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DergiPark tarafından yürürlüğe konulan kurallar çerçevesinde yazarların
"Etik İlkeler ve Yayın Politikası" ile "Yazım Kuralları" na uyulması konusunda ilgili başlıkları
dikkatlice incelemesi tavsiye edilmektedir.

Dergi 2023 yılından itibaren sadece İngilizce yazı kabul etmeye başlayacaktır.

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Değerli Bilim İnsanları,

Biyoteknolojik ve Stratejik Sağlık Araştırmaları Dergisi (JOURNAL OF BIOTECHNOLOGY AND STRATEGIC HEALTH RESEARCH), Deneysel, Biyoteknolojik, Klinik ve Stratejik Sağlık Araştırmaları Derneği'nin uluslararası, bağımsız, önyargısız ve çift-kör hakemlik ilkeleri çerçevesinde yayın yapan açık erişimli, bilimsel yayın organıdır. Dergi, Nisan, Agustos ve Aralık aylarında olmak üzere yılda 3 sayı yayınlanır. Dergi ağırlıklı olarak İngilizce yayın kabul etmektedir.

Derginin amacı; etik kurallara uyumlu hazırlanmış biyoteknolojik, kritik, stratejik sağlık araştırmaları ile ilgili bilimsel makaleleri, klinik ve deneysel çalışmaları, derleme, olgu sunumu, editöre mektup ve editöryel yorum türündeki yazıları yayınlayarak literatüre ve sağlık alanındaki tüm disiplinlerde katkı sağlamaktır.

Derginin hedef kitlesi; sağlık alanındaki tüm disiplinlerde çalışan araştırmacılardır.

Dergimizin 7. Yılı, Aralık'2023 sayımızda da yine birbirinden ilginç derleme ve araştırma yazıları ile karşınızdayız. Makalelerini gönderen değerli yazar arkadaşlarımıza ve zaman ayıran hakemlerimize teşekkür eder, bilginin kullanılarak toplum sağlığına değerli katkılar sağlamasını temenni ederiz.

Editör
Prof. Dr. Mustafa ALTINDİŞ
Editor in Chief

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Yazışma Adresi (Corresponding Address)
Prof. Dr. Mustafa ALTINDİŞ
Sakarya Üniversitesi Tıp Fakültesi Dekanlık Binası, KORUCUK, 54200, Sakarya

Dergi Yazı Gönderimi Sayfası: http://dergipark.gov.tr/bshr

E-posta: jbiosad@gmail.com, maltindis@gmail.com

Tel: +90 (264) 295 72 77 **Faks:** +90.264.295 6629

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YAZARLARA BİLGİLER

MAKALE YAZIM KURALLARI

Derginin Kapsamı

JOURNAL OF BIOTECHNOLOGY AND STRATEGIC HEALTH RESEARCH, yılda üç kez Deneysel, Biyoteknolojik, Klinik ve Stratejik Sağlık Araştırmaları Derneği tarafından yayımlanmakta olup tıp alanında ve sağlık bilimlerinin ilgili konularında yazılmış İngilizce veya Türkçe makaleler kabul edilmektedir. Dergiye kabul edilecek yazı türleri deneysel araştırmaları, klinik ve laboratuvar çalışmalarının sunulması amaçlı özgün makaleler, vaka sunumları, derleme makaleleri ve editöre mektuplardır.

A. Genel Bilgiler

➢ Etik Kurallar

Dergiye gönderilen makalelerin daha önce başka bir dergide değerlendirme sürecinde olmaması, yayım için kabul edilmemiş ve de yayınlanmamış, olması, bilimsel ve etik kurallara uygun şekilde hazırlanması gereklidir. Yazarlar, makalelerin bilimsel ve etik kurallara uygunluğundan sorumludur. (http://www.icmje.org/about-icmje/faqs/conflict-of-interest-disclosure-forms/).

Klinik araştırmaların protokolü etik komitesi tarafından onaylanmış olmalıdır. İnsanlar üzerinde yapılan tüm çalışmalarda "Yöntem" bölümünde çalışmanın ilgili komite tarafından onaylandığı veya çalışmanın Helsinki İlkeler Deklarasyonuna (www.wma.net/e/policy/b3.htm) uyularak gerçekleştirildiğine dair bir cümle yer almalıdır. Çalışmaya dahil edilen tüm insanların bilgilendirilmiş onam formunu imzaladığı metin içinde belirtilmelidir. JOURNAL OF BIOTECHNOLOGY AND STRATEGIC HEALTH RESEARCH'ne gönderilen yazıların Helsinki Deklarasyonuna uygun olarak yapıldığını, kurumsal etik ve yasal izinlerin alındığını varsayacak ve bu konuda sorumluluk kabul etmeyecektir. Çalışmada "Hayvan" öğesi kullanılmış ise yazarlar, makalenin "Yöntem" bölümünde Guide for the Care and Use of Laboratory Animals (www.nap.edu/catalog/5140.html) prensipleri doğrultusunda çalışmalarında hayvan haklarını koruduklarını ve kurumlarının etik kurullarından onay aldıklarını belirtmek zorundadır. Sonuç olarak, etik kurul kararı gerektiren klinik ve deneysel insan ve hayvanlar üzerindeki çalışmalar için etik kurul onayı alınmış olmalı, bu onay makalede "Etik Kurul Onay Numarası" ile belirtilmelidir ve belgelendirilmelidir.

Dergide çıkan yazıların tüm hakkı dergiye aittir. Yazılar için yazarlara telif hakkı ödenmez. Makaleye ek olarak yukarıdaki şartları kaşif taramalarına dayalı yazılarda Anabilim Dalı (Bilim Dalı) Başkanlığı, Başhekimlik veya Servis Şefliği tarafından arşivde çalışılmasına izin verdiğine dair bir belgenin çalışmaya eklenmesi zorunludur. Prospektif klinik çalışmalar için resmi gazetenin 29.01.1993 tarih ve 21480 sayılı nüshasında yayımlanan yönetmeliğe uygun bir şekilde Etik Kurulu onayı alınmalıdır. Dergide yer alan makalelerin etik sorumluluğu yazarlarına aittir.

Dergiye gönderilen makalelerden hakeme gönderilmesi uygun görülen makaleler konunun uzmanı hakemlere gönderilir. Makalenin yayımlanabilmesi için iki hakemin de olumlu görüş bildirmesi gerekmektedir. Değişikliğe gerek görüldüğü takdirde, istenilen değişiklikler yazarlarca 15 gün içerisinde yapıldıktan sonra yayın tekrar incelemeye alınır, yazım ve dil bilgisi hataları makalenin içeriğine dokunulmaksızın yayın kurulu tarafından düzeltilir.

Derleme yazılarında, tüm yazarların derleme konusu ile ilgili en az bir SCI/SCI-expanded indekse giren yayınının bulunması gerekmektedir.

Sonucu desteklemek için istatistiksel analiz genellikle gereklidir. İstatistiksel analiz, tıbbi dergilerdeki istatistik verilerini bildirme kurallarına göre yapılmalıdır (Altman DG, Gore SM, Gardner MJ, Pocock SJ. Statistical guidelines for contributors to medical journals. Br Med J 1983: 7; 1489-93). İstatistiksel analiz ile ilgili bilgi, Yöntemler bölümü içinde ayrı bir alt başlık olarak yazılmalı ve kullanılan yazılım kesinlikle tanımlanmalıdır.

Dergi İntihal İlkesi

JOURNAL OF BIOTECHNOLOGY AND STRATEGIC HEALTH RESEARCH'de makale göndermeden önce uygun intihal yazılım programlarıyla (iThenticate, Turnitin: Tezler için vb.) makalenizdeki benzerlik durumunu belirlemeniz beklenir. Benzerlik oranlarının dergimiz için kaynaklar hariç % 20'un altında olması istenmektedir.

Simgeler, Birimler ve Kısaltmalar

Dergimiz, İngilizce makalelerde Scientific Style and Format, The CSE Manual for Authors, Editors, and Publishers, Council of Science Editors, Reston, VA, USA (7th ed.) uzlaşılarını; Türkçe makalelerde ise TDK Yazım Kılavuzu, Türkiye Bilim Terimleri ve TÜBA Türkçe Bilim Terimleri Sözlüğü'nü esas almaktadır. p, ×, μ, η, or v gibi karakterler, sözcük işlem uygulamasının simge menüsünden seçilerek kullanılmalıdır. Sayılarla birimler arasında bir boşluk bırakılmalı (örn. "3 kg"), sayılarla yüzde simgesi arasında boşluk bırakılmamalıdır (örn. "%45"). Tüm kısaltma ve kısa adlar, ilk kez kullanıldıklarında tanımlanmalıdır. Canlıların ve mikroorganizmaların jenerik isimleri, tür adını değiştirmeden, uygun şekilde kısaltılmalı ve yatık olarak yazılmalıdır.

