısına bağlı yetersizliklerin bel ağrılı grupta istatistiksel olarak anlamlı derecede yüksek olduğu bulundu (p<0,05). GrupAğrılı'nın LPSMT skorunun GrupAğrısız'a kıyasla anlamlı derecede düşük olduğu (p<0,05), GrupAğrısız'ın gövde ekstansör kas endurans süresinin anlamlı derecede daha yüksek (p<0,05) olduğu tespit edildi. Ayrıca, bel ağrısı olan stajyer fizyoterapistlerin ağrı süresi ve aktivite sırasındaki SADÖ skorları arttıkça OÖİ skorları da artış gösterdi (sırasıyla rho=0,328; p<0,05 ve rho=0,466; p<0,01).

Tartışma: Çalışmamızdan elde edilen veriler ışığında, stajyer fizyoterapistlerde bel ağrısının; postür değişikliğine neden olmamakla birlikte, gövde ekstansör kas enduransında azalma, bel ağrısı kaynaklı yetersizlik ve zayıf lumbopelvik stabilite ile ilişkili olabileceği öngörülmüştür.

Anahtar Kelimeler: Bel Ağrısı, Fiziksel Aktivite, Fizyoterapistler, Kor Endurans, Postür

THE RELATIONSHIP OF NONSPECIFIC LOW BACK PAIN WITH POSTURE, CORE ENDURANCE AND LUMBOPELVIC STABILITY IN INTERN PHYSIOTHERAPISTS

ORIGINAL ARTICLE

ABSTRACT

Purpose: In our study, it was aimed to compare the posture, core endurance and lumbopelvic stability of intern physiotherapist with and without nonspecific low back pain (NLBP).

Methods: Ninety-seven students studying in the Department of Physiotherapy and Rehabilitation of the Faculty of Health Sciences of Süleyman Demirel University in the 2021-2022 academic year were included in the study. The physical activity levels of the participants were determined by the International Physical Activity Questionnaire-Short Form (IPAQ-SF). Low back pain severity was evaluated with the Numerical Pain Rating Scale (NRS). The New York Posture Analysis Scale (NYPAS) was used for posture analysis, and the Oswestry Low Back Disability Index (ODI) was used to evaluate low back pain related disabilities. The Lumbopelvic Stability Cuff Test (LPSCT) was performed with the McGill Torso Endurance Test Battery to evaluate the core endurance and lumbopelvic stability of the participants.

Results: The study was completed with a total of 90 intern physiotherapist with (GroupPain, n=46, 51.1%) and without (GroupPainless, n=44, 48.9%) low back pain. Although the groups were similar in terms of posture characteristics (p>0.05), it was found that the level of physical activity and low back pain-related inadequacies were statistically significantly higher in the low back pain group (p<0.05). It was determined that the LPSCT score of GroupPain was significantly lower than that of GroupPainless (p<0.05), and the trunk extensor muscle endurance time of GroupPainless was significantly higher (p<0.05). In addition, as the duration of pain and NRS scores during activity of the intern physiotherapists with low back pain increased, the ODI scores also increased (rho=0.328, p<0.05 and rho=0.466, p<0.01, respectively).

Conclusion: In the light of the data obtained from our study, low back pain in intern physiotherapists; although it does not cause a change in posture, it has been predicted that it may be associated with decreased trunk extensor muscle endurance, insufficiency due to low back pain, and poor lumbopelvic stability.

Keywords: Low Back Pain, Physical Activity, Physiotherapists, Core Endurance, Posture

GİRİŞ

Bel ağrısı, dünya genelinde neredeyse her yaş grubunun deneyimlediği, %11-84 oranında yüksek prevalansa sahip sağlıkla ilişkili bir problemdir (1–3). Yaşla birlikte görülme sıklığı artsa da gençlerdeki bel ağrısı prevalansının yetişkinlerle benzer olduğu bildirilmiştir (2,3). Nonspesifik bel ağrısı (NSBA); enfeksiyon, tümör, osteoporoz, kırık, yapısal deformite, inflamatuar bozukluk, radiküler sendrom veya kauda ekuina sendromu gibi özel bir neden olmadan görülen bel ağrısı olarak tanımlanmaktadır (4).

NSBA'nın risk faktörleri incelendiğinde obezite, kadın cinsiyet, anormal postür, omurgaya yük bindiren mekanik stresler, psikososyal ve genetik faktörler ön plana çıkmaktadır (5). Bel ağrısı oluşumuna ilişkin yapılan çalışmalarda %37'lik bir oranla mesleki risk faktörlerine atıfta bulunulmuştur (6). Kas-iskelet sistemine tekrarlayıcı yüklenmeye sıklıkla maruz kalan meslek gruplarından biri fizyoterapistlerdir. Rehabilitasyon uygulamalarında ağır kaldırma, hasta transferleri, tekrarlayan hareketler, itme-çekme, eğilme gibi vertebral kolona olan mekanik yüklenmeler gibi durumlar fizyoterapistlerde NSBA'nın gelişiminde rol oynamaktadır (7,8). Yapılan çalışmalarda fizyoterapi öğrencilerinin yarısından fazlasının (%56-73) bel ağrısı yaşadığı, son sınıf öğrencilerinde bu oranın daha da arttığı tespit edilmiştir (7,8).

Kor stabilizasyon kasları, spinal stabilitenin sürdürülmesinde rol oynayan temel yapılardır. Lumbopelvik stabilite, statik duruş ve dinamik aktiviteler sırasında omurganın, pelvisin ve bacakların optimal diziliminin sağlanması ve sürdürülmesi şeklinde tanımlanmıştır (9). Gövde kaslarının zayıf enduransı lomber omurganın pasif yapılarında yaralanmaya yol açmakta ve bel ağrısına neden olmaktadır (9). Lomber multifidus ve transversus abdominis (TrA) kaslarındaki gecikmiş ya da azalmış kas aktivasyonu nedeniyle lomber omurga desteğinde zayıflık, eklemlerde ve ligamentlerde aşırı yüklenme meydana gelmektedir (10). TrA kasının yetersiz kasılması lomber lordozu artırmakta ve postural dizilimde değişiklikler görülebilmektedir (11). Kor stabilizasyon kaslarının düzensiz çalışması bel ağrısı oluşumuna ve orta-yüksek derecede fonksiyonel kayıplara neden olmaktadır (4).

Öğrencilik döneminde başlayan klinik uygulamalar stajyer fizyoterapistlerde mekanik yüklenmeye neden olarak NSBA'nın oluşmasına zemin hazırlamaktadır (6, 7, 8). Ancak literatürdeki güncel çalışmalarda stajyer fizyoterapistlerin postür, endurans gibi kas iskelet sistemi özellikleri göz önünde bulundurulmadan NSBA varlığı incelenmiştir. Çalışmamız ise stajyer fizyoterapistlerde NSBA'nın postür, kor endurans ve lumbopelvik stabilite ile ilişkili olduğu hipotezine dayanarak, bu faktörlerin karşılaştırılması ve NSBA ile ilişkisinin belirlenmesi amacıyla planlanmıştır.

YÖNTEM

Çalışmanın etik kurul izni Süleyman Demirel Üniversitesi Tıp Fakültesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulunun 11.02.2022 tarihli toplantısındaki 54 no'lu karar ile alındı.

Katılımcılar ve Çalışmanın Tasarımı

Kesitsel klinik bir araştırma olarak planlanan çalışmaya, Süleyman Demirel Üniversitesi Fizyoterapi ve Rehabilitasyon Bölümü son sınıf öğrencileri gönüllü olarak dahil edildi. Seçilen evrende (n=97) yer alan kişilerin hepsine ulaşıldı. Çalışma dışı kalan öğrenciler (n=7) haricinde toplam 90 katılımcı ile Mart-Mayıs 2022 tarihleri arasında çalışma tamamlandı.

Çalışmaya 20-25 yaş arasında, Türkçe konuşup anlayabilen, çalışmanın yapıldığı tarihler göz önünde bulundurularak en az 6 ve en fazla 8 aydır staj yapan öğrenciler katıldı. Çalışmada yer alan spor hekimi araştırmacılar tarafından gerekli muayeneleri yapılan romatolojik, nörojenik ya da travmatik nedenden bağımsız olarak akut ve subakut ağrısı (1 hafta-3 ay) olanlar GrupAğrılı'ya dahil edilirken, bel ağrısı şikayeti olmayan öğrenciler GrupAğrısız'a dahil edildi. Aralıksız olarak 3 aydan fazla süren ve organik nedenlere bağlı bel ağrısı olan katılımcılar, bel ağrısı için tedavi alan katılımcılar ile çalışmaya katılmak istemeyen öğrenciler çalışmadan dışlandı. Yapılacak değerlendirmeler hakkında katılımcılara ayrıntılı bir şekilde bilgi verildikten sonra Bilgilendirilmiş Gönüllü Olur Formu imzalatılarak çalışmaya başlandı.

Katılımcıların demografik özellikleri [yaş, cinsiyet, boy, vücut ağırlığı, beden kitle indeksi (BKİ)] araştırmacılar tarafından hazırlanan forma kaydedildi.

Daha sonra bel ağrısının istirahat ve aktivite sırasındaki şiddeti Sayısal Ağrı Derecelendirme Ölçeği (SADÖ) ile, bel ağrısına bağlı yetersizlikler Oswestry Bel Özürlülük İndeksi (OÖİ) ile, postür sapmaları New York Postür Analizi Skalası (NYPAS) ile ve fiziksel aktivite düzeyleri Uluslararası Fiziksel Aktivite Anketi-Kısa Form (UFAA-KF) aracılığıyla belirlendi. Kor endurans ve lumbopelvik stabilite değerlendirmesi için McGill Endurans Test Bataryası ve Lumbopelvik Stabilite Manşon Testi (LPMST) kullanıldı. Katılımcıların verileri alınırken her bir test farklı bir araştırmacı tarafından körlük sağlanarak uygulandı (P.Y.: postür değerlendirmesi, H.T.A.: LPSMT testi, A.S.U.: Lateral plank testleri ve McGill-F testi).

Veri Toplama Araçları

Sayısal Ağrı Derecelendirme Ölçeği (SADÖ): Katılımcıların aktivite [SADÖ (A)] ve istirahat [SADÖ (İ)] esnasındaki bel ağrısı şiddetini belirlemek için kullanıldı. Üzerinde eşit aralıkların olduğu 10 cm'lik bir çizgi üzerinde işaretleme yapılarak 0-10 arasında bir puan elde edilir. Hiç ağrı olmaması 0 (sıfır) puana karşılık gelirken, ağrı şiddeti arttıkça puan artmaktadır (12).

Oswestry Bel Özürlülük İndeksi (OÖİ): Türkçe geçerliliği Yakut ve ark. tarafından yapılan indeks, bel ağrısı nedeniyle oluşan fonksiyonel yetersizliklerin belirlenmesinde kullanılmaktadır. Bel ağrısının şiddetini, kişisel bakım, yük kaldırma-taşıma, yürüme, oturma, ayakta durma, uyku, sosyal yaşam ve seyahat gibi aktiviteler sırasındaki fonksiyonellik düzeyini ölçen toplam 10 maddeden oluşmaktadır. Her bir madde 0-5 arasında derecelendirilmekte ve maksimum 50 puan (1-10=hafif, 11-30=orta, 31-50=ağır özürlülük) üzerinden değerlendirilmektedir. Elde edilen toplam puan yüzdelik sisteme çevrilerek yetersizlik yüzdesi hesaplanmaktadır (13).

Uluslararası Fiziksel Aktivite Anketi-Kısa Formu (UFAA-KF): Fiziksel aktivite (FA) düzeyinin belirlenmesinde kullanılan anket, son 7 gün içinde en az 10 dakika yapılan FA ile ilgili sorular içeren 4 bölüm ve toplam 7 sorudan oluşmaktadır. İlk bölümde son 7 gün içinde yapılan şiddetli fiziksel aktivite (ŞFA) düzeyi belirlenmektedir. İkinci bölümde orta yoğunlukta fiziksel aktivite (OFA), üçüncü bölümde ise yürüyüş yapılan gün sayısı ve süresi sorgulanmaktadır. Son soruda ise günlük oturma süresi kaydedilmektedir. Toplam puan gün sayısı, aktivite süresi ve her bölüm için belirlenen katsayıların (yürüyüş: 3,3 MET; OFA: 4 MET; ŞFA: 8 MET) çarpımı ile elde edilir. Hesaplanan metabolik eşik değer (MET) <600 ise düşük fiziksel aktivite, 600-3000 MET arasında ise OFA ve <3000 MET ise ŞFA düzeyi olarak bildirilmektedir. Anketin Türkçe geçerlilik güvenilirlik çalışması Sağlam ve ark. tarafından 2010 yılında yapılmıştır (14).

New York Postür Analizi Skalası (NYPAS): Vücudun 13 ayrı kısmında meydana gelebilecek postür değişiklikleri izlenerek puanlandırıldı. Buna göre kişinin ilgili vücut bölgesinin postürü düzgün ise 5 (beş), orta derecede bozulmuş ise 3 (üç) ve ciddi şekilde bozukluk mevcut ise 1 (bir) puan verilerek puanlandı. Test sonucunda elde edilebilecek toplam puan minimum 13-maksimum 65 olmaktadır (15).

McGill Torso Endurans Test Bataryası: Kor kaslarının endurans testi için McGill Torso Endurans Test Bataryası gövde fleksör ve ekstansör kasları için endurans testi ile sağ-sol lateral plank testini içermektedir. Ayrıca bu test sürelerinin birbirlerine oranları hesaplanır.

Gövde fleksör endurans testi (McGill-F); derin kor kasların (transversus abdominis, quadratus lumborum, and erektör spina) statik ve izometrik kasılması ile değerlendirilmesine olanak tanımaktadır. Testin başlangıç pozisyonu; kalça ve dizler 90o fleksiyonda iken katılımcı arkasından 60o'lik bir eğimle desteklenir. Kollar göğüste çaprazlanarak, eller karşı omuzlara yerleştirilerek, destek katılımcının arkasından çekilir ve süre başlatılır. Bu pozisyonu koruyabildiği süre saniye cinsinden kaydedilir (Şekil 2a-b) (16).

Sağ ve sol lateral plank (Sağ LP, Sol LP) testleri ile lateral kor kasların (transversus abdominis, eksternal ve internal oblik, quadratus lumborum ve erektör spina) dayanıklılığı değerlendirilmektedir. Yan yatış pozisyonunda bacak düz haldeyken kalçanın mattan tam kaldırılarak, vücut düz bir hizada tutulmalıdır. Kişinin gövdesi yalnızca ayakları, altta kalan dirsek ile ön kol tarafından desteklenerek bu pozisyonun korunabildiği süre kaydedilir (Şekil 2c-d) (16).

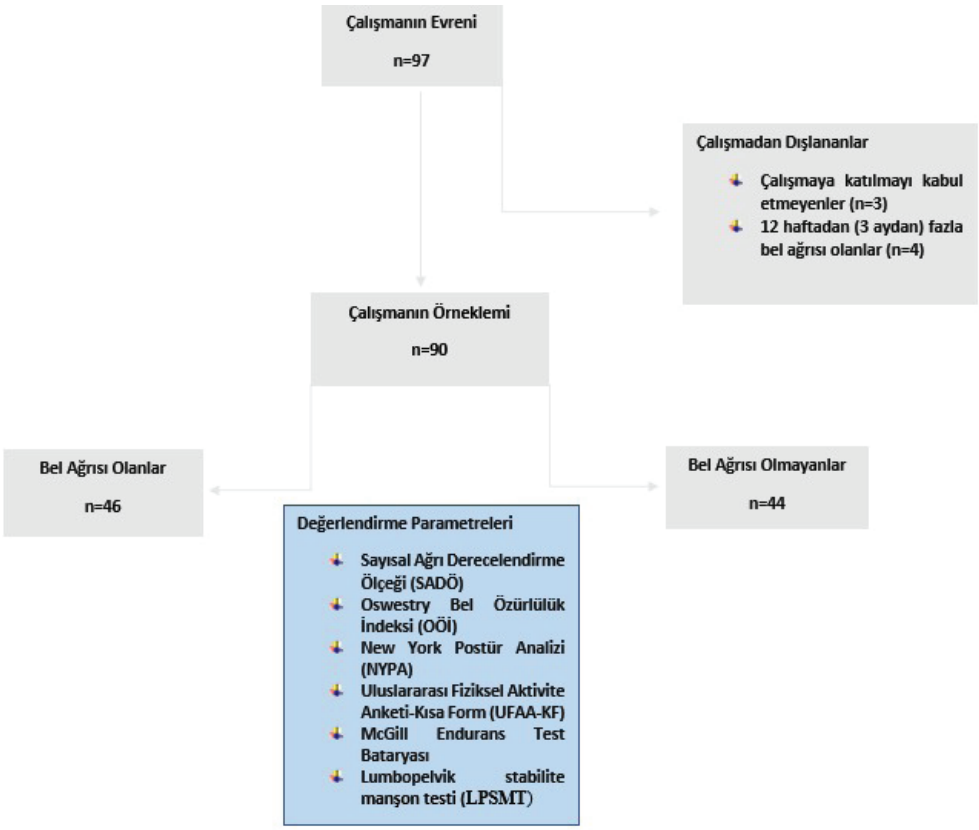
Gövde ekstansör endurans testinde (McGill-E) erektör spina, longissimus, iliokostalis ve multifidus kasların enduransı belirlenmektedir. Katılımcı, elleri bir yükselticiye yerleştirilerek, spina iliaka anterior

superior hizasında gövde sedyede olmayacak şekilde pozisyonlanır. Kollarını göğsünde çaprazlayarak gövdesi zemine paralel olacak şekilde ekstansiyon yapması istenir. Bu pozisyonu koruyabildiği süre saniye cinsinden kaydedilir (Şekil 2e) (16).

Lumbopelvik Stabilite Manşon Testi (LPSMT): Basınç geribildirim (İng.biofeedback) yöntemi ile aneroid sfigmomanometre (Erka, Türkiye) kullanılarak yapıldı. Katılımcı çengel pozisyonda yatırıldıktan sonra "abdominal çekme (İng. abdominal drawin) manevrası" öğretilerek ayaklarını sedyeden 20 cm yukarıya kaldırması istendi. Katılımcının L1-S1 vertebraları aralığında yerleştirilen manşon 40 mmHg'ye şişirilerek katılımcıya gösterildi. Daha sonra abdominal çekme manevrası yaparak manşonun sıkıştırılması ve ayaklar havadayken basıncın 40-50 mmHg arasında tutulması istendi. Bu pozisyonun korunabildiği süre kaydedildi (Şekil 2f-g) (17).

İstatistiksel Analiz

Veriler IBM SPSS v26.0 (IBM Corp., Armonk, New York, ABD) istatistik paket programında analiz edildi. Tanımlayıcı istatistikler birim sayısı (n), yüzde (%), ortalama±standart sapma (x±ss), Median (25.p-75.p) değerleri olarak verildi. Sayısal değişkenlere ait verilerin normal dağılıma uygunlukları Skewness-Kurtosis değerleri ve Shapiro-Wilk normallik testleri ile değerlendirildi. Gruplar arası karşılaştırmalarda, parametrik koşulların sağlandığı durumlarda Bağımsız Örneklem T testi kullanılırken, parametrik koşulların sağlanmadığı durumlarda Mann Whitney U testi kullanıldı. Normal dağılıma uymayan sayısal değişkenler arasındaki ilişkinin incelenmesinde ise Spearman korelasyon analizi kullanıldı. $p<0,05$ değeri istatistiksel olarak anlamlı kabul edildi. Korelasyon düzeyleri için $0 <$ rho $< 0,20$: çok zayıf ilişki, $0,20 \leq$ rho $< 0,40$: zayıf ilişki, $0,40 \leq$ rho $< 0,60$: orta düzeyde ilişki, $0,60 \leq$ rho $< 0,80$: iyi ilişki, $0,80 \leq$ rho ≤ 1 : güçlü ilişki olarak belirlendi.



Şekil 1. Katılımcıların akış diyagramı

Güç analizi

Araştırmanın yürütüldüğü merkezde, Fizyoterapi ve Rehabilitasyon Bölümü'nün son sınıfında toplam 97 stajyer fizyoterapist yer almaktaydı. Çalışma boyunca, bu kişilerin 90 tanesi gönüllü olarak araştırmaya dahil oldu (Şekil 1). Çalışmamızın post-hoc güç analizi G*Power 3.1.9.4 paket programında gerçekleştirilmiştir. LPSMT değişkeninden elde edilen verilerle yapılan analizde güven aralığı %95, tip 1 hata düzeyi (α) 0,05 kabul edilmiş olup toplam 90 katılımcının yer almasıyla elde edilen etki büyüklüğü (d) değeri 0,58 ve çalışmanın güç değeri (1-β) 83,94 olarak hesaplanmıştır.

SONUÇLAR

Çalışma bel ağrısı olan (n=46) ve bel ağrısı olmayan (n=44) toplam 90 öğrenci ile sonlandırıldı. Katılımcıların demografik özellikleri Tablo 1'de verildi.

Cinsiyet dağılımlarına göre incelendiğinde hem bel ağrısı olan grubun (n=38, %42,2) hem de bel ağrısı olmayan grubun (n=30, %33,3) çoğunluğu kadın öğrencilerden oluşmaktaydı.

Katılımcıların lumbopelvik stabilite, fiziksel aktivite düzeyi, postür özellikleri ve bel ağrısına bağlı görülen yetersizliklerin karşılaştırılması Tablo 2'de verildi. Bel ağrılı grubun LPSMT skoru ağrısız gruba göre anlamlı derecede düşük olduğu tespit edildi (p<0,05). Gruplar postür özellikleri bakımında benzerlik gösterse de (p>0,05), fiziksel aktivite düzeyi ve bel ağrısı kaynaklı yetersizlikleri karşılaştırıldığında bel ağrılı grubun UFAA-KF ve OÖİ skorlarının istatistiksel olarak anlamlı derecede yüksek olduğu bulundu (p<0,05).

Kor endurans değerlendirmesinde kullanılan McGill Torso Test Bataryası sonuçlarına göre bel ağrısı olmayan grubun gövde ekstansör kas endurans süresi daha yüksek bulunurken (p<0,05), diğer test parametreleri gruplar arasında benzer sonuçlara sahipti (p>0,05) (Tablo 3).

Bel ağrılı grupta ağrı süresi ve ağrı şiddeti ile incelenen postür ve fiziksel performans parametreleri arasındaki ilişkiyi incelemek amacıyla korelasyon analizleri yapıldı. Buna göre, aktivite sırasındaki ağrı şiddeti, şiddetli fiziksel aktivite parametresi ile pozitif yönlü zayıf düzeyde korelasyona sahipti. UFAA-KF yürüyüş parametresinin ağrı süresi ve aktivite sırasındaki ağrı şiddeti ile sırasıyla pozitif yönlü orta ve zayıf düzeyde ilişkiye sahipti. Bel ağrısı ile ilişkili yetersizlik aktivite sırasındaki ağrı şiddeti ile pozitif yönlü orta düzeyde ilişkiye sahipken lumbopelvik stabilite ile negatif yönlü zayıf düzeyde ilişkili olduğu görüldü (Tablo 4).

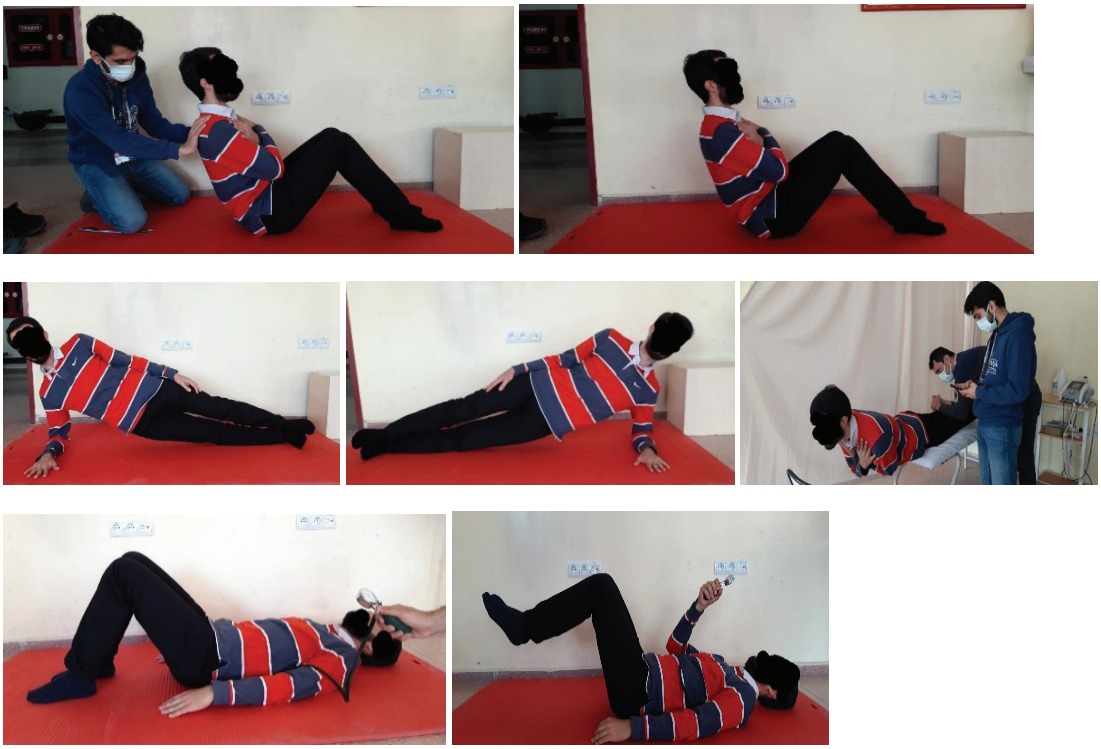
Bel ağrısı ile endurans testlerinin ilişkisi Tablo 4 (devamı)'te verildi. Ağrı süresi, SADÖ (A) ve postürün gövde fleksör enduransı ile negatif yönlü zayıf düzeyde korele olduğu görüldü. Sağ ve sol lateral plank sürelerinin her ikisi de gövde fleksör enduransı ile pozitif yönlü orta düzeyde ilişkiye sahipti. Sol lateral plank süresi ile sağ lateral plank süresi arasında sırasıyla pozitif yönlü yüksek düzeyde korelasyon vardı. McGill-E'nin McGill-F ile pozitif yönlü zayıf düzeyde ilişkili olduğu tespit edildi.

Stajyer fizyoterapistlerde NSBA'nın postür, kor endurans ve lumbopelvik stabilite ile ilişkisinin incelendiği çalışmamızda; bel ağrılı grupta ağrısız gruba kıyasla LPMST süresinin daha düşük olduğu, OÖİ puanlarının ve UFAA-KF toplam puanının daha yüksek olduğu tespit edildi. Bununla birlikte,

Tablo 1. Katılımcıların Demografik ve Tanımlayıcı Verileri

	$Grup_{Ağrılı}$ *n=46* *Medyan (25.p-75.p)*	$Grup_{Ağrısız}$ *n=44* *Medyan (25.p-75.p)*	p^a değeri
Yaş (yıl)	22 (22-23)	22 (22-23)	0,434
***Boy (cm)**	166,03±6,27	169,4±7,3	**0,021**[b]
Vücut ağırlığı (kg)	58 (52-68)	61,25 (54,25-73)	0,162
BKİ (kg/m²)	21,39 (19,47-23,81)	21,42 (20,25-24,22)	0,508

BKİ: Beden Kitle İndeksi, p<0,05 anlamlılık değeri, *Boy değişkeni normal dağılıma uyduğu için ort±SS şeklinde verilmiştir, [a]: Mann Whitney *U* testi, [b]: Bağımsız örneklem *T* testi.



Şekil 2. McGill Torso Endurans Test Bataryası (a, b, c, d, e) ve Lumbopelvik stabilite manşon testi (f, g)

McGill-E testi süresi bel ağrılı grupta daha düşük olduğu görüldü. Gruplar arasında NYPAS ve McGill Torso Test Bataryası'nın alt testlerinde anlamlı bir fark bulunmadı. Ayrıca, OÖİ ile ağrı süresi, SADÖ (A) ve LPSMT verilerinin ilişkili olduğu gözlendi. Benzer şekilde, McGill-F testi değerleri ile NYPAS puanları arasında ilişki vardı.

Bel ağrısının risk faktörlerinden biri olarak vücudun mekanik tekrarlı yüklenmelere maruz kalması sayılabilmektedir (5). Son sınıf fizyoterapi öğrencilerinde yaptığımız bu çalışmada NSBA'nın varlığını göz ardı etmek mümkün değildir. Bunun nedenlerinin klinik uygulama dönemlerinde hastalara müdahale sırasında ağır kaldırma, transferler, tekrarlayan hareketler, itme-çekme, bükülme gibi kolumna vertebralise olan mekanik yüklenmelerin olduğu bununla birlikte akademik eğitim süresinde uzun süreli oturmalar, akademik stres gibi faktörlerin olduğu belirtilmiştir (8).

Literatürde farklı popülasyonlarda postür ile bel ağrısını inceleyen çalışmalar bulunmakta ve postüral değişikliklerin bel ağrısı ile ilişkili olduğu bildirilmektedir (18–21). Nourollahi ve ark. hemşirelerde anormal postüre maruz kalma süresi ile bel ağrısı oluşumunun ilişkili olduğu tespit edilmiştir (18). Sağlık çalışanlarında bel ağrısını etkileyen faktörlerin incelendiği başka bir çalışmada, bel ağrısından muzdarip olan sağlık çalışanlarının riskli postürlere sahip oldukları ve postürün bel ağrısını etkileyen bir faktör olduğu belirtilmiştir (19). Khan ve ark. 2018 yılında 9 çalışmayı dahil ederek yaptıkları sistematik derlemede, çiftçilerde anormal postürün bel ağrısı ile ilişkili olduğuna dair kanıtlar sunmuşlardır (20). Bir başka çalışmada ise sağlık çalışanlarındaki bel ağrısının uzun süreli ayakta durma ile ilişkili olduğunu ancak, inşaat işçilerindeki bel ağrısının çalışmamızla benzer şekilde postürle ilişkili olmadığını bildirmişlerdir (21). Güncel literatürde, fizyoterapi öğrencilerinde bel ağrısı ve postür ilişkisinin değerlendirildiği bir çalışmaya rastlanılmamıştır. Çalışmamızda bel ağrısı olan ve olmayan grupların postürleri arasında anlamlı bir farklılık olmadığı ve her iki grubun postüral olarak minimal bozukluğa sahip olduğu tespit edildi. Glista ve ark. yaptıkları da sonuçlarımızla uyumlu şekilde fizyoterapi öğrencilerinin eğitim hayatları süresince postürlerinde kötüleşmelerin olduğunu bildirmişlerdir (22). Öğrencilerin eğitimleri boyunca uzun süreli oturma pozisyonuna maruz kalma ve klinik uygulamalar sırasında ergonomilerine dikkat etmemeleri bu durumun nedeni olarak düşünülebilir.