Makale Hazırlama Şekli ve Biçimi & Gönderim

Makale gönderimi çevrimiçi olarak http://dergipark.gov.tr/bshr adresine Microsoft Word dosyası olarak eklenmelidir. "Öz", "Ana Metin ve Kaynaklar (Çizelgeler dahil)" Microsoft Word dosyası (.doc veya .docx uzantılı) olarak, 12 yazı tipi boyutunda, Times New Roman karakterleriyle, 1,5 satır aralığıyla ve paragraflar iki yana yaslanmış olarak yazılmalıdır. Makalelerin değerlendirilmeye alınabilmesi için, başvuru esnasında 'Telif Hakkı devir formu' doldurulmalıdır. Bu formu içermeyen yazılar değerlendirmeye alınmaz. Makaleler, Ana metnin sayfa numaraları, her sayfanın sağ alt köşesinde belirtilmelidir.

Makaleler, Türkçe veya İngilizce yazılabilir.

B. Yazım Kuralları

Metin içi ve metin sonu kaynak gösterimi için, AMA (Amerikan Tıp Birliği/American Medical Association) Stili kullanılmalıdır (http://library.nymc.edu/informatics/amastyle.cfm; https://drive.google.com/drive/folders/1hzvgxnau1lBPUBYfKN1vTBKbPE31LBXQ) .

Dergide kör hakemlik uygulaması söz konusu olduğundan makale ana metin üstünde yazarlara ilişkin herhangi bir bilgi bulunmamalıdır.

Tüm makale yazarlarının, ORCID iD (Open Researcher and Contributor ID) numaraları başlık sayfasına eklenmelidir.

B. 1. Başlık Sayfası

Yazılar başlık sayfasından başlanarak numaralandırılmalı, sayfa numaraları sağ alt köşeye yazılmalıdır.Başlık sayfasında; yazının başlığı (Türkçe ve İngilizce), başlık altında tüm yazarların ad ve soyadları, kurumları yer almalıdır. Sorumlu yazarın adı ve soyadı, telefon numarası, e-posta ve yazışma adresleri bulunmalıdır. Makale başlığı, 25 kelime ile sınırlı, Türkçe ve İngilizce dillerinde verilmelidir. Kısa başlık (running title, running head) 50 karakterle (boşluk dahil) sınırlı şekilde Türkçe ve İngilizce olmalıdır.

B. 2. Öz Sayfası

Öz (Abstract), Türkçe ve İngilizce olarak en fazla 250 sözcük olacak şekilde; 'Amaç (Objective)', 'Yöntem (Methods)', 'Bulgular (Results)' ve 'Sonuç (Conclusion)' bölümlerinden oluşmalıdır. Derleme ve olgu sunumunda öz sayfası bölümlere ayrılmadan yazılmalıdır.

Öz'ün altına "anahtar kelimeler" (en az 3, en fazla 6) verilmelidir. Anahtar kelimeler Türkçe ve İngilizce yazılmalıdır. İngilizce anahtar kelimeler Index Medicus'da "Medical Subjects Headings" listesine uygun olmalıdır (Bkz: www.nlm.nih.gov/mesh/MBrowser.html). Türkçe anahtar kelimeler Türkiye Bilim Terimleri, uygun olarak verilmelidir (Bkz: www.bilimterimleri.com). Bulunamaması durumunda bire bir Türkçe tercümesi verilmelidir.

B. 3. Ana Metin

B. 3. 1. Özgün Araştırma

Sırasıyla ve kesin sınırlarla ayrılmış "Giriş", "Yöntem", "Sonuç" ve "Tartışma" bölümlerinden oluşmalıdır. Sonuç kısmı, ayrı bir bölüm olarak veya Tartışma'nın son paragrafı olarak yazılabilir. Tartışma kısmının son paragrafında çalışmanın sonuçları ifade edilebilir, ek bir başlık açılmasına gerek yoktur.

En çok 15 sayfa (öz, teşekkür ve kaynaklar hariç) olmalıdır.

Sistematik derleme ve meta-analiz özgün araştırma makalesi kapsamındadır. Yazarlar, taslaklarını gönderirken sistematik derleme ve meta-analiz için, PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) beyanatı (http://www.prisma-statement.org/). yönergesine uyduklarını gösteren standart kontrol listelerini kullanmalı ve istendiğinde sunmalıdır.

Sözcük sayısı öz, teşekkür ve kaynaklar hariç en çok 5 000 olmalıdır. Kaynak sayısı, 50'yi geçmemelidir(derleme hariç). Metin boyunca bilimsel terimler yatık olarak yazılmalıdır.

B.3.2. Derleme

En çok 20 sayfa (öz ve kaynaklar hariç) olmalıdır. Derlemeler, standart yazı şeklinden farklıdırlar. Yazı yazmanın evrensel formatı IMRAD derleme yazılarında uygulanmamaktadır. Ana hatlarıyla "Giriş" bölümü daha geniş olmakta ve derlemenin amacını ve yazı gerekçesini açıklamaktadır.

"Yöntem" ve "Bulgular" kısmı bulunmamaktadır. Tartışma kısmı yine geniş tutulacak ve kişisel deneyimler doğrultusunda aynı konuda yapılmış çalışmalar ve onların sentezi yapılacaktır. Sonuç anlamında bir yorum ve değerlendirme paragrafı bulunmalıdır. Kaynaklar ise tüm yazılara göre daha fazla sayıda olacaktır. Ancak mutlaka yazarın kendi çalışmaları da bulunacaktır.

B.3.3. Olgu Sunumu

En çok 10 sayfa (öz, teşekkür ve kaynaklar hariç) olmalıdırr. Olgu sunumlarında ise sırasıyla giriş, olgu sunumu ve tartışma bölümlerini içermelidir.

B.3.4. Editöre Mektup

En çok 5 sayfa (öz ve kaynaklar hariç) olmalıdır. Çizim ve çizelge içermez. Bir makaleye ithaf olarak yazılmış ise sayı ve tarih verilerek belirtilmeli ve metnin sonunda yazarın ismi, kurumu ve adresi bulunmalıdır.

B.4. Çizim ve Çizelgeler

Metin içerisinde kullanılan fotoğraf, grafik, şekil, resim gibi görsel sunum araçları 'Çizim' olarak tanımlanır. 'Tablo' ise sınıflandırılmış verilerin yer aldığı görsel sunum araçlarıdır. Tablolar kaynaklardan sonra başlıklarıyla birlikte verilmelidir. Tablolar, başlığın alt ve üstünde, ayrıca alt satırın altında yatay kenarlık ve sol sütunun sağ dikey kenarlığı olacak şekilde düzenlenmelidir.

Figür ve Tablolar, numaraları ile metin içinde geçtiği yerlerde ilgili cümlenin sonunda ayıraç içinde belirtilmeli; sırayla numaralandırılmalıdır.

Örnek tablo:

Tablo 1. Araştırmaya katılanların ilk başvurularını birinci basamakta çalışan hekime yapmama nedenleri

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YAZARLARA BİLGİLER

Başvurmama Nedeni	*n	%
Sadece psikiyatri uzmanı ruh sağlığı hizmeti sunabilir		
Birinci basamakta çalışan hekimin bu hizmeti sunduğunu bilmemem		
Ebeveyn kararıydı		
Birinci basamakta çalışan hekime güveniyorum ancak tercih etmedim		
	47	53,4
	17	19,3
	12	13,6
	12	13,6

* Toplam hasta sayısı

Tablolar, metne dahil edilmemeli ve sistem üzerinden "Görseller" başlığı seçilerek yüklenmelidir. Görseller; JPG, GIFF, PNG veya TIFF formatında gönderilmelidir. Metine ek olarak sisteme yüklenen tüm çizim başlıkları, "Çizim Başlığı" altında, kaynaklardan sonra listelenmelidir. Kullanılan kısaltmalar çizim ve çizelgelerin altındaki açıklamada 10 yazı boyutunda belirtilmelidir. Ondalıklı sayıların belirtilmesinde Türkçe metinlerde virgül işareti, İngilizce metinlerde nokta işareti kullanılmalıdır. Yüzde ile belirtilen sayılarda Türkçe metinlerde sayı önünde, İngilizce metinlerde ise sayı arkasında % işareti kullanılmalıdır.

B. 5. Açıklamalar

Çalışmada teşekkür, daha önce sunulduğu kongre, çıkar çatışması olmadığı, maddi destek, bağış ya da teknik yardım gibi konular metnin sonunda kaynaklardan önce belirtilmelidir. Çalışmayı maddi olarak destekleyen kişi ve kuruluşlar ve varsa bu kuruluşların yazarlarla olan çıkar ilişkileri belirtilmelidir. (Olmaması durumu da "Çalışmayı maddi olarak destekleyen kişi/kuruluş yoktur ve yazarların herhangi bir çıkar dayalı ilişkisi yoktur" şeklinde yazı yazılmalıdır. Araştırma desteği (Üniversite Bilimsel Araştırma projeleri , TÜBİTAK projeleri ve benzeri kurumlardan) alınmışsa, proje numarası belirtilmelidir.

C. Kaynak Gösterimi

Dergimiz, kaynak gösteriminde AMA stilini kullanılmaktadır ve kaynak yazımında atıf düzenleme programlarının kullanımını tavsiye edilmektedir (EndNote, Mendeley, Zotero vb.).

C. 1. Metin İçinde;

Kaynaklar, metinde geçiş sırasına göre numaralandırılmalıdır ve kaynak numaraları üst simge olarak verilmelidir. Örneğin,"… belirtilmektedir8. , bildirilmiştir8,13,18. , şeklindedir8-10

C. 2. 'Kaynaklar' Başlığı Altında;

Kaynaklar ayrı bir liste olarak metin içindeki sıralamalarına göre numaralandırılarak verilmelidir. Kaynak sayısı özgün araştırmalarda en çok 50, olgu sunumlarında en çok 20, editöre mektuplarda ise en çok 5 olmalıdır.

Kaynaktaki yazar sayısı 3 veya daha az ise tüm yazarlar belirtilmeli; 3'den fazla ise, Türkçe kaynak gösteriminde sadece ilk 3 isim yazılmalı "ve ark." şeklinde, İngilizce kaynak gösteriminde ise ilk 3 isim yazılmalı ve "et al." şeklinde gösterilmelidir.

Dergi isimleri Index Medicus/Medline/PubMed'de yer alan dergi kısaltmaları ile uyumlu olarak kısaltılmalıdır. Index Medicus'ta indekslenmeyen bir dergi kısaltılmadan yazılmalıdır. Çevrimiçi yayınlar için DOİ (digital object identifier) numarası verilmelidir.

Örnek:

1. Gage BF, Fihn SD, White RH. Management and dosing of warfarin therapy. The American Journal of Medicine. 2000; 109(6): 481-488. doi:10.1016/S0002-9343(00)00545-3.

Örnekler:

1. Debes-Marun CS, Dewald GW, Bryant S, et al. Chromosome abnormalities clustering and its implications for pathogenesis and prognosis in myeloma. Leukemia. 2003; 17: 427–436.
2. Ozcelik F, Oztosun M, Gülsün M, ve ark. İdiopatik trombositopenik purpura ön tanılı bir olguda EDTA'ya bağlı psödotrombositopeni. Turk J Biochem. 2012; 37(3): 336–339.

Örnek:

1. Yoldas O, Bulut A, Altindis M. Hepatit A Enfeksiyonlarının Güncel Yaklaşımı. Viral Hepatit J 2012; 18: 81-86.
2. Bir derginin ek sayısı (Supplement) kaynak gösterileceği zaman; İngilizce makalelerde (Suppl.) ve Türkçe makalelerde ise (ES) şeklinde gösterilmelidir.

Çevrimiçi makale ise tam yayın tarihi kullanılır. Genellikle cilt ve dergi sayıları, sayfa numaraları yoktur. Makaleye doğrudan ulaşım adresi ve erişildiği tarih verilmelidir.

Örnek:

5. Frederickson BL (2000, Mart 7). Cultivating positive emotions to optimize health and well-being. Prevention & Treatment 3, Makale 0001a. http://journals.apa.org./prevention/volume3/pre003000-1a.html adresinden 20 Kasım 2000'de erişildi.

Kitabın kaynak gösterimi ise yazarların adı, kitabın adı, birden çok basımı varsa kaçıncı basım olduğu, basımevi, basım yeri, basım tarihi belirtilmelidir

Örnek:

2. Strunk W Jr., White EB. The Elements of Style (4. baskı). Longman, New York, 2000.

Kaynak çok yazarlı bir kitabın bölümü ya da bir makalesi ise bölümün ya da makalenin yazarı, bölümün ya da makalenin adı, kitabın adı, kaçıncı baskı olduğu, cildi, kitabın yayın yönetmenleri, basım yeri, sayfaları, tarih yazılmalıdır.

Örnek:

3. Meltzer HY, Lowy MT. Neuroendocrin function in psychiatric disorders. American Handbook of Psychiatry, 2. Baskı, cilt 8, PA Berger, HKH Brodie (Ed), New York. Basic Books Inc, 1986; s. 110-117.

Çeviri kitaplar aşağıdaki şekilde kaynak olarak gösterilmelidir.

Örnek:

4. Liberman RP. Yetiyitiminden İyileşmeye: Psikiyatrik İyileştirim Elkitabı. American Psychiatric Publishing Inc. Washington DC. 2008. Çev. Mustafa Yıldız, Türkiye Sosyal Psikiyatri Derneği, Ankara, 2011.

Kaynak çevrimiçi (internette yer alıyor) ise erişim tarihi ile birlikte yazılmalıdır.

MAKALE SÜREÇ YÖNETİMİ

A. Çift-Kör Hakemlik

JOURNAL OF BIOTECHNOLOGY AND STRATEGIC HEALTH RESEARCH (J of BSHRS), yılda 3 kez yayınlanan ve çift-kör hakemlik sürecinden geçen bilimsel makalelerin yayınlandığı ulusal/uluslararası ve hakemli bir akademik dergidir. Yayınların incelenmesi için çalışmaların içeriğine ve hakemlerin uzmanlık alanlarına göre en az iki hakem, makale alan editörü/leri tarafından atanır. Bu süreçte hakem değerlendirme raporları elektronik ortamda isimsiz olarak gönderilir. Değerlendirmeyi yapan hakemlerin isimleri çift-kör yöntemi gereği raporlarda ve dergide belirtilmemektedir. Talep edilmesi halinde, hakem olarak dergiye katkı sağladığına ilişkin yazılı bir belge hakemlere verilebilir. Yazarlar, hakemlerle doğrudan iletişime geçemez, değerlendirme ve hakem raporları dergi yönetim sistemi aracılığıyla iletilir. Bu süreçte değerlendirme formları ve hakem raporları editör aracılığıyla sorumlu yazara iletilir.

B. Karar Alma Süreçleri

Yayınlanmak üzere gönderilen tüm çalışmalar, değerlendirme için alanlarında uzman en az iki hakeme gönderilir. İnceleme sürecinin tamamlanmasının ardından editör, söz konusu çalışmanın doğruluğu, araştırmacı ve okuyucular için önemi, hakem raporları, telif hakkı ihlali ve intihal gibi yasal düzenlemeleri de göz önünde bulundurarak hangi çalışmaların yayınlanacağına karar verir. Editör, bu kararı verirken diğer editörlerden veya hakemlerden de tavsiyeler alabilir.

C. İvedilik

Hakem değerlendirmesi yapmak üzere davet alan bir hakem, ilgili çalışma için hakemlik yapıp yapamayacağını yedi gün içinde editöre bildirmelidir. Kabul edilen hakemlik değerlendirme süreci onbeş, sorumlu yazara bildirilen değişikliklerin tamamlanması için, yazarlara verilen süre ortalama onbeş gündür. Sorumlu yazara son okuma için gönderilen metnin değerlendirme süresi ise üç gündür. Değerlendirme için hakemlere gönderilen çalışmalar gizli belge olarak tutulmalıdır. Çalışmalar başkalarına gösterilmemeli, içerikleri tartışılmamalıdır. Gerekli durumlarda editörün izni dahilinde hakemler başka meslektaşlarından tavsiye isteyebilirler. Editör, bu izni ancak istisnai bir koşul olması durumda verebilir. Gizlilik kuralı, hakemlik yapmayı reddeden kişileri de kapsamaktadır.

E. Tarafsızlık İlkesi

Değerlendirme sürecinde yazarlara yönelik kişisel eleştiri yapılmamalıdır. Değerlendirmeler, nesnel ve çalışmaların geliştirilmesine katkı sağlayacak şekilde olmalıdır.

F. Kaynak Belirtme

Hakemler, çalışmada atıf olarak belirtilmeyen alıntılar varsa bunları yazarlara bildirmekle yükümlüdür. Hakemler, alanda atıfta bulunulmayan eserlere ya da benzer eserlerle çakışan alıntılara özellikle dikkat etmelidir. Hakemler, daha önce yayınlanmış herhangi bir çalışma ya da bilgiyle benzerliği olan yayınların farkedilmesi durumunda editörleri bilgilendirmelidir.

G. Bilgilendirme ve Çıkar Çatışması

Hakemler, çalışmasını değerlendirmekle görevlendirildikleri herhangi bir yazar, şirket ya da kurumla işbirliğine dayalı herhangi bir bağlantıları olması durumunda değerlendirme yapmayı kabul etmemeli ve durumdan editörü haberdar etmelidir.

Hakemler, değerlendirme için gönderilmiş, yayınlanmamış eserleri ya da eserlerin bölümlerini yazar(lar)ının yazılı onayı olmadan kendi çalışmalarında kullanamaz. Değerlendirme sırasında elde edilen bilgi ve fikirler hakemler tarafından gizli tutulmalı ve kendi çıkarları için kullanılmamalıdır. Bu kurallar, hakemlik görevini kabul etmeyen kişileri de kapsamaktadır.

YAZI GERİ ÇEKME TÜM YAZARLARIN ONAYI İLE OLMALIDIR.

Yazışma Adresi (Corresponding Address)
Prof. Dr. Mustafa Altındiş
Sakarya Üniversitesi Tıp Fakültesi Dekanlık Binası,
KORUCUK, 54200, Sakarya

Dergi Yazı Gönderimi Sayfası:
http://dergipark.gov.tr/bshr

E-posta: jbiosad@gmail.com, maltindis@gmail.com
Tel: +90 (264) 295 72 77
Faks: +90.264.295 6629

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Journal of Biotechnology and Strategic Health Research

HEALTH RESEARCH

INSTRUCTIONS FOR AUTHORS

Scope of the Journal

The JOURNAL OF BIOTECHNOLOGY AND STRATEGIC HEALTH RESEARCH is published electronically 3 times a year by the Experimental, Biotechnological, Clinical and Strategic Health Research Association and accepts English or Turkish-language manuscripts in all fields of medicine(Experimental, Biotechnological, Clinical and Strategic Health Research) and other related health sciences. Contribution is open to researchers of all nationalities. The following types of papers are welcome: original articles (for the presentation of clinical and laboratory studies), case reports, review articles, and letters to the editor.