Tablo 2. Katılımcıların Gruplara Göre Lomber Kor Stabilizasyon Manşon Testi Sürelerinin, Fiziksel Aktivite Düzeylerinin, Postür Skorlarının ve Bel Özürlülük İndeksi Skorlarının Karşılaştırılması

	$Grup_{Ağrılı}$ *n=46* *Medyan (25.p-75.p)*	$Grup_{Ağrısız}$ *n=44* *Medyan (25.p-75.p)*	p^a değeri
LPSMT (sn)	71 (45-100,5)	90 (65,5-131,75)	**0,027**
UFAA-KF/Yürüyüş (MET. dk/hf)	1386 (693-2772)	990 (495-1386)	0,700
UFAA-KF/Orta Şiddet (MET.dk/hf)	240 (0-780)	0 (0-480)	0,116
UFAA-KF/Şiddetli (MET. dk/hf)	0 (0-720)	0 (0-480)	0,640
UFAA-KF/Toplam (MET. dk/hf)	2772 (1677,75-4158)	1577 (1003,5-2772)	**0,009**
NYPAS skoru	58 (53-63)	58 (49-61)	0,510
OÖİ skoru	12 (10-17,83)	4,2 (0-8,88)	**0,001**

LPSMT: Lomber kor stabilizasyon manşon testi, **UFAA-KF:** Uluslararası Fiziksel Aktivite Anketi-Kısa Form, **NYPAS:** New York Postür Analizi Skalası, **OÖİ:** Oswestry Bel Özürlülük İndeksi, **MET:** Metabolik eşdeğeri, **MET.dk/hf:** Metabolik eşdeğeri x dakika/hafta, p<0,05 anlamlılık değeri, [a]: Mann Whitney *U* testi.

Tablo 3. Katılımcıların Gruplara Göre Mcgill Torso Test Bataryası Değerleri ve Oranlarının Karşılaştırılması

	$Grup_{Ağrılı}$ *n=46* *Medyan (25.p-75.p)*	$Grup_{Ağrısız}$ *n=44* *Medyan (25.p-75.p)*	p^a değeri
McGill-F (sn)	107 (65,25-181)	128 (76,25-228,75)	0,364
McGill-E (sn)	100 (70-131)	119 (86,25-178,75)	**0,049**
McGill-Sağ LP (sn)	36,5 (21,75-59,25)	47,5 (25,5-62)	0,247
McGill-Sol LP (sn)	40 (28,5-55,25)	49 (25-62,75)	0,450
F/E Oranı	3,42 (1,82-4,50)	2,84 (1,56-4,37	0,666
Sağ LP/Sol LP Oranı	0,9 (0,73-1,15)	0,94 (0,83-1,17)	0,205
Sağ LP/E Oranı	0,34 (0,20-0,69)	0,35 (0,20-0,52)	0,768
Sol LP/E Oranı	0,4 (0,25-0,62)	0,32 (0,21-0,54)	0,226

McGill-F: McGill Torso Gövde Fleksör Testi, **McGill-E:** McGill Torso Gövde Ekstansör Testi, **McGill-Sağ LP:** McGill Torso Sağ Lateral Plank Testi, **McGill-Sol LP:** McGill Torso Sol Lateral Plank Testi, **F/E Oranı:** Gövde Fleksör/Ekstansör Oranı, **Sağ LP/Sol LP Oranı:** Sağ Lateral Plank/Sol Lateral Plank Oranı, **Sağ LP/E Oranı:** Sağ Lateral Plank /Gövde Ekstansör Oranı, **Sol LP/E Oranı:** Sol Lateral Plank /Gövde Ekstansör Oranı, p<0,05 anlamlılık değeri, [a]: Mann Whitney *U* testi.

Literatürde kor enduransı ile bel ağrısı arasında ilişkinin incelendiği çalışmalar yer almaktadır (23,24). Bununla birlikte, tekrarlayan bel ağrısının, gövde kaslarının değişmiş motor koordinasyonu ile ilişkili olduğu belirtilmektedir (25). Vanti ve ark. 2016 yılında 115 kronik NSBA olan katılımcıyla gerçekleştirdikleri bir çalışmada, bel ağrısı düzeyinin bel ağrısına bağlı yetersizlik ile ilişkili olduğunu bildirmişlerdir. Buna ek olarak, yazarlar bel ağrısı süresinin artmasıyla antero-posterior kor kaslarında dayanıklılığın önemli ölçüde azalacağını belirtmişlerdir (24). NSBA'nın erkek sporculardaki kor enduransı ve disfonksiyonu üzerine etkileri 2016 yılında Abdelraouf ve ark. tarafından gerçekleştirilen bir çalışma ile incelenmiştir. Otuz NSBA'lı ve 25 sağlıklı erkek sporcu katılımcıdan oluşan çalışmanın sonucunda; bel ağrısı olan erkek sporcuların oluşturduğu grubun daha düşük dayanıklılık süresine sahip oldu-

Tablo 4. Bel Ağrısı Olan Gruptaki Bireylerin Spearman's Rho Korelasyon Verileri

	Ağrı süresi	SADÖ (İ)	SADÖ (A)	LPSMT	UFAA-KF Şiddetli	UFAA-KF Orta	UFAA-KF Yürüyüş	UFAA-KF Toplam	OÖİ skoru
Ağrı süresi									
SADÖ (İ)	0,066								
SADÖ (A)	0,189	**0,313***							
LPSMT	-0,123	-0,048	-0,200						
UFAA-KF Şiddetli	-0,189	**0,361***	0,166	0,003					
UFAA-KF Orta	-0,252	0,021	-0,001	0,538	**0,297***				
UFAA-KF Yürüyüş	**0,581****	0,016	**0,351***	-0,094	-0,128	-0,175			
UFAA-KF Toplam	0,196	0,064	**0,307***	-0,028	**0,416****	**0,388***	**0,649****		
OÖİ skoru	**0,328***	0,020	**0,466****	**-0,299***	-0,113	0,157	**0,323***	0,183	

Tablo 4. Bel Ağrısı Olan Gruptaki Bireylerin Spearman's Rho Korelasyon Verileri (devam)

	Ağrı süresi	SADÖ (İ)	SADÖ (A)	NYPAS	McGill-F	McGill-Sağ LP	McGill-sol LP	McGill-E	F/E Oranı	Sağ LP/Sol LP Oranı	Sağ LP/E Oranı	Sol LP/E Oranı
Ağrı süresi												
SADÖ (İ)	0,066											
SADÖ (A)	0,189	**0,313***										
NYPAS	-0,282	-0,071	-0,109									
McGill-F	**-0,391****	-0,001	**-0,353***	**0,386****								
McGill-Sağ LP	-0,248	-0,007	-0,254	0,223	**0,511****							
McGill-Sol LP	-0,170	0,032	-0,255	0,179	**0,570****	**0,862****						
McGill-E	-0,001	0,217	-0,058	0,086	**0,347***	**0,460****	**0,384***					
F/E Oranı	-0,212	-0,022	-0,136	0,129	**0,568****	**-0,306***	-0,292	-0,153				
Sağ LP/Sol LP Oranı	-0,154	-0,015	-0,122	0,192	0,126	0,173	-0,285	0,067	-0,200			
Sağ LP/E Oranı	-0,189	-0,138	-0,220	0,191	0,231	**0,592****	**0,528****	**-0,375***	-0,227	0,105		
Sol LP/E Oranı	-0,141	-0,124	-0,156	0,127	0,213	**0,525****	**0,706****	**-0,315***	-0,165	**-0,325***	**0,858****	

SADÖ (İ): Sayısal ağrı derecelendirme ölçeği-İstirahat, **SADÖ (A):** Sayısal ağrı derecelendirme ölçeği-Aktivite, **NYPAS:** New York Postür Analizi Skalası, **McGill-F:** McGill Torso Gövde Fleksör Testi, **McGill-E:** McGill Torso Gövde Ekstansör Testi, **McGill-Sağ LP:** McGill Torso Sağ Lateral Plank Testi, **McGill-Sol LP:** McGill Torso Sol Lateral Plank Testi, **F/E Oranı:** Gövde Fleksör/Ekstansör Oranı, **Sağ LP/Sol LP Oranı:** Sağ Lateral Plank/Sol Lateral Plank Oranı, **Sağ LP/E Oranı:** Sağ Lateral Plank/Gövde Ekstansör Oranı, **Sol LP/E Oranı:** Sol Lateral Plank/Gövde Ekstansör Oranı *: 2 yönlü korelasyon 0,05 düzeyinde, **: 2 yönlü korelasyon 0,01 düzeyinde anlamlılık göstermektedir. Negatif yönlü ilişkiler '-' ile pozitif yönlü ilişkiler ise '+' ile gösterilmiştir

ğu gösterilmiştir (23). Çalışmamızda ise literatürdeki bu çalışmalardan farklı olarak bel ağrısı olan grupta sadece McGill-E testinde anlamlı düzeyde daha düşük değerler olduğu bulundu. Correia ve ark. ise 2016 yılında tenis sporcuları üzerinde yaptıkları çalışmada, NSBA'lı tenisçilerin asemptomatik sağlıklı oyuncularla karşılaştırıldığında, sonuçlarımızla uyumlu şekilde gövde ekstansör kaslarında (longissimus thoracis ve erector spina) daha düşük kassal aktivasyona, daha az ko-kontraksiyon paternlerine ve daha zayıf abdominal kassal dayanıklılığa sahip olduğunu belirtmişlerdir (26). Çalışmamızda gruplar arasında McGill Torso testlerinden yalnızca ekstansör dayanıklılık testi sürelerinin farklı olması, McGill-E test pozisyonunun faset eklem üzerindeki mekanik yüklenme nedeniyle NSBA'lı stajyer

fizyoterapistlerde bel ağrısını daha kısa sürede şiddetlendirmesi nedeniyle açıklanabilir ve ağrılı katılımcıların McGill-E testini daha erken sürede tamamlamalarına neden olmuş olabilir. Ayrıca, çalışmamızda McGill-F Testi süresi ile NYPAS puanlarının ilişkili olması NSBA'lı olup daha düzgün postüre sahip stajyer fizyoterapistlerde gövde fleksör kas dayanıklılığının daha iyi olduğunu göstermektedir. Böylece, iyi postüre sahip bireylerde gövde fleksör kaslarının yeterli kuvvet ve enduransa sahip olduğunu düşündürmektedir. Ancak, çalışmamızın sonucundan farklı olarak Özdemir ve ark. 2021 yılında elit genç dağcılarda yaptıkları çalışmada dağcıların postürlerinin kötüleştiğini ancak kor kaslarının dayanıklılık test sürelerinde artış olduğunu bildirmişlerdir (27). Çalışmamızın sonuçlarına kıyasla farklı çıkan bu sonucun nedeni, Özdemir ve ark. çalışmasındaki katılımcıların profesyonel dağcılık sporcuları olmaları ve spor geçmişlerinin olması olarak yorumlanabilir.

Lumbopelvik stabilite, yaralanmaların önlenmesinde önemli bir etkendir ve azalmış lumbopelvik stabilite omurgaya mekanik yüklenme ile sonuçlanmaktadır (28). Tekrarlayan mekanik yüklenmeler ise zamanla bel ağrısına neden olabilmektedir (29). Literatürde bazı çalışmalarda lumbopelvik stabilitenin/lumbopelvik motor kontrolün bel ağrısı yaşayanlarda azaldığı bildirilmektedir (28–30). Jung ve ark. 2020 yılında 278 katılımcıyla yaptıkları çalışmada, kronik bel ağrısı olan katılımcıların sağlıklı kontrollerle karşılaştırıldığında lumbopelvik motor kontrol fonksiyonunun daha düşük olduğunu göstermişlerdir (28). Benzer şekilde, Grosdent ve ark. 2015 yılında 43 elit düzeyde rekabet eden futbolcu katılımcı ile gerçekleştirdikleri başka bir çalışmada da bel ağrısı olan sporcuların olmayanlara kıyasla daha kötü lumbopelvik motor kontrole sahip olduklarını bildirmiştir (29). Dansçılarda yapılan randomize kontrollü başka bir çalışmada ise bel ağrısı olan dansçıların zayıf lumbopelvik stabilite gösterdikleri tespit edilmiştir (30). Çalışmamızda, literatürdeki bu çalışmaların sonuçlarına benzer olarak bel ağrısı olan stajyer fizyoterapistlerde bel ağrısı olmayanlara kıyasla daha kötü lumbopelvik stabilite değerleri izlendi.

Bel ağrısı kaynaklı yetersizlik ve ağrı şiddeti arasındaki ilişkiyi inceleyen çalışmalar genellikle benzer sonuçlar sunmuştur (31, 32). Bel ağrılı bireylerde saptanan yetersizlik, ağrısız bireylere göre beklenen bir durumdur. Yılmaz ve ark. ile Changulani ve ark. çalışmamızla benzer şekilde ağrı şiddeti ile bel ağrısı kaynaklı yetersizlik arasında pozitif yönlü bir ilişki tespit etmişlerdir (31, 32), Kovacs ve ark. da bu durumun yaşam kalitesini olumsuz etkilediğini bildirmiştir (33). Ancak çalışmamızda Yılmaz ve ark. çalışmasında elde edilen yetersizlik puanları kadar yüksek değerler saptanmadı (31). Bu farklılığın nedeninin çalışmamıza dahil edilen katılımcıların akut ve subakut NSBA'ya sahip olmalarından kaynaklandığı düşünülmektedir.

Fiziksel aktivite düzeyi ile bel ağrısı arasındaki ilişkiyle ilgili literatürde çelişkili kanıtların olduğu bildirilmiştir (34). Lin ve ark. 18 çalışmayı dahil ettikleri sistematik derlemede, 3 aydan kısa süren (akut ve subakut) bel ağrısı olan kişilerde fiziksel aktivite ve bel ağrısı kaynaklı yetersizlik arasında negatif yönlü zayıf düzeyde anlamlı bir ilişki olduğunu tespit etmişlerdir. Yine aynı çalışmada araştırmacılar, 3 aydan daha uzun süredir bel ağrısı olan (kronik) kişilerde ise fiziksel aktivite ile bel ağrısı kaynaklı yetersizlik arasında negatif yönlü ve orta derecede bir ilişki olduğu sonucuna ulaşmışlardır (35). Bu çalışmadan da anlaşıldığı üzere bel ağrısından muzdarip olunan süre arttıkça fiziksel aktivite düzeylerinde bir azalma olurken bel ağrısı kaynaklı yetersizlikte bir artış olmaktadır. Yapılan başka bir derleme çalışmasında ise benzer şekilde NSBA'ya sahip olan bireylerin fiziksel aktivite düzeylerinin bel ağrısı kaynaklı yetersizlik veya ağrı şiddeti düzeyleri ile ilişkili olmadığı belirtilmiştir (36). Heneweer ve ark. fiziksel aktivite ile kronik bel ağrısı arasındaki ilişkisini inceledikleri çalışmalarında hem hareketsiz yaşam tarzı olanlarda hem de fiziksel olarak aşırı derece aktif olanların bel ağrısı için orta derecede artmış bir riske sahip olduklarını bildirmişlerdir ve fiziksel aktivite ve bel ağrısı ilişkisinin U şeklinde bir eğri olduğuna dair kanıtlar sunmuşlardır (37). Alzahrani ve ark. yaptıkları ve 24 farklı çalışmayı değerlendirdikleri güncel bir meta-analiz çalışmasının sonucunda, fiziksel aktivite ile bel ağrısı arasında ters yönlü bir ilişki olduğu ve orta düzeyde fiziksel aktivitede bulunan kişilerin, düşük seviyeli fiziksel aktivitede bulunanlara kıyasla %10 daha düşük bel ağrısı riskine sahip olduğu belirtilmiştir (38). Çalışmamızda ise bel ağrısı olan grupta bel ağrısı olmayanlara kıyasla daha yüksek UFAA-KF

toplam puanı değerleri tespit edildi. Bu sonuç, bel ağrısı olan stajyer fizyoterapi öğrencilerinin klinik uygulama sırasında fiziksel olarak daha aktif olması ve artan fiziksel aktivite düzeyinin bel ağrısına neden olabilmesiyle açıklanabilir. Bir diğer olası neden ise UFAA-KF ölçeğinin son bir haftadaki fiziksel aktivite düzeyini değerlendiren bir ölçüm aracı olmasından dolayı, bel ağrısı olanların değerlendirme zamanındaki son bir haftada fiziksel olarak aktif olma durumu ile açıklanabilir.

Stajyer fizyoterapistlerin kendi beden sağlığını farketmeleri ve gelecek meslek yaşamlarında da bunu korumaları fizyoterapide sürdürülebilirlik açısından (olası işgücü kaybı, hastane başvurusu ve maliyetleri, karbon ayak izinin artması gibi etmenlerin azaltılması bağlamında) kıymetli olması çalışmamızın güçlü yanlarından sayılabilir. Çalışma tasarımının kesitsel bir çalışma olması, akut-subakut bel ağrısı olanların dahil edilmesi, katılımcıların belirli yaş aralığında ve çoğunluğunun kadın cinsiyetten oluşması çalışmamızın kısıtlılıkları arasında belirtilebilir.

Sonuç olarak; stajyer fizyoterapistlerde NSBA'nın, gövde ekstansör kas enduransında azalma, bel ağrısı kaynaklı yetersizlik ve zayıf lumbopelvik stabilite ile ilişkili olduğu saptandı. Ancak, hipotezimizin aksine NSBA'nın postür değişikliği ile ilişkili olmadığı bulundu. Bu nedenle, fizyoterapistlerin eğitim süreci ve meslek hayatları boyunca NSBA'dan korunma konusunda bilgilendirilmesi ve egzersiz uygulamaları ile desteklenmesi gerekmektedir. Gelecek çalışmalarda stajyer fizyoterapistlerde NSBA varlığı ve ilişkili faktörlerle ilgili bilgi düzeyi ve tutumun incelenmesi, bu faktörlerin yönetiminde tercih edilebilecek egzersiz uygulamalarının yer aldığı randomize kontrollü çalışmaların yapılması önerilmektedir.

Destekleyen Kuruluş: Çalışmamızı destekleyen kuruluş yoktur.

Çıkar Çatışması: Yazarlar arasında herhangi bir çıkar çatışması yoktur. Fotoğrafların çekilmesi ve bilimsel araştırmalarda kullanılması amacıyla kişilerden bilgilendirilmiş ayrıntılı onam alındı. KVKK kapsamında kişisel bilgilerin gizli tutulacağı bildirildi.

Yazar Katkıları: Fikir/Kavram: HTA, PY, RA, AC; Tasarım: HTA, PY, RA, AC; Denetleme/Danışmanlık: SE, ZB; Veri Toplama ve/ veya İşleme: HTA, PY, RA, ASU; Analiz ve/veya Yorumlama: HTA, PY, RA, ASU, AC; Literatür Taraması: HTA, PY, RA, ASU, AC; Makale Yazımı: HTA, PY, RA, ASU, AC; Eleştirel İnceleme: HTA, PY, RA, SE, ZB.

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Teşekkür: Çalışmamıza katılan tüm stajyer fizyoterapistlere teşekkür ederiz.

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ADHERENCE TO THERAPEUTIC EXERCISE IN PATIENTS WITH NONSPECIFIC LOW BACK PAIN

ORIGINAL ARTICLE

ABSTRACT

Purpose: Adherence to therapeutic exercises for low back pain can significantly impact longevity, quality of life, and health care costs. There is insufficient research describing the nature and relationship between specific patient characteristics and exercise adherence in non-specific low back pain (NSLBP). This research aimed to examine: (i) the relationship between education and adherence, (ii) the relationship between perceived pain level and adherence, and (iii) whether education and pain level are significant predictors of adherence.

Methods: Observational analytic research was conducted in a physiotherapy outpatient setting on a sample of 50 subjects with NSLBP. Data collected were: sociodemographic, pain level according to the visual analogue scale (VAS) and adherence measured by the Exercise Adherence Rating Scale (EARS). For hypotheses testing, statistical methods used were; t-test for small independent samples (i), Pearson correlation coefficient (ii) and linear regression analysis (iii).

Results: The results show that: (i) people with a college education are more adherent, (ii) increasing adherence reduces pain level, and (iii) education and pain level are significant in predicting adherence, where education is a stronger predictor.

Conclusion: College-educated persons are more prone to therapeutic exercise, and adherence determines physiotherapy outcomes. The contribution of research to clinical practice is reflected in the findings of the nature and relationship between education level and exercise adherence in NSLBP and its significant impact on physiotherapy outcomes.

Keywords: Exercise, Low Back Pain, Patient Adherence, Physical Therapy Modalities

SPESİFİK OLMAYAN BEL AĞRILI HASTALARDA TERAPÖTİK EGZERSİZLERE OLAN UYUM

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bel ağrısında terapötik egzersizlere olan uyum, bireylerin uzun ömürlülüğünü, yaşam kalitesini ve sağlık bakım maliyetlerini önemli ölçüde etkileyebilir. Spesifik olmayan bel ağrısında, belirli hasta özellikleri ile egzersize olan uyumun özelliklerini ve ilişkisini açıklayan yeterli sayıda araştırma yoktur. Bu araştırma, (i) eğitim ile uyum arasındaki ilişkiyi, (ii) algılanan ağrı düzeyi ile uyum arasındaki ilişkiyi ve (iii) eğitim ve ağrı düzeyinin, egzersize olan uyumda anlamlı prediktörler olup olmadığını incelemeyi amaçlamıştır.

Yöntem: Bu çalışma, spesifik olmayan bel ağrılı 50 birey ile fizyoterapi polikliniği ortamında nicel araştırma olarak yapılmıştır. Toplanan veriler şunlardır: Sosyodemografik özellikler, Görsel Analog Skala (GAS) ile ölçülen ağrı seviyesi ve Egzersize Uyum Derecelendirme Ölçeği (EUDÖ) ölçülen egzersize olan uyum. Hipotez testleri için kullanılan istatistiksel yöntemler; (i) Küçük Bağımsız Örneklerde t testi, (ii) Pearson Korelasyon Katsayısı ve (iii) Doğrusal Regresyon Analizi.

Sonuçlar: Sonuçlar, (i) üniversite eğitimi almış kişilerde egzersize uyumun daha iyi olduğunu, (ii) artmış uyumun ağrı düzeyini azalttığını ve (iii) eğitimin daha güçlü bir prediktör olduğu durumlarda uyumu öngörmede, eğitimin ve ağrı düzeyinin önemli olduğunu göstermektedir.

Tartışma: Üniversite eğitimli kişiler terapötik egzersize daha yatkındır ve bu uyum fizyoterapi sonuçlarını belirler. Bu araştırmanın klinik uygulamaya katkısı, spesifik olmayan bel ağrısında egzersize uyum ve eğitim düzeyi ilişkisi ve doğası ve bunun fizyoterapi sonuçları üzerindeki önemli etkisine ilişkin bulguları yansıtmaktadır.

Anahtar Kelimeler: Bel Ağrısı, Egzersiz, Fizik Tedavi Modaliteleri, Hasta Uyumu

INTRODUCTION

Low back pain (LBP) is the most common musculoskeletal problem and the leading global cause of; years spent with disabilities (1), activity restrictions and absenteeism (2). Because of this, LBP results in a vast medical burden and economic cost (3) globally. LBP belongs to chronic non-communicable diseases, and its non-specific form is dominant among the affected population. The term "nonspecific low back pain" (NSLBP) corresponds to the description and pathophysiology of "back pain that is not attributed to a recognisable, known, specific pathology" (4) which is associated with various factors, primarily related to age, gender, physical condition and work environment.

Well-known clinical guidelines for treating LBP, NICE guidelines (5), emphasise physical, psychological and pharmacological therapies, primarily exercising and self-management. Exercise recommendations for adults with chronic NSLBP vary depending on the patient's physical condition, intensity and progression of the underlying disease, and associated diseases (6), so physiotherapy and self-management programs are tailored to the patient. Self-management involves the collaboration of the patient and the physiotherapist and ultimately allows patients to manage their health and difficulties (7) and maintain the health improvements achieved by physiotherapy. The guidelines emphasise that patients with chronic LBP should exercise and maintain a physically active lifestyle, so patients are usually advised and prescribed home exercise programs (5).

Adherence to physiotherapy programs that include therapeutic exercise and health behaviours in self-management is essential to ensure the sustainability of the benefits achieved (8). Outpatient exercise programs are moderately effective in reducing pain and improving function in chronic NSLBP (9,10). More effective are individually designed programs representing the so-called supervised form of physiotherapy, therapeutic exercises at home with regular check-ups and consultations with a physiotherapist (11). Adherence means the degree to which a person's behaviour corresponds to the agreed recommendations of a health professional (12), so health outcomes will depend on the same. Good adherence is a prerequisite for the effectiveness of exercise programs (12), and patients who adhere achieve a more significant increase in physical function than those who adhere less (13). However, evidence shows that adherence to recommended exercise is very often low, thus limiting the benefits that could be achieved (12,14-16). Exercise adherence declines significantly over time among older people with chronic LBP (17). Similar barriers include fear of worsening pain, time management, and uncertainty about exercise benefits (18,19). Education is also a limiting factor for adherence (20,21) in LBP and other chronic musculoskeletal disorders, but the same needs to be investigated more. As individuals, we differ in the cognitive, emotional, and physical levels of behaviour, so the difference in adherence to therapeutic exercise is expected concerning our characteristics.

This study aimed to examine the existence and the nature of the relationship between adherence, pain and level of education in patients with NSLBP.

The objectives were: (i) to examine the relationship between education and adherence to therapeutic exercise, (ii) to explore the relationship between the level of perceived pain and the adherence to exercise, and (iii) to examine whether education and perceived pain levels are significant predictors of adherence. The following hypotheses were defined and stated; (H1) adherence to therapeutic exercise is higher in persons with a college education, H2 (0) there is no association between the level of exercise adherence and the perceived reduction in pain and (H3) education and perceived pain levels are significant predictors of exercise adherence.

METHODS

This observational analytic research was carried out in the Department of Rehabilitation and Orthopaedics Aids and its physiotherapeutic outpatient unit from May until the mid of June 2022. It was preceded by a comprehensive search of existing evidence and research methodologically similar to ours. It was previously approved by the Ethics Committee of the University Hospital Centre Zagreb (Class: 8.1-22/95-2, number: 02/013 AG) and has followed the tenets of the Declaration of Helsinki.

All the respondents signed the Informed Consent. In accordance with the study design, an effort was made to follow STROBE recommendations.

Participants

The target group consisted of patients with clinical manifestations corresponding to the diagnosis of NSLBP who were referred by a medical doctor to outpatient ten-appointment physiotherapy. Exclusion criteria were: subjects <18, issues with musculoskeletal disorders associated with severe or potentially severe causes or specific pathology, perceived pain levels on VAS <4, pregnant women, subjects with impaired cognitive abilities and inability to follow verbal instructions and non-consent, physical and mental problems that could affect the reduction of reliability in self-completion of the questionnaire (deafness, illiteracy, behavioural disorders, cognitive problems, etc.). The minimum required sample size for the study was estimated a priori. With an effect size of 0.35, 5% type error and 80% statistical power condition, at least 31 respondents in the total sample were required. Considering the coronavirus pandemic and the possibility of dropouts, it was decided that more respondents would be included in the research to ensure a minimum sample size for testing the hypothesis with the desired statistical power. NSLBP patients were initially screened for eligibility on their first visit to physiotherapy. Fifty-one patients who met the study's criteria were offered to participate in this research with a full explanation of the research's need, purpose, and objectives. Based on informed consent, all 51 subjects were initially included, with a dropout of one who did not complete the planned physiotherapy cycle. So, the final statistical analysis was based on 50 subjects.

Measurements

This research was carried out within the framework of everyday practice, where each patient is assigned a physiotherapist or two cooperating physiotherapists who work with them on an individual level rather than through a group approach. As usual, during the initial physiotherapy appointment, sociodemographic data of the respondents were collected: age, gender, and level of education, which were later for study purposes, grouped into groups without college and with a college education. Medical data related to perceived pain was measured as usual with VAS, a validated instrument for pain assessment (22), where zero indicates no pain, and ten is the worst possible pain. After the assessment, joint goals were reached with each patient, including an individual outpatient physiotherapy plan, with additional home exercises advised and initially agreed upon. In general, the treatment for all subjects included spine mobility and strengthening exercises in sitting, pronated and supinated and standing positions; in the form of activation of the lumbar-sacral-pelvic complex and deep muscles, stimulation of proper breathing (approx. 30 minutes, five days a week, ten days in total) and pain relief electrotherapy on the lumbosacral part (lasting 20 minutes). In addition, patients were given recommendations on self-management (protective positions during work, daily activities and sleep). Furthermore, as in regular daily practice, patients were advised to prefer medicines with paracetamol as the only active ingredient during physiotherapy for pain associated with NSLBP rather than taking over-the-counter and prescribed, if necessary, painkillers. For the home program of exercises during outpatient physiotherapy, recommended were repetitions of, mainly, several mobility exercises in the form of self-mobilization aimed at improving mobility in areas of the spine that were restricted and associated with pain and stiffness. To patients, exercise instructions were given verbally and through their experiential performance during outpatient physiotherapy. Daily frequency was at least once, the number of repetitions minimum of ten and retention of the end movement depended on individual tolerance. The choice of exercise position was based on the possibility of their performance at home (such as an adequate exercise mat or chair).

The perceived pain level assessment was repeated with VAS at the final appointment (at the end of the tenth treatment), and adherence to the recommended exercise program at home was simultaneously assessed using the Exercise Adherence Rating Scale (EARS) (23). The EARS consists of 6 statements measuring the adherence to exercises on the Likert scale of 0-4 (23), where zero refers to the statement "strongly disagree" and four "strongly agree". Three questions were formulated posi-

Table 1. Descriptive Data of Exercise Adherence concerning Education

Group	n	X±SD
Without college education	27	11.52 ± 7.743
College education	23	20.09 ± 5.783

n- frequency, X- arithmetic mean, SD- standard deviation

tively and three negatively, which were reversed. The maximum score is 24 and represents the highest adherence. EARS has good psychometric characteristics, adequate internal consistency, and high test-retest reliability (23) in LBP and other chronic musculoskeletal diseases, proven even during cultural adaptations (24, 25, 26). The form of the questionnaire in English can be found in work by Newman-Beinart et al. (2017), in which the authors presented its development and initial psychometric evaluation (23). It was downloaded from the Supplementary data for personal, non-commercial use, and permission was subsequently obtained for thesis verification of this observational research. The questionnaire was translated into Croatian using the forward-backwards translation method by an experienced physiotherapist clinician fluid in English, with no prior validation since there was no aim of testing its psychometric properties in this observational research.

Statistical analysis

The G* Power (the University of Dusseldorf, Germany version 3.1.9.5/14 January 2020) was used to define the required sample size. Statistical data processing was performed in the PSPP program (GNU Project, version 1.4.1/5 September 2020). Category variables are presented by numbers and percentages and continuous by measures of mean and scatter, arithmetic means, and standard deviation. To test the hypotheses, based on the normality of the distribution verified by the Kolmogorov Smirnov test, the following statistics were used: t-test for small independent samples (H1), Pearson's correlation coefficient (H2 (H0)) and linear regression analysis (H3), with a defined significance level set at $p<0.05$.

RESULTS

Sample structure

The study involved 50 respondents with an average of 49.96 ± 13.89 years. Respondents were primarily females (58 %) and non-college-educated persons (46 %).