Submission Procedures

All manuscripts must be submitted electronically via the internet to the JOURNAL OF BIOTECHNOLOGY AND STRATEGIC HEALTH RESEARCH through the online system for ULAKBIM dergipark http://dergipark.gov.tr/bshr You will be guided stepwise through the creation and uploading of the various files.

There are no page charges.

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All experimental or clinical researches done in humans or animals should follow the ethical rules. The ethical approval form must be sent and the number of approval must be given in the manuscript. The ethical problems belong only to the author(s).

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The copyright fee is not paid to all authors.

In manuscripts based on scanning of archieve records, a consent form is needed that shows the permission for retrospective work and signed by Head of the Department, hospital manager or clinic manager.

Preparation of Manuscript Style and format:

Manuscripts should be submitted to http://dergipark.gov.tr/bshr as Microsoft word file in Times New Roman font. All manuscripts including references should be typed in 12 font size,one and a half (1.5) line space and justified. Upon submission, the copyright release form should be filled and downloaded. The manuscript submissions without a copyright release form will not be evaluated.

Each page of main text of the manuscript should be numbered on the right hand side. Manuscripts should be written in Turkish or English. Contributors who are not native English speakers are strongly advised to ensure that a colleague fluent in the English language or a professional language editor has reviewed their manuscript. Repetitive use of long sentences and passive voice should be avoided. It is strongly recommended that the text be run through computer spelling and grammar programs.

Symbols, Units, And Abbreviations:

In general, the journal follows the conventions of Scientific Style and Format, The CSE Manual for Authors, Editors, and Publishers, Council of Science Editors, Reston, VA, USA (7th ed.). Spaces must be inserted between numbers and units (e.g., 3 kg), but not between numbers and mathematical symbols (+, –, ±, ×, =, <, >) and between numbers and percent symbols (e.g., 45%). Please use International System (SI) units. All abbreviations and acronyms should be defined at first mention. Thereafter, generic names should be abbreviated as appropriate without altering the species name.

Typs of Manuscripts Original Article

It should consists of "Introduction", "Methods", "Results" and "Discussion". Conclusion may be written as a last paragraph of discussion, there is no need to add a separate section for conclusion. The whole length of text should be maximum 5 000 words (except abstract, acknowledgements and references). The numbers of references should be maximum 50. Also, scientific names should be spelled italics throughout the text.

Review

It should be maximum 6 000 words (except abstract and references). The author(s) should have at least one published paper in a journal indexed in SCI/SCI-expanded related to the topics of the review. The abstract should be as one paragraph and should be written without a section. The numbers of references should be maximum 100.

Case Report

It should be maximum 1 500 words (except abstract, acknowledgement and references). Case reports should consist of abstract, keywords, introduction, case report and discussion sections. The numbers of references should be maximum 10. Figures or Tables should follow the main text in a separate pages.

Letter to Editor

It should be maximum 1 000 words (except abstract and references). No Tables or Figures are included. If it was written refering to another article, the number and the date should also be added. The name, affiliation(s) and address of author(s) should be written at the end of the text. The numbers of references should be maximum 5.

Manuscript Arrangement

Manuscripts should be arranged as follows: "Title page", "Abstract", "Keywords", "Main text", "Acknowledgements", "References", "Tables",and "Figures".

Title page

All submissions must include a title page, which is to be uploaded as a separate document. The title page should contain the full title in sentence case (e.g., Urothelial cancers: clinical and imaging evaluation). The title should be limited to 25 words or less and should not containabbreviations.The title should be a brief phrase describing the contents of the paper.Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible. It should be written in capital letters both in Turkish and in English. Title in English should be written using italic letters for Turkish manuscripts and vice versa. The first and the family names of the authors should be written in small letters as the first letter being the capital.

The full names and affiliations of all authors should be given clearly and briefly with theirinstitutions, address with zip code and name of country, and the contact details of corresponding author (E-mail address and telephone). In addition, ORCID (Open Researcher and Contributor ID) numbers of all authors should be included into the title page.

Abstract

The abstract should be brief, indicating the purpose/significance of the research, methodology, major findings and the most significant conclusion (s). The abstract shouldnot contain literature citations that refer to the main list of reference attached to the complete article. The abstract should be written as a single paragraph and should be in reported speech format (past tense); complete sentences, active verbs and the third person should be used.

The abstract should be structured to include the study's "Objective", "Methods", "Results", and "Conclusion" under 4 separate headings. Abstracts of review articles should be a brief overview of the main points from the review. In reviews and case reports, abstract should be written without any sections. The abstract (English and Turkish) should not be more than 300 words.

Keywords

The authors must provide 3-6 keywords for indexing purposes and to facilitate the retrieval of articles by search engines. Keywords should be different from the words that make up the title of the article. Keywords should be written below the abstracts both inTurkish andEnglish. Acronyms should be avoided. For English keywords, always try to use terms from the Medical Subjects Headings list from Index Medicus (www.nlm.nih.gov/mesh/MBrowser.html). For Turkish keywords, terms from Turkish Scientific Terms (www.bilimterimleri.com) should be used.

Main text

Introduction

The introduction should be clear and concise, with relevant references on the study subject and the proposed approach or solution. There should be no subheadings. Excessive citation of literature should be avoided. Only necessary and the latest citations of literature that are required to indicate the reason forthe research undertaken and the essential background should be given.

Methods

Explain clearly but concisely your clinical, technical, or experimental procedures. A precise description of the selection of your observational or experimental subjects (for example patients or laboratory animals including controls) must be presented. Experimental research involving human or animals should be approved by ethical committiee.All chemicals and drugs used must be identified correctly, including the generic names, the name of the manufacturer, city and country in parenthesis. The techniques or methodology adopted should be supported with standard references. Briefly describe methods that have been published but are not well known as well as new or substantially modified methods. Description of established procedures are unnecessary. Apparatus should be described only is it is non-standard; commercially available apparatus used should be stated (including manufacturers' name, address in parenthesis). Only SI units should be used for each measurements.

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Results

The result section should provide complete details of the experiment that are required to support the conclusion of the study. The results should be written in the past tense when describing findings in authors experiments. Previously published findings should be written in the present tense. Speculation and the detailed interpretation of the data should not be included in the results but should be put into the discussion section.

Discussion

Statements from the "Introduction" and "Results" sections should not be repeated here. The final paragraph shouldhighlight the main conclusions of the study.

Tables and Figures

The visual presentations like photographs, graphics, picturesetc. must be labelled "Figures". Whereas, the "Tables" shows the classifieddata.Tables should be added after the "References" section. Figure legends should be placed into the end of the main text. Figures should be uploaded as a separate file following the Dergipark System.

All tables and figures must have a caption and/or legend and be numbered (e.g., Table 1., Figure 2.), unless there is only one table or figure, in which case it should be labelled "Table" or "Figure" with no numbering. Captions mustbe written in sentence case (e.g., Figure 1. Macroscopic appearance of the samples.). The font used in the figures should beTimes New Roman. If symbols such as ×, μ, η, or ν are used, they should be added using the Symbols menu of Word.

All tables and figures must be numbered consecutively as they are referred in the text. Please refer to tablesand figures with capitalisation and unabbreviated (e.g., "As shown in Figure 2. …", and not "Fig. 2" or "figure 2").
The resolution of images should not be less than 118 pixels/cm when width is set to 16 cm. Images must bescanned at 300 dpi resolution and submitted in .jpeg, .png or .tif format.

Graphics and diagrams must be drawn with a line weight between 0.5 and 1 point. Scanned or photocopied graphs anddiagrams are not accepted.

Charts must be prepared in 2 dimensions unless required by the data used. Charts unnecessarily prepared in3 dimensions are not accepted.

Figures that are charts, diagrams, or drawings must be submitted in a modifiable format, i.e. our graphicspersonnel should be able to modify them. Therefore, if the program with which the figure is drawn has a "Save as"option, it must be saved as .pdf. If the "Save as" option does not include .pdf extension, the figure must becopied and pasted into a blank Microsoft Word document as an editable object. It must not be pasted as an imagefile (.tiff or.jpeg) unless it is a photograph.

Tables and figures, including caption, title, column heads, and footnotes, must not exceed 16 × 20 cm andshould be no smaller than 8 cm in width. For all tables, please use Word's "Create Table" feature, with no tabbedtext or tables created with spaces and drawn lines. Please do not duplicate information that is already presented inthe figures.
Tables must be clearly typed, each on a separate sheet, and single-spaced. Tables may be continued on anothersheet if necessary, but the dimensions stated above still apply.

Tables should be arranged as a horizontal borderline as well as below the last line. Moreover, there sould be vertical line on the right of first column on the left hand site. Abbreviations used in the tables such as (*) should be explained below the table in 10 font size.

In Tables written in Turkish, decimal numbers should be written with comma, however in English text, decimal numbers should be written with dots. Percentages (%) should be placed in front of the numbers without space and behind the numbers in Turkish and English text, respectively.

Example for a Table:

Table1. The reasons of not applying to general practioner for the first application.

The reasons	*n**	*%*
Only Psychiatrist can do it		
No information about general practioner Parents decision		
Not preferred	*47*	*53.4*
17	*19.3*	
12	*13.6*	
12	*13.6*	

**Total number of patients.*

Acknowledgement

All acknowledgements, poster/oral presentations, financial supports, grants, technical supports and the conflict of interest should be mentioned at the end of the text.

Funding

The type of Project or the financial support such as scientific projects of University, TUBITAK projects etc. should be added at the end of the text including the numbers and the year of the projects.

References

While talking about the source in the text, the first author's surname ın Er and his firends' study12"…… or ın Er et al.12. Both authors should be given the surnames of both authors (similar results were found in the study conducted by Öncü and Ilke13).

Citations in the text should be identified by numbers assuperscript, for example, "The results were as follows: 4
If there are more than one references, separate the numbers with comma, for example, "Several interventions have been successful at increasing compliance.11,14"

In following journals, first and the last numbers should be seperated by "-" , for example: Diabetes mellitus is associated with a high risk of foot ulcers1-3 or "As reported previously,1,3-6"

Do not include personal communications, unpublished data, or other unpublished materials as references, although such material may be inserted (in parentheses) in the text. In the case of publications in languages other than English, the published English title should be provided if one exists, with an annotation such as "(article inTurkish with an abstract in English)". If the publication was not published with an English title, provide the original title only; do not provide a self-translation. A short title for use as a running head (not to exceed 30 characters in length, including spaces between words) is needed. References should be formatted as follows (please note the punctuationand capitalisation):
The list of references at the end of the paper should be given in order of their first appearance in the text. All authors should be included in reference lists unless there are more than 6, in which case only the first 3 should be given, followed by "et al." in English and "ve ark." in Turkish references.

The number of references should not be more than 60 in original articles, not more than 100 in review articles, not more than 20 in case reports and not more than 5 in letter to editor. The journal requires DOI numbers, when available, to be included in all references. Personal experiences and researches without a DOI number should not be used.

In order to arrange the reference list easly, our journal suggest the use of reference arrangement programmes such as EndNote or Mendeley etc.).

For a reference in the reference list, the surname of author, the first letter of author's name, the title of the reference, the name of the journal, the year of the journal, the numbers of its volume, issue and pages should be written. The name of the journal should be abbreviated as in AMA (American Medical Association) ((http://library.nymc.edu/informatics/amastyle.cfm). If the abbreviation is not avalible, whole name of the journal should be written.

Published papers

Yoldas O, Bulut A, Altindis M. Current Approach to Hepatitis A Infections. Viral Hepatit J 2012; 18: 81-86..
Debes-Marun CS, Dewald GW, Bryant S, et al. Chromosome abnormalities clustering and its implications for pathogenesis and prognosis in myeloma. Leukemia. 2003;17:427–436.
Ozcelik F, Oztosun M, Gülsün M, ve ark. Pseudothrombocytopenia due to EDTA in a case with idiopathic thrombocytopenic purpura. Turk J Biochem. 2012;37(3):336–339.

Gage BF, Fihn SD, White RH. Management and dosing of warfarin therapy. Am J Med. 2000;109(6):481- 488. doi:10.1016/S0002-9343(00)00545-3.

If a supplement of a journal is referred, (suppl.) in English and (ES) in Turkish manuscripts should be used.

Electronic journal articles

If a journal from a website is used, the date of publishing is used. Usually, there is no numbers of volume, issue or pages. The web adress and date of download should be given.

Example:

Acetaminophen poisoning. In: DynaMed [database online]. EBSCO Information Services. http://0-search.ebscohost.com.topcat.switchinc.org/login.aspx?direct=true&site=DynaMed&id=113862.

Updated

March 09, 2010. Accessed March 23, 2010.

Book

Harmening D. Modern Blood Banking & Transfusion Practices. 6th ed. Philadelphia, PA: F.A. Davis Company; 2012.
Strunk W Jr., White EB. The Elements of Style. 4th ed. New York, NY: Longman; 2000.
Chapter in a book
Solensky R. Drug allergy: desensitization and treatment of reactions to antibiotics and aspirin. In: Lockey P, ed. Allergens and Allergen Immunotherapy. 3rd ed. New York, NY: Marcel Dekker; 2004:585-606.
McCall RE, Tankersley CM. Phlebotomy and specimen considerations. In: Bishop ML, Fody EP, Schoeff LE, editors. Clinical Chemistry: Techniques, Principles, Correlations. Philadelphia, PA, USA: Lippincott Williams & Williams; 2010:33-73.

Conference proceedings

Weber KJ, Lee J, Decresce R, Subjasis M, Prinz R. Intraoperative PTH monitoring in parathyroid hyperplasia requires stricter criteria for success. Paper presented at: 25th Annual American Association of Endocrine Surgeons Meeting; April 6, 2004; Charlottesville, VA.

Chu H, Rosenthal M. Search engines for the World Wide Web: a comparative study and evaluation met-

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hodology. Paper presented at: American Society for Information Science Annual Conference; October 19-24, 1996; Baltimore, MD. http://www.asis.org/annual-96/electronicproceedings/chu.html. Accessed February 26, 2004.

Theses

Fenster SD. Cloning and Characterization of Piccolo, a Novel Component of the Presynaptic Cytoskeletal Matrix [master's thesis]. Birmingham: University of Alabama; 2000.

Publication Policy and Manuscript Evaluation Process

A. Double-blinded peer-reviewed method

Biotechnology and Strategic Health Research (J BSHRS) is published 3 times a year (April, August, December) and it is double-blinded peer-reviewed system national journal.

Editorial and publication processes of the BSHRS Derg. are shaped in accordance with the guidelines of the international organizations such as the International Council of Medical Journal Editors (ICMJE), the World Association of Medical Editors (WAME), the Council of Science Editors (CSE), the Committee on Publication Ethics (COPE), the European Association of Science Editors (EASE). The journal is in conformity with Principles of Transparency and Best Practice in Scholarly Publishing (doaj.org/bestpractice). Processing and publication is free of charge with the Biyoteknolojik ve Stratejik Sağlık Araştırmaları Dergisi. Authors are not charged a fee at any point during the publication process. All manuscripts should be submitted through the journal's web page at http://dergipark.gov.tr/bshr.

For the evaluation of papers, at least two referees are determined considering the content of the manuscript or the professional scientific area of the referees. In this step, referee assessment form is sent via internet without names. The personal data of the referee is not shown since the double-blind peer-reviewed method is used. Upon request, a written document given to referee as the referee for that contribute to the journal. The authors cannot directly contact with the referees. The referee's evaluation report is sent by the journal management system. The evaluation forms and the referees' reports are sent to the corresponding author(s) by the editor.

B. Decision process

After the referees' evaluation process, the editor decides whether the manuscript will be accepted or not considering the accuracy and the importance of the work, referee's reports, copyright infringement and ethical problems such as plagiarism.

As the editor decides about the manuscript, he or she may require the suggestions of the other member of editorial board or referees.

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A referee invited to the journal for the evaluation of a manuscript should inform the editor about the acceptance in 7 days. The referee should complete the evaluation in 15 days and the corresponding author(s) should download the revised manuscript in 15 days. The requested reading time for the last version of the manuscript by the corresponding author is only 3 days.

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The referees should inform the authors if there are any citations that are not referred in the manuscript. The referees should pay particular attention to the citations that do not refer to the subject or to the citations that coincide with similar works. The referees should inform the editors if any publications that have similarity to any previously published work or information are recognized.

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The referees should not agree to make any evaluation if they have any relation with any author, company or institution in which they are tasked to evaluate their work and inform the editor. The referees may not use the unpublished works or sections of the works submitted for evaluation in their own work without the written consent of the author(s). The information and ideas obtained during the assessment should be kept secret by the referees and should not be used for their own interests. These rules include those who refuse the manuscript assessment.

H. Prevention of Plagiarism

J of Biotechnology and Strategic Health Research(J of BSHR) reports the similarity rates of the articles through the iThenticate and Turnitin programs and shows the care and sensitivity required to prevent plagiarism.

THE WITHDRAW OF THE ARTICLE MUST BE WITH THE APPROVAL OF ALL AUTHORS.

Corresponding Address

Prof. Dr. Mustafa Altındiş

Sakarya Üniversitesi Tıp Fakültesi Dekanlık Binası,

KORUCUK, 54200, Sakarya

Dergi Yazı Gönderimi Sayfası:

http://dergipark.gov.tr/bshr

E-mail:

jbiosad@gmail.com, maltindis@gmail.com

Phone: +90 (264) 295 72 77

Fax: +90.264.295 6629

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ARAŞTIRMA MAKALESİ / *RESEARCH ARTICLES*

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Journal of Biotechnology and Strategic Health Research

Review / Derleme

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COVID-19 Vaccine-Associated Adverse Effects; Benefits Outweigh the Risks?

COVID-19 Aşısına Bağlı Yan Etkiler; Faydalar Risklerden Ağır Basıyor Mu?