Adherence to therapeutic exercise concerning education

According to Leven's test, variances of the sample do not differ significantly, so the result of the t-test for independent samples, $t (48) = - 4.367$, $p <0.01$,

Table 2. Correlation between Adherence and Perceived Level of Pain Reduction

	Level of pain before therapy	Level of pain after therapy	Adherence
Level of pain before therapy	1	0.475**	0.159
Level of pain after therapy		1	-0.579**
Adherence			1

Pearson's correlation test; **p<0.01

Table 3. Descriptive Data for EARS, Pain Level Before Therapy and Education in All Respondents

	n	X±SD
EARS	50	15.46 ± 8.089
Pain level before therapy	50	7.02 ± 1.545
Education	50	0.46 ± 0.503

n- frequency, X- arithmetic mean, SD- standard deviation

Table 4. Regression Coefficients

	β	t	p	Correlations		
				Zero- order	Partial	Part
1 (Constant)		-0.272	> 0.05			
Level of pain before therapy	0.330	2.779	< 0.01	0.159	0.376	0.318
Education	0.624	5.247	< 0.01	0.533	0.608	0.600

β- strength of predictive factor, t- result of t-test, p- significance

confirms the H1. To a greater extent, college-educated persons adhere to therapeutic exercise, clearly seen in the almost twice as large arithmetic mean (20.9 ± 5.78) shown in Table 1.

Correlation between adherence and perceived level of pain reduction

A significant reduction in perceived pain was found in all subjects, regardless of adherence (Figure 1). However, as seen in Table 2, a statistically significant, negative correlation was found between adherence to therapeutic exercise and the perceived reduction in pain; r = -0.579, p<0.05. This indicates that increasing adherence to therapeutic exercise reduces the perceived pain level and vice versa, rejecting the H2 (H0).

Education and perceived baseline pain levels as predictors of exercise adherence

Descriptive data can be seen in Table 3, where education per se was used as a "dummy" independent variable along with the level of pain before, while the dependent was adherence.

The linear regression analysis revealed the existence of a significant effect of education and perceived baseline pain levels on exercise adherence; F (2.47) =14.735, p <0.01, R2 =0.38. The resulting model explains 38% of the variance in therapeutic exercise adherence, and by checking individual predictors, as seen in Table 4, both are significant in the prediction of adherence, where education (t = 5.247, p<0.01), β =0.624 is a stronger predictor from baseline pain level (t =2.779, p<0.01), β =0.330, which confirms H3.

DISCUSSION

As emphasised by clinical guidelines, patients with NSLBP are advised to maintain an active lifestyle and follow their healthcare provider's advice, which includes adherence to home exercise, which we believe should be obligatorily preceded by active out-

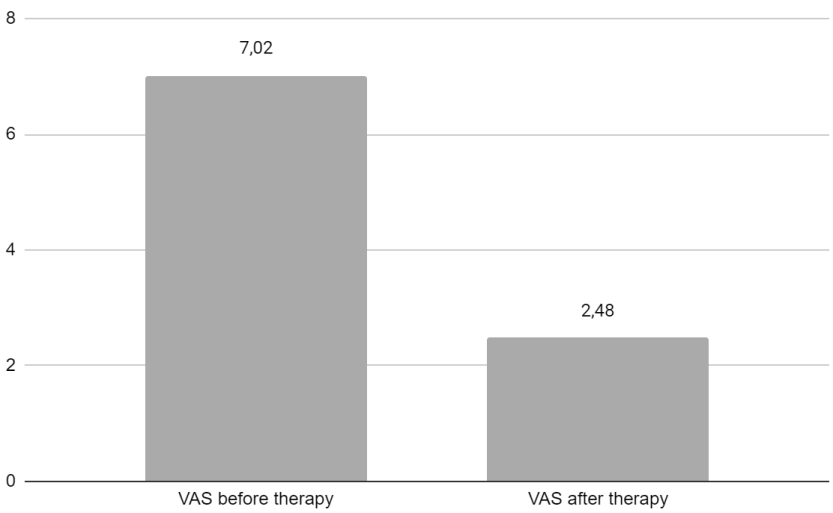

Figure 1. Pain Level According to Visual Analogue Scale (VAS) in Both Groups Before and After Therapy

patient physiotherapy so that patients have a living experience of exercise, and so the possibility of improper exercise out of the clinical setting would be minimised. This non-experimental research revealed significant findings about the nature and relationship between specific patient characteristics and exercise adherence in nonspecific low back pain.

Research shows that exercise adherence determines the effectiveness of physiotherapy programs (12) but also that levels of adherence are very often low, thus limiting the benefits that could be achieved (12,14-16). Recently described limiting factors for exercise adherence in people with chronic LBP are older age (17), fear of worsening pain, time management, uncertainty about exercise benefits (18,19), self-efficacy (21), and level of education (20,21). Research on exercise adherence and related factors is insufficient; even adherence can significantly impact longevity, quality of life, and health care costs (20). Therefore, this study aimed to examine the existence and nature of the relationship between education, perceived pain levels, and adherence to therapeutic exercise in patients with NSLBP.

The sample in our study consisted of 50 respondents with an average age of 49.96 ± 13.89 years, which is generally considered to be middle age and associated with an increased incidence of health problems and lifestyle-related diseases. The majority of the respondents were women and college-educated persons. Additionally, research indicates gender differences in terms of prevalence and degree of disability, which are more significant in persons who identify as women (27) and is most often associated with biological attributes of physical and physiological characteristics of women.

Recent research shows that the level of education may affect exercise adherence among people with chronic LBP (21,28). We confirmed that the level of education is a limiting factor for adherence; college-educated people adhere more to therapeutic exercise than those without a college education. Additionally, Taulaniemi et al. showed that lower levels of education are associated with lower exercise adherence (29). The reason for this maybe can be found in the fact that college education, according to the European Qualification Framework, represents the highest levels of knowledge, skills, responsibilities and independence in an area and the overlap of different areas (30), and certainly equally advanced levels of thinking, analysing and reasoning in the context of autonomous health behaviour.

It is a well-known fact that pain is closely correlated with the level of bodily functions, that is, functional abilities. The research of di Fabio et al. has shown that patients who adhere to prescribed exercises achieve a more significant increase in physical function than those who adhere less (13). Although the level of perceived pain in all our subjects was significantly lower after therapy than before, with increased adherence to exercise, the perceived pain level was reduced considerably. Additionally, Mannion et al. showed that pain reduction in LBP is associated with adherence to exercise (31). Nava-Brigas et al. pointed out that adherent patients have a faster and more significant reduction in pain and improved function (32). Our finding corroborates the statement; that good adherence is needed to improve the effectiveness of exercise programs (12).

Because adherence to an exercise program affects the outcome of physiotherapy treatment in patients with NSLBP (33), there is a need to identify patient characteristics before treatment that could predict adherence and outcome after (34) physiotherapy. Our findings revealed that education and baseline pain levels significantly predict exercise adherence; however, education was a stronger predictor than pain. Dhondt et al. showed that lower levels of education and back pain not associated with poor posture increased the chances of non-adherence. At the same time, a favourable outcome was predicted if the cause of low back pain, shorter duration of symptoms and pain-free status, and recovery of functional abilities were known (34). Saner et al. showed that a positive association between exercise and pain reduction helps overcome adherence barriers (33). Deliberating our findings, the level of education and, consequently, the way in which patients understand or do not understand the importance of exercise adherence and the issue of NSLBP in general obviously in the first line determines their adherence.

Contrary to these findings, Ris et al. have demonstrated that individual patient characteristics, such as sociodemographic characteristics, level of disability, comorbidities, and clinical assessment results, are not significant predictors of exercise adherence in LBP (35). This confrontation of results implies the need for further qualitative and quantitative research to identify the possible predictors of exercise adherence as clearly as possible. Although not observed in our study, it is vital to highlight the patient-physiotherapist relationship and its impact on adherence and treatment outcomes (36), primarily the potential of the physiotherapist to influence the level of knowledge and acceptance of therapeutic exercises by the patient.

Deliberating the limitations and risks of bias, we highlight several possible ones. We point out that in all subjects, in addition to therapeutic exercises, electrotherapy procedures were applied on an outpatient basis, which, in addition to adherence, may have contributed to the reduction of pain, including both groups. Additionally, although it was generally about spine mobility and strengthening exercises in the outpatient setting and self-mobilization exercises at home, the fact is that not all patients made the same movement patterns, for example, due to intolerance to a certain position. At the same time, it was about a different number of recommended home exercises between patients. Although no self-initiated reports of events that resulted in taking paracetamol, prescription drugs or over-the-counter painkillers during physiotherapy were noted, the fact is that subjects who use analgesics and anti-inflammatory drugs as regular therapy to treat other bodily complaints or comorbidities such as pericarditis (and others not excluded by the criteria) may have passed under our radar, which could in that case, individually or together, contribute to the risk of bias in terms of pain. Despite the appropriate sample size in our study, we suggest further research on a larger sample and examining other characteristics of patients as possible predictors of adherence. Also, it would be desirable to test the Croatian version of the questionnaire for reliability and validity, including the entire EARS instrument, in order to obtain information on the reasons for non-adherence.

As a final upgrade of this research, it is necessary, while avoiding the previously mentioned risks of bias, to change the design of the study to an experimental one, with preferably a very similar baseline to the experimental and control group attending outpatient physiotherapy, which would differ only in terms of additional exercises at home, additionally monitoring not only short-term but also long-term outcomes in terms of pain and disability. Still, it is necessary to take into account the ethics of this kind of study design, considering that it is about persons in pain who are looking for a remedy for their ailments.

College-educated persons are more prone to therapeutic exercise, and adherence determines physiotherapy outcomes. The contribution of this research to clinical practice is reflected in the findings of the relationship between exercise adherence, education, and pain in patients with NSLBP and the importance of assessing adherence, given the significant impact on longevity and quality of life and health care costs. Despite the efforts of a thorough and detailed description of the participants and the research environment, it is up to the readers to make the final assessment of the generalizability and application of the findings in their own environment.

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EVALUATION OF Q ANGLE, LOWER EXTREMITY FLEXIBILITY AND MUSCLE SHORTNESS IN WRESTLERS

ORIGINAL ARTICLE

ABSTRACT

Purpose: The aim of the present study was to determine the Q angle in wrestlers, to evaluate the flexibility and muscle shortness of the lower extremities, and to examine the relationship between the evaluated parameters.

Methods: 38 national athletes whose branch is wrestling were included in this cross-sectional study. The Q angles of the wrestlers were measured. The sit-reach flexibility test, m. quadriceps femoris and hip flexors flexibility assessment were performed for flexibility in wrestlers. In addition, a shortness test was applied to the wrestlers for m. tensor fasciae latae.

Results: According to the measurement made at the standing position, the Q angle was found to be 12.14±1.71° for the right side and 11.46±1.81° for the left side. According to the measurement made at the supine position, the Q angle was found to be 11.89±1.80° for the right side and 11.33±1.69° for the left side. According to the correlation analysis, a statistically significant relationship was found between the Q angle and the flexibility of the m. quadriceps femoris and hip flexors, between the Q angle and the shortness of m. tensor fasciae latae ($p<0.05$).

Conclusion: The Q angle values may differ depending on the right extremity, left extremity, and measurement positions. The Q angle is thought to be related to lower extremity flexibility and muscle shortness. It is recommended to consider the Q angle and related parameters together in the processes of evaluating the wrestlers and planning the training.

Keywords: Flexibility, Lower Extremity, Quadriceps Angle, Shortness, Wrestling

GÜREŞÇİLERDE Q AÇISI, ALT EKSTREMİTE ESNEKLİK VE KAS KISALIĞININ DEĞERLENDİRİLMESİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı güreşçilerde Q açısının belirlenmesi, alt ekstremitelerin esneklik ve kas kısalığının değerlendirilmesi ve değerlendirilen parametreler arasındaki ilişkinin incelenmesidir.

Yöntem: Çalışmaya branşı güreş olan 38 milli sporcu dâhil edilmiştir. Güreşçilerin Q açıları ölçülmüştür. Güreşçilerde esneklik için otur-uzan esneklik testi, m. quadriceps femoris ve kalça fleksörleri esneklik değerlendirmesi yapılmıştır. Ayrıca güreşçilere m. tensor fasciae latae için kısalık testi yapılmıştır.

Sonuçlar: Ayakta duruş pozisyonunda yapılan ölçüme göre, sağ tarafın Q açısı 12,14±1,71° ve sol tarafın Q açısı 11,46±1,81° olarak bulunmuştur. Sırtüstü pozisyonda yapılan ölçüme göre, sağ tarafın Q açısı 11,89±1,80° ve sol tarafın Q açısı 11,33±1,69° olarak bulunmuştur. Korelasyon analizine göre, Q açısı ile m. quadriceps femoris ve kalça fleksörlerinin esnekliği arasında, Q açısı ile m. tensor fasciae latae kısalığı arasında istatistiksel olarak anlamlı ilişki bulunmuştur ($p<0,05$).

Tartışma: Q açısı değerleri sağ ekstremiteye, sol ekstremiteye ve ölçüm yapılan pozisyona göre farklılık gösterebilir. Q açısının alt ekstremite esnekliği ve kas kısalığı ile ilişkili olduğu düşünülmektedir. Güreşçilerin değerlendirilmesi ve antrenmanların planlanması süreçlerinde Q açısı ve ilişkili olabilecek parametrelerin birlikte dikkate alınması önerilmektedir.

Anahtar Kelimeler: Esneklik, Alt Ekstremite, Quadriceps Açısı, Kısalık, Güreş

INTRODUCTION

The Q angle is used in the kinesiological evaluation of the lower extremity. It provides information about foot, pelvis and patella positions, and tibial torsion. It is an indicator of the biomechanical alignment of the lower extremity (1,2). It is a parameter associated with the bone structure and the condition of the soft tissues of the lower extremity. The Q angle is between the line from the Spina Iliaca Anterior Superior (SIAS) to the patella and the line from the patella to the tuberositas tibiae (3,4).

Some measurement methods such as goniometric, photographing method, radiological imaging, and computerized imaging techniques are used in the evaluation of the Q angle. Since goniometric measurement is more economical, easier, and more practical than other measurement methods in the evaluation of Q angle, it is much more preferred (5,6,7).

Flexibility is the ability to move the joint along the range of motion. It can be defined as the range of motion that occurs in the joint. The conditions of muscles, tendons, ligaments, and bone structures affect flexibility. Flexibility can be evaluated with joint range of motion measurements and flexibility tests. The muscles must be of sufficient length to allow normal mobility in the joints. The purpose of muscle shortness tests is to decide on muscle length and normal joint motion (8).

Wrestling is a sport two opponents do to gain technical advantage over each other. In wrestling, two opponents try to bring one another's back to the ground within certain rules by using all their physiological and psychological powers in a special area for a certain time without using any materials or tools. Aerobic and anaerobic energy systems are used in wrestling. Factors such as strength, speed, quickness, flexibility, balance, coordination, muscular, and cardiovascular endurance affect the performance of wrestlers (9,10,11). Wrestlers may have some changes in the bone structure or soft tissues of the lower limb due to the characteristics of the wrestling branch (12,13). The performance status of the athletes is related to their anthropometric characteristics, muscle strength, and structural factors. In this context, it is very important to evaluate the Q angle associated with the m. quadriceps femoris in athletes (14,15).

When the literature was examined, it was seen that there were studies determining the Q angle, examining it in terms of some variables, and investigating its relationship with some parameters in athletes. Melekoğlu and Işın found out that the Q angle was higher in amateur football players when compared to elite football players and non-athletes (16). Mohanty and Koley found in their study that there was a significant positive correlation between right femoral anteversion, right tibial torsion, and right navicular drop with right Q angle (17). However, it has been understood that studies evaluating the Q angle for the right and left extremities in wrestlers at the supine and standing positions are not sufficient. In addition, studies examining the relationship of the Q angle with flexibility and muscle shortness of the lower extremities in wrestlers have not been found. The present study is original in these aspects. The aim of the present study was to determine the Q angle in wrestlers, to evaluate the flexibility and muscle shortness of the lower extremities, and to examine the relationship between the evaluated parameters.

METHODS

The present study is a cross-sectional one. The ethics committee approval of the study was obtained from Kahramanmaras Sutcu Imam University, Faculty of Medicine, Clinical Research Ethics Committee (Date: 18.03.2020, Session no: 2020/06, Decision no: 08). The inclusion criteria for the study were to be male, engaged in wrestling for at least 3 years, to be between the ages of 15-25 years, not to have any deformities or complaints about the lower extremities, not to have any chronic diseases, not to have any discomfort for the musculoskeletal system, and not to have any psychological or neurologic problems. Exclusion criteria for the study were to be female, be engaged in wrestling for less than 3 years, to be less than 15 or more than 25 years old, to have any deformity or complaint regarding the lower extremity, have any diagnosed chronic disease, have any disorder for the musculoskeletal system, and to have any psychological or neurologic problem. For the present study, 41 male wrestlers who met the inclusion

criteria were reached. Three of the wrestlers were excluded from the study because they did not fully agree with the measurements and evaluations. 38 wrestlers were included in the present study. Wrestlers or their parents signed the informed consent form before the study. The study was carried out in accordance with the principles of the Declaration of Helsinki. Evaluations were made between March 2022 and May 2022. Measurements, evaluations, and filling out the information form were made in the Sport Sciences Faculty laboratory of Kahramanmaras Sutcu Imam University. The Q angles of the wrestlers were measured with a goniometer at the standing and supine positions. The flexibility of the wrestlers was evaluated with the sit-reach flexibility test. Flexibility was also evaluated for the m. quadriceps femoris and hip flexors. In addition, the shortness test of the m. tensor fasciae latae was applied to the wrestlers.

Measurement of the Q angle: For measuring the Q angle while standing, the feet are kept in an upright and a neutral position. At this position, the SIAS, midpoint of the patella, and tuberositas tibiae are palpated and marked with a skin marker. The line passing through the SIAS and midpoint of the patella, the line passing through the middle of the patella and the tuberositas tibiae are determined. The acute angle between these two lines is measured with a goniometer. In the measurement at the supine position, the Q angle is measured by marking the same anatomical points (SIAS, midpoint of the patella, and tuberositas tibiae) as in the during standing measurement. For the evaluation at the supine position, the acute angle between two lines that are the same as in the standing metage is measured (3,6).

Sit-reach flexibility test: In this test, a long sitting position is taken on the floor. The person places the soles of the feet on the measuring table with the metric scale on it. The person is requested to reach forward. The farthest reachable distance is recorded in cm (18).

Flexibility assessment of m. quadriceps femoris and hip flexors: The person lies in the prone position, the leg to be tested is flexed 90° from the knee joint, and asked to raise the leg from the ground without disturbing this position. The distance between the knee and the ground is measured with a tape measure. The measurement result is recorded in cm. The pelvis is stabilized during the assessment (8).

Shortness test for m. tensor fasciae latae (TFL): The person lies in the supine position with the hips and knees extended. The untested leg is brought to the abduction position by the investigator. The other leg is brought to the side of the abducted leg (hyperabduction). If the TFL muscle is short, the tested leg will not go into the hyperadduction position (8).

In addition to the measurements and evaluations mentioned above, the wrestlers have also completed a personal information form. Questions such as age, sports age, becoming a national athlete, number of training sessions per week, and the weight they wrestled with were included in the personal information form. This form was filled out by wrestlers using the face-to-face interview technique.

Statistical analysis

After the data collection process was completed in the research, the power analysis for the current sample was made with the G*Power program (version 3.1.9.4, Franz Faul, Universität Kiel, Germany). Based on the one sample t-test, the power of the study was determined as 85% according to the parameters of 0.05 error level, 0.5 effect size, and sample number 38. For the power analysis, the primary outcome was determined as the Q angle. The SPSS program (version 25, SPSS Inc., Chicago, IL, USA) was used for the statistical analysis of the data in the present study. Descriptive statistical analyses were performed. The distribution of the data was tested in order to determine whether the tests to be used in the comparisons are parametric or non-parametric. Shapiro-Wilk test was performed to determine the normality distribution. The normality distribution was also checked with kurtosis-skewness values. Since the data were distributed normally, parametric tests were used. A dependent sample t-test was used for comparisons. Pearson correlation analysis was performed to determine the relationship between the variables. Correlation can be evaluated as follows: If r <0.2 very weak correlation or no correlation, 0.2-0.4 weak correlation, 0.4-0.6 moderate correlation,

0.6-0.8 high correlation, 0.8> very high correlation (19). The alpha value was accepted as 0.05 in all statistical analyses.

RESULTS

38 national athletes whose branch is wrestling were included in the present study. The mean and standard deviation values of some features of the wrestlers are given in Table 1.

The mean and standard deviation values of the Q angles of the wrestlers measured at the standing and supine position are given in Table 2. The comparison findings between the right and left extremities are also given in Table 2. It was found that there was a statistically significant difference between the right and left extremities for the measurement at the standing position (p=0.017). It was found that there was no statistically significant difference between the right and left extremities for the measurement at the supine position (p=0.760) (Table 2).

The flexibility evaluation findings of the wrestlers are shown in Table 3.

The distribution of wrestlers according to their TFL shortness is shown in Table 4.

Correlation findings regarding the relationship between Q angle with m. quadriceps femoris and hip flexors flexibility, and between Q angle with TFL shortness are given in Table 5. A statistically significant positive correlation was found between the left Q angle at the standing measurement and the flexibility of the left m. quadriceps femoris and hip flexors (r=0.394; p=0.014). A statistically significant positive correlation was found between the left Q angle at the standing measurement and

Table 1. The Mean and Standard Deviation Values of Some Features of Wrestlers

Some Features	Mean±SD
Age (year)	18.00±2.28
Sports age (year)	7.61±2.40
Number of workouts per week (hour)	13.21±0.99
Wrestling weight (kg)	77.39±14.63

SD: Standard Deviation, kg: kilogram

Table 2. The Comparisons of Wrestlers' Q Angle Values between Right and Left Extremities

Position and Side	Q Angle Mean±SD	t	p
Q angle at standing position (right extremity)	12.14±1.71	2.488	**0.017***
Q angle at standing position (left extremity)	11.46±1.81		
Q angle at supine position (right extremity)	11.89±1.80	0.308	0.760
Q angle at supine position (left extremity)	11.33±1.69		

SD:: Standard Deviation, t: dependent sample t-test, p: statistical significance level, *p<0.05

Table 3. The Flexibility Values of Wrestlers

Flexibility	Mean±SD
Sit-reach flexibility test (cm)	37.58±4.48
The flexibility of m. quadriceps femoris and hip flexors (right extremity) (cm)	24.43±3.14
The flexibility of m. quadriceps femoris and hip flexors (left extremity) (cm)	23.63±3.14

SD: Standard Deviation, cm: centimeter

Table 4. The Distribution of Wrestlers by TFL Shortness

TFL Shortness	n (%)
The ones with shortness (right extremity)	7 (18.42%)
The ones with shortness (left extremity)	10 (26.32%)

TFL: M. Tensor Fasciae Latae

Table 5. The Relationship between Q Angle with M. Quadriceps Femoris and Hip Flexors Flexibility and TFL Shortness

Variables		Flexibility of the left m. quadriceps femoris and hip flexors	Shortness of the right TFL	Shortness of the left TFL
Q angle (left extremity, at the standing)	**r**	0.394	0.332	0.363
	p	**0.014***	**0.042***	**0.025***

TFL: M. Tensor Fasciae Latae, pearson correlation analysis, r: correlation coefficient, p: statistical significance level, *p<0.05

the shortness of the right TFL (r=0.332; p=0.042). A statistically significant positive correlation was found between the left Q angle at the standing measurement and the shortness of the left TFL (r=0.363; p=0.025) (Table 5).

DISCUSSION

The present study aimed to determine the Q angle, evaluate the flexibility, and muscle shortness of the lower extremities in wrestlers, and examine the relationship between the evaluated parameters. The present study findings indicated that Q angle values in wrestlers may differ according to right extremity, left extremity, and measurement positions. In addition, it has been observed that the Q angle may be related to lower extremity flexibility and muscle shortness.

For the standing measurement, the mean value of the Q angle on the right extremity was 12.14±1.71° and the mean value of the Q angle on the left extremity was 11.46±1.81°. For the supine position, the mean value of the Q angle on the right extremity was 11.89±1.80° and the mean value of the Q angle on the left extremity was 11.33±1.69°. It was determined that there was a statistically significant difference between the right and left extremities in the measurement made while standing. It was found that there was no statistically significant difference between the right and left extremities for the measurement at the supine position.

In the study of Tural and Imamoğlu, the average values of the Q angle in male athletes were found to be 14.15° at the standing position and 13.10° at the supine position (20). The results of Tural and İmamoğlu's study and the present study suggest that Q angle values may be different for measurements made at standing and supine positions in athletes. Şen et al. conducted a study on athletes including wrestlers. The right Q angle values of the athletes in the standing and supine positions were higher than the left Q angle values. The Q angle in the standing position was higher than the Q angle in the supine position (21). The results of Şen et al.'s study are similar to the results of the present study. It is thought that it is important to evaluate the Q angle in athletes at different positions such as standing and supine positions. Norasteh and Bayati reported that experienced freestyle wrestlers had a higher degree of Q angle in the dominant leg (22). Akınoğlu et al. found that the right-side passive Q angles of the athletes were lower than the left side, and the active Q angles of both sides were similar to each other (1). This result obtained from the study of Akınoğlu et al. differs from the results of the present study. In the study of Erdağı, the Q angle was evaluated while individuals were at the supine position and m. quadriceps femoris was in a passive position. It was determined that the left quadriceps femoris angle values of weightlifters were greater than the right quadriceps femoris angle values (23). This result of Erdağı's study does not show similarity in terms of the result that there is no significant difference between the right Q angle and the left Q angle in wrestlers according to the values of the measurement made at the

supine position in the present study. Bayraktar et al. carried out a study on a total of 1239 people, including 474 football players and 765 sedentary boys between the ages of 9-19. Right and left Q angle values were not statistically significant in both groups (24). Bayraktar et al.'s study can be evaluated as parallel to the results of the present study for the supine position. Evaluation of the Q angle for both lower extremities in athletes may be important for lower extremity biomechanics. It should not be ignored that the Q angle values for the right and left lower extremities can be transferred according to the measurement positions. It is thought that specifying the Q angle values in wrestlers according to the measurement positions and separately according to both lower extremities will gain the perspective in terms of biomechanics.

In the present study, the flexibility of the wrestlers was found to be 37.58±4.48 cm according to the results of the sit-reach flexibility test. Flexibility values of m. quadriceps femoris and hip flexors were found 24.43±3.14 cm for the right side and 23.63±3.14 cm for the left side. In addition, it was determined in the present study that there were 7(18.42%) wrestlers with TFL shortness on the right side and 10 (26.32%) wrestlers with TFL shortness on the left side.

In the study of Kaya et al., a total of 40 wrestlers, 20 freestyle and 20 Greco-roman participated. In the study, flexibility (sit-reach) values were measured as 37.45±4.51 cm for the national freestyle wrestling team and as 32.70±6.94 cm for the Greco-roman wrestling national team (25). Aydos and Koç evaluated flexibility with the sit-reach flexibility test in their study and found the flexibility of 17–18-year-old Greco-roman youth national team wrestlers as 31.30±6.04 cm (26). Campos et al. evaluated the flexibility of Marajoara wrestlers with the sit-reach flexibility test and the flexibility values were found 33.25±8.40 cm (27). When the studies in the literature and the present study are examined, it is thought that the structural and biomechanical characteristics of the lower extremities, the scope of their training, age range, wrestling style are effective in the flexibility results of wrestlers.

According to the correlation findings in the present study, a positive, weak correlation was found between the left Q angle at the standing measurement and the flexibility of the left m. quadriceps femoris and hip flexors. In other words, as the Q angle values increased, the flexibility of the m. quadriceps femoris and hip flexors also increased. A positive, weak correlation was found between the left Q angle at the standing measurement and the shortness of the right TFL. A positive, weak correlation was found between the left Q angle at the standing position and the shortness of the left TFL. It has been found that muscle flexibility and shortness which is an important parameter for athletes are related to the Q angle. This result suggests that the conditions of the joints and soft tissues may be affected by the Q angle.

In the study of Eliöz et al., it was found that there was a negative and weak relationship between the Q angle and the length of the femur (14). Hazar et al. conducted a study on 125 athletes who regularly train and participate in sports competitions. In their study, it was determined that those with high Q angle values had a decrease in leg strength and balance values (28). In the study of Akınoğlu et al., the relationship between the Q angle and quadriceps muscle strength of all athletes was examined. In their study, it was determined that there was a statistically significant negative and very weak relationship between the passive Q angle on the right side and the eccentric strength of the knee extensors at angular velocities of 60º/sec and 180º/sec (1). Minoonejad et al. found in their study that there was a significant difference in Q angle between premier league futsal players with and without hamstring tightness. In Minoonejad et al.'s study, the Q angle was found to be significantly higher in futsal players with hamstring tightness when compared to futsal players without hamstring tightness (29). Q angle may be related to parameters such as flexibility, muscle shortness, muscle strength, balance, and anthropometric characteristics. In this direction, it is important to examine the Q angle in athletes together with some parameters and anthropometric features.

The values of the Q angle may differ in athletes. Some factors are effective in the difference of the Q angle. Among the factors that can cause change are bone structures, soft tissues, right or left ex-

tremity, age, the strength of the m. quadriceps femoris, flexibility, gender, lower extremity length, the length of the femur, the width of the pelvis, an increased femoral anteversion angle, tibial rotation, varus-valgus deformities, engaging in sports, sports branch, and daily living habits. In addition, the value of the Q angle may differ depending on the measuring positions (standing position or supine position). Since it is important in the evaluation of knee functions in terms of participation in sports, it may be useful to evaluate the Q angle not only at the supine but also standing position. There may be a relationship between the Q angle and some factors such as flexibility, muscle shortness, muscle strength, balance, and anthropometric characteristics among athletes. It is important to evaluate the Q angle together with the parameters that are thought to be related. It is thought that the Q angle value and the parameters that are thought to be related should not be generalized and should be interpreted specifically for the age, branch, gender, and sports age of the athletes. The contributions of the results of the present study to future scientific studies and clinical applications may be in the scope of using the values obtained from the Q angle as reference values, knowing the factors that will affect the Q angle, assessing malalignment in the lower extremity, and providing predictions of risk factors for sports injuries. Conducting studies that examine the Q angle and the factors affecting the Q angle in athletes according to their characteristics will contribute to the field of sports sciences.

The present study has some limitations. Only male wrestlers were included, but females were excluded as it was thought that there would not be enough female participants to make comparisons between the genders. In addition, wrestlers were not categorized according to their wrestling style.

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Informed Consent: Written informed consent was obtained from the individuals participating in the study and their parents.

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OBSTETRİK BRAKİYAL PLEKSUS YARALANMASI OLAN ÇOCUKLARDA ÖLÇÜLEN POSTURAL SALINIM TİPİK GELİŞİM GÖSTEREN ÇOCUKLARDAN FARKLI MIDIR?

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Obstetrik Brakiyal Pleksus Yaralanması (OBPY) olan çocuklarda yaralanma sonucu üst ekstremitede gelişen asimetrik kullanım postural kontrol gelişimini ve postural salınım değerlerini etkilemektedir. Bu çalışmada OBPY'li çocuklarda postural salınım değerlerindeki değişimi incelemek sağlıklı kontrol olgularıyla karşılaştırmak amaçlandı.

Yöntem: Çalışmaya, yaşları ortalama 6,35±1,40 yıl olan OBPY tanılı 55 çocuk ve yaşları ortalama 6,09±0,76 yıl olan 45 tipik gelişim gösteren sağlıklı olgu dahil edildi. Her iki grubun demografik bilgileri ve OBPY'li çocukların ayrıca Narakas Sınıflandırma Sistemine göre yaralanma dereceleri kaydedildi. Çalışmada grupların postural kontrol parametrelerine ait postural salınım değerleri Balance Check Screener kuvvet platformu (Model BP5050; Bertec, Columbus, OH, ABD) ile elde edildi.