Büşra Sultan Kibar[1], Öner Özdemir[2]

[1] Research and Training Hospital of Sakarya University, Department of Pediatrics, 54100, Sakarya, Türkiye

[2] Sakarya University, Faculty of Medicine, Department of Pediatric Allergy and Immunology, 54100, Sakarya, Türkiye

ORCID ID: Büşra Sultan Kibar: https://orcid.org/0000-0002-6535-1034, Öner Özdemir: https://orcid.org/0000-0002-5338-9561

***Sorumlu Yazar / Corresponding Author:** Öner Özdemir, **e-posta / e-mail:** ozdemironer@hotmail.com

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Öz

COVID-19 vaccines are vaccines produced with the latest technology in a very short time to get rid of this disease. These vaccines have been produced and used in millions around the world. Although some simple local side effects have been reported during and immediately after the administration of the vaccine, long-term side effects affecting various organs have recently been begun to be reported, especially with the use of mRNA vaccines. This minireview discusses the issues related to these simple and less common side effects.

Anahtar Kelimeler COVID-19, SARS-CoV-2, side effect, vaccine

Abstract

COVID-19 aşıları, bu salgını kontrol altına almak için çok kısa sürede, son teknolojiyle üretilen aşılardır. Bu aşılar dünya çapında milyonlarca üretilip kullanılmaktadır. Aşının uygulanması sırasında ve hemen sonrasında bazı hafif lokal yan etkiler bildirilse de, son zamanlarda özellikle mRNA aşılarının kullanılmaya başlanmasıyla birlikte çeşitli organları etkileyen uzun vadeli yan etkiler de bildirilmeye başlanmıştır. Bu derlemede, hafif ve daha nadir olan yan etkilerle ilgili konular tartışılmaktadır.

Keywords *COVID-19, SARS-CoV-2, yan etki, aşı,*

INTRODUCTION

The SARS-CoV-2 outbreak was declared a pandemic by the World Health Organization (WHO) on March 11, 2020, and a public health emergency of international concern (PHEIC) in late January 2020.[1] It has caused a lot of morbidity and mortality. Since the beginning of the pandemic, studies have been carried out for effective vaccines and disease-specific antiviral treatments to minimize the harmful effects of the disease.[2]

Vaccines have a significant place in preventing infectious diseases. The way to make it easier to control the epidemic is to ensure that the susceptible population becomes immune by vaccinating them. While vaccination protects individuals against the disease, if administered to a sufficient number of people, it also provides adequate 'herd immunity' to reduce the spread of the virus, morbidity, and mortality worldwide.[3]

In recent years, increasing anti-vaccination movement and vaccine hesitancy with the influence of social media has led to the re-increase of many infectious diseases such as measles.[4] According to the World Health Organization (WHO) statement in 2019, one of the top 10 health threats in the world is anti-vaccination movement.[5] Unfortunately, anti-vaccination movement and vaccine hesitancy towards COVID-19 vaccines is quite common.

COVID-19 vaccines may effectively contain the devastating social and economic impacts of this new virus (SARS-CoV-2) and alleviate the severity of this epidemic. Herd immunity provides an indirect protection against an infectious disease that occurs when a population is immune through vaccination or previous infection.[6]

Types of vaccines developed for COVID-19

There are vaccines developed against SARS-CoV-2 using different principles. These are complete virion vaccines (live attenuated, inactivated), nucleic acid-based DNA and mRNA vaccines, viral vector vaccines (replicative and nonreplicative), recombinant protein/protein subunit and virus- like particle (VLP)] vaccines.[7]

Some of the vaccine types developed for COVID-19 are listed in the Table 1.[8]

Table 1. Some of the types of vaccines developed for COVID-19

Manufacturer	Vaccine name	Vaccine type
Pfizer-Biontech	BNT162b2/ COMIRNATY Tozinameran (INN)	RNA based vaccine/ BNT162b2(3 LNP-mRNAs)
AstraZeneca +University of Oxford	AZD1222	Viral vector/ ChAdOx1-S-(AZD1222)
Janssen/Johnson & Johnson	Ad26.COV2.S	Viral vector/Ad26. COV2.S
Moderna+National Institute of Allergy and Infectious Diseases (NIAID)	mRNA -1273	RNA-based vaccine/mRNA-1273
Sinovac Research and Development Co., Ltd. (CoronaVac)	COVID-19 Vaccine (Vero Cell), Inactivated / CoronavacTM	Inactivated SARS-CoV-2 vaccine
Sinopharm+China National Biotec group Co. + Wuhan Institute of Biological Products	SARS-CoV-2 Vaccine (Vero Cell), Inactivated (lnCoV)	Inactivated SARS-CoV-2 vaccine
Novavax	NVX-CoV2373/ Covovax	Protein subunit / SARS-CoV-2 rS / Matrix M1-Adjuvant
IMBCAMS, China	SARS-CoV-2 Vaccine, Inactivated (Vero Cell)	Inactivated SARS-CoV-2 vaccine
Erciyes University Hakan Çetinsaya Good Clinical Practice and Research Centre and Erciyes University Vaccine Research, Development and Application Centre (ERAGEM)	ERUCoV-VAC (Turkovac)	Inactivated SARS-CoV-2 vaccine

Expected (Common) Side Effects of Vaccines

Sinovac vaccine is a vaccine containing an inactivated virus and has been produced using the same methods that have been used to produce vaccines for decades. BioN-

Tech, on the other hand, is made using m-RNA, a newer technology. Both vaccines are particularly effective at preventing severe infections and death.[9]

Sinovac vaccine is a vaccine containing inactivated virus. Inactivated vaccines are produced by growing SARS-CoV-2 in cell culture and chemically inactivating the virus. The inactivated virus is often combined with an adjuvant such as aluminum to enhance the immune response. The Coronavac vaccine produced by Sinovac and Turkovac vaccine was also prepared with this method.[10,11]

No severe side effects have been found in clinical studies and current vaccine applications for both BioNTech® and Sinovac® used in our country and other vaccines used in various countries worldwide. Turkovac vaccine, which received emergency use authorization (EUA) by the Turkish Medicines and Medical Devices Agency in December 2021, was also used in our country. The side effects seen in the Turkovac vaccine were similar to other inactive vaccine studies.[11] Side effects that occur after vaccination are mostly mild. After vaccination, complaints such as redness, swelling, and pain may appear on the arm where the vaccine was applied.[12-14] Side effects such as headache, feeling tired, fever, pain in the arm where the vaccine is used, redness in the area where the vaccine is applied, muscle and joint pain, chills, nausea, and diarrhea are the most common side effects of COVID-19 vaccines.[14-16]

Side effects such as severe hypersensitivity reactions are rare and usually occur shortly after vaccine administration. Therefore, vaccines should be administered in settings where immediate allergic responses can be appropriately managed. The mRNA vaccines, Pfizer/BioNTech (BNT162b2) and Moderna (mRNA-1273) contain polyethylene glycol. The vector vaccine Janssen/Johnson & Johnson (Ad26.COV2.S) contains polysorbate.[17] Allergy to these substances in individuals constitutes a contraindication for vaccination.

Rare Side Effects of Vaccines

The Pfizer/BioNTech (BNT162b2) vaccine is an mRNA-based vaccine. Myocarditis and pericarditis have been reported more frequently than expected in male adolescents and young adults who received the Pfizer/BioNTech (BNT162b2) and Moderna (mRNA-1273) vaccines.[18,19] Signs of myocarditis usually appear within the first week after administration of the vaccine and, more commonly, after the second dose. Considering the low rates of myocarditis and pericarditis developing after mRNA vaccines, its mild clinical course, and its rapid and good response to medical treatment, it is obvious that it can be preferred to the devastating consequences of COVID-19.[20-21] The second dose can be postponed if the side effect occurs after the first dose. If the risk of COVID-19 is high, these people can be given a second dose of vaccine after the myocarditis episode resolves. Myocarditis should be suspected when palpitations, chest pain, and shortness of breath develop in adolescents after administration of the mRNA vaccine.[22] Meanwhile, it should not be forgotten that SARS-CoV-2 infection simultaneously with the vaccine can also cause myocarditis.[18]

A potential relationship between Adenovirus vector vaccines e.g. AstraZeneca and Janssen/Johnson & Johnson and Guillain-Barre syndrome (GBS) is being investigated.[23] Despite this possible side effect, the US Food and Drug Administration (FDA), US Centers for Disease Control and Prevention (CDC), and European Medicines Agency (EMA) confirm that the benefits of these vaccines outweigh their risks.[24] Cases of GBS have also been reported during SARS-CoV-2 infection; for individuals with a previous history of GBS, vaccines other than adenovirus vector vaccines should be preferred.[25]

Since thrombosis with thrombocytopenia can be seen at very low rates after the administration of Adenovirus vector vaccines such as AstraZeneca and Janssen/Johnson & Johnson mRNA vaccines [BNT162b2 (Pfizer-BioNTech) and mRNA-1273 (Moderna) vaccines] or other vaccines

(such as CoronaVac) are preferred if possible. However, if access to these vaccines is not possible, the AstraZeneca or Janssen vaccine can also be administered according to the benefit-risk analysis.[26]

Relation between COVID-19 Vaccination and Autoimmune Diseases

Some studies have shown that human papillomavirus, hepatitis B, and influenza vaccines may trigger the onset or exacerbation of autoimmune diseases through molecular mimicry that causes autoimmunity.[27–29]

Studies show that new-onset autoimmune symptoms, including thrombosis with thrombocytopenia after vaccine administration, myocarditis, chronic spontaneous / idiopathic urticaria, autoimmune liver diseases, GBS, and IgA nephropathy might be associated with COVID-19 vaccines.[30,31] Possible mechanisms by which COVID-19 vaccines cause autoimmune manifestations include molecular mimicry, production of specific autoantibodies, and the role of particular vaccine adjuvants. Further studies are needed to elucidate the underlying biological mechanisms and determine precise causality.[30]

CONCLUSION

In conclusion, even when all side effects are considered, vaccine effectiveness prevents rare problems. The benefits of COVID-19 vaccines in preventing disease and related deaths far outweigh any possible adverse effects. Studies show that approved vaccines against COVID-19 have a primary role in controlling hospitalizations and deaths. To create herd immunity, most of the population must be vaccinated. Negative effects on the functioning of social life can be minimized through vaccination. Concerns about rare side effects following COVID-19 immunization should not diminish overall confidence in the value of vaccination.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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Prevalence and Antimicrobial Susceptibility Pattern of *Staphylococcus Species* Causing Urinary Tract Infections in Women of Reproductive Age: 5 Years Retrospective Study

Üreme Çağındaki Kadınlarda İdrar Yolu Enfeksiyonlarına Neden Olan Stafilokok Suşlarının Prevalansı ve Antimikrobiyal Duyarlılık Paterni: 5 Yıl Retrospektif Çalışma

Sondos A. A. Ibnouf[1], Sait Ramazan Gülbay[2], Metin Doğan[2]

[1] Necmettin Erbakan University, Institute of Health Sciences, Department of Microbiology, Konya, Türkiye

[2] Necmettin Erbakan University, Meram Faculty of Medicine, Department of Microbiology, Konya, Türkiye

ORCID ID: Sondos A. A. Ibnouf: https://orcid.org/0000-0002-4715-386X, Sait Ramazan Gülbay: https://orcid.org/0000-0001-6531-886X, Metin Doğan: https://orcid.org/0000-0003-3471-4768

***Sorumlu Yazar / Corresponding Author:** Sondos A. A. Ibnouf, **e-posta / e-mail:** sondosabdalaziz076@gmail.com

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Abstract

Aim Infections of the urinary tract are amongst the most prevalent infections in women, females at child-bearing age have a higher predisposition to urinary tract infections. Approximately 13% of health-care-associated urinary tract infections occur due to Coagulase Negative *Staphylococci* (CNS); this species' resistance rate is alarming. The study aims to describe urinary tract infections of women of reproductive age through 5 years of results, emphasizing *Staphylococcus species* (*Staphylococcus aureus, Staphylococcus saprophyticus* ve other CNS) as an etiological agent and their patterns of antimicrobial susceptibility.

Material and Method In the study, 4562 urine samples sent between November 2017 and November 2022 were retrospectively analyzed. Routine culture methods were used to isolate bacteria from urine specimens. According to the European Committee on Antimicrobial Susceptibility Testing (version 8.0-12.0) recommendations, an antimicrobial susceptibility test was performed using the disc diffusion technique. Obtained data analysis was achieved by Statistical Package for Social Sciences (SPSS 20.0), Categorical variables were presented as frequency and percentage however continuous variable was described as mean ± Standard deviation (SD), and binary logistic regression test was done to determine the association with statistical significance of ($p<0.05$).

Results Of the 4562 urine samples taken from women of reproductive age, 166 (3.6%) had a UTI due to *Staphylococcus species*. The most common species was other CNS 110 (66.2%). Followed by, S. aureus which was 42 (25.3%), and *S. saprophyticus* 14 (8.4%). All isolate species showed susceptibility to tigecycline and linezolid (100%). The highest level of antibiotic resistance was showed by *S. aureus* and other CNS against penicillin-G which was (83.30%) and (58.1%) respectively, while the majority of *S. saprophyticus* showed resistance against Erythromycin (64.2%). Other CNS displayed the highest oxacillin resistance (20.90%) among *Staphylococcus species*.

Conclusion The study illustrates the significance of *Staphylococcus species* as a pathogen of the urinary tract, especially in women of reproductive age. There is clear evidence of the resistance of isolates to penicillin-G which may suggest the production of penicillin-binding protein 2a. Regular surveillance of the frequency and resistance pattern of *Staphylococcus species* causing urinary tract infections in local regions, especially keeping in mind the high-risk patients mentioned in our study should be monitored.

Keywords : Reproductive age, *Staphylococcus species*, urinary tract infection, women.

Özet

Amaç *İdrar yolu enfeksiyonları kadınlarda en sık görülen enfeksiyonların arasındadır. Doğurganlık çağındaki kadınların idrar yolu enfeksiyonlarına yatkınlığı daha fazladır. Koagülaz Negatif Stafilokoklar (KNS), yatan hastalarda idrar yolu enfeksiyonlarının (İYE) yaklaşık %13'ünden sorumludur. Bu patojen grubunun antimikrobiyallerine karşı direncin artması da endişe vericidir. Bu çalışmada, üreme çağındaki kadınların idrar yolu enfeksiyonlarının etiyolojik bir ajanı olan Stafilokok türlerini (Staphylococcus aureus, Staphylococcus saprophyticus ve diğer KNS) ve bunların antimikrobiyal duyarlılık paternlerinin araştırması amaçlanmıştır.*

Gereç ve Yöntem *Bu çalışmada, Kasım 2017-Kasım 2022 tarihleri arasında toplanan 4562 adet idrar örneği retrospektif olarak incelenmiştir. Bakterileri idrar örneklerinden izole etmek için rutin kültür yöntemleri kullanıldı. European Committee on Antimicrobial Susceptibility Testing (versiyon 8,0-12,0) önerilerine göre disk difüzyon tekniği kullanılarak antimikrobiyal duyarlılık testi yapıldı Veriler Statistical Package for Social Sciences (SPSS 20,0) programıyla analiz edildi. Kategorik değişkenler frekans ve yüzde olarak ifade edildi, sürekli değişkenler ise ortalama ± standart sapma (SS) şeklinde verildi. Tüm karşılaştırmalarda $P<0,05$ istatistiksel anlamlılık düzeyi olarak kabul edildi.*

Bulgular *Doğurgan çağındaki kadınlardan elde edilen 4562 idrar örneğinin 166'sında (%3,6) stafilokok türlerine bağlı İYE saptandı. En sık karşılaşılan stafilokok türü diğer KNS olup, 110 adet (%66.2) idrar örneğinde etken olarak tespit edildi. Bunu takiben, 42 adet S. aureus (%25.3) ve 14 adet (%8.4) S. saprophyticus etken olarak saptandı. Tüm izolatlar tigesiklin ve linezolide karşı (%100) duyarlıydı. En yüksek antibiyotik direnci, penisilin-G'ye karşı S. aureus (%83,30) ve diğer KNS (%58,1) tarafından gelişirken, S. saprophyticus'un büyük çoğunluğu eritromisin'e (%64,2) karşı direnç göstermiştir. Diğer KNS, stafilokok türleri arasında en yüksek oksasilin direncini (%20,90) göstermiştir.*

Sonuç *Stafilokok türleri, özellikle üreme çağındaki kadınlarda idrar yolu patojeni olarak önemini göstermektedir. İzolatların penisilin-G'ye karşı direncine açık kanıtlar vardır. Bu direncin gelişmesine penisilin bağlayıcı protein 2a üretimi yol açmış olabilir. İdrar yolu enfeksiyonlarına neden olan stafilokok türlerinin sık görülen prevalansı ve duyarlılık paternleri, özellikle çalışmamızda ele alınan yüksek riskli hastaları tedavi ederken göz önünde bulundurulmalıdır.*

Anahtar Kelimeler *Doğurgan çağ, Stafilokok suşları. idrar yolu enfeksiyonu, kadınlar*

INTRODUCTION

Infections of the Urinary tract (UTI) are defined as the existence and growth of microbes in the different parts of the urinary system from the kidney, ureter, bladder, and urethra, which may or may not be accompanied by clinical symptoms and pyuria.[1] It is one of the most common infections known to be caused by bacteria, with an incidence rate of 150 million,[2] and causes almost 85,000 deaths annually worldwide according to the reports of the World Health Organization.[3] Reports from Turkey show that 15.7% of infections that occur in healthcare settings are UTIs.[4] It comes in the second ranking of the highest prevalent infections after respiratory.[5] Women have a high predisposition for UTI, females are 35 times more susceptible to UTI than males, especially between the age of 16–35.[6] Once in a lifetime, nearly 60% of women will be diagnosed with a symptomatic infection of the lower urinary tract,1 10% of females get infected yearly,[7] and 30% - 44% of women will have a recurrence.[8] The higher predisposition to infection in women is influenced by structural factors, the shortness of the urethra and its closeness to bacterial normal flora present in the rectum and vagina that allows easier colonization of those bacteria,[6] as well as behavioral factors e.g., sexual intercourse, spermicide exposure, and intrauterine devices. Furthermore, the previous history of UTI, the presence of a history of UTI in the mother, and the existence of UTI in childhood are also considered predisposing factors.[9]