Sonuçlar: Yapılan istatistiksel analizde gruplar arası demografik özellikler benzer bulundu (p>0,05). OBPY olgularında, tipik gelişim gösteren sağlıklı olgulara göre, anterio-posterior salınım değerlerinin istatistiksel olarak anlamlı düzeyde artmış olduğu saptandı (p<0,05). OBPY olgularında gözler kapalı medio-lateral yönde salınım miktarının daha yüksek olduğu ve farkın istatistiksel olarak anlamlı olduğu belirlendi (p<0,05). Sert ve yumuşak zeminde gözler açık olarak elde edilen medio-lateral salınım değerleri açısından gruplar arası karşılaştırma sonuçları arasında fark olmadığı görüldü (p>0,05).

Tartışma: Çalışmamızın sonuçları, OBPY'li çocukların sağlıklı yaşıtları ile karşılaştırıldığında, postural salınımlarının arttığını göstermiştir. OBPY'li çocuklarda yaralanma sonucu üst ekstremitelerin asimetrik gelişimi ve buna bağlı olarak kompansasyonların açığa çıkmasının, postural kontrol gelişimini de olumsuz etkilediği düşünülmektedir. Bu kapsamda, OBPY'li bireylerde sadece etkilenen ekstremiteyi içeren tedavi yaklaşımları yerine, bütüncül bir bakış açısıyla gövde asimetrisi, postural kontrol ve denge kayıplarının değerlendirilmesi ve bunlara yönelik tedavi stratejilerinin en erken dönemde oluşturularak tedavi programlarına dahil edilmesi önerilmektedir.

Anahtar Kelimeler: Obstetrik Brakiyal Pleksus Yaralanması, Postural Kontrol, Postural Salınım

IS POSTURAL SWAY MEASURED IN CHILDREN WITH OBSTETRIC BRACHIAL PLEXUS INJURY DIFFERENT FROM TYPICALLY DEVELOPING CHILDREN?

ORIGINAL ARTICLE

ABSTRACT

Purpose: Asymmetric use of the upper extremity as a result of injury in children with Obstetric Brachial Plexus Injury (OBPI) affects the development of postural control and postural sway values. The objective of the present study was to investigate the changes in postural sway values in children with OBPI and to compare them with healthy controls.

Methods: Fifty-five children with OBPI with a mean age of 6.35±1.40 years and 45 healthy subjects with typical development, with a mean age of 6.09±0.76 years were included in the study. Demographic information of both groups and the degree of injury of children with OBPI according to the Narakas Classification System were recorded. The postural sway values of the postural control parameters of the groups were obtained with the Balance Check Screener force platform (Model BP5050; Bertec, Columbus, OH, USA).

Results: In the statistical analysis, demographic characteristics between the groups were found to be similar (p>0.05). The statistics related to anteroposterior oscillation values were found to be significantly increased in patients with OBPI compared to healthy patients with typical development (p<0.05). It was observed that the amount of oscillation in the medio-lateral direction was higher in OBPY cases with eyes closed and the difference was statistically significant (p<0.05). No difference was observed between the results of the groups in terms of medio-lateral oscillation values obtained with eyes open on hard and soft ground (p>0.05).

Conclusion: The results of our study showed that the postural sway of children with OBPI increased when compared to their healthy peers. It is assumed that the asymmetric development of the upper extremities and the emergence of compensations as a result of injury in children with OBPI negatively affect the development of postural control. In this context, it is recommended to evaluate the effects of trunk asymmetry, postural control and balance losses from a holistic perspective, instead of treatment approaches involving only the affected extremity in individuals with OBPI, and to create treatment strategies for them in the earliest period and include them in treatment programs.

Keywords: Obstetric Brachial Plexus Injury, Postural Control, Postural Sway

GİRİŞ

Obstetrik brakiyal pleksus yaralanması (OBPY), doğum sırasında brakiyal pleksusun travması sonucu kas, eklem ve kemik yapılarda geçici veya kalıcı sekonder deformitelere neden olan klinik bir tablodur (1) . Dünyada rapor edilen OBPY insidansı, 1000 canlı doğumda 0,4 ile 5,1 arasında değişirken ülkemizde 0,9/1000 canlı doğum olarak bildirilmektedir (2-4). OBPY'de bozulan konnektif dokular ve etkilenen ekstremitenin kullanımının azalması sebebiyle kas, eklem ve kemiklerde büyüme ile ilgili yetersizlikler ve buna bağlı olarak ekstremite eşitsizlikleri gelişmektedir (5).

Omuz ve dirsek deformiteleri, eklem limitasyonları, postural bozukluklar, skapular diskinezi ve vücudun ağırlık merkezindeki değişim sonucunda gövde kontrolü ve dengede oluşan sorunlar, OBPY'li çocuklarda fonksiyonel problemlere yol açabilmektedir (6). Souza L. ve diğ; OBPY sonucunda gelişen üst ekstremite sensorimotor eksikliğinin dengeye olan etkisini araştırdıkları çalışmalarında, statik ve dinamik denge ölçümlerinde kontrol ve hasta grubu arasında OBPY'li bireylerin daha düşük puan aldığını bildirmektedirler (7). Ayrıca literatürde OBPY'li çocuklarda, etkilenen ve etkilenmeyen kollar arasındaki olası üst ekstremite kuvveti ve hareket açıklığı asimetrisi veya kaba motor becerilerde daha az uygulama sonucunda vücut koordinasyonu ve dengesinin etkilenebileceği bildirilmektedir (6).

Konservatif ve cerrahi tedavi yaklaşımları ile fonksiyonel gelişime katkı sağlanmakla birlikte, bu çocukların yaklaşık %20'sinde kalıcı deformiteler görülmektedir (8). OBPY'nin, etkilenmiş ekstremitede yarattığı sorunlara ek olarak vücudun diğer ekstremitelerini, gövdeyi ve omurgayı etkileyen sorunlar konusundaki çalışmalar kısıtlı olmakla birlikte uzun dönemde gövde asimetrisi, postural kontrol ve denge kayıplarının gelişebileceği bildirilmektedir (9). Postural kontrolün gelişimi yaşamın ilk yılında baş kontrolü ile başlar ve kaudal yönde ilerler. Yüzüstünde önkolların pozisyonu omuz kuşağının, gövdenin, pelvisin ve bacakların postural gelişimini kolaylaştırır (9). Her iki kolda bu erken simetrik ağırlık aktarımı olmadan, oturma/ayakta duruşta postural kontrolün gelişimi etkilenecektir. Postural kontrol eksiklikleri 4 aylıkken belirgin hale gelebilir (9). OBPY'li bireylerde etkilenen kolun asimetrik kullanımı, simetrik postural kontrolün gelişimini sınırlayan kompansasyonlara yol açabilmektedir (9).

Literatürde tek taraflı üst ekstremite etkileniminin vücut kütle merkezinde (Center of Mass- CoM) yer değişikliği yaratarak, postural stabilite parametrelerinden biri olan postural salınım değişikliklerine yol açtığı gösterilmiştir (9). Bununla birlikte özellikle OBPY'li bireylerde postural salınımı, değişikliklerini ve dengeye etkilerini araştıran sınırlı sayıdaki çalışmada da, dengeyi etkileyen parametrelerin statik ve dinamik koşullarda objektif olarak ortaya konmasında kısıtlılıklar görülmektedir (6, 9). Çalışmamızda, bu kısıtlılıkları göz önünde bulundurarak, vertikal kuvvet ve CoM'daki anlık değişimleri objektif olarak ölçmeyi esas alan ve ayakta dururken dengenin korunabilme becerisini değerlendirmek amacıyla tasarlanmış objektif ve nicel veri sunan bir değerlendirme yöntemi kullanıldı. Bu doğrultuda çalışmamızda OBPY'li çocuklarda postural salınım benzer yaştaki sağlıklı olgularla karşılaştırarak farklılıkların ortaya konulması amaçlandı.

YÖNTEM

Bireyler

Çalışmamıza 4-10 yaş aralığında, cerrahi geçirmemiş ve ek bir hastalık ya da patolojisi bulunmayan, ayakta durma ve yürüme motor seviyelerine sahip, OBPY tanısı almış, Narakas Sınıflandırmasına göre Tip1-Tip 4 arasındaki olgular dâhil edildi. Kliniğimize başvuran dahil edilme kriterlerini karşılayan 55 olgu, çalışma grubu olarak (G-OBPY) belirlendi. Son altı ay içinde cerrahi operasyon geçiren olgular çalışmaya dahil edilmedi. Kliniğimize farklı amaçlar doğrultusunda başvuru yapmış 4-10 yaş grubunda çocuğu olan, ailelerin, çalışmaya dahil olmayı kabul edenler arasından tipik gelişim gösteren 45 çocuk ise kontrol grubu (G-TGG) olarak belirlendi.

Çalışma öncesi çalışma grubu ve kontrol grubu olgularının ebeveynlerinden aydınlatılmış onamları ve çalışma için gönüllülük rızaları alındı. Çalışma için, ilgili kurumun Girişimsel Olmayan Klinik Araştırmalar Etik Kurulundan 24.10.2018 tarih ve 18/1001-39 karar numarası ile onay alındı. Çalışmaya dahil edilecek vaka sayısının belirlenmesi için güç analizi çalışması

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nün hesaplanmasında Gpower 3.1 programı kullanılarak %80 güçle 0.05 alfa hata katsayısı ile her grup için en az 37 birey gerektiği bulundu. Çalışma için vakalar Mart 2019- Ağustos 2019 tarihleri arasında Hacettepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Fakültesi El Cerrahisi Rehabilitasyon Ünitesi'ne başvuran OBPY'li olgulardan ve hasta yakınlarından sağlandı.

Değerlendirme

Her iki gruptaki olguların yaş, cinsiyet, vücut ağırlığı ve boy uzunluğu verileri kaydedildi. G-OBPY olgularında demografik bilgilere ek olarak etkilenen ekstremite ve Narakas Sınıflandırma Sistemine göre brakiyal pleksus tutulum derecesi kaydedildi. Bu sınıflandırma sistemine göre, C5–C6 düzeyindeki yaralanmalar Tip 1; C5–C6–C7 yaralanmalar Tip 2a ve 2b; C5–C6–C7–C7–C8–T1düzeyindeki yaralanmalar Tip 3 ve C5–C6–C7–C8–C8–T1 düzeyindeki yaralanmalara Horner Sendromunun eşlik ettiği bireyler Tip 4 olarak gruplandırılmaktadır (10).

Bertec denge testi olarak adlandırılan değerlendirme yöntemlerinden biri, klinik uygulamada postural stabiliteyi araştırmak için yaygın olarak kullanılmaktadır. Ayakta dik duruş sırasında dengenin sürdürülebilmesi ve korunması için referans niteliğindeki Postural Salınım (Postural Sway-PS) verileri, Balance Check Screener kuvvet platformu (Model BP5050; Bertec, Columbus, OH, ABD) ile elde edildi. Değerlendirme öncesi her iki gruptaki olgular ve aileleri, değerlendirme prosedürü konusunda bilgilendirildi. PS değerleri, sert zeminde gözler açık (SZ-GA), sert zeminde gözler kapalı (SZ-GK), yumuşak zeminde gözler açık (YZ-GA) ve yumuşak zeminde gözler kapalı (YZ-GK) olacak şekilde 4 farklı koşulda değerlendirildi. Tüm bireylerden bu 4 ölçüm için 10 sn. cihaz üstünde belirlenen alanlara ayakta rahat pozisyonda basarak dik durmaları istendi. Bu sırada olguların, kuvvet platformu üzerindeki basınç merkezinin (Center of Pressure- CoP) anterior-posterior (AP) ve medio-lateral (ML) yönlerindeki yer değiştirme miktarları cm cinsinden elde edilerek kaydedildi (11).

İstatistiksel Analiz

İstatistiksel değerlendirme, IBM SPSS 27,0 paket programı kullanılarak yapıldı (SPSS Inc., Chicago, IL, USA). Normal dağılıma uygunluk, Kolmogorow Smirnow Testi ile değerlendirildi. Çalışma grubu ve kontrol grubunun karşılaştırmaları normal dağılıma sahip olmayan sayısal değişkenler için Mann Whitney U Testi ile değerlendirildi. İstatistiksel anlamlılık değeri $p<0,05$ olarak kabul edildi.

SONUÇLAR

Bu çalışmada, G-OBPY grubu için yaşları ortalama 6,35±1,40 yıl olan 55 obstetrik brakiyal pleksus tanılı ve G-TGG grubu için yaşları ortalama 6,09±0,76 yıl olan 45 tipik gelişim gösteren olgu değerlendirildi. Grupların demografik özellikler açısından benzer olduğu görüldü ($p>0,05$). Çalışmada değerlendirilen gruplara ait demografik özellikler Tablo 1'de gösterildi.

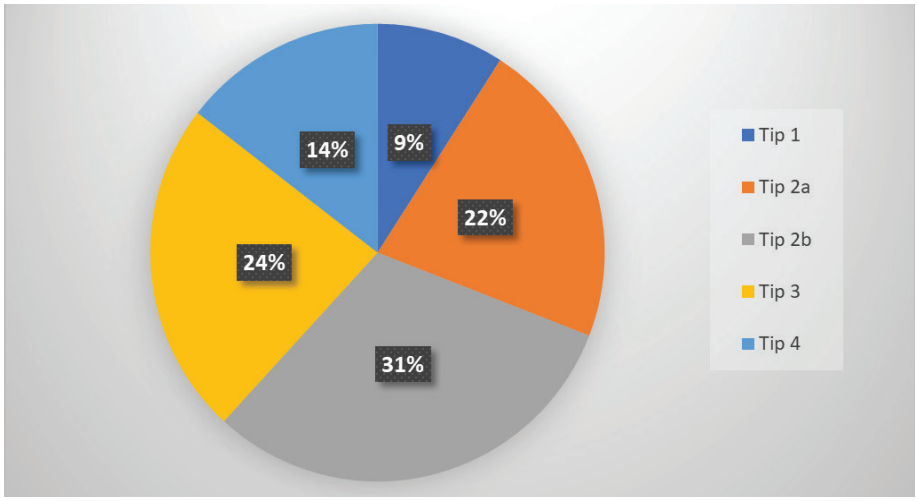
G-OBPY olgularının 37'sinin sağ ve 18 inin sol ekstremitelerinin etkilendiği belirlendi. Olguların OBPY dereceleri Narakas Sınıflandırma sistemine göre 5 kişi (%9) Tip 1 12 kişi (%22) Tip 2a, 17 kişi (%31) Tip 2b, 13 kişi (%24) Tip 3, ve 8 kişi (%14) Tip 4 grubunda yer aldığı görüldü (Grafik 1).

Olguların sert ve yumuşak zeminlerde elde edilen AP ve ML yönlerindeki PS değerlerinin gruplar arası karşılaştırma sonuçlarına göre; G-OBPY olgularında, G-TGG olgularına göre, sert ve yumuşak zeminde, hem gözler açık hem de kapalı durumlar için AP salınım miktarlarının artmış olduğu saptandı ($p<0,05$). Sert ve yumuşak zeminin ikisinde

Tablo 1. Grupların Demografik Özelliklerine İlişkin Aritmetik Ortalama ve Standart Sapma Değerleri İle Gruplar Arası Karşılaştırma Sonuçları.

	G-OBPY (n=55)	G-TGG (n=45)	p
	X ± SS	X ± SS	
Yaş (yıl)	6,35±1,40	6,09±0,76	0,65
Boy Uzunluğu (cm)	109,4±15,73	112,84±7,9	0,185
Vücut Ağırlığı (kg)	22,38±11,38	23,42±5,18	0,569

G-OBPY: *Obstetrik brakiyal pleksus yaralanması grubu;* ***G-TGG:*** *Tipik gelişim gösteren olgular grubu.*



Grafik 1. G-OBPY'nin Narakas Sınıflandırılmasına Göre Dağılımları

de gözler kapalı olarak yapılan değerlendirmede G-OBPY olgularında ML yönde salınım miktarının daha yüksek olduğu ve farkın istatistiksel olarak anlamlı olduğu belirlendi (p<0,05). Sert ve yumuşak zeminde gözler açık olarak elde edilen LL PS değerleri açısından grupları arası karşılaştırma sonuçları arasında fark olmadığı görüldü (p>0,05) (Tablo 2).

TARTIŞMA

OBPY'li çocuklarda ayakta duruşta postural salınım değişikliklerini incelemek ve benzer yaştaki tipik gelişim gösteren olgularda karşılaştırmak amacıyla yapılan çalışmamızın sonuçları, OBPY'li çocukların postural salınımlarının sağlıklı yaşıtlarına göre arttığını ortaya koymaktadır.

OBPY'de çocuğun etkilenmiş ekstremitesini kullanmaması veya kullanımının azalması, postural kontrolün azalmasına neden olmaktadır (9). Postural kontrol sistemi, beyin ve kas-iskelet sistemi arasında etkileşimli geribildirim mekanizması ile kontrol edilmektedir (12) . Ekstremite ve gövde üzerinde bulunan ilgili kas grupları bu geri bildirim devrelerini kullanarak, görsel, vestibular ve somatosensoriyel sistemlerin afferent ve/veya efferent integresyonuyla birlikte bireyin yer çekim merkezine karşı ayakta durmasını sağlamaktadır (13). OBPY'de, omuz çevresi kas, tendon ve konnektif doku etkileniminin, eklem içi etkilenim ile birlikte olduğu düşünüldüğünde, duyusal girdilerin kalitesinin etkilenmesi sebebiyle denge ve postural kontrolün etkilenmesi de kaçınılmazdır. Ridgway ve diğ. yaptıkları çalışmada, postural kontrolün neonatal dö-

Tablo 2. Grupların Anterior-Posterior ve Medio-Lateral Salınım Miktarlarının Ortalama ve Standart Sapma Değerleri ve Gruplar Arası Karşılaştırma Sonuçları

Yön	Koşul X ± SS		G-OBPY (n=55) X ± SS	G-TGG (n=45)	p
AP- PS	Sert Zemin (cm)	GA	0,55	0,690,32	**0,008***
		GK	1,050,44	0,800,34	**0,003***
	Yumuşak Zemin (cm)	GA	1,160,60	0,900,35	**0,023***
		GK	11,460,60	0,980,29	**<0,001***
ML- PS	Sert Zemin (cm)	GA	0,840,73	0,610,44	0,102
		GK	00,700,61	0,420,21	**0,001***
	Yumuşak Zemin (cm)	GA	1,201,03	0,850,51	0,064
		GK	1,231,01	0,740,37	**0,002***

***: P<0,05; G-OBPY:** Obstetrik brakiyal pleksus yaralanması grubu; **G-TGG:** Tipik gelişim gösteren olgular grubu; AP: Antero-Posterior; ML: Medio-Lateral; PS: Postural Salınım; GA: Gözler Açık; GK: Gözler Kapalı.*

nemde baş kontrolü ile başlayıp supin pozisyonun omuz ve çevresi, gövde, pelvis ve alt ekstremitelerdeki postural gelişimi fasilite ettiği, fakat brakiyal pleksus yaralanması sonucu üst ekstremitede gelişen deformitelerin simetrik vücut gelişimini engelleyerek postural kontrol ve motor gelişiminin atipik ilerlemesine sebep olduğunu bildirmektedirler (9). Değerlendirmelerimiz sırasında gözler açık ve kapalı uygulamalar ile somatosensoriyal girdilerde oluşturulan farklılaştırma doğrultusunda postural kontrolün devam ettirilmesinde OBPY'li çocuklarda sağlıklı çocuklara göre artmış olan postural salınım değerleri, literatürde bildirilen etkilenen postural kontrol mekanizmalarını desteklemektedir. Görsel bilginin özellikle başka bir duyu sistemi bozukluğu durumunda, postural stabilitenin korunmasına yardımcı olduğunu vurgulayan çalışmalar da bulunmaktadır (14). Çalışmalar ayrıca, görmenin ayak bileği kaslarının oluşturduğu tork varyansını azalttığını ve özellikle yumuşak zemin ve yüzeylerin neden olduğu dengesizlikleri tespit etme ve önleme fırsatı sağladığını göstermiştir (15). Çalışmamız kapsamında mediolateral salınımda gözler açık ve kapalı durumlar arasındaki iki grup karşılaştırmasında sonucunda elde ettiğimiz veriler bu açıdan literatürdeki bulgularla uyumluydu.

Postural kontrolün değerlendirildiği bazı çalışmalarda, ayakta durma ve yürüme performansı sırasında üst ekstremitelerin postural stabilitedeki rolüne odaklanılmıştır (16). Koruyucu ekstansiyon veya otamatik kol hareketleri, postural kontrolü sürdürmek, yeniden kazanmak veya düşme sırasında olası yaralanmaları önlemek için açığa çıkarılan otomatik reaksiyonlardır (17). Galia ve diğ., OBPY'li çocuklarda etkilenen ekstremitedeki azalan otomatik kol hareketlerinin sebebinin santral komponente ilişkin olabileceğini; bu durumun, doğum sırasında beyin ve etkilenen kol arasındaki motor ve duyusal bağlantının bozulmasına, kas zayıflığına ve duyusal girdilerin azalmasına neden olması ve takiben otomatik motor kontrol mekanizmalarının oluşumunun engellenmesi ile açıklanacağını bildirmişlerdir (18). Hill ve diğ., üst ekstemite hareketleri kısıtlanmış çocuklarda yaptıkları çalışmada, çeşitli denge testlerinde çocukların denge performanslarının düştüğünü bildirmiştir (19). Wdowski ve diğ.nin çeşitli yaşlarda çocukları dahil ettikleri çalışmalarında statik, dinamik ve proaktif denge performansının kol hareketlerinden etkilendiğini bildirmişlerdir (20). Boström ve diğ., daraltılmış bir yüzeyde yürümek gibi denge görevinin daha zor hale getirilmesiyle üst ekstremite hareketlerinin dengenin sürdürülmesine katkısının arttığını, ancak alt vücut hareketlerinin sabit kaldığını göstermiştir (21). Bu bulgular, tipik gelişim gösteren çocuklar veya genç yetişkinlerin postural görevleri yerine getirirken, üst ekstremite stratejilerinin denge ve postür kontrolüne açık bir şekilde katkıda bulunduğunu göstermektedir. Çalışmamız sonucunda, OBPY'li çocuklardaki postural kontrolün etkilenimini gösteren postural salınım değerlerinin artması önceki çalışmaların bulgularıyla uyumluluk göstererek üst ekstremitenin postural stabilitedeki rolü açısından literatürü destekleyici bilgi sunmaktadır.

Çalışmamızda, OBPY'li bireylerin, anterior posterior yönde gözler açık ve kapalı pozisyonda postural salınım değerlerinde tipik gelişim gösteren çocuklara göre anlamlı derecede artış gösterdiği bulunmuştur. Bununla birlikte OBPY'li çocuklarda mediolateral postural salınım değerlerinde gözler açık durumda sağlıklı kontrol grubuna göre anlamlı fark olmadığı ancak gözler kapalı iken salınım miktarında artış olduğu bulunmuştur. Bingham ve diğ. yaptıkları çalışmada mediolateral stabiliteyi korumanın anteroposterior stabiliteden daha kolay olduğu vurgulamışlardır (22). Araştırmacılar ayakta duruş pozisyonundaki artmış stabilite algısının iki mekanizma ile gerçekleştiğini vurgulamaktadırlar. Bunlardan ilki bidepal pozisyonun getirdiği biyomekanik avantajların artması ve ikincisi ise ayakta iken dengeyi kontrol eden nöral mekanizmaların daha etkin çalışmasıdır (22). Bu doğrultuda anterior-posterior salınıma karşı mediolateral salınım değerlerinin mevcut sonuçları Bingham ve diğ.nin bulguları ile uyumludur. Öte yandan, mediolateral stabilite düşme riskini öngören ve bunu engelleyen bir faktördür (23). Bu nedenle, mediolateral planının biyomekanik avantajı sayesinde postural salınımı stabilize etmek için anteroposterior planına göre daha üstün performans sağlanabilir.

Çalışmaya dahil edilen OBPY'li bireylerin homojen olarak aynı taraf ekstremite tutulumu göstermemesi ve farklı sınıflandırmaya sahip olan gruplardan oluşması değerlendirmelerde daha yüksek standart sapmalara yol açarak olabilir. Bu da bazı parametreler için farklılıkları tespit etmeyi zorlaş-

tırmış olabilir. Bu çalışmanın diğer bir limitasyonu da OBPY'li bireylerin günlük yaşam aktivitelerinde karşılaştıkları zorluklar ve denge kayıplarının kaydedilmemiş olmasıdır. Çalışmamızdan elde edilen bilgiler, gelecekteki çalışmalarda grup ve örneklem büyüklüğünü belirlemek için kullanılabilir.

Çalışmamız sonucunda OBPY sonrası sadece etkilenmiş ekstremitede kas iskelet sistemi problemlerinin görülmediği bununla birlikte yaralanmaya sekonder olarak gelişen diğer vücut yapı ve fonksiyonlarındaki etkilenimler arasında denge ve postural değişikliklerin de olduğu gösterilmiştir. OBPY'li bireylerde artan postural salınım değerleri nedeniyle, bu bireylerin tedavi planlarının yönetilmesinde, denge ve postural kontrol değişikliklerinin değerlendirilmesi ve geliştirilmesine yönelik yaklaşımların eklenmesinin önemi vurgulanmaktadır.

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Yazar Katkıları: Fikir/kavram: TF, AM, ST; Tasarım: TF, ST; Denetleme/ danışmanlık: ST, Kaynaklar ve fon sağlama: TF, ST; Materyaller: ST; Veri toplama ve/ veya işleme: ART; Analiz ve/ veya yorumlama: ART; Literatür taraması ART; Makale yazımı: ART, AM, TF, ST; Eleştirel inceleme: AM, TF, ST.

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THE RELATIONSHIP BETWEEN BURNOUT LEVEL AND HOPELESSNESS, PERCEIVED SOCIAL SUPPORT AND MENTAL WELL-BEING IN PHYSIOTHERAPY AND REHABILITATION SENIOR UNDERGRADUATE STUDENTS

ORIGINAL ARTICLE

ABSTRACT

Purpose: This study aimed to investigate the relationship between burnout level and hopelessness, perceived social support, and mental well-being among physiotherapy and rehabilitation senior undergraduate students.

Methods: Three hundred sixty-nine physiotherapy and rehabilitation senior undergraduate students (195 female, mean age: 22.81±3.72 years) were included in the present study. Data were collected using the online survey with a combination of the Maslach Burnout Inventory-Student Survey (MBI-SS), Beck Hopelessness Scale (BHS), Multidimensional Scale of Perceived Social Support (MSPSS), and Warwick-Edinburgh Mental Well-Being Scale (WEMWBS).

Results: There are no gender differences in burnout level and hopelessness level, perceived social support, mental well-being, and sociodemographic characteristics (p>0.05). There were significant relationships between the emotional exhaustion and cynicism subscales of MBI-SS and BHS, MSPSS, and WEMWBS (p<0.05) while the efficacy subscale of MBI-SS correlated with WEMWBS (rho=0.526, p=0.017). In addition, BHS, MSPSS, and WEMWBS were significant predictors in the emotional exhaustion model describing 19% of the adjusted R^2, and in the cynicism model describing 9% of the adjusted R^2.

Conclusion: This study found that burnout level has a relationship between hopelessness, perceived social support, and mental well-being in physiotherapy and rehabilitation senior undergraduate students. Hopelessness, perceived social support, and mental well-being were significant predictors of the emotional exhaustion and cynicism aspects of burnout. Initiatives aimed at increasing hope level and social support for physiotherapy and rehabilitation senior undergraduate students might reduce burnout levels and improve mental well-being.

Keywords: Burnout, Hopelessness, Physiotherapy, Student, Mental Well-Being

FİZYOTERAPİ VE REHABİLİTASYON BÖLÜMÜ SON SINIF ÖĞRENCİLERİNDE TÜKENMİŞLİK DÜZEYİ İLE UMUTSUZLUK, MENTAL İYİLİK HALİ VE ALGILANAN SOSYAL DESTEK İLİŞKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışma, fizyoterapi ve rehabilitasyon lisans son sınıf öğrencilerinde tükenmişlik düzeyi ile umutsuzluk, algılanan sosyal destek ve mental iyi oluş arasındaki ilişkiyi incelemeyi amaçlamıştır.

Yöntem: Bu çalışmaya 369 fizyoterapi ve rehabilitasyon lisans son sınıf öğrencisi (195 kadın, ortalama yaş: 22,81±3,72 yıl) dahil edildi. Veriler, Maslach Tükenmişlik Envanteri-Öğrenci Anketi (MTE-ÖA), Beck Umutsuzluk Ölçeği (BUÖ), Çok Boyutlu Algılanan Sosyal Destek Ölçeği (ÇBASDÖ) ve Warwick-Edinburgh Mental İyi Oluş Ölçeği (WEMİOÖ)'nden oluşan çevrimiçi anket kullanılarak toplanmıştır.

Sonuçlar: Tükenmişlik düzeyi, umutsuzluk düzeyi, algılanan sosyal destek, mental iyi oluş ve sosyodemografik özellikler açısından cinsiyetler arası fark bulunmadı (p>0,05). MTE-ÖA'nın duygusal tükenme ve duyarsızlaşma alt ölçekleri ile BUÖ, ÇBASDÖ ve WEMİOÖ ile ilişkili bulunurken (p<0,05), MTE-ÖA'nin yetkinlik alt ölçeği yalnızca WEMİOÖ ile ilişkiliydi (rho=0,526, p=0,017). Ek olarak, BUÖ, ÇBASDÖ ve WEMİOÖ duygusal tükenmenin %19'unu açıklayan ve duyarsızlaşma modelinin %9'unu açıklayan istatistiksel olarak anlamlı belirleyicileri olarak bulundu.

Tartışma: Bu çalışma, fizyoterapi ve rehabilitasyon lisans son sınıf öğrencilerinde tükenmişlik düzeyinin umutsuzluk, algılanan sosyal destek ve mental iyi oluş arasında bir ilişki olduğunu bulmuştur. Umutsuzluk, algılanan sosyal destek ve mental iyi oluş, tükenmişliğin duygusal tükenme ve duyarsızlaşma yönlerinin önemli belirleyicileriydi. Fizyoterapi ve rehabilitasyon son sınıf öğrencilerinde umut düzeyini ve sosyal desteği artırmayı amaçlayan girişimler, tükenmişlik düzeylerini azaltabilir ve mental iyilik halini iyileştirebilir.

Anahtar kelimeler: Tükenmişlik, Umutsuzluk, Fizyoterapi, Öğrenci, Mental İyi Oluş

INTRODUCTION

Studies on burnout in sectors that involve excessive human relations such as health, education, and service have extended to involve students (1-3). Learning burnout which is defined for students refers to the emotional exhaustion that stems from the necessity of studying lessons; cynicism and indifference towards the research, and low learning efficiency are observed (2,3). Literature shows that the effect of burnout on learning is widespread and in a nature that affects the student in the aspects of academic, personal, and social lives (4-7). This effect causes a decrease in academic involvement and performance by the deterioration of learning motivation (6,7). Along with this in an up-to-date study regarding students of physiotherapy and rehabilitation (PTR) who are future health personnel and are in communication with patients who have degradation in body structure and functions and with those who are in pain, it has been shown that along with the progression to the upper classes, the level of burnout increases and by the 4th grade reaches an all-time high (5). Özdinçler et al. found that the level of hopelessness varies depending on the faculty where students are educated, and the students of the Faculty of Health Sciences, including the students of the PTR department, experienced mild hopelessness (8).

According to the theory of burnout, hopelessness is defined as having negative expectations and emotions, and high-level hopelessness, can cause a loss of motivation, negatively affect mental well-being, and can be related to many psychological conditions (9,10). Levels of hopelessness have risen a meaningful amount in university students in the last few years (11). Social support can be estimated as a negative predictor of hopelessness. The majority of researches on physical and mental health have focused on social support. While the objective compound that contributes to the forming of the social support concept refers to the social support that is received in actuality, the subjective compound refers to the perceived social support. Compared to actually receiving social support, the support that people perceived to have helped themselves has been detected to be more effective. According to the studies, as the perceived social support increases, people's beliefs regarding the solution to their problems can be higher and they can distance themselves from negative expectations of the future. Due to this fact, some researchers pointed out that perceived social support is important for the health of the mind and contributes to putting a distance to hopelessness (12). With this, perceived social support decreases the burnout level (13).

The positive effect of perceived social support from family and friends on the mental well-being of students is shown in the literature (14). Although mental well-being is defined in various ways by different authorities, it is a complex phenomenon that can be expressed as optimal functionality and mood in general (15). On the other hand, Kaya Mutlu et al. concluded that PTR students are at a level of mild hopelessness and have detected that anxiety about finding a job plays a crucial factor in the hopelessness (16). A recent study that focused on the employment time of PTR graduates has found that following 2015 the ratio of graduate physiotherapists who found a job compared to previous years has decreased prominently (17).

Although studies on the level of burnout and hopelessness have been conducted in Turkey, no studies have been found on the association of these two factors with the level of perceived social support and mental well-being. It may be that the level of burnout is high and the level of hopelessness, mental well-being, and perceived social support may be related to the level of burnout in PTR students whose rate of graduates increases every year and cannot be employed at the same rate (17). This study aimed to investigate the relationship between burnout level and hopelessness level, mental well-being, and perceived social support in PTR senior undergraduate students.

METHODS

Study Protocol

The present study was a cross-sectional design study and was conducted from 27/02/2023 to 27/03/2023. Ethical approval was obtained from the University of Health Sciences, Hamidiye Scientific Research Ethics Committee (Approval number: 4/18 and Date: 24/02/2023) and conducted according to the Declaration of Helsinki. The informed

consent form approved by the Research Ethics Committee was obtained from all participants. Written explanations were provided to patients about the study, and each provided written informed consent.

Participants

Three hundred sixty-nine PTR senior undergraduate students studying at state and foundation universities in Turkey were included in the present study. The eligibility criteria were as follows: (1) being a senior undergraduate student in the PTR department in Turkey; (2) using computers or smartphones and having internet access; (3) ability to read and write in Turkish and (4) being a volunteer to participate. The exclusion criteria were as follows: (1) suspending education on any grounds; (2) having any work in return for money; and (3) not being Turkish citizens.

The sample size and power calculation were performed using the G*Power 3.1 power analysis program. In the sample size calculated using the correlation model "Correlation: Bivariate normal model," the effect size was small to moderate (|ρ|=0.2), α error was 0.05, the 95% confidence interval, and the desired power was 95% (18). These parameters generated a sample size of at least 319 participants. Due to the high drop-out rate of internet-mediated university studies, 400 senior undergraduate PTR students were invited to the present study (19).

Data Collection

Data collection was carried out via an e-survey sent out with an e-mail to the targeted sample. The questionnaire created through Google Forms was delivered to the participants via the link. The link had been active within a month for the data collection process. The participants were informed that the study was carried out for scientific purposes, and the information was not shared with third parties. The online survey had an introductory page explaining the purpose of the research, the identity and affiliations of the researchers, details of what participation will entail, and confirmation of ethical approval by the ethics committee. Before they started the questionnaire, they were asked whether they were willing to participate. All participants answered "yes" to the question, "Do you agree to participate in the survey?". Thus, all participants have provided voluntary consent to participate. The selection of one response option was enforced, and completeness checks were performed before the questionnaire was submitted. Participants could review and change their answers through a Back button, and the survey was never displayed again once they had filled it. The questionnaires that terminated early were not analyzed.

Data Collection Tools

The evaluation was composed of three parts: (1) socio-demographic characteristics, (2) information about occupational anxiety, professional competence, and satisfaction, and (3) questionnaires.

Age, sex, marriage status, and having a child or not were questioned. Information about occupational anxiety, professional competence, and satisfaction was questioned via the following statements: Being worried about finding a job, thinking that your profession is respected enough by society, thinking that your profession will meet your demands, feeling professionally competent, thinking of choosing the PTR department again and thinking of recommending the PTR department to candidates.

Maslach Burnout Inventory-Student Survey (MBI-SS) was used to determine the degree of burnout. The MBI-SS consists of 15 items that aimed to assess three major aspects of burnout: emotional exhaustion (5 items), cynicism (5 items), and efficacy (6 items) (3,20). Turkish version of MBI-SS has 13 items and 3 subscales (emotional exhaustion (5 items), cynicism (4 items), and efficacy (4 items)) and was obtained as a result of confirmatory factor analysis (21). Higher scores indicate greater burnout levels in the exhaustion and cynicism subscales, and lower scores indicate greater burnout levels in the efficacy subscale (3,21).

Beck Hopelessness Scale (BHS) was used to determine the degree of hopelessness. The BHS consists of 20 dichotomous (true/false) items that aimed to assess three major aspects of hopelessness: feelings about the future, loss of motivation, and expectations (9,22). The total score ranges from 0 to 20, and higher scores indicate greater hopelessness. The total scores from 0 to 3 indicate the normal range, scores from 4 to 8 reflect mild hopelessness,

Table 1. Characteristics of Participants (n=369)

Parameters	n (%)
Age, years	22.81±3.72 [20-27]
Sex	
Female	195 (52.84%)
Male	174 (47.16%)
Cumulative Grade Point Average, score (out of 4)	3.01±1.76
Marriage status	
Single	16 (4.33%)
Married	353 (95.67%)
Having a child	
Yes	10 (2.71%)
No	269 (97.29%)
Being worried about finding a job	
Yes	210 (56.91%)
No	159 (43.08)
Thinking that your profession is respected enough by society	
Yes	239 (64.77%)
No	130 (35.23%)
Thinking that your profession will meet your demands	
Yes	175 (47.43%)
No	194 (52.57%)
Feeling professionally competent	
Yes	185 (50.13%)
No	184 (49.86%)
Thinking of choosing the PTR department again	
Yes	166 (44.99%)
No	203 (55.01%)
Thinking of recommending the PTR department to candidates	
Yes	194 (52.58%)
No	175 (47.42%)
MBI-SS, score	
Emotional Exhaustion	15.33±4.78 [5-25]
Cynicism	10.30±3.81 [4-20]
Efficacy	12.18±3.13 [4-20]
BHS, score	10.58±1.95 [3-16]
MSPSS, score	46.28±12.53 [10-60]
WEMWBS, score	48.12±10.82 [14-56]

Notes: BHS, Beck Hopelessness Scale; MBI-SS, Maslach Burnout Inventory-Student Survey; MSPSS, Multidimensional Scale of Perceived Social Support; PTR, Physiotherapy and Rehabilitation; WEMWBS, Warwick-Edinburgh Mental Well-Being Scale. Data are expressed as number (percentage of the total number) and mean±standard deviation [Minimum-Maximum].

scores from 9 to 14 reflect moderate hopelessness, and scores greater than 14 reflect severe hopelessness (23).

Multidimensional Scale of Perceived Social Support (MSPSS) was used to determine the degree of perceived social support. The MSPSS consists of 12 items that aim to measure three sources of social support: family, friends, and a significant other (24,25). Total score ranges from 12 to 84, and higher scores indicate greater perceived social support. The total scores from 12 to 35 indicate low perceived support, scores from 36 to 60 reflect moderate perceived support, and scores from 61 to 84 reflect high perceived support (24).

Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) was used to determine the degree of mental well-being. The WEMWBS consists of 14 items that aim to assess well-being (26,27). Total

Table 2. The Relationship between Burnout Level and Hopelessness Level, Perceived Social Support, and Mental Well-Being (N=369)

Variables	Emotional Exhaustion[a]	Cynicism[a]	Efficacy[a]	Hopelessness[b]	Perceived Social Support[c]	Mental Well-Being[d]
Hopelessness	-0.63 (0.001)**	-0.57 (0.001)**	0.37 (0.06)	1	0.41 (0.02)*	0.61 (0.001)**
Perceived Social Support	-0.43 (0.03)*	-0.42 (0.01)*	0.41 (0.08)	0.41 (0.02)*	1	0.57 (0.001)**
Mental Well-Being	-0.64 (0.001)**	-0.63 (0.001)**	0.52 (0.01)*	0.61 (0.001)**	0.57 (0.001)**	1

Spearman correlation test p<0.05*, p<0.01**

Data are expressed as rho (p).

[a] As assessed by the Maslach Burnout Inventory-Student Survey.

[b] As assessed by the Beck Hopelessness Scale.

[c] As assessed by the Multidimensional Scale of Perceived Social Support.

[d] As assessed by the Warwick-Edinburgh Mental Well-Being Scale.

Table 3. Linear Regression Analysis of Predictors of Emotional Exhaustion Level

Predictors	Independent Variables	Standardized Coefficient			*P*-value	Adjusted R^2
		B	SE	Beta		
Model I	**Hopelessness[a]**	0.27	0.10	0.16	0.001	0.19
	Perceived Social Support[b]	0.14	0.15	0.07	0.03	
	Mental Well-Being[c]	0.76	0.33	0.37	0.001	

[a] As assessed by the Beck Hopelessness Scale.

[b] As assessed by the Multidimensional Scale of Perceived Social Support.

[c] As assessed by the Warwick-Edinburgh Mental Well-Being Scale.

score ranges from 14 to 70, and higher scores indicate higher mental well-being (26).

Statistical Analysis

Statistical Package for Social Science (SPSS) version 21.0 for Windows software (SPSS, Inc., Chicago, IL, USA) was used for all statistical analyses. Before the statistical analysis, the Kolmogorov–Smirnov test was used to assess data distribution. Descriptive statistics, including frequency, the percentage for nominal variables, and mean and standard deviation for continuous variables were calculated. Spearman correlation analysis was used to explore the relationship between hopelessness level, burnout level, mental well-being, perceived social support, and other factors. The significance level was set as p<0.05. The correlation coefficient was interpreted as: 0.00-0.30 negligible correlation; 0.30-0.50 weak correlation; 0.50-0.70 moderate correlation; 0.70-0.90 strong correlation; and 0.90-1.00 very strong correlation (28). Variables with significant correlations in the correlation analysis were used in linear regression models to predict burnout levels in the PTR senior undergraduate students.

RESULTS

Three hundred sixty-nine PTR senior undergraduate students (195 female, mean age: 22.81±3.72 years) volunteered to participate in the study. The sociodemographic characteristics of participants, data about occupational anxiety, professional competence and satisfaction, and mean scores of questionnaires are shown in Table 1. No students did a double major or minor in another program or engaged voluntarily in the internship.

There are no gender differences in burnout level and hopelessness level, perceived social support, mental well-being, and sociodemographic characteristics (p>0.05). The mean scores of emotional exhaustion, cynicism, and efficacy subscales of MBI-SS were similar in both sexes (14.82±3.28, 10.21±2.75, 12.02±1.75 for female students, and 15.90±4.21, 10.39±4.23, 12.35±2.51 for males students, respectively) (p<0.05). In addition, the

Table 4. Linear Regression Analysis of Predictors of Cynicism Level

Predictors	Independent Variables	Standardized Coefficient			*P*-value	Adjusted R^2
		B	SE	Beta		
Model I	Hopelessness[a]	0.37	0.21	0.06	0.008	0.09
	Perceived Social Support[b]	0.34	0.25	0.10	0.06	
	Mental Well-Being[c]	0.54	0.31	0.30	0.006	

[a] As assessed by the Beck Hopelessness Scale.
[b] As assessed by the Multidimensional Scale of Perceived Social Support.
[c] As assessed by the Warwick-Edinburgh Mental Well-Being Scale.

mean scores of BHS (10.98±1.54 for female students and 10.13±2.14 for male students), MSPSS (45.40±11.48 for female students and 47.43±10.53 for male students), and WEMWBS (47.68±11.08 for female students and 48.61±9.97 for male students) were also similar for female and male PTR senior undergraduate students (p=0.21, p=0.45, and p=0.26, respectively).

The relationship between burnout level and hopelessness level, perceived social support, mental well-being, and sociodemographic characteristics of participants are presented in Table 2. There were significant relationships between the emotional exhaustion subscale of MBI-SS and BHS, MSPSS, and WEMWBS (rho= -0.632, p=0.001; rho= -0.435, p=0.031; and rho= -0.644, p=0.001; respectively). The cynicism subscale of MBI-SS was also related to BHS, MSPSS, and WEMWBS (rho= -0.577, p=0.001; rho= -0.425, p=0.012; and rho= -0.634, p=0.001; respectively). However, the efficacy subscale of MBI-SS correlated only with WEMWBS (rho= 0.526, p=0.017).

Linear regression analysis of predictors of emotional exhaustion was statistically significant for hopelessness (p=0.001), perceived social support (p=0.032), and mental well-being (p=0.001), describing 19% of the adjusted R^2 (in Model I, Table 3). Besides, hopelessness (p=0.008), perceived social support (p=0.041), and mental well-being (p=0.006) were significant predictors in the cynicism model, describing 9% of the adjusted R^2 (in Model I, Table 4).

DISCUSSION

The present study aimed to investigate the relationship between burnout level and hopelessness, perceived social support, and mental well-being among PTR senior undergraduate students. About 57% of students were worried about finding a job, 53% of them did not think that their profession would meet their demands, and 55% of them did not think of choosing the PTR department again if they had a chance. Moreover, burnout level has a relationship between hopelessness, perceived social support, and mental well-being in PTR senior undergraduate students. Hopelessness, perceived social support, and mental well-being were significant predictors of the emotional exhaustion and cynicism aspects of burnout. Similarly, a recent study showed that the burnout levels of the students increased as the years progressed and reached their peaks in the 4th grade (5). As graduation time approaches, it has been shown that burnout and anxiety increase (29), but no research in the PTR field reviewing the relationship between burnout levels of senior undergraduate students with their perceived social support, mental well-being, and hopelessness parameters was found.

Although the research on burnout was specific in the service/service sector fields before, it started to deal with student burnout in the mid-2000s (30-32). Burnout assessment inventories have been diversified by considering students and academic burnout (3,21). A previous meta-analysis stated that students with low perceived social support levels had higher burnout levels. In addition, strong correlations were found between all subcomponents of burnout, including inefficiency, cynicism, exhaustion, and social support (33). In our study, there was a strong relationship between cynicism and exhaustion and perceived social support, but unlike the literature, no relationship was found with efficiency.

In a study that was conducted in Turkey in the year

2017 on 330 registered undergraduate students, it was found that the hopelessness levels of the students were meaningfully higher than their American peers (34). Girgin et al. concluded that hopelessness levels in male students are higher than in female students and it has been stated the situation is directly correlated with social relations (35). However, there are no gender differences in burnout level and hopelessness level, perceived social support, or mental well-being in the present study. The absence of difference between female and male students can be related to the similarity of perceived social support because hopelessness level is found to be directly correlated with perceived social support in the present study.

The last comprehensive study regarding the employment of physiotherapists has been done by Karagozoglu Coskunsu et al. They found that following the year 2018, the last 3 years, progressively decreasing employment levels have been detected. While in 2012 the percentage of graduated and found a job is %76.2, this ratio is %24.4 for 2016 graduates. On top of this, on the date the study was conducted, it is seen that the number of universities giving PTR license education was 61 (17). By the year 2023, the number of faculties that are offering bachelor's degrees on PTR has reached 102 (36). This sharp increase might cause the unemployment problem to increase further, thus affecting hopelessness levels. Findings of a recent study supporting this hypothesis pointed out that while anxiety about professional competence was higher in the first graders of undergraduate PTR students, future and employability anxiety was higher in the fourth graders of undergraduate PTR students (37).

One parameter that has proven to have an impact on mental well-being is perceived social support (38). Cobo-Rendon et al. found that emotional well-being increased significantly as perceived social support increased (39). In our study, it is seen that perceived social support is associated with higher mental well-being, in line with the literature. It has been shown that mental well-being is negatively affected in students with high hopelessness, and the incidence of suicidal thoughts increases (40). In the present study, it was determined that the level of hopelessness affected mental well-being significantly negatively. Hopelessness, perceived social support, and mental well-being are significant predictors of two major aspects of burnout (emotional exhaustion and cynicism). Therefore, PTR senior undergraduate students should be monitored in terms of hopelessness and perceived social support, and their mental well-being should be supported.

The present study will contribute to the field in terms of understanding burnout and associating it with perceived social support, hopelessness, and mental well-being in PTR senior undergraduate students and students in general. In a meta-analysis on the subject, it was seen that teacher/counselor support came first among the types of social support that reduced the level of burnout, followed by family and friends (33). We hope that raising awareness on the subject will enable academic advisors to develop new strategies.

This study has some limitations that should be highlighted. First, the concept of perceived social support was not examined in detail in itself and only senior undergraduate students were included. Second, it was carried out through an online platform. Third, other sociodemographic data that may lead to an increase in burnout and hopelessness and a decrease in well-being were not focused on.

CONCLUSION

This study found that burnout level has a relationship between hopelessness, perceived social support, and mental well-being in PTR senior undergraduate students. Hopelessness, perceived social support, and mental well-being were significant predictors of the emotional exhaustion and cynicism aspects of burnout. Initiatives aimed at increasing hope level and social support for PTR senior undergraduate students might reduce burnout levels and improve mental well-being. Future studies can also follow the development of the effect of work anxiety by including students from all classes in the studies to be planned in the field.

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preparation, Writing-Reviewing, and Editing. PB: Conceptualization, Methodology, Investigation, Writing-Original draft preparation, Formal Analysis, Writing-Reviewing, and Editing.

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THE RESULTS OF ENVIRONMENTAL ENRICHMENT AND NEURODEVELOPMENTAL TREATMENT IN SHPRINTZEN-GOLDBERG SYNDROME: A CASE REPORT

ORIGINAL ARTICLE

ABSTRACT

Purpose: This case report aimed to investigate the efficacy of the physiotherapy program in a child with Shprintzen-Goldberg syndrome (SGS).

Methods: A 9-month-old case diagnosed with SGS by a medical geneticist was the focus of the study. Congenital pes varus, craniosynostosis and craniofacial deformities, mental, social, emotional and motor retardation, regulation and sensory hyperreactivity symptoms were observed in the case. The physiotherapy program consists of environmental enrichment and Neurodevelopmental Treatment (NDT) approaches twice a week for 12 months and was conducted by a physiotherapist at Karadeniz Ereğli Private Gökkuşağı Special Education and Rehabilitation Center. Gross motor function and disability level were assessed using Gross Motor Function Measurement-88 (GMFM-88) and Gross Motor Function Classification System (GMFCS), respectively. The success of physiotherapy goals was determined by Goal Attainment Scaling (GAS).

Results: At 12 months follow-up, GMFM-88 score increased from 5.52% to 45.47% and GAS total scores increased from -6 to +6 point.

Conclusions: The literature review shows that no previous study assessed the effectiveness of 12 months physiotherapy program in a child with SGS. We consider that physiotherapy including targeted NDT approaches can support motor development in rare cases, such as SGS characterized by severe motor involvement.

Keywords: Case Report, Craniosynostosis, Multiple Anomalies, Physical Therapy and Rehabilitation, Shprintzen-Goldberg Syndrome.

SHPRİNTZEN-GOLDBERG SENDROMUNDA ÇEVRESEL ZENGİNLEŞTİRME VE NÖROGELİŞİMSEL TEDAVİ SONUÇLARI: BİR OLGU SUNUMU

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu olgu sunumu, Shprintzen-Goldberg sendromlu (SGS) bir çocukta fizyoterapi programının etkinliğini araştırmayı amaçlamaktadır.

Yöntem: Tıbbi genetik uzmanı tarafından SGS tanısı konmuş 9 aylık bir olgu çalışmaya dahil edildi. Olguda konjenital pes varus, kraniyosinostoz ve kraniyofasiyal deformiteler, mental, sosyal, emosyonel ve motor retardasyon, regülasyon ve duyu hiperreaktivite semptomları gözlendi. Haftada iki gün, 12 ay boyunca çevresel zenginleştirme ve Nörogelişimsel Tedavi (NGT) yaklaşımlarını içeren fizyoterapi programı, Karadeniz Ereğli Özel Gökkuşağı Özel Eğitim ve Rehabilitasyon Merkezi'nde fizyoterapist tarafından uygulandı. Kaba motor fonksiyon ve özürlülük düzeyi sırasıyla Kaba Motor Fonksiyon Ölçümü-88 ve Kaba Motor Fonksiyon Sınıflandırma Sistemi ile değerlendirildi. Fizyoterapi hedeflerinin başarısı, Hedefe Ulaşma Ölçeklendirmesi ile belirlendi.

Sonuçlar: On iki aylık takipte, Kaba Motor Fonksiyon Ölçümü-88 puanı %5,52'den %45,47'ye, Hedefe Ulaşma Ölçeklendirme toplam puanları -6'dan +6 puana yükseldi.

Tartışma: Bu olgu sunumu, literatür taramasına göre SGS'li bir çocukta 12 aylık fizyoterapi programının etkinliği hakkında yapılan ilk çalışmadır. Hedefe yönelik NGT yaklaşımlarını içeren fizyoterapinin ciddi motor etkilenim ile karakterize SGS gibi nadir görülen olgularda, motor gelişimi destekleyebileceğini düşünüyoruz.

Anahtar Kelimeler: Çoklu Anomaliler, Fizik Tedavi ve Rehabilitasyon, Kraniyosinostoz, Olgu Sunumu, Shprintzen-Goldberg Sendromu.

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INTRODUCTION

Shprintzen-Goldberg syndrome (SGS) is an extremely rare connective tissue disorder involving several body regions, first documented by Shprintzen in 1982 (1). It is characterized by craniosynostosis of coronal, sagittal or lambdoidal sutures, dolichocephaly, typical craniofacial features, neurological findings, mental retardation and skeletal abnormalities such as scoliosis, joint hypermobility or contractures, pectus chest deformity, multiple abdominal wall hernia and infantile hypotonia (2,3).

Although there is no complete cure for SGS, a lifelong multidisciplinary approach is recommended due to developmental delay and the presence of cardiovascular anomalies (4). In addition to other treatment approaches, it was recommended that physiotherapy interventions for deformities should begin as early as possible (2). To our knowledge, there are no studies examining cases of SGS involving developmental delays that show the results of physiotherapy intervention as prognostic in the long term.

The aim of this study is to demonstrate the effectiveness of physiotherapy intervention and to discuss the results of 12 months follow-up in a child with SGS. We consider that this study will contribute to the literature on the long-term (12 months) results of physiotherapy intervention in individuals with SGS.

CASE PRESENTATION

The 9-month-old baby was admitted to the rehabilitation center by his family with the complaint of hypotonia, i.e., the inability to sit or roll. The baby had not previously received physiotherapy intervention. The birth weight of the baby was 3750 g, the gestational age was 38 weeks, and the delivery method was cesarean section. For the Auditory Brainstem Response scan, results were normal limits of hearing function in the left ear, and mild conductive hearing loss in the right. According to the genetic test results, it was concluded that the c.104C>G (p.Pro35Arg) variation detected in the SKI gene was consistent with Shprintzen-Goldberg syndrome and clinical findings. He the second child of the family that had no history of genetic disease. The genetic structure of the family is being investigated. The baby was taking no medication. He has a five-year old sister. He did not need neonatal intensive care after birth.

According to medical reports, he had bilateral flexible congenital varus deformity of the foot, craniosynostosis, craniofacial deformities, mental retardation, pectus chest deformity, high palate,

Table 1. The Goals Steps of The Case

GAS	-2	-1	0	+1	+2
GAS-1	He cannot roll from supine to prone.	He can roll from supine to side-lying position.	He can roll from supine to prone	He rolls over a distance of 3m from supine to prone, and from prone to supine.	He rolls over a distance of 10m from supine to prone, and from prone to supine.
GAS-2	He cannot sit without support.	He can sit with his hands supported from the front.	He can sit without support.	He can move his trunk in the sagittal and frontal planes in the sitting position without support.	He can move his trunk in the vertical plane in the sitting position without support.
GAS-3	He cannot play with toys in the sitting position.	In a sitting position, he reaches for the toy in front of him with his hands but falls.	He can reach for the toy in front of him and play with his hands in a sitting position.	He can reach and play toys of different heights in the sagittal and frontal planes in the sitting position.	He can reach and play with toys with trunk rotation in sitting position.

GAS: Goal Attainment Scaling

GAS-1: Rolling while lying, GAS-2: Sitting without support, GAS-3: Playing with toys while sitting.

umbilical hernia, and undescended testis. The baby's regulation skills were quite weak and mostly lethargic. He had poor midline orientation, body awareness, and avoided tummy time positions. He was unable to bear weight on his legs or sit without support. It was observed that he did not use his extremities for functional skills such as reaching, playing with toys, or rolling. He also had sensory reactivity problems, such as avoiding touching the floor with his feet and hands in supine, prone, and supported sitting positions. He is not comfortable with movement and position transitions. In daily life, he is unable to roll, reach out, sit or stand, i.e., his participation level is limited.

Written informed consent was provided by the child's parents.

Physiotherapy Assessments

(1) Disability level: We used the Gross Motor Function Classification System (GMFCS) to measure the level of disability. The classification levels range from I (independent ambulatory function but some minor troubles of balance, speed or coordination) to V (no independent ambulatory function). The GMFCS is an accepted classification system used to classify motor functions in cerebral palsy and other pediatric problems (5).

(2) Gross Motor Function Measurement (GMFM): We used GMFM-88 for evaluating gross motor function of the case. This tool is suitable for children with ages ranging from 5 months to 16 years. The child's movements and postures are benchmarked with specific identifiers and these are used to determine change in performance over time. The GMFM-88 item scores can be summarized to count raw and percent scores for each of five GMFM category, selected target areas and a total GMFM-88 score (6).

(3) Goal Attainment Scaling (GAS): GAS is a method for individual goal-setting. In a study, 70% of therapists and 60% of parents confirmed that GAS is an appropriate tool to improve rehabilitation quality (7). Goal settings were edited by parents, and the therapist according to the child's areas of interest. The goals were considered SMART, an acronym for specific, measurable, achievable, relevant and timed. The achievement of goals was rated using a scale of five points (-2 to +2), with 0 equivalent to goal achievement. The scores means that '–2' is the initial pre-treatment (baseline), '–1' is progression towards the goal without attainment, '0' is the expected level after treatment, '+1' is a better-than-expected outcome, and '+2' is a much better-than-expected outcome. Three of the goals created by SMART were selected: rolling while lying, sitting without support, and playing with toys

Table 2. Gross Motor Function Measurement-88 And Goal Attainment Scaling Results

GMFM-88	Pretreatment	Posttreatment
A. Lying and Rolling (%)	17.64	100
B. Sitting (%)	10	60
C. Crawling and Kneeling (%)	0	57.17
D: Standing (%)	0	10.25
E: Walking, Running and Jumping (%)	0	0
Total score (%)	5.52	45.47
GAS (point)		
1. Rolling on lying	-2	+2
2. Sitting without support	-2	+2
3.Playing toys on sitting	-2	+2
Total GAS score	-6	+6

GMFM-88: Gross motor function measurement-88, GAS: Goal Attainment Scaling

GMFM-88 data expressed as a percentage (%).

while sitting. These three goals were chosen to create the transfer skill of the child, to develop postural control against gravity, to increase the upper extremity functions in the sitting position and to support the playing skills (Table 1).

Treatment

The physiotherapy program started when the case was 9 months old. The case was evaluated in Kdz. Ereğli Private Gökkuşağı Special Education and Rehabilitation Center between February 2021 and February 2022 and was included in the rehabilitation program during this period. The duration of the treatment was two days a week for 12 months, each session being 60 minutes. The case was assessed and treated by a pediatric physical therapist with at least 10 years of experience (S.A.T). The treatment concept was NDT approach and environmental enrichment therapy (Figure 1, Figure 2). In the NDT concept, techniques such as facilitation of extensor muscles, facilitation of rolling, righting and balance reactions were practiced with the use of appropriate handling techniques and key points. These studies were integrated into the child's rehabilitation and home environment according to the principles of environmental enrichment. For example, one of the goals was sitting without support, and by creating a safe environment, i.e., placing him in a basket, it was possible to develop the righting and balance reaction in sitting. The family were present at the physiotherapy sessions. A home program was given for its implementation in line with the determined goals; the child received no additional treatment.

Also, orthoses were used for correct alignment of the lower extremities. Since the patient was standing with bilateral hip-knee flexion, ring-locked Knee Ankle Foot Orthosis was given to ensure proper lower extremity alignment. He used the orthosis for 5 hours daily. No adverse effects were experienced during the therapy process.

Figure 1. Playing Toys on Sitting Position with Enriched Environmental Perspective

Figure 2. FFunctional Reaching on the Kneeling Position According to the Neurodevelopmental Treatment Approach

Outcome and Follow-Up

At the end of the 12-month follow-up period, our case was 21 months old. During this time, GMFCS levels changed from level V to level II.. The percentage of total GMFM-88 and GAS scores before and after treatment are shown in Table 2. GMFM-88 increased from 5.52% to 45.47% and GAS total scores increased from -6 to +6 point.

DISCUSSION

SGS is a rare genetic disorder with specific features. The features in this case are consistent with previous cases reported in the literature (2,3). A child's overall quality of life and participation can be improved by a multidisciplinary approach that includes input from a physician, cardiologist, pediatrician, otorhinolaryngologist, ophthalmologist, surgeon, speech and language pathologist, physiotherapist, radiologist and a pediatric dentist (4). In addition to its use primarily in cerebral palsy, NDT has also been used as a supportive rehabilitation technique in other conditions (8). NDT is a holistic problem-solving approach based on the teaching of normal movement patterns based on the evaluation and treatment of impairment in function (9). Environmental factors can sometimes be an obstacle for children but can also have a facilitating effect. It is known that development is affected by individual and environmental factors, and recent studies have often emphasized the effects of the environment, whether complicating or facilitating, on the function and disability process of children with physical disabilities (10). In the literature, the definition of environmental enrichment includes socialization, exercise, sensory and cognitive stimulation and environmental modification. This approach emphasizes that the individual's environmental, social, physical and cognitive context should encourage positive stimulation, interactions and activities, and this positive experience will stimulate, support and contribute to the development of structural changes in the brain due (11). Therefore, for our case we selected the NDT approach and enriched environmental therapy. In this case, the NDT approach supported the child's postural alignment, and environmental enrichment provided the child with the opportunity to move more independently. With this combined approach, more movement was achieved while maintaining postural alignment.

Well-defined goals need a goal-oriented scale as a measure of rehabilitation success. There are four main goals of rehabilitation: the target activity, the support needed, quantification of performance and the time for achievement (12). GAS is a personalized assessment scale that measures progress towards defined goals. It is a common evaluation method in the field of physical therapy and rehabilitation, in which setting goals is a fundamental part of treatment planning (13). The key aspect of this case report is the goal-oriented basis of rehabilitation program through the use of SMART principles. The family and the physiotherapist agreed on the methods used and various roles taken in achieving these goals. In this case, to determine the achievement of rehabilitation goals, we used the GAS, which is convenient, quick, patient-specific, goal directed and widely applicable. In this case, the three SMART goals were selected, for each of which better-than-expected outcome scores were found after 12 months of NDT approach and environmental enrichment therapy.

Although the typical and clinical features of SGS have been described in previous case reports (2,3), due to the lack of specific tests to determine the levels of motor function and disability, we used three different functional outcome measures in our evaluation: GMFCS, GAS and GMFM-88. After the NDT approach, according to these measurements with proven validity, the level of change in motor function and disability levels is described as improvement, no change, or worsening. In this case, we used GMFCS to assess the disability level. The patient's GMFCS level progressed from level V before treatment to level II after treatment. This indicates that the NDT approach positively affects the gross motor function level of a patient with SGS, and leads to an improvement in disability level.

Gross motor function was assessed by GMFM-88 (8). GMFM-88 has been mainly used to evaluate children with cerebral palsy in the literature (14,15), but also to evaluate the motor functions of children with other diagnoses, such as Down syndrome (16) and muscular dystrophy (17). Two different studies reported that NDT approach is

useful for lying, rolling, sitting, crawling and kneeling, and standing abilities but there was no significant improvement in walking, running and jumping in children with cerebral palsy (14,15). Similarly, in this case, we determined that after the treatment, there was improvement in all four abilities, except for walking, running, and jumping. The GMFM-88 scores of our case, who is 21 months old is as follows: can turn and lie down, 100%; can sit, 60%; can crawl, 57.17%; can stand, 10%.

In this study, the environmental enrichment and NDT approach allowed the child to develop in social, emotional, motor, and sensory areas. It was observed that the child, who had had no experience of social interaction lethargic and compatible after the 12-month therapy process. We are therefore of the opinion that the development of motor skills also contributes to the child's emotional well-being. The child's poor regulation skills negatively affected his participation in life. Environmental enrichment and NDT approach contributed to the child's participation in therapy, and the experience of acting independently; applying the principle of 'just right challenge', therapy involved movement experience, and games supporting all development areas (social, emotional, motor, cognitive). 'Just right challenge' offers activities that are sufficiently challenging, and this principle results in faster progress in areas targeted for development (18).

We consider that the combination of NDT approach and environmental enrichment therapies were beneficial gross motor skills and increased the level of functional independence for this case with SGS. In addition, it is important to support all the child's developmental areas (social, emotional, cognitive, motor), integrating therapy into all areas of life, and family education.

In conclusion, SGS is a rare connective tissue disease with multiple anomalies, and for a child with SGS, physiotherapy is an important part of a multidisciplinary teamwork aimed at reducing joint deformities, functional disability and increasing the level of motor function. To the best of our knowledge, this case report is the first study on the effectiveness of physiotherapy and rehabilitation program in a child with SGS. The physiotherapy results were encouraging in this case with SGS. However, this study is a case report, making it difficult to generalize the results, which is the limitation. Additional studies and randomized controlled trials are needed to confirm these benefits and the efficacy of a physiotherapy intervention for cases with SGS in long-term follow-up.

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EFFECTIVENESS OF MODIFIED POSTERIOR SHOULDER STRETCHING EXERCISES IN POSTERIOR SHOULDER TIGHTNESS AND GLENOHUMERAL INTERNAL ROTATION DEFICIT: A SYSTEMATIC REVIEW

ORIGINAL ARTICLE

ABSTRACT

Purpose: Posterior shoulder tightness (PST) and Glenohumeral internal rotation deficit (GIRD) can impact shoulder biomechanics and damage shoulder function. Posterior shoulder stretching exercises (PSSEs) are often performed in traditional positions to improve posterior shoulder inflexibility. However, these traditional positions can cause inadequate control of the scapula and glenohumeral rotation. The modified PSSEs through scapular stabilization are preferred as current trends to effective management of the GIRD and PST. However, there is a lack of consensus regarding which type of modified PSSE is more effective on PST and GIRD improvement. Therefore, we aimed to describe the efficacy of modified PSSEs on PST and GIRD in symptomatic and asymptomatic populations to aid clinicians when making decisions for these populations.

Methods: A literature search was conducted for a systematic review. Relevant studies were searched from appropriate electronic databases (CINAHL, Cochrane Review, Pubmed (MEDLINE), Web of Science as well as Google Scholar©), and selected the eligible studies for inclusion.

Results: The present systematic literature search generated 127 relevant citations and 17 articles were included in the final review. As an outcome measure GIRD was assessed in all included studies, whereas PST was assessed in 10 studies.There was high evidence related to the positive effects of both modified cross-body and sleeper stretch to improve GIRD and PST.

Conclusion: According to this systematic literature review, both modified cross-body and sleeper stretch are effective in the improvement of GIRD and PST. Future research should focus on other specific shoulder diseases and should also recruit specific participants to address the effectiveness of modified PSSEs on GIRD and PST.

Keywords: Injuries, Mobility, Physical Therapy

MODİFİYE POSTERİOR OMUZ GERME EGZERSİZLERİNİN POSTERİOR OMUZ GERGİNLİĞİ VE GLENOHUMERAL İNTERNAL ROTASYON DEFİSİTİNDEKİ ETKİNLİĞİ: BİR SİSTEMATİK DERLEME

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Glenohumeral internal rotasyon defisiti (GİRD) ve posterior omuz gerginliği (POG), omuz biyomekaniğini etkileyebilir ve omuz fonksiyonuna zarar verebilir. GİRD ve POG tedavisinde posterior omuz germe egzersizleri (POGE) sıklıkla geleneksel pozisyonlarda uygulanmaktadır. Ancak bu geleneksel pozisyonlar skapulanın ve glenohumeral rotasyonun yetersiz kontrolüne neden olabilmektedir. GİRD ve POG'un etkin tedavisi için güncel yaklaşımlar olarak skapular stabilizasyon ile gerçekleştirilen modifiye POGE tercih edilmektedir. Ancak hangi modifiye germe egzersizinin GİRD ve POG'un iyileşmesinde daha etkili olduğuna dair bir fikir birliği bulunmamaktadır. Bu nedenle, klinisyenlere semptomatik ve asemptomatik popülasyonlar için karar vermede yardımcı olmak için modifiye POGE'nin bu popülasyonlarda POG ve GİRD üzerindeki etkinliğini tanımlamayı amaçladık.

Yöntem: Sistematik bir literatür taraması gerçekleştirdik. İlgili çalışmalar dahil edilmek üzere değerlendirildi ve seçilen çalışmalar uygun elektronik veri tabanlarından (CINAHL, Cochrane Review, Pubmed (MEDLINE), Web of Science ve Google Scholar©) araştırıldı.

Sonuçlar: Sistematik literatür araştırması 127 ilgili makale ile sonuçlandı ve final incelemeye 17 makale dahil edildi. Sonuç ölçümü olarak GİRD dahil edilen tüm çalışmalarda değerlendirilirken, POG 10 çalışmada değerlendirildi.

Tartışma: Bu sistematik literatür derlemesine göre, hem modifiye cross-body germe hem de modifiye sleeper germe GİRD ve POG'u iyileştirmede etkilidir. Gelecekteki araştırmalar POGE'nin GİRD ve POG üzerindeki etkinliğini belirlemek için diğer spesifik omuz hastalıklarına da odaklanmalı ve ayrıca spesifik katılımcıları çalışmalara almalıdır.

Anahtar Kelimeler: Yaralanmalar, Mobilite, Fizik Tedavi

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INTRODUCTION

Shoulder pain is a common musculoskeletal complaint affecting up to 67% of adults at some point in their lifetime. Shoulder pain etiology is multifactorial and includes multiple impairments, including also the biomechanical consequences of decreased mobility (1).

Posterior shoulder tightness (PST) is defined as the restriction of the posterior shoulder soft tissues, including contractile (infraspinatus, teres minor, and posterior deltoid muscles) and non-contractile structures (posterior glenohumeral capsule) as well as osseous changes (increased humeral retroversion) (1). Glenohumeral internal rotation deficit (GIRD) is defined as a loss of shoulder IR of the dominant side compared to the non-dominant side (2). PST has been associated with restricted glenohumeral internal rotation (IR) and horizontal adduction (HA) range of motion (ROM) (3,4). From a biomechanical point of view, evidence suggests that PST and GIRD, causing anterosuperior migration of the humeral head, lead to increased subacromial contact pressures (5,6,7) that are sources of subacromial and internal impingement (8), rotator cuff (RC) tendinopathy (9), collectively termed as subacromial pain syndrome (SPS) (10).

PST and GIRD are well documented in overhead athletes (7) as well as the general population (11). In the management of PST and GIRD, researchers focus on posterior shoulder stretching exercises (PSSEs), the most common PSSE types are sleeper and cross-body stretches, to reduce subacromial contact pressure and contribute to prevention as well as treatment for SPS in clinical practice (12,13). Although these traditional PSSEs are effective to improve GIRD and PST, they may have some disadvantages. The most important disadvantage is the lack of scapular stabilization. This leads to prevent isolating the intended stretch to the posteroinferior aspect of the glenohumeral joint and increased the risk of impingement during stretching.

The traditional sleeper PSSE is performed while the person is side-lying on the affected side, arm at 90° shoulder flexion, using the opposite hand to internally rotate the shoulder at 45°-90° flexion by grasping the distal forearm and moving the arm toward the treatment table (14). This traditional position usually causes aggravation of the pain and could not provide enough scapular stabilization to stretch the isolated posterior RC and inferior capsule of the glenohumeral ligament. The traditional cross-body PSSE is performed while the person is in the standing position, sitting position, and rarely in the supine position. The opposite hand horizontally adducts the shoulder. Because of the insufficient scapular stabilization, while the humerus is horizontally adducted, undesired accessory abduction of the scapula, as well as excessive humerus external rotation, occurs.

There is increasing evidence that modification of these PSSEs can provide isolated posterior capsule stretching by preventing accessory abduction of the scapula and restricting the external rotation range of motion of the humerus without the aggravation of the pain. It is assumed that posterior glenohumeral joint soft tissues are greater isolated by stabilizing the scapula (14). For the first time, Johansen et al. recommended the modified PSSE by manually stabilizing the scapula in the prone position when the shoulder was abducted 90° and 90°-120° of IR with the forearm in pronation (15). Wilk et al. recommended the modified sleeper stretch and modified cross-body stretch rather than the traditional ones to better isolate stretching for the posterior glenohumeral soft tissues (14). A systematic review conducted by Mine et al. was related to the effectiveness of PSSEs on PST and GIRD without distinguishing the modified and traditional PSSE (4). The authors concluded that there was moderate evidence to support the immediate and short-term effects of cross-body PSSE to improve PST and GIRD. For the active sleeper PSSE, moderate evidence was concluded that the sleeper PSSE is not more effective than no intervention in improvement of PST and GIRD in the short-term (4). Although many studies have investigated the effects of traditional and modified PSSEs on PST and GIRD (16,17,18,19,20,21) no literature synthesis has been published to determine the efficacy of modified PSSEs in im-

proving PST and GIRD. Therefore, the purpose of the present study was to perform a systematic review of the literature that has investigated the effectiveness of modified PSSEs on PST and GIRD.

METHOD

Eligibility Criteria for Studies

A clinical question was developed according to the PICOS (P: participant, I: intervention, C: comparator, O: outcome, and S: study design) format for the present systematic review (Table 1). PICOS includes the population characteristics, treatments given, comparative treatments, primary and secondary outcomes, and data collection settings. This systematic review included Turkish-language and English-language studies. As a result of literature research, no Turkish-language study was found related to this topic. Available relevant peer-reviewed English-language randomized controlled trials (RCTs), prospective cohort, and controlled laboratory studies investigating the effects of modified PSSEs on GIRD and/or PST were included. Studies with living human participants with symptomatic and asymptomatic shoulders were accepted for inclusion. Stretching interventions included only modified stretching (i.e. with scapular stabilization); active or passive techniques. Interventions that are composed of a combination of traditional and modified PSSEs were excluded. We did not set a limitation on the timeframe of stretching or types of comparator interventions. Eligible studies determined shoulder HAROM or IRROM (active or passive) as outcome measures (12,13,15-30).

Data Sources and Literature Search Strategy

A systematic search was conducted using English databases (CINAHL, Cochrane Review, Pubmed [MEDLINE], and Web of Science) as well as Google Scholar© to identify peer reviewed articles about the effectiveness of modified PSSEs on PST as well as GIRD according to PRISMA statement (32). The following keywords were used to identify eligible studies: Glenohumeral internal rotation deficit, posterior shoulder tightness, posterior shoulder stretching, posterior shoulder stretch, posterior capsule stretch, modified posterior capsule stretch, modified cross-body stretch, modified sleeper stretch, modified posterior shoulder stretching. We used both 'and' as well as 'or' to combine these keywords. To determine eligible studies using keywords, abstracts were scanned firstly, and then the full texts were investigated. Additionally, reference lists of included articles were searched manually. Databases were searched from inception 1995 to October 2021.

Study Characteristics

A summary of included studies as well as detailed information related to modified PSSEs methods is shown in Table 2.

The risk of bias in included studies was assessed with Physiotherapy Evidence Database (PEDro) scale in Table 3. The quality of each study was

Table 1. PICOS Format and Search Keywords

	Definition	Search Key Words
Participants	Any participants	Not set
Intervention	Any form of modified stretching	Modified posterior shoulder stretch, modified cross-body stretch, Or modified sleeper stretch
Comparison	Any interventions	Not set
Outcome	PST or GIRD	(Posterior shoulder tightness) Or PST Or (glenohumeral internal rotation deficit) Or GIRD
Study Design	RCTs, prospective cohort studies, controlled laboratory study	Not set

GIRD: Glenohumeral internal rotation deficit; PST: Posterior shoulder tightness; RCTs: Randomized controlled trials

Table 2. Summary of Included Studies

Study	Participants	Intervention	Outcome measure	Results	Study Design
Guney et al. (2015)	Asymptomatic non-athletic women with GIRD (n = 74) Age: 24.0 ± 1.5 (Modified CBS group), 24.2 ± 4.1 years (Traditional CBS group) and 23.8 ± 1.7 years (Traditional SS group)	The following interventions were performed everyday over 1 week. *__Modified CBS group__ (n = 25): passive static stretching was performed in supine position with scapular stabilization, 30 seconds, 3 repetitions * __Traditional CBS group__ (n = 25): static stretching, 30 seconds, 3 repetitions * __Traditional SS grou__p (n = 24): static stretching, 30 seconds, 3 repetitions	The following were assessed for the dominant side before and after interventions. * Passive HA ROM (PST) * Passive IR and ER ROM at 90° abduction	Improvements in passive HA and IRROM were significantly higher in the modified CBS group compared to traditional CBS and SS groups ($P < 0.001$). Passive HA and IRROM improved after interventions in all three groups ($P < 0.05$).	A randomized controlled trial
Hammons et al. (2015)	Asymptomatic young athletes with GIRD (n = 34, 19 men and 15 women) Age: 21.1 ± 1.6 (Traditional CBS group) and 21.6 ± 3.3 years (Modified PPPS group) Sports: Baseball, softball, and swimming	The following interventions were performed three times per week over 4 weeks. *__Traditional CBS group__ (n = 17): active, static stretching were performed in standing position, 30 seconds, 5 repetitions *__Modified PPST group__ (n = 17): passive IR at 90° abduction with the scapula stabilized in prone, performing static stretching, 30 seconds, 5 repetitions	The following were assessed for the dominant side before and after interventions. *Passive IR and ER ROM at 90° abduction *GIRD * Total arc of motion	Passive IRROM increased and GIRD improved after interventions in both groups ($P < 0.01$). However, there was no significant difference between the two groups. There was no significant improvement in ER ROM in the two groups.	A randomized controlled trial
Salamh et al. (2015)	Asymptomatic elite female volleyball players with GIRD (n = 60) Age: 16.1 ± 1.2 (Modified CBS group) and 16.5 ± 1.5 years (Traditional CBS group)	Single session of PSSE was performed. Passive static CBS with or without passive scapular stabilization was performed for the dominant shoulder in supine. *__Modified CBS group__ (n = 30): passive stretching with scapular stabilization in the supine position, 30 seconds, 3 repetitions * __Traditional CBS group__ (n = 30): passive stretching in supine position without stabilization, 30 seconds, 3 repetitions	The following were assessed before and immediately after interventions. * Passive HA ROM in side-lying PST) * Passive IRROM at 90° abduction	Baseline data for horizontal adduction and IRROM were not different between the two groups. Both post-intervention horizontal adduction and IRROM were greater in the Modified CBS group compared to the Traditional CBS group ($P < 0.01$).	A randomized controlled trial
Cools et al. (2012)	Overhead athletes (n=60, 31 men and 29 women) with GIRD, including 30 athletes with impingement symptoms and 30 asymptomatic athletes Age: 25.0 ± 7.2 years Sports: Volleyball, tennis, squash, and badminton	The following interventions were performed during 3 weeks * __Symptomatic, modified CBS + SS group__ (n=15): passive static modified CBS performed with scapular stabilization in the supine position, passive static modified SS performed with scapular stabilization in the side-lying position, each stretching technique sustained 30 secs, repeated until the end of 15-minute sessions * __Symptomatic, Joint Mobilization group__ (n=15): dorsal and caudal glide, high grade, 30 seconds, 30-second rest, repeated until the end of 15-minute sessions * __Asymptomatic, modified CBS + SS group__ (n=15): the same implementation as above * __Asymptomatic, Joint Mobilization group__ (n=15): the same implementation as above	The following were assessed for both sides before and after 3-week interventions and at 6-week follow-up. *Pain (VAS) *Modified Rowe Score *Passive IRROM at 90° abduction	There was an increase in ROM ($P<0.05$) in both treatment groups, in symptomatic groups as well as in asymptomatic groups. Symptomatic athletes showed a significant improvement in pain and Modified Rowe Score There was no significant difference between the two treatment techniques.	A randomized controlled trial
Oyama et al. (2010)	Asymptomatic male collegiate baseball pitchers (n=15) Age: 20.4 ± 1.35 years	A single session of PSSE was performed. ***Modified SS at 90° group** In standing position, the dominant shoulder was placed against the wall, and the scapula pressed the wall to maintain scapular stabilization. The shoulder flexed to 90° with the elbow in 90° of flexion and internally rotated using contralateral arm ***Modified SS at 45° group** The same position as above, the dominant shoulder flexed to 45° with elbow in 90° of flexion, and internally rotated using contralateral arm ***Modified CBS g**roup The same position as above, the dominant shoulder flexed to 90° and passively horizontally adducted to end range using the contralateral arm *Each stretch repeated 3 times, sustained 30 seconds, with 30 seconds of rest	The following were assessed immediately before and after interventions. * Passive HA ROM in supine (PST) * Passive IR and ER ROM at 90° abduction and 90° of elbow flexion.	There was no significant stretch by session (prestretch versus post stretch) interaction for IR (P=.919), ER (P=.494), or HA ROM (P =.536). There were significant session main effects for IRROM (P< 001) and horizontal adduction ROM (P<.001). There was a significant increase in IRROM (< .001) and HA ROM (< .001) following all modified PSSEs, while no significant session main effect for external rotation ROM (P=.971).	Prospective cohort study

Brown et al. (2015)	Asymptomatic collegiate baseball players (n=40) Age between 18 and 21 years Traditional CBS group (n=20) age= 18.9 ±.94 years Modified CBS group (n=20) age= 19.9 ± 1.3 years	A single session of PSSE was performed ***Traditional CBS group** (n=20) In upright standing position CBS was performed without scapular stabilization ***Modified CBS group** (n=20) In side-lying position, the participant pulled the throwing arm across the body using the non-throwing arm while maintaining 90° of shoulder and elbow flexion with scapular stabilization. Scapular stabilization ensured using a standard foam roller (it placed horizontally under the participant's lateral scapular border to provide external stabilization while the stretch was performed) Each stretch was repeated 5 times, sustained 30 seconds, with 15 seconds of rest	The following were assessed at three different intervals: 1) after their initial warm-up but before throwing 2) after throwing, and 3) after stretching intervention *Passive HA ROM in supine (PST) * Passive IR and ER ROM at 90° abduction and 90° of elbow flexion. *TR ROM (IR+ER ROM)	There was no significant difference for IR, ER, HAD, and TROM when the two groups compared across the various time points (p>.05). Both the modified CBS and Traditional CBS improved the passive shoulder IR, HA, and TR ROM in the overhead athlete after an acute bout of throwing (P<.05).	A double-blind randomized controlled trial
Bailey et al. (2017)	Asymptomatic male baseball players (n=60) with GIRD,	A single session of treatment was performed. *** Instrumented manual therapy plus modified SS and CBS group (n=30)** In the prone position, instrumented manual therapy was performed targeting the infraspinatus and teres minor muscles for 2 minutes. In the side-lying position, the dominant shoulder flexed at 90° with the elbow flexed to 90°; the shoulder was then rotated internally using the opposite hand. The scapula was retracted and stabilized using a towel roll during modified SS. The modified CBS was performed in the same starting position described above. The athlete grasped the dominant elbow with the opposite hand placed beneath the arm and pull across the front of the body. Each stretch repeated 2 times, sustained 60seconds, with 30 seconds of rest ***Modified SS and CBS groups (n=30)** The same stretching techniques, as above, was performed	The following were assessed immediately before and after a single treatment session. *Passive HA ROM in supine (PST) * Passive IR and ER ROM at 90° abduction and 90° of elbow flexion. *TR ROM *Humeral Torsion	There was a significant improvements in ROM in both groups after the intervention. The instrumented manual therapy plus modified SS and CBS stretching group was significantly greater increases in internal rotation, TR ROM and HA ROM compared with modified CBS and SS group (p<.05).	Controlled laboratory study
Mine et al. (2017)	Young healthy individuals n=12, 9 men and 3 women) Age 20.9 ± 0.3 years	A single session of PSSE was performed. Each subject completed the stretching interventions for 48 hours. Two testing sessions were separated by a minimum of 48 hours, to minimize potential carry-over effects of stretching. ***Modified SS group (n=6)** Participants performed modified SS by rotating their upper trunk posteriorly 20-30° in side-lying, and rotating the dominant shoulder internally at 90° shoulder flexion and 90° elbow flexion using the non-dominant hand ***Traditional CBS gr**oup (n=6) Participants performed the traditional cross-body stretch in a sitting position. Each stretch repeated 5 times, sustained 20 seconds, with 10 seconds of rest	The following were assessed at two separate sessions. In the first experimental sessions, anthropometric measurements were taken, and body mass index was calculated accordingly. In both intervention sessions, the baseline data for ER, IR, and HA ROM on the dominant side was collected in this order. *Passive HA ROM in supine (PST) * Passive IR and ER ROM at 90° abduction and 90° of elbow flexion.	There was a significant immediate improvement in IR and HA ROM in both stretching interventions (p<0.01). There was no significant difference between the two intervention groups in terms of ROM changes (p>.05).	A crossover randomized controlled trial.

Joung et al. (2019)	Asymptomatic participants (n=26, 14 males, 12 females) with limited shoulder HA ROM (<115°), GIRD (>10°) when compared dominant and non-dominant side Age for traditional CBS group 21.0 ± 1.5 years Age for modified CBS group 21.5 ± 1.3 years	The following interventions were performed four times per week over 4 weeks. ***Traditional CBS group** In the side-lying position, the dominant shoulder flexed at 90° with the elbow flexed to 90°; the participant grasped the dominant elbow with the opposite hand placed beneath the arm and pulled the elbow as possible as on the transverse plane without scapular stabilization. ***Modified CBS group** Modified CBS performed with scapular stabilization. For scapular stabilization participants used a non-elastic orthopedic manual therapy belt. When the participant retracted the scapula, the belt was applied just under the participant's axilla with a tension of 2 to 3 kg stabilization force for allowing a normal breath pattern. A towel was applied between both scapulae. The same stretching position as mentioned above, modified CBS performed with scapular stabilization. Each stretch repeated 10 times, sustained 30 seconds, with 10 seconds of rest	The following were assessed for both sides before and after 4-week interventions *Passive HA ROM (PST) * Passive IRROM at 90° abduction and 90° of elbow flexion. *Horizontal adductor strength	There were significant improvements in IR and HA ROM in both stretching interventions ($p<0.01$). There was a significant increase for HA ROM in the modified CBS group when compared to the traditional CBS group ($p<.05$). There was no significant difference between the two intervention groups in terms of IRROM changes as well as shoulder horizontal adductor strength ($p>.05$).	A randomized controlled trial.
Rao et al. (2016)	Asymptomatic Overhead Athletes (n=45) There was no information related to sex, age as well as the type of overhead sports	The following interventions were performed five repetitions daily, for 4 weeks. ***Modified SS group (n=15)** The athlete performed modified SS by rotating their upper trunk posteriorly 20-30° in side-lying, and rotating the dominant shoulder internally at 90° shoulder flexion and 90° elbow flexion using the non-dominant hand ***Modified CBS group (n=15)** In a side-lying position on the involved side, the trunk rolled posteriorly 20-30°, and both knees semi-flexed. The shoulder is elevated to 90° and then aligned the forearm that to be stretched with the opposite forearm on the top. During stretching the athlete stabilized the scapula against the treatment table as the shoulder was horizontally adducted, while external rotation was restricted via counterpressure of the opposite forearm, and a therapist stood behind the athlete, supported the back to prevent further trunk rotation to maintain scapular stabilization. ***Traditional CBS group (n=15)**) Participants performed the traditional cross-body stretch in upright standing position. Each stretch repeated 5 times, sustained 20 seconds, with 10 seconds of rest	The following interventions were assessed before and after 4-week interventions. * Passive IRROM at 90° abduction and 90° of elbow flexion * Thumb-up-the back * Penn Shoulder Score	There were significant improvements in IRROM, Thumb-up-the back, and Penn Score (Decrease in shoulder disability) in three stretching interventions ($p<0.05$). There was a significant improvement for IRROM and disability level in the modified CBS group when compared to modified SS as well as traditional CBS group ($p<.001$).	A randomized controlled trial.
Pandya et al. (2018)	Asymptomatic overhead throwers (n=60) Modified SS group age= 32.20±8.9 years and Modified SS with kinesio taping group age=24.96 ±4.9 years. There was no information related to sex as well as the type of overhead sports	The following interventions were performed five times a week for 4 weeks. ***Modified SS group** (n=30) The athlete was positioned in the side-lying on the throwing side to stabilize the scapula against the treatment table, and both the shoulder and elbow flexed to 90°. In this position, the dominant arm passively internally rotated by using the opposite hand. ***Modified SS with Kinesio taping group** (n=30) Stretching performed as mentioned above. Before stretching, kinesio tape was applied from the anterior aspect of the humeral head, just lateral to the acromion process to finish at the inferior angle of the scapulae, as well as the second piece of tape commenced on the anterior aspect of the humeral head over the acromion in sitting position. The opposite hand lifted the humeral head up and back during the application of the tape. Each stretch was repeated 3 times, sustained 30 seconds, with 30 seconds of rest. The tape was changed on an alternate day.	The following were assessed for both sides before treatment (1st day), 1st week, 2nd week, 3rd week, and after 4-week interventions. *IRROM deficit (GIRD)	There was a significant improvement in IRROM in the dominant side of the shoulder in the modified SS group after 1st, 2nd, 3rd and 4 weeks of treatment ($p<.05$) There was a significant improvement in IRROM in the dominant side of the shoulder in modified SS with kinesio taping group ($p<.05$) except for 3rd and 4 weeks conclusion, where there was no significant improvement ($p>.05$). For IRROM improvement, the short-term effect of modified SS with kinesio taping was significantly greater than modified SS ($p<.05$). However, the effectiveness of kinesio taping on long-term effect was less as compared to 1st day and there was no significant difference between groups on 3rd week to 4th week ($P>.05$).	A randomized controlled trial.

Salamh et al. (2017)	Patients who underwent arthroscopic shoulder surgery (all participants having undergone subacromial decompression, distal clavicle excision, and RC debridement) within 2 weeks preceding data collection (n=63) Age=51 ±12 years	The following interventions were performed two times per day with a mean of 2 days at home (48–72 h between baseline and follow-up) ***Traditional SS group (n=21)** In the supine position, The patient was abducted to the operative shoulder approximately 45° and flexed the elbow at 90° with neutral rotation of the glenohumeral joint. The patient placed the other hand on the wrist of the involved extremity, and then passively internally rotated without scapular stabilization. ***Modified CBS group (n=21)** In an upright standing position, the patient stabilized the operative scapula against a wall. The opposite hand is placed on the elbow of the involved extremity and assists the operative shoulder into horizontal adduction. In addition to stretching, pendulum exercises were performed. ***Control Group (n=2**1) The patients performed only pendulum exercises twice a day. No stretching was performed. Each stretch was repeated 3 times, sustained 30 seconds, twice a day.	The following interventions were assessed before treatment and 48–72 h follow-up. *Passive HA ROM (PST) in the side-lying position * Passive IRROM at 90° abduction and 90° of elbow flexion *QuickDASH *Pain	There was a statistically significant difference for PST improvement between both the modified CBS group and the traditional SS group (p = 0.01) as well as between the modified CBS group and the control group (p < 0.01), favoring greater improvement in the modified CBS group in both instances at 48–72 h. There were no significant differences acutely with regards to IRROM (p>.05), average pain scores (p>.05) and QuickDASH scores (p>.05) between groups	A single-blinded randomized control trial
Tahran et al. (2020)	Patients with subacromial impingement syndrome and GIRD (n=67, 45 male, 22 female) Age=52.94 ± 11.05 years	The following interventions were performed five times a week for 4 weeks (5 days under physical therapist supervision and 2 days at home). ***Modified SS group (n=22)** They received a standard treatment program with modified SS. Modified SS was performed in a side-lying position; the body was rolled 20° to 30° posteriorly to reduce symptoms of pain, and the humerus was moved into IR using the opposite arm ***Modified CBS Group (n=22**) They received a standard treatment program with modified CBS. Modified CBS was performed in a side-lying position to limit scapular abduction. The forearms were aligned, with the opposite arm on top to limit the ER of the humerus, and the humerus was moved into horizontal adduction using the opposite arm. ***Control Group (n=2**3) Standart treatment program consisting of modalities, ROM, and strength training but no PSSE. Each stretch was repeated 5 times, sustained 30 seconds, once a day for 4 weeks.	The following interventions were assessed before and after 4-week interventions. *Passive HA ROM (PST) * IRROM *ER ROM *TR ROM (IR+ER ROM) *Pain at rest *Pain during activity *CMS score *QuickDASH score	There was a significant improvement in pain, PST, shoulder rotation ROM, function, and disability in all groups after treatment (P<.05). The modified stretching groups were superior to the control group in improving pain with activity, IRROM, function, and disability (P<.05). There was no significant difference between modified stretching groups (p>.05).	A randomized controlled trial.
Yamauchi et al. (2016)	Asymptomatic college baseball players (n=24) with GIRD Modified CBS group age=21.4 ± 1.2, Modified SS group age= 20.3 ± 0.9 There was no information related to sex.	The following interventions were performed once daily after practice or before going to bed for 4 weeks. ***Modified CBS group (n=12)**Modified CBS was performed with the subjects in the side-lying position on the throwing side to stabilize the scapula; the forearms were aligned, with the opposite forearm on top to restrict ER of the stretched shoulder; and the humerus of the throwing side was moved into HA using the opposite arm. ***Modified SS group (n=12**) Modified SS was performed with the subjects in the side-lying position on the throwing side; the trunk was rolled 30° posteriorly on the throwing side to decrease the pressure at the glenohumeral joint; a towel was placed under the subject's humerus to increase the amount of glenohumeral HA; and the humerus of the throwing side was moved into IR using the opposite arm. Each stretch was repeated 3 times, sustained 30 seconds, for 4 weeks.	The following interventions were assessed before and after 4-week interventions. *IRROM *ER ROM *TR ROM (IR + ER ROM) *HA ROM *Muscle stiffness for infraspinatus, teres minor, and posterior deltoid	There was a significant improvement in IRROM and HA ROM in both modified stretching groups (P<.05). After 4-week intervention muscle stiffness of the teres minor significantly decreased in the modified CBS group (P<.05), while muscle stiffness of the infraspinatus significantly decreased in the modified SS group (P<.05).	A randomized controlled trial.

Gharisa et al. (2021)	Asymptomatic and symptomatic overhead athletes (n=42, 22 female, 20 male) having GIRD (IRROM deficiency >10°) Age= 25.9 ± 2.6 years Sports: Baseball, volleyball, tennis, water polo, squash, and swimming	The following interventions were performed 3 times a week for 4 weeks ***Novel SS with Clam Shell Bridging Group (n=20)** In a supine position, a resistance band was placed around the participant's knees, and then he/her opened knees. After, the participant was a bridge as high as possible, with the elbow flexed to 90° and shoulder abducted to 90° . The bridging maneuver shifts the body weight superiorly and stabilized the medial border of the scapula against the thorax without directly compressing or restricting posterior shoulder structures. While maintaining this position, participants were asked to contract their gluteal muscles and perform the stretching by actively internally rotating their shoulder to the end of ROM using the opposite hand. ***Modified SS Group (n=22**) In a side-lying position; the body was rolled 20° to 30° posteriorly to reduce symptoms of pain, and the elbow flexed to 90°, the shoulder elevated to 90. In the side-lying position, on the affected side, with the elbow flexed to 90°, scapula was stabilized with the participant's body weight. Passive IR stretching was performed using the opposite hand. Each stretch repeated 3 times a week with 3 repetitions, sustained 30 seconds, with 30 s rest between repetitions for 4weeks	The following interventions were assessed baseline, immediately after and after 4-week post interventions for IRROM, baseline, and after 4-week post interventions for pain. *IRROM *Pain	There was a significant increase in IRROM from baseline to immediate and week 4, and from immediate to week 4 in both groups ($p < .001$). There was no significant difference between groups ($p > .05$) There was a significant reduction in pain intensity over time in the novel SS with Clam Shell Bridging Group $p < .05$), but not in the modified SS group ($p > .05$).	A parallel-design 2-arm, assessor-blinded randomized controlled clinical trial.
John et al. (2010)	Asymptomatic male bowlers athletes with GIRD (n=45, age between 16-24 years) There was no information related to mean age.	The following interventions were performed 6 times a week for 3 weeks ***Modified SS and CBS Group (n=15)** -For modified SS, the athlete is in a side-lying position, with the humerus flexed 90° and the elbow flexed 90°. The practitioner was placed one hand on the proximal humerus to assist the body weight in stabilizing the scapula, and placed the other hand on the posterior aspect of the distal ulna. A downward motion at the distal ulna internally rotated the humerus. After IR, the trunk was rotated toward the humerus to enhance the stretch. -For modified CBS, in a supine position, the practitioner was stabilized the scapula with the help of the hip and the shoulder was stretched in the direction of the horizontal adduction. ***Posterior glide mobilization group (n=15)** In the supine position, the athlete's arm flexed to 90° internally rotated, and with elbow flexed. The practitioner used to place padding under the scapula for stabilization. The practitioner placed one hand across the proximal surface of the humerus and the other hand over the athlete's elbow, the humeral head was glided posteriorly by pushing down at the elbow through the long axis of the humerus. ***Combination of modified SS and CBS, as well as posterior glide mobilization group (n=1**5) The combination of the same implementations as mentioned above. Each stretch was repeated 6 times a week with 5 repetitions, sustained 30 seconds, with 30 s rest between repetitions for 3 weeks. Posterior glide mobilization performed 3 times a week for 10 repetitions per session maintaining end position for one minute for 3 weeks	The following interventions were assessed baseline, weekly and at the end of 3-week post interventions for IRROM, baseline and after 3 week past interventions for HA distance *IRROM *HA distance	There was a significant improvement for IRROM and HA distance in all groups at the end of the weeks ($p < .05$) At the different intervals (1 week, 2 weeks) as well as at the end of 3 weeks interventions, IRROM and HA distance were significantly improved in combination of modified SS and CBS plus posterior glide mobilization group when compared to the modified SS and CBS group and the posterior glide mobilization group ($p < .05$). There was no significant difference between the modified SS and CBS group and the posterior glide mobilization group for IRROM ROM outcome, whereas for HA distance outcome, modified SS and CBS group significantly greater decreased when compared to the posterior glide mobilization group ($p < .05$)	A randomized controlled trial

Lo, et al. (2021)	Asymptomatic baseball pitchers with GIRD (n=31) Modified SS group (n=10, 20.5 ± 2.6 1.2years) Kinezio Tape Group (n=11, age=20.4± 1.9 years) Control group (n=10, 20.9 ± 1.5 years)	A single session of treatment was performed. *Modified SS group (n=10) Each participant laid on the dominant shoulder, the shoulder abducted to 90, and elbows flexed to 90. The scapula was stabilized using the participant's body weight to avoid movement of the scapula. Each participant was required to grab the wrist of his or her dominant side with the non-dominant hand and slowly press the wrists in the direction of IR until feeling that the shoulder tissue was being pulled without any pain. Modified SS was repeated five times, each lasting 30 s *Kinesio Tape Group (n=11) Four I-shaped strips of Kinesio tape were used on the posterior deltoid fibers, infraspinatus, and teres minor. Each participant sat down, and taping was applied from the endpoints to the starting points of the relevant muscles to help the muscles relax. No tensile force was applied during the tape application.	The following were assessed immediately before and after a single intervention. *Active IRROM * Active ER ROM * TR ROM (IR+ER ROM) *Active HA ROM *IR, ER, and HA strength *AHD	There were significant changes between the pretest and post-test values concerning the measurement of shoulder IR, ER, HA, and TR ROM in the Kinesio tape group and the modified SS group increased (p<.05), whereas shoulder ER exhibited reduced ROM in these two groups when compared to the control group. ER strength significantly increased followingkKinesio tape application, but significantly decreased after modified SS (p<.05). There was no change in the control group (p>.05) There was no significant change on the sub-acromial space after intervention and among the groups (p>.05).	A randomized controlled trial

AHD: Acromio-humeral distance, CBS: Cross-body stretching, SS: Sleeper stretching, PPST: Prone-passive stretching technique, GIRD: Glenohumeral Internal Rotation Deficit, HA: Horizontal adduction, IR: Internal rotation, ROM: Range of Motion, TR ROM: Total rotational range of motion, PST: Posterior shoulder tightness, JM: Joint mobilization. Values are described as mean ± standard deviation.

Table 3. Risk of Bias Assessment in the Included Studies

Study	1	2	3	4	5	6	7	8	9	10	11	Total
Guney et al. (2015)	1	1	1	1	0	0	1	1	1	1	1	8/10
Hammons et al. (2015)	1	1	1	1	0	0	1	0	0	1	1	6/10
Salamh et al. (2015)	1	1	0	1	0	0	1	0	0	1	1	5/10
Cools et al. (2012)	1	1	0	1	0	0	0	0	0	1	1	4/10
Oyama et al. (2010)	1	0	0	0	0	0	0	1	1	1	1	4/10
Brown et al. (2015)	1	1	1	1	0	0	1	1	0	1	1	8/10
Bailey et al. (2017)	1	1	0	0	0	0	1	1	1	1	1	7/10
Mine et al. (2017)	1	1	1	1	0	0	1	1	1	1	1	8/10
Joung et al. (2019)	1	1	0	1	0	0	0	1	1	1	1	6/10
Rao et al. (2016)	0	1	0	0	0	0	0	1	1	1	1	5/10
Pandya et al. (2018)	1	1	0	0	0	0	0	1	1	1	1	5/10
Salamh et al. (2017)	1	1	1	1	1	0	1	1	1	1	1	9/10
Tahran et al. (2020)	1	1	0	1	0	0	1	1	1	1	1	7/10
Yamauchi et al. (2016)	1	1	0	1	0	0	1	1	1	1	1	7/10
Gharisa et al. (2021)	1	1	1	1	1	0	1	1	1	1	1	9/10
John et al. (2010)	1	1	0	1	0	0	0	1	1	1	1	6/10
Lo et al. (2021)	1	1	0	1	0	0	0	1	1	1	1	6/10

PEDro scale: 1, eligibility criteria 2, random allocation; 3, concealed allocation; 4, similarity at baseline; 5, blinding of participants; 6, blinding of therapists; 7, blinding of assessors; 8, measures of at least one key outcome from at least 85% of participants initially allocated to groups; 9, intention to treat analysis; 10, between-group comparison; 11, point measures and measures of variability. 1: Yes (1 point), 0: No (0 point), maximum score: 10 (criterion 1 is not included in scores)

classified as "high" (≥7/10), "moderate" (5/10, 6/10), or "poor" (≤4/10) considering total scores. The effect size was assessed for data extraction and synthesis as follows; small (0.20 to 0.49), moderate (0.50 to 0.79), and large (0.80 or greater) (33).

RESULTS

Study Selection

The literature search generated 127 relevant papers. Following duplicates and irrelevant articles were excluded through screening in title and abstract, and then full-text assessment. According to the examination of eligibility criteria, 69 articles underwent title and abstract screening. Subsequently, 35 articles underwent full-text review, ultimately producing 17 articles that met the inclusion criteria for the present systematic review (Figure 1).The presence of GIRD or PST was in the inclusion criteria of twelve studies, although GIRD and PST definitions were somewhat different among studies. GIRD was defined as >10° restriction in IRROM at 90° shoulder abduction in the dominant side compared to the non-dominant side, in five studies (16,19,20,24,25,26). Two studies defined GIRD as more than 15° decrease (23,27), one study as more than or equal to 18° (28) decrease, and the other one as more than 20° decrease (12) in IRROM. Apart from these studies, one study defined GIRD as more than 10% of the total shoulder ROM [sum of the IR and external rotation (ER)ROM] (29).

***Study Designs*:** Fourteen RCTs used parallel designs, whereas one RCT used a cross-over design (16). Oyama et al. conducted a prospective cohort study (22). Only one study conducted by Bailey et al. was a controlled laboratory study (23).

Participants: PSSEs were generally performed in overhead athletes performing baseball, volleyball, softball, swimming, badminton, tennis, water polo, softball, basketball, and squash sports (12,16,19,20,24,25,26). On the other hand, PSSE was also performed in the non-athletic population with shoulder pain syndrome (18,27). Sample sizes ranged between 15-65. The total sam-

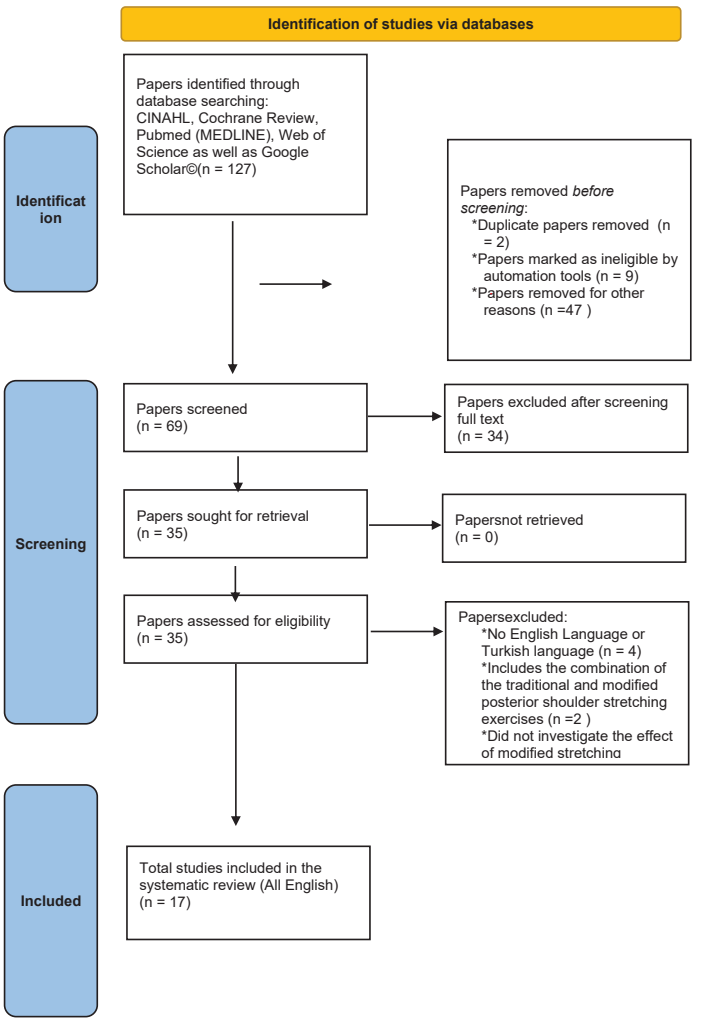

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Diagram of the Literature Search Used

ple size for the present review was 758 subjects (390 male and 263 female, no given information related to sex in 105 subjects (21,30).

Interventions: Isolated modified cross-body stretch was used in eight studies (17,18, 19,20,21,22,25,28), whilst isolated modified sleeper stretch was used in eight studies (16,21,22,24,25,27,29,30). One study used the passive stretching technique in the prone position, where the examiner stretched the participants' shoulder into IR at 90° abduction passively whilst stabilizing the scapula (26). The combination of the modified cross-body and modified sleeper stretch was examined in three studies (12,23,31). Other interventions utilized in the included studies were traditional cross-body stretch (16,17,19,20,21,26), traditional sleeper stretch (18,28) kinesio taping (29,30) joint mobilization (12,31), prone passive IR stretching with manual scapular stabilization (26), instrumented manual therapy with combination of modified modified cross-body and modified sleeper stretch (23), sleeper stretch with clamshell bridging (24). Control groups without any stretching intervention were used in three studies (18,27,29).

Outcome Measures: All studies included in the present review measured either or both active/passive IRROM at 90° abduction (12,15-31), and active/passive HAROM (16,17,18,20,22,24,25,27,28,31).

Effectiveness of Modified Cross-body Stretch on PST and GIRD

In the literature, the effects of modified cross-body stretch and its variations were investigated. In studies investigating the effects of modified cross-body stretch and its variations (12,17,18,19,20,21,22,25,27,28) single-session (immediate effect) modified active static cross-body stretch was found to have similar positive effects with active static traditional cross-body stretch (18) and passive static modified sleeper stretch (22) on PST and GIRD. Salamh et al. demonstrated that two sessions of passive static modified cross-body stretch, performed in standing position with scapular stabilization improved PST in 48–72 hours compared to passive static traditional sleeper stretch and no-stretch in postoperative population, but GIRD improvements were similar among groups (18). In asymptomatic non-athletic women, one week of passive static modified cross-body stretch program performed in supine position with manual scapular stabilization improved PST and GIRD compared to the passive static traditional cross-body stretch and sleeper stretch (28). In short term (4-weeks stretching period), both passive static and active static modified cross-body stretch were found to be more effective to improve PST (20) and GIRD (21) when compared to passive static traditional cross-body stretch. 4 weeks of Wilk's Modified active static cross-body stretch was found to be beneficial in improving PST and GIRD similar to Wilk's modified sleeper stretch.

Effectiveness of Modified Sleeper Stretch on PST and GIRD

The effectiveness of isolated modified sleeper stretch was performed in eight studies (4,21,22,24,25,27,29,30). After a single session intervention, Oyama et al. (22) demonstrated no difference between passive static modified sleeper stretch (at 45° and at 90° shoulder flexion) and passive static modified cross-body stretch on PST and GIRD in asymptomatic male overhead athletes. Furthermore, Mine et al. (4) concluded no difference between active static modified sleeper stretch and active static traditional cross-body stretch in terms of PST and IRROM improvements in young healthy individuals. Lo et al. (29) showed no difference between the modified sleeper stretch and kinesio taping on GIRD and PST in asymptomatic overhead athletes having GIRD. Pandya et al. (30) concluded that kinesio taping plus passive static modified sleeper stretch provided more improvement in GIRD when compared to only passive static modified sleeper stretch in a short term (1st and 2nd week) in asymptomatic overhead throwers. They found no difference during the 3rd and 4th weeks between groups. After 4 weeks of stretching (21,24,25,27), Rao et al. (21) found significant improvement in GIRD with passive static modified cross-body stretch when compared to passive static modified sleeper stretch and traditional cross-body stretch in asymptomatic overhead athletes. Tahran et al. (27) found no significant difference in PST and GIRD improvements of active static modified cross-body stretch and modified sleeper stretch groups in patients with SPS after 4 weeks of intervention. Yamauchi et al. (25) reported no significant difference in GIRD and PST recovery between active static modified sleeper and cross-body stretch in asymptomatic overhead throwers. Gharisa et al. (24) investigated the effects of novel sleeper stretch with clamshell bridging and the modified sleeper stretch on GIRD in both asymptomatic and symptomatic overhead athletes. They stated no significant difference between stretching techniques in terms of GIRD improvement.

Effectiveness of Combined Modified Stretch Interventions on PST and GIRD

The combination of the modified cross-body and sleeper stretch on GIRD and PST was investigated in three studies. A combination of passive static modified cross-body stretch and passive static sleeper stretch (12,31) was as effective as joint mobilization in improving GIRD in short term. PST improved more after a combination of passive static modified sleeper and cross-body stretch when compared to posterior glide mobilization (31). The addition of the instrumented manual therapy to the active static modified sleeper and cross-body stretch combination for a single session was found to be more effective

Table 4. Comparison of Within-Group Effect Sizes

Study	Outcome measure	Intervention	Effect size [95%CI]
Guney et al. (2015)	IR	Modified CBS group	4.27 [2.58 to 5.96]*
		Traditional SS group	1.44 [-0.40 to 3.28]
		Traditional CBS group	1.95 [0.54 to 3.37]*
	HA	Modified CBS group	1.37 [-0.71 to 3.44]
		Traditional SS group	1.09 [-0.35 to 2.52]
		Traditional CBS group	1.04 [-0.50 to 2.58]
Hammons et al. (2015)	IR	Traditional CBS group	0.96 [-2.00 to 3.92]
		Modified PPST group	1.04 [-3.27 to 5.34]
Salamh et al. (2015)	IR	Modified CBS group	0.93 [-2.07 to 3.93]
		Traditional CBS group	0.48 [-1.64 to 2.60]
	HA	Modified CBS group	1.33 [-2.66 to 5.32]
		Traditional CBS group	0.00 [-3.23 to 3.23]
Cools et al. (2012)	IR	Symptomatic, modified CBS + SS group	1.21 [-1.82 to 4.23]
		Symptomatic, Joint Mobilization group	2.38 [0.48 to 4.27]*
		Asymptomatic, modified CBS + SS group	2.81 [0.20 to 5.42]*
		Asymptomatic, Joint Mobilization group	1.75 [-2.21 to 5.70]
Oyama et al. (2010)	IR	Modified CBS	0.42 [-3.31 to 4.16]
		Modified SS at 90°	0.41 [-2.97 to 3.80]
		Modified SS at 45°	0.41 [-3.56 to 4.39]
	HA	Modified CBS	1.02 [-0.46 to 2.50]
		Modified SS at 90°	0.63 [-1.13 to 2.40]
		Modified SS at 45°	0.56 [-1.29 to 2.41]
Brown et al. (2015)	IR	Modified CBS	0.56 [-2.51 to 3.64]
		Traditional CBS	0,24 [-2,84 to 3,32]
	HA	Modified CBS	-0.37 [-3.82 to 3.08]
		Traditional CBS	-0.29 [-3.56 to 2.97]
Bailey et al. (2017)	IR	Modified SS and CBS groups	0.76 [-1.62 to 3.15]
		Instrumented manual therapy plus modified SS and CBS group	1.15 [-1.51 to 3.81]
	HA	Modified SS and CBS groups	0.69 [-1.83 to 3.22]
		Instrumented manual therapy plus modified SS and CBS group	1.58 [-0.58 to 3.74]
Mine et al. (2017)	IR	Modified SS group	1.23 [-1.11 to 3.57]
		Traditional CBS group	0.89 [-1.76 to 3.54]
	HA	Modified SS group	0.74 [-2.64 to 4.11]
		Tarditional CBS group	0.67 [-2.30 to 3.64]
Joung et al. (2019)	IR	Modified CBS group	0.53 [-2.51 to 3.57]
		Traditional CBS group	0.31 [-2.59 to 3.20]
	HA	Modified CBS group	7.70 [6.60 to 8.80]*
		Traditional CBS group	17.46 [14.97 to 19.94]*
Rao et al. (2016)	The data not available*		
Pandya et al. (2018)	IR	Modified SS group	8.6 [7.59 to 9.61]*
		Modified SS with kinesio taping group	10.98 [10.03 to 11.94]*

Salamh et al. (2017)	**IR**	**Modified CBS group**	0.51 [-3.04 to 4.07]
		Traditional SS group	0.26 [-4.31 to 4.84]
		Control Group	0.0 [-4.0 to 4.0]
	HA	**Modified CBS group**	1.24 [-2.19 to 4.7]
		Traditional SS group	0.39 [-3.50 to 4.27]
		Control Group	0.08 [-3.61 to 3.77]
Tahran et al. (2020)	**IR**	**Modified CBS group**	2.26 [-0.57 to 5.08]
		Modified SS group	1.67 [-2.24 to 5.58]
		Control Group	0.68 [-3.06 to 4.42]
	HA	**Modified CBS group**	2.58 [0.06 to 5.09]*
		Modified SS group	1.57 [-2.60 to 5.75]
		Control Group	0.80 [-2.60 to 4.21]
Yamauchi et al. (2016)	**IR**	**Modified CBS group**	1.28 [-1.22 to 3.78]
		Modified SS group	1.39 [-0.91 to 3.69]
	HA	**Modified CBS group**	0.52 [-3.33 to 4.37]
		Modified SS group	0.39 [-3.67 to 4.46]
Gharisa et al. (2021)	**IR**	**Novel SS with Clam Shell Bridging Group**	2.0 [-1.53 to 5.53]
		Modified SS Group	1.25 [-3.11 to 5.62]
John et al. (2010)	**The date not available***		
Lo et al. (2021)	**IR**	**Modified SS group**	1.42 [-2.76 to 5.59]
		Kinesio Tape Group	1.61 [-0.74 to 3.96]
		Control group	-4.05 [-9.11 to 1.01]
	HA	**Modified SS group**	11.40 [7.09 to 15.70]*
		Kinesio Tape Group	1.19 [-2.92 to 5.29]
		Control group	0.15 [-7.25 to 7.54]

CBS: Cross-body stretching, SS: Sleeper stretching, HA: Horizontal adduction, IR: Internal rotation, PST: Posterior shoulder tightness, JM: Joint mobilisation. CI: Confidence interval.

* The necessary data were lacking in two studies to calculate the effect size. We contacted to corresponding authors by e-mail. However, we could not reach the authors. Because of this reason, the data is not available

in improving GIRD than using the active static modified sleeper stretch and cross-body stretch combination alone (23).

Effectiveness of Modified Prone Passive Stretching Technique on GIRD

In addition to the two most popular arm positions used in modified PSSE in the literature, a different modified stretching position is defined in Hammer et al. (26). The authors compared the effects of modified passive stretching in the prone position with manual scapular stabilization and passive static traditional cross-body stretch on asymptomatic GIRD in young athletes. The authors found similar benefits in terms of the GIRD improvement.

DISCUSSION

To the best of the authors' knowledge, the present systematic review is the first studyon the effectiveness of modified posterior shoulder stretching exercises for PST and GIRD. This systematic literature review demonstrates that there is high evidence related to the positive effects of both modified cross-body and sleeper stretch for GIRD and PST in acute or short-term durations. According to research results, only three studies with different treatment durations and different populations concluded that modified cross-body stretch was more effective than modified sleeper stretch to improve PST (18,20) and GIRD (21). However, the results of the other studies indicated that the effects of the two modified stretching applications were similar (16,22,25,27). In three research, the effects of a single-session stretching intervention on posterior shoulder mobility were evaluated inoverhead

athletes as well as postoperative populations. They found no difference between modified and traditional PSSEs (16,17,18). However, the studies comparing the short-term effects of modified and traditional PSSEs on GIRD and PST concluded that modified PSSEs were more effective than traditional PSSEs in terms of GIRD and PST improvement (19,20,21,28).

In the literature, the two most popular arm positions used in modified PSSE (modified cross-body and modified sleeper stretch) have been defined by Wilk et al. (14). and eight studies used these modified PSSEs (16,17,21,23,25,27,30,31). Different modified PSSE positions have been used in three studies (15,24,26). Johansen et al. (15) and Hammons et al. (26) used prone passive stretching with manual stabilization of the scapula. Modified prone passive stretching with manual scapular stabilization and passive static traditional cross-body stretch on GIRD demonstrated similar short-term benefits in terms of the GIRD improvement in asymptomatic young athletes with GIRD (26). Gharise et al. investigated the effect of novel sleeper stretching with clamshell bridging and only modified sleeper stretching on GIRD in overhead athletes and found no difference between interventions for GIRD improvement (24).

Source of Bias and Limitations of Included Studies

Studies without allocation concealment or adequate blinding for participants, therapists as well as assessors showed larger effects of exercises. This suggests Type 1 error (12,20,23,29,30). Furthermore, the four included studies did not perform intention-to-treat analysis even they reported drop-outs (12,17,19,26). These methodological flaws might have resulted in the overestimation of the intervention effects. Therefore, positive findings should be interpreted critically.

Within-group effect sizes were generally found as large in most studies (12,16,18,19,20,23,24,26, 27,28,29,30); however, roughly less then half 95% CIs around effect sizes excluded zero meaning no effect (12,20,27,28,29,30) (Table 4).

In one low-quality prospective cohort study that was conducted by Oyama et al., the authors investigated three different modified PSSEs performing one treatment session in a standing position. IRROM was improved statistically significant in all modified stretch groups (modified cross-body stretch, modified sleeper stretch at 45° or 90°), whereas the effect size was small in all groups. Without allocation concealment, similarity at baseline data, as well as inadequate blinding procedures may probably cause this result (22).

In one high-quality study, the authors investigated the modified cross body and sleeper stretch in asymptomatic college baseball players with GIRD. The participants performed stretching exercises as a home program daily. IRROM and PST were improved in both modified PSSEs groups. However, the effect size was small for the modified sleeper stretch group and moderate for the modified cross-body stretch group in terms of the IRROM improvements. The modified PSSEs were given as a home exercise program in this study and this may affect the results (25).

The necessary data were lacking in two studies to calculate the effect size. We contacted corresponding authors by e-mail. However, we could not reach the authors. Because of this reason, the data is not available (21,31).

Most research was conducted on asymptomatic young overhead athletes or non-overhead population throughout the included studies (17,19,22,23,24,25,28). Two research were conducted with the symptomatic non-overhead population (18,27), whereas the other two research were conducted with the symptomatic overhead athletes (12,24). Due to the heterogeneity of studies, findings cannot be generalized to symptomatic or older people. Furthermore, the six studies investigated the immediate effect of modified stretching exercises(16,17,19,22,23,29), whereas the other studies investigated the short-term effect of modified stretching exercises (12,18,2 0,21,24,25,26,27,28,30,31). The included studies did not conduct long-term follow-up except for Cools et al.'s study (12) included six-week follow-up period.

Limitations of This Systematic Review

The present systematic review has several limitations. The included studies were potentially limited by the English-language, since language limitation may lead to bias. Furthermore, heterogeneity of included studies such as stretching positions, duration of stretching, repetitions as well as total treatment duration, study populations prevented us from objectively summarising the present review findings.

Clinical Recommendations for Future Research

Future research should focus on other specific shoulder diseasessuch as subacromial pain syndrome, SLAP lesions or other glenohumeralinstability. It is unclear whether the traditional or modified techniques are superior to each other as few studies compare traditional and modified PSSE. Future studies with larger sample sizes to provide better statistical precision and conducting longer treatment durations with follow-ups to determine how long the treatment effect lasts are needed.

This systematic literature review describes the effectiveness of modified PSSEs on PST and GIRD in different populations. There is high evidence to support both the immediate and short-term positive effects of modified cross-body and sleeper stretch on PST and GIRD among symptomatic and asymptomatic subjects. It was found that modified cross-body and modified sleeper stretch have better effects compared to no intervention (18,27,29) or traditional PSSEs (19,20,21,28) in both immediate and short-term interventions. Furthermore, high (18) and moderate (20,21) quality studies with different treatment durations and different populations found that modified cross-body stretch was more effective than modified sleeper stretch to improve PST and IRROM, whereas the other studies, ranging from high to poor quality, reported that the effects of the two methods were similar in acute or short-term durations (12-17,19,23,24,25,26,27,28,29,30,31). Studies demonstrated no difference between the results of different modified stretching types (sleeper and cross-body) in terms of GIRD and PST gains. There is a need for high-quality studies examining the long-term effectiveness of modified PSSEs on PST and GIRD in symptomatic people.

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EFFECTIVENESS OF MUSCLE ENERGY TECHNIQUES ON GLENOHUMERAL INTERNAL ROTATION DEFICIT IN OVERHEAD ATHLETES: A SYSTEMATIC REVIEW

ORIGINAL ARTICLE

ABSTRACT

Purpose: Posterior shoulder tightness (PST) and Glenohumeral Internal Rotation Deficit (GIRD) are frequent biomechanical changes in overhead athletes. Evidence has shown that PST and the presence of GIRD increase subacromial pain syndrome. Posterior shoulder stretching exercises are used to improve posterior shoulder tightness. Muscle Energy Techniques (MET) are a long-established and effective approach, and the number of studies investigating the effects of MET on GIRD has been increasing in recent years. Despite the use of static stretching techniques in training, GIRD continues to be common in athletes performing overhead activities. Therefore, revealing the effects of MET on GIRD might be effective in determining the type of stretching most appropriate for preventing GIRD in athletes.

Methods: We performed a systematic literature review, assessing the relevance of studies for inclusion and selecting the studies from appropriate electronic databases (CINAHL, Cochrane Review, Pubmed (MEDLINE), Web of Science as well as Google Scholar©).

Results: The present systematic literature search generated 178 relevant citations and 8 articles were included in the final review. As an outcome measure, GIRD was assessed in all eight, whereas PST was assessed in four.

Conclusion: According to this systematic literature review, MET is effective in the improvement of GIRD and PST in overhead athletes. Future research should focus on symptomatic shoulders and investigate the long-term benefits of MET.

Keywords: Injuries, Mobility, Physical Therapy

BAŞ ÜSTÜ AKTİVİTE YAPAN SPORCULARDA KAS ENERJİ TEKNİKLERİNİN POSTERİOR OMUZ GERGİNLİĞİ VE GLENOHUMERAL İNTERNAL ROTASYON DEFİSİTİNDEKİ ETKİNLİĞİ: SİSTEMATİK DERLEME

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Posterior omuz gerginliği (POG) ve glenohumeral internal rotasyon defisiti (GİRD), baş üstü sporcularda sık görülen biyomekanik değişikliklerdir. Kanıtlar, POG ve GİRD varlığının subakromiyal ağrı sendromuyla ilişkili olduğunu göstermiştir. POG'u iyileştirmek için sıklıkla posterior omuz germe egzersizleri yapılır. Kas Enerjisi Teknikleri (KET) uzun süredir rehabilitasyonda etkin bir şekilde kullanılmakta ve son yıllarda KET'in GİRD üzerindeki etkilerini araştıran çalışmaların sayısı artmaktadır. Sporcular antrenmanda genelliklestatik germe tekniklerini kullanırlar, ancak GİRD, baş üstü aktivite yapan sporcularda yaygın bir şekilde görülmeye devam etmektedir. GİRD'de KET'in etkisinin ortaya çıkarılması, sporcularda GİRD oluşumunu etkin bir şekilde önleyebilecek germe egzersizinin belirlenmesinde faydalı olabilir.

Yöntem: Sistematik bir literatür taraması gerçekleştirdik. İlgili çalışmalar uygun elektronik veri tabanlarından (CINAHL, Cochrane Review, Pubmed (MEDLINE), Web of Science ve Google Scholar©) araştırıldı ve dahil edilmek üzere değerlendirildi.

Sonuçlar: Sistematik literatür araştırması 178 ilgili makale ile sonuçlandı ve derlemeye 8 makale dahil edildi. Sonuç ölçümü olarak GİRD'in dahil edilen tüm çalışmalarda değerlendirilirken, POG'un 4 çalışmada değerlendirildiği belirlendi.

Tartışma: Bu sistematik literatür derlemesine göre MET, baş üstü aktivite yapan sporcularda GİRD ve POG'un iyileştirilmesinde tavsiye edilmektedir. Gelecekteki araştırmalar semptomatik omuzlara odaklanmalı ve KET germelerinin uzun süreli etkilerini araştırmalıdır.

Anahtar Kelimeler: Yaralanmalar, Mobilite, Fizik tedavi

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INTRODUCTION

Glenohumeral joint dysfunctions are common in overhead athletes. A study conducted on university athletes implemented that the incidence of shoulder injury in overhead athletes was 30% (1). Posterior shoulder tightness (PST) and Glenohumeral Internal Rotation Deficit (GIRD) are frequent biomechanical changes in overhead athletes (2). PST is described as the restriction of the posterior shoulder soft tissues, including contractile (infraspinatus, teres minor, and posterior deltoid muscles) and non-contractile structures (posterior glenohumeral capsule) (3). GIRD is characterized as concurrent deficits of the shoulder, and internal rotation (IR) of the dominant side compared to the non-dominant side (4). Evidence has shown that PST and the presence of GIRD results in an increase in athletes' subacromial pain syndrome (SPS) (1,5). A cross-sectional study by Tyler et al. demonstrated that PST and GIRD were correlated with impingement findings (6). Additionally, PST increases subacromial compression when the shoulder is in flexion (7). A prospective cohort study found that a reduction of SPS symptoms was associated with decreased capsular tension (8). In this context, maintaining the flexibility of the posterior shoulder structures is extremely important for the prevention of future SPS and other related shoulder injuries.

Considering that GIRD is associated with PST, posterior shoulder stretching exercises are frequently used in routine, especially in static form, in order to prevent and rehabilitate possible injuries, and to improve performance (8,9). Although stretching exercises can be performed in different positions (10–12), the most common are sleeper and cross-body stretching. Studies have reported that cross-body stretching exercise is more effective in increasing shoulder internal rotation (IR) (11–15). Furthermore, Wilk et al., suggested that performing cross-body stretching in the modified position may increase the stabilization of the scapula and humerus and reduce the symptoms of impingement, and they recommend that this exercise be performed in the modified position (16). A recent systematic review concluded that cross-body stretching can be effective to improve GIRD (17).

Muscle Energy Techniques (MET) covers soft tissue stretching methods that aim to mobilize joints with limited movement, strengthen weak muscles, stretch shortened muscles and fascia, increase regional circulation, stretch fibrous tissues, and reduce tissue edema and muscle spasm (18). MET is well-established and effective, and the number of studies investigating the effects of MET on GIRD has increased in recent years (11,19,20).

It has been reported that MET can reduce pain with the gate control theory, and stretching when the muscle is in a hypertonic state immediately after isometric contraction can help the muscle reach a new resting length (21). Studies comparing static and MET on individuals with neck pain have shown that MET is more effective than static stretching in reducing pain and disability and increasing range of motion (ROM) (22,23). MET exercises might be more beneficial than other types of exercises in adhesive capsulitis patients in regard to ROM and pain (24). Static stretching techniques are commonly used in athlete training, but GIRD continues to be common in athletes who do overhead activities. Therefore, revealing the effects of MET in GIRD may contribute to determining the type of stretching most appropriate for preventing the formation of GIRD in athletes.

Objective

The objective of this study was to identify and analyze available studies reporting on the effectiveness of MET interventions for PST and GIRD.

METHOD

Eligibility Criteria for Studies

A clinical question was developed according to the PICOS (P: participant, I: intervention, C: comparator, O: outcome, and S: study design) format for the present systematic review (Table 1). PICOS includes the population characteristics, treatments given, comparative treatments, primary and secondary outcomes, and data collection settings. Available studies investigating the effects of MET on GIRD or PST were included in this review. Eligible studies reported IR or horizontal abduction (HA); also included were studies with overhead athletes with symptomatic and asymptomatic shoulders. All MET methods were screened but the literature research

revealed only studies on Post Isometric Relaxation (PIR) method. No criteria were included for the timeframe of interventions or type of interventions compared.

Data Sources and Literature Search Strategy

According to the PRISMA statement, English databases (CINAHL, Cochrane Review, Pubmed (MEDLINE), and Web of Science), as well as Google Scholar©, were systematically searched to identify peer-reviewed articles about the effectiveness of MET on GIRD and PST (25). The following keywords were used to identify eligible studies: Muscle energy techniques, Glenohumeral internal rotation deficit, posterior shoulder tightness, posterior shoulder stretching, and posterior shoulder stretch. After a scan of abstracts of the eligible studies, the full texts were investigated to determine eligible studies. Databases were searched from inception (1995) to March 2022. Additionally, the reference lists of included articles were manually scanned. The effect size was assessed for data extraction and synthesis as follows; small (0.20 to 0.49), moderate (0.50 to 0.79), and large (0.80 or greater) (26).

Assessment of Risk of Bias

To assess the risk of bias in included studies, the PEDro scale was used. This is reported to be valid tool for assessing randomized controlled trials (RTC) (27). The total scores indicated the quality of each study as "high" (≥7/10), "moderate" (5/10, 6/10), or "poor" (≤4/10). Total PEDro scores are presented in Table 2 Table 2 (Table 2).

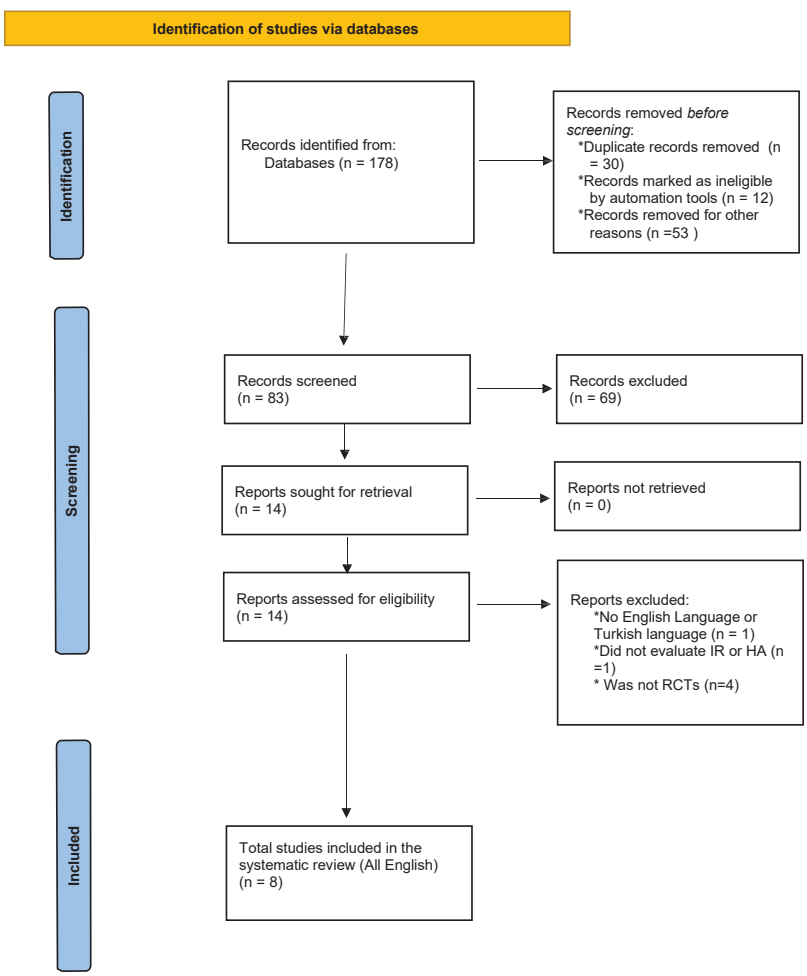

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Diagram of the Literature Search Used.

Study Selection

The initial literature search revealed 178 papers. After removing the duplicates and irrelevant studies, 14 articles underwent a full-text review. 8 studies met the inclusion criteria for this systematic review (Figure 1).

Study Characteristics

Table 3 shows the summaries of the studies and detailed information on the MET procedures.

Study Designs: Five RCTs used parallel designs (11,19,28–30), whereas one RCT used a cross- over design (20). Two studies conducted a quasi-randomized study (31,32).

Participants: MET were performed in overhead athletes, including players of baseball, softball, volleyball, and cricket (bowlers) (11,19,20,28–32). Sample sizes ages ranged 16 to 30. The total sample size for the present review was 315 subjects [197 male and 12 female, no given information related to sex in 106 subjects (11,29,30)]. Of the athletes included in the studies, 85 were baseball players (11,19), 78 were volleyball players (20,31), and 18 were softball players (11), 64 were cricket bowlers (29,32) and two studies reported no specific sport for the 70 overhead athletes that they included (28,30). Six studies cited the presence of GIRD as an inclusion criteria (20,28–32). GIRD definition varied among studies; two studies identified it as >10° restriction in IR ROM at 90° shoulder abduction in the dominant side compared to the non-dominant side (29,31), while Avci et al. (20) and Akula et al. (28) specified 18° and 20° decrease in IR ROM respectively. Kini et al. made no specification, (32) and Sehgal et al.'s definition was 18° to 20° of IR ROM restriction (30).

Interventions: All studies used the PIR technique among the MET (11,19,20,28–32). PIR was used in crossbody stretching in supine position in 5 studies (11,19,20,28,29). One study by Kumar et al. performed MET in IR, external rotation (ER), flexion, extension and HA of the glenohumeral joint (31), and three studies applied MET for external rotators in supine position while shoulder and elbow flexed 90° (19,30,32). MET methods differed among studies. Six studies used 25% of maximal voluntary contraction (MVC) during isometric contraction (11,19,20,29,30,32), Kumar et al. reported the isometric contraction as a forceful contraction (31) and the other study did not report the amount of force (28). Five studies applied 30-s of active assistive stretch after 3-7 seconds of isometric contraction (19,20,29,30,32), one study applied 3 seconds of active assistive stretching (11), and two others applied no stretching (28,31). Other interventions exploited in the included studies were static crossbody stretch in supine position (29), traditional sleeper stretch (30,31), a self-stretching method similar to sleeper stretch in standing position (28), joint mobilization (JM) (11), mulligan mobilization (32) and a sham MET procedure (20). Control groups with no stretching intervention were used in two studies (11,19). Additionally, the dosage of interventions as weekly frequencies were as follows: twice (28), three times (30), four times (29), five times (31) and six times (32).

Outcome Measures: All studies included in the present review measured IR ROM at 90° abduction (11,19,20,28–32), and four studies measured HA ROM (11,19,29,31).

RESULTS

Immediate Effects of MET on PST and GIRD

There were three studies that investigated the immediate effects of MET on PST and GIRD (11,19,20). Moore et al. found that a single session of MET for horizontal abductors (Habd) resulted in greater IR ROM than both no intervention and MET for ER. Furthermore, MET for Habd group had significantly more HA ROM than the no intervention group, but the benefit compared to MET for ER group was not significant. On the other hand, MET for ER group's improvement was not better than no intervention in any outcome (19). Reed et al. performed a single session of MET for Habd and compared it with a single session of JM and no intervention. Results show that shoulders treated with MET had significantly more passive HA ROM post-treatment compared with the no intervention group. There were no significant differences between either JM and MET or JM, and no intervention for post-intervention HA ROM. There was no significant between-group difference in IR ROM post-intervention. An analysis of the results of measurements collected 15 minutes post-intervention showed no significance between

Table 1. PICOS Format and Search Keywords

	Definition	Search Key Words
Participants	Overhead Athletes	Not set
Intervention	Any form of MET	Muscle Energy Technique, AND Shoulder stretching
Comparison	Any interventions	Not set
Outcome	PST or GIRD	(posterior shoulder tightness) OR PST OR (glenohumeral internal rotation deficit) OR GIRD
Study Design	RCTs, prospective cohort studies, controlled laboratory studies	Not set

MET: Muscle energy technique, GIRD: Glenohumeral internal rotation deficit, PST: Posterior shoulder tightness, RCTs: Randomized controlled trials.

groups differences for either HA or IR (11). Avci et al. concluded that a single session of MET improved IR ROM more than no intervention (20).

Short Term Effects of MET on PST and GIRD

Two studies reported the results over two weeks (29,30), while three reported the results over four weeks (28,31,32) of MET intervention. Bathia et al. reported that MET for Habd significantly improved IR and HA ROM after two weeks, but effects were similar to static stretching in supine cross-body position (29). Another study showed MET for ER improved IR ROM and IR strength after two weeks of intervention, whereas two weeks of static stretching showed no corresponding statistically significant improvement (30). Akula et al. showed that MET for Habd has similar improvements to a self-sleeper stretching regarding GIRD after four weeks (28). Similarly, Kumar et al. found that MET for Habd and sleeper stretching were both equally beneficial in terms of gains in GIRD and PST after four weeks (31). Additionally, Kini et al. reported that MET for ER and Mulligan mobilization were successful in improving rotational ROM after four weeks of intervention (32).

Table 2. Risk of Bias Assessment in the Included Studies

Study	1	2	3	4	5	6	7	8	9	10	11	Total
Akula et al. (2017)	1	1	0	1	0	0	0	0	1	1	1	5/10
Kumar et al. (2021)	1	0	0	0	0	0	0	1	1	1	0	3/10
Moore et al. (2011)	1	1	0	1	0	0	1	1	1	1	1	7/10
Bathia et al. (2016)	1	1	0	1	0	0	0	0	1	1	1	6/10
Avci et al. (2021)	1	1	1	1	1	0	1	1	1	1	0	8/10
Reed et al. (2018)	1	1	0	1	0	0	0	1	1	1	1	6/10
Seghal et al. (2016)	1	1	0	1	0	0	0	0	1	1	1	5/10
Kini et al. (2021)	1	0	0	1	0	0	0	0	1	0	1	3/10

PEDro scale: 1, eligibility criteria; 2, random allocation; 3, concealed allocation; 4, similarity at baseline; 5, blinding of participants; 6, blinding of therapists; 7, blinding of assessors; 8, measures of at least 1 key outcome from at least 85% of participants initially allocated to groups; 9, intention-to-treat analysis; 10, between-groups comparison; 11, point measures and measures of variability. 1 = Yes (1 point), 0 = No (0 point), maximum score = 10 (criterion 1 is not included in scores).

Table 3. Summary of the Included Studies

Study	Participants	Interventions	Outcome Measures	Results	Study Design
Moore et al. (2011)	Asymptomatic elite male baseball players (N=61). Age: 19.5±1.0 years (MET for HAbd group), 20.4±1.1 years (MET for ER group) and 19.8±1.1 years (control group)	The following interventions were performed • MET for HAbd group (n=19): Cross-body stretch with PIR was applied to the dominant side in the supine position. Participants were asked to move their arms towards horizontal ADD until the first barrier of movement. Then they performed a 5-s isometric contraction (%25 MVC) followed by a 30-s active assisted stretch, 3 repetitions. • MET for ER group (n=22): PIR stretching was applied to the ER as the same protocol as above. • Control (n=20): no intervention.	The following were assessed immediately before and after the stretching intervention. • Passive IR and ER ROM at 90° ABD. • Passive HAbd ROM.	MET for the HAbd group had a significantly greater increase in horizontal ADD and IR ROM compared with the control group ($p<0.05$) and a greater increase in IR ROM compared with MET for the ER group ($p<0.05$) and the control group ($p<0.05$).	RCT
Bathia et al. (2016)	Cricket bowlers with GIRD>10° (N=34) Age 22.47±3.84 years (MET for HAbd group) 21.29±3.98 years (Passive stretch for HAbd group)	The following interventions were performed • MET for HAbd group (N=17): cross-body stretch with PIR was applied for GIRD shoulder in the supine position. Participants were asked to move their arm towards horizontal ADD until the first barrier of movement and performed 7-s isometric contraction (%25 of MVC) followed by 30-s active assistive stretch, 3 repetitions a session, 4 sessions a week of total 2 weeks. • Passive stretch for HAbd group (N=17): 30-s passive stretch in supine cross-body position 3 repetitions a session, 4 sessions a week of total 2 weeks.	The following were assessed before treatment (1st day), 1st week, and 2nd week. • Passive IR and ER ROM at 90° ABD. • Passive HAbd ROM.	Both MET and Passive stretch groups significantly improved in HAbd and IR ROM after 1st and 2nd weeks ($p<0.05$). There was no statistical difference between groups for passive IR, ER, and HAbd ROM at 1st and 2nd week ($p>0.05$).	RCT
Sehgal et al. (2016)	Overthrowing athletes with GIRD between 18° to 20° (N=30) Age between 16-30 years	The following interventions were performed • MET for ER group (n=15): Participants were positioned supine with shoulder at 90° ABD and elbow at 90° FLEX. Participants were asked to move their arms towards IR until the first barrier of movement. Then they performed 5-s isometric contraction (%25 MVC) followed by a 30-s active assisted stretch, 3 repetitions a session, 3 sessions a week for 2 weeks. • Static stretching group (n=15): Participants were positioned supine with shoulder at 90° ABD and elbow at 90° FLEX. The shoulder was stabilized at the acromion with one hand and the arm was passively rotated with the other hand. Stretch was maintained for 10-s and repeated 3 times a session, 3 sessions a week for 2 weeks. All participants received a hot pack with the stretching.	The following were assessed before treatment (1st day), 1st week, and 2nd week. • Passive IR ROM • IR isometric muscle strength	MET for the ER group significantly improved in IR ROM and IR strength ($p<0.05$) and the static stretching group showed no significant results in IR ROM and IR strength ($p>0.05$).	RCT
Akula et al (2017)	Overhead athletes with GIRD>20° (N=40) Age: 22.05±2.89 years (EG) and 24.10±3.08 years (CG)	The following interventions were performed • MET for HAbd group (N=20): cross-body stretch with PIR was applied for GIRD shoulder in the supine position. Participants were asked to move their arm towards horizontal ADD until the first barrier of movement and performed 7-s isometric contraction followed by 5-s relaxation, 3 repetitions a session, 2 sessions a week of total 4 weeks. • SS group (N=20): A self-stretching method was performed in a standing position. Participants placed their shoulders and elbows at 90° FLEX and put their elbows and scapula against the wall for stabilization. Then they moved their shoulder into IR with their other hand and held it for 30-s for 3 times with 30-s rest between.	The following were assessed at the baseline and after the 4 weeks. • Passive IR ROM • SPADI score	Both EG and CG significantly improved in IR ROM and SPADI scores after 4 weeks ($p<.05$). There was no statistical difference between groups for IR ROM and SPADI scores after 4 weeks of treatment ($p>0.05$).	RCT
Reed et al. (2018)	High school baseball or softball players (N=42) Age 17.07±1.0 years (METG),16.43±0.8 (Joint mobs), 16.50±1.2 years (CG)	The following interventions were performed • MET for HAbd group (N=14): cross-body stretch with PIR was applied for throwing the shoulder in the supine position. Participants were asked to move their arm towards horizontal ADD until the first barrier of movement and performed 5-s isometric contraction (%25 of MVC) followed by 3-s active assistive stretch, 4 repetitions. • JM group (N=14): Participants received the joint mobilization in the supine position. The participant's shoulder was abducted to 90° and internally rotated to the first barrier of resistance, with the elbow flexed and relaxed. The clinician's hand applied overpressure to the GHJ in the posterior direction and then applied fifteen, one second, grade III posterior oscillations to the humeral head parallel to the glenoid treatment plane. Total of 15 oscillations in 30-s. • CG (N=14): No intervention	The following were assessed before, immediately after, and 15 minutes posttest. • Passive IR ROM at 90° ABD. • Passive HAbd ROM.	METG had significantly more passive HAbd ROM post-treatment compared with the CG ($p=0.04$). There were no significant differences between JMG and METG ($p=0.16$) or JMG and CG ($p=0.48$) for HAbd ROM. There was no significant between-group difference in IR ROM post-intervention ($p=0.28$). There were no significant between-group differences for either HAbd ($p=0.70$) or IR ROM ($p=0.91$) after 15 mins.	RCT

Kumar et al. (2021)	Male volleyball players with GIRD GIRD>10° (N=60) and subacute shoulder pain Age between 18-25 years	The following interventions were performed • MET group: PIR was applied for IR, ER, EXT, FLEX, ABD, and ADD for 40 mins, 5 days a week and 4 weeks. Participants were asked to perform a forceful isometric contraction for 3 5-s at the end of the available range then the participants were asked to relax for 2-s. • SS group: Sleeper stretch was applied while participants' shoulders and elbows were positioned into 90 degrees of FLEX with the lateral border of the scapula positioned firmly against the treatment table. The knees were bent for a stable base. The pressure was applied from the arm just below the wrist and the forearm was slowly pushed (rotated) toward the floor. The pressure was held constant at the end range of motion for 30 seconds and then repeated twice with 30 seconds of rest between stretching. This Technique is given two times per session, 5 days per week for 4 weeks.	The following were assessed at the baseline and after the 4 weeks. • IR, ER, EXT, FLEX, ABD, ADD ROM • Pain with NPRS	Both the MET group and SS group improved significantly after 4 weeks of treatment ($p<0.001$) regarding all parameters. There were no significant differences in any parameters between groups ($p>0.05$).	Quasi-RCT
Avci et al. (2021)	Male volleyball players with GIRD GIRD>18° (N=18)	The following interventions were performed in a cross-over design • MET for HAbd group: cross-body stretch with PIR was applied for GIRD shoulder in the supine position. Participants were asked to move their arm towards horizontal ADD until the first barrier of movement and performed 5-s isometric contraction (%25 of MVC) followed by 30-s active assistive stretch, 3 repetitions. • Sham MET group: The athlete's arm was positioned in 90° shoulder FLEX and with the elbow flexed. The athlete was asked to perform an isometric contraction with minimum effort in the same position. After the contraction, the athlete was asked to abduct his harm and then instructed to relax. The number of sets and time intervals were similar to the MET application.	The following were assessed 1st day (before procedures), 2nd day (after the first application according to the group allocation), and 3rd day (after the other procedure). • IR and ER ROM • Isokinetic muscle force for IR and ER.	• IR after MET was significantly different than control ($p<0.05$) and control and MET ER were significantly different than sham ($p<0.05$). • 60° IR and ER and 180° IR peak torque values showed a significant increase between the MET and control/sham trials ($p<0.05$). Also, the 180° ER peak torque value showed a significant difference between the experimental and sham trials ($p<0.05$).	RCT
Kini et al. (2021)	Male cricket bowlers with GIRD (N=30) Age under 19 years	The following interventions were performed • MET for ER group (n=15): Participants were positioned supine with shoulder at 90° ABD and elbow at 90° FLEX. Participants were asked to move their arms towards IR until the first barrier of movement. Then they performed a 5-s isometric contraction (%25 MVC) followed by a 30-s active assisted stretch. • Mulligan group (n=15): Participants were positioned supine with shoulder at 90° ABD and elbow at 90° FLEX. The therapist grasped the distal humerus with both hands and the mobilization belt was secured around the therapist's waist and was perpendicular to the humerus. The therapist pulled the mobilization belt and shifted its weight backward to track the joint. Therapists sustained the traction force with the belt meanwhile the participant performed active IR. The program was continued for 4 weeks with 6 sessions a week. All patients were given hot packs for relaxation after the treatments and before treatment patients were asked to do stretching for IR.	The following were assessed at the baseline and after the 4 weeks. • Active shoulder range of motion	Both MET for ER and Mulligan group improved significantly after 4 weeks of treatment ($p<0.001$) There were no significant differences between groups ($p>0.05$).	Quasi-RCT

ABD: Abduction, ADD: Adduction, ER: External Rotation, EXT: Extension, FLEX: Flexion, GHJ: Glenohumeral Joint, GIRD: Glenohumeral Internal Rotation Deficit, Habd: Horizontal Abductor, JM: Joint Mobilization, IR: Internal Rotation, MET: Muscle Energy Technique, NPRS: Numeric Pain Rating Scale, PIR: Post Isometric Relaxation, RCT: Randomized Controlled Trial, ROM: Range of Motion, SPADI: Shoulder Pain Disability Index, SS: Sleeper Stretch.

Table 4. Comparison of Within-Group Effect Sizes

Study	Outcome measure	Intervention	Effect size [95%CI]
Moore et al. (2011)	**IR**	**MET for HAbd group**	0.40 [-2.99 to 3.78]
		MET for ER group	0.02 [-2.46 to 2.51]
	HA	**MET for HAbd group**	0.71 [-2.30 to 3.73]
		MET for ER group	0.62 [-1.79 to 3.02]
Bathia et al. (2016)	**IR**	**MET for HAbd group**	1.97 [-1.55 to 5.49]
		Passive stretch for HAbd group	2.68 [0.71 to 4.65] *
	HA	**MET for HAbd group**	2.11 [-0.13 to 4.34]
		Passive stretch for HAbd group	1.51 [-1.73 to 4.75]
Sehgal et al. (2016)	**IR**	**MET for ER group**	*
		Static streching group	*
Akula et al (2017)	**IR**	**MET for HAbd group**	0.43 [-2.71 to 3.13]
		SS group	0.15 [-3.63 to 3.93]
Reed et al. (2018)	**IR**	**MET for HAbd group**	0.56 [-2.70 to 3.83]
		JM gruop	0,22 [-3,94 to 4,38]
	HA	**MET for HAbd group**	1.15 [-1.54 to 3.85]
		JM gruop	0.23 [-2.05 to 2.50]
Kumar et al. (2021)	**IR**	**METG**	*
		SS group	*
	HA	**METG**	*
		SS group	*
Avci et al. (2021)	**IR**	**MET for HAbd group**	0.54 [-3.25 to 4.32]
		Sham MET group	0.12 [-3.12 to 3.35]
Kini et al. (2021)	**IR**	**MET for ER group**	1.70 [-2.52 to 5.92]
		Mulligan group	2.44 [-0.98 to 5.85]

MET: Muscle Energy Tecnique, HAbd: Horizontal Abduction, SS: Sleeper Stretching, HA: Horizontal adduction, IR: Internal rotation, JMG: Joint mobilisation group, CG: Control group, CI: Confidence interval.

*The necessary data were lacking in two studies to calculate the effect size. We contacted to corresponding authors by e-mail. However, we could not reach the authors. Because of this reason, the data is not available.

*Effect size statistically significant

DISCUSSION

To the authors' best knowledge, the current systematic review is the first to attempt to integrate English and Turkish-language studies on the effectiveness of MET for PST and GIRD in overhead athletes; however, no Turkish language research on this topic was discovered. According to this systematic literature review, MET has favourable effects and is highly recommended for the treatment of GIRD and PST in acute or short-term durations.

Based on the research results, three studies of high to moderate quality showed MET's greater effectiveness on GIRD and PST compared to no intervention (11,19) or sham intervention (20), while moderate to poor quality studies comparing MET with other interventions showed no such greater effectiveness (11,28–32).

Additionally, the study by Avci et al. evaluated glenohumeral rotators' isokinetic torque values. Their results showed glenohumeral rotators' isokinetic torque values improved more than sham or control group in the MET group (20). Furthermore, Sehgal et al. reported improvements for IR isometric strength only in MET for ER group (30).

Source of Bias and Limitations of Included Studies

Larger effects of MET were shown in studies without allocation concealment or adequate blinding for participants, therapists or assessors, (11,29), suggesting Type 1 error. Four studies did not report whether any dropouts occurred (28–30,32). Because of these methodological shortcomings, the intervention effects might have been overestimated, and therefore favourable results should be viewed with caution.

Within-group effect sizes were generally found as moderate to large in most studies (11,19,20,29,32); however, 95% CIs around effect sizes included zero, i.e., no effect in all MET groups (11,19,20,28–32) (Table 4). Two studies lacked sufficient data to calculate the effect sizes. E-mails sent to the corresponding authors brought no response, and the relevant information is therefore unavailable (30,31).

Some of the studies were conducted on asymptomatic young overhead athletes with or without GIRD (11,19,20,28–32). One study, by Kumar et al., included athletes with subacute shoulder pain (31) whereas the others only included asymptomatic overhead athletes (11,19,20,28– 30,32). Very few studies focused on symptomatic athletes, and therefore these studies' findings cannot be generalized. Furthermore, three studies investigated the immediate effect of MET stretching (11,19,20) and the other five studies investigated the short-term effect (28–30,32,33), but none involved long-term follow-up.

Limitations of This Systematic Review

The present systematic review has several limitations. Only Turkish and English databases were searched, which resulted in language bias. Furthermore, the heterogeneity of included studies in aspects such as total treatment period, stretching durations, and frequency of repetitions prevents an objective summary of the present review findings.

Clinical Recommendations for Future Research

The present review presents the results of MET applications on asymptomatic overhead athletes. Future research should also focus on symptomatic shoulders. Larger sample sizes might provide greater statistical precision. Efforts should be made to include more female athletes to ensure the greater generalizability of the studies. The long-term effects of MET on GIRD and PST remain unclear and should be investigated. Effects of the frequency of weekly sessions should be investigated to allow frequency standardization. Different types of MET should also be studied.

This systematic literature review describes the effectiveness of MET on PST and GIRD in overhead athletes. There is strong evidence to support both the immediate and short-term positive effects of MET on PST and GIRD among overhead athletes; METs were found to be more effective than no intervention (11,19) or sham intervention (20) immediately after the intervention. All the included studies showed improvements after MET intervention but reported no additional effects on other interventions in short term (28–32). There is a need for high-quality studies examining the long-term effectiveness of MET on PST and GIRD.

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