Infections in the urinary tract can be attributable to various microbes, among which bacterial UTIs are highly dangerous and frequently occur in both inpatient and outpatient.[10] The most frequent isolated causative agents of UTI are members of *Enterobacterales*, including *Escherichia coli, Klebsiella spp., Enterobacter spp*., and *Proteus spp.*, commonly isolated Gram-positive bacteria comprehend *Enterococcus faecalis, Streptococcus agalactiae* and *Staphylococcus spp*..[5] *S. aureus* is a ubiquitous causative agent of UTI, with a growing prevalence rate.[11] *S. saprophyticu*s is one of the main causal pathogens of UTI in females and a species of the CNS which is categorized as the second most significant uropathogenic after *E. coli* representing 10–15% of cases.[12] CNS generally displays vague pathogenicity for the urinary system. Nonetheless, several studies have assessed the existence of CNS members (*S. haemolyticus, S. simulans, S. warneri*, and *S.hominis*) which have a clinically significant part in UTI. These species are important causes of UTI in young females, the elderly, hospital inpatients, and patients with a urinary tract surgery history.[13]

Nearly 50% to 60% of females of fertility age develop UTI.[14] Women reach sexual maturity between the ages of 15 and 49, in this period the fertile functions develop with which the risk of genital infections increases, subsequently UTI.[15] Increasing antimicrobial resistance in the control of UTI is a serious public health concern globally.[1] Reasoning from the fact that in most cases medications are prescribed empirically, it is crucial to identify the pathogens as well as the antibiotic susceptibility in urinary tract infections to ensure successful treatment.[16] The significance of *Staphylococcus species* is not merely as a human pathogen, but also because its resistance to antibiotics has increased.[13]

This retrospective study aimed to describe UTIs of women of reproductive age diagnosed in the University Hospital in Konya through 5 years of results, with a particular emphasis on *Staphylococcus species* (*S. aureus, S. saprophyticus*, and other CNS) as an etiological agent and their patterns of antimicrobial susceptibility.

MATERIALS and METHODS

1. Study design

This descriptive retrospective study was conducted at University Hospital in Konya, Türkiye. Ethical clearance was obtained from the Ethics Committee for Non-Medical and Medical Devices Research with the date of 20 January 2023 (Decision no. 2023/4166). All the medical records of analyzed urine samples of female patients admitted to the several clinics of the hospital between the period of November 2017 and November 2022 were reviewed. *Staph-*

ylococcus species grown in the urine culture of women of reproductive age (15-49 years) were grouped as *S. aureus, S. saprophyticus*, and other CNS, considering their importance for this population. Culture and in vitro antimicrobial susceptibility test results of these *Staphylococcus species* were analyzed retrospectively.

2. Isolation and identification of organisms

The samples were collected as clean-catch midstream urine from each patient, and all samples were cultured on 5% blood agar as well as eosin methylene blue (EMB) media and incubated at 37 °C for 24-48 h. Urine cultures were re-evaluated if two or more different types of bacteria growth were observed. Urine culture was accepted as positive if the colony count exceeded 105 CFU/ml. Bacterial isolates were identified based on Gram staining, culture characteristics, and the biochemical test result implemented on the isolates.[17] To identify Gram-positive bacteria biochemical tests such as catalase, coagulase, and novobiocin disc (5/µg) were performed.

3. Antibiotic sensitivity test

The antibiotic sensitivity test using the disc diffusion method was carried out in accordance with the European Committee on Antimicrobial Susceptibility Testing (version 8.0-12.0) instructions. The interpretation was done after overnight incubation at 37°.[17] The used antibiotics in this study were ampicillin/sulbactam, cefoxitin, ciprofloxacin, daptomycin, erythromycin, fusidic acid, gentamicin, clindamycin, chloramphenicol, linezolid, oxacillin, penicillin-G, teicoplanin, tetracycline, tigecycline, trimethoprim/ sulfamethoxazole, vancomycin. In antimicrobial susceptibility determination, *S. aureus* ATCC 25923 strains were used as quality control organisms.

4. Statistical Analysis

Attained data were statistically analyzed by The Statistical Package for Social Sciences (SPSS version 20). Categorical variables (i.e., age categories, organism isolated, sensitivity, and resistance) were presented as frequency and percentage however continuous variable (i.e., age) was described as mean ± Standard deviation (SD), binary logistic regression test was done to determine the association with statistical significance of ($p<0.05$).

RESULTS

Over 5 years, out of 4562 urine samples obtained 166 women had UTIs due to *Staphylococcus species*, other CNS is the predominant *Staphylococcus species* 110 (66.2%), Followed by *S. aureus* 42 (25.3%), and *S. saprophyticus* 14 (8.4%), as illustrated in Figure 1.

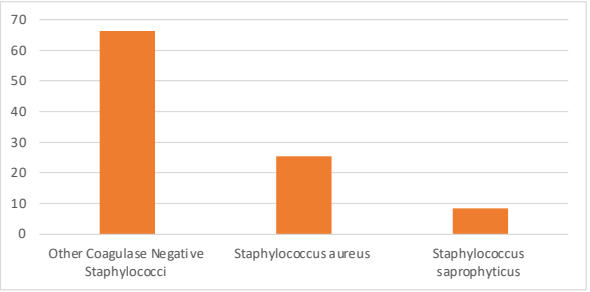

Figure 1. Distribution of Staphylococcus species isolated from urine samples

The mean age of women involved in the study was 29.4 ± 10.9 (15–49 years). A considerable number of women were between the ages of 15 to 24 years (39.8%), followed by 36 to 49 years (33.1%), and 25 to 35 years (27.1%) as shown in Figure 2. While UTIs due to *S. aureus* are more prevalent in the old age group (36-49 years), other CNS and *S. saprophyticus* UTIs were more frequent in the young age group (15-24 years) (Figure 2).

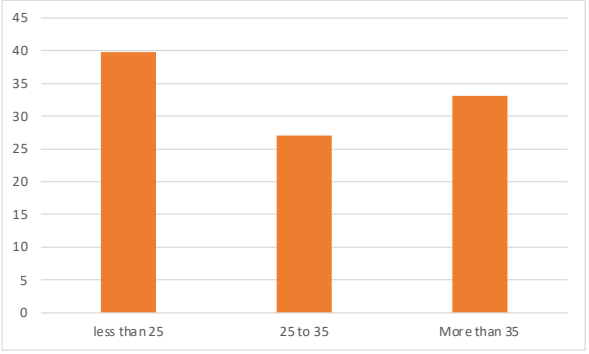

Figure 2. Distribution of age groups

An insignificant association was found between age groups and the infectious agents. The majority of samples (135) are from outpatients and an insignificant association was found between patient care and the infectious agents, as shown in Table 1.

The susceptibly pattern of Staphylococcal isolates to the used antibiotics is illustrated in Table 2. Against 17 antibiotics assayed all isolates are sensitive to tigecycline and linezolid (100%). Isolates show high susceptibility to vancomycin and chloramphenicol (99.4%), followed by daptomycin (98.2%) and gentamicin (89.8%). Most isolated *Staphylococcus species* showed high resistance to penicillin-G (64.5%) however, only (16.3%) were resistant to oxacillin, while resistance to ampicillin/sulbactam was (21.7 %). Regarding other antibiotics, resistance to erythromycin was (40.4%), fusidic acid (31.9%), clindamycin (23.5%), tetracycline (20.5%), cefoxitin (19.9%) and trimethoprim/ sulfamethoxazole was (18.7%).

Table 1. Association of *Staphylococcus species* with age groups and patient care.

		Microorganisms				Sig.
		S. aureus	*S. saprophyticus*	Other CNS	Total	
Age groups	15 to 24	12	5	49	66	0.107
	25 to 34	8	2	28	38	
	35 to 49	22	7	33	62	
	Total	42	14	110	166	
Patient Care	Inpatient	9	3	19	31	0.769
	Outpatient	33	11	91	135	
	Total	42	14	110	166	

Table 2. The antimicrobial susceptibly patterns of *Staphylococcus species* causing urinary tract infections

	Sensitive	Intermediate	Resistant
Ampicillin/sulbactam	75.9	2.4	21.7
Cefoxitin	80.1	0	19.9
Ciprofloxacin	83.1	1.2	15.7
Daptomycin	98.2	0	1.8
Erythromycin	59	0.6	40.4
Fusidic Acid	65.1	3	31.9
Gentamicin	89.8	0.6	9.6
Clindamycin	76.5	0	23.5
Chloramphenicol	99.4	0	0.6
Linezolid	100	0	0
Oxacillin	83.1	0.6	16.3
Penicillin-G	33.7	1.8	64.5
Teicoplanin	100	0	0
Tetracycline	79.5	0	20.5
Tigecycline	100	0	0
Trimethoprim/ Sulfamethoxazole	80.7	0.6	18.7
Vancomycin	99.4	0.6	0

As demonstrated in Table 3, the highest antibiotic resistance level was exhibited by *S. aureus* against penicillin-G which was (83.30%), followed by resistance to clindamycin and erythromycin (21.4%) for each antibiotic. While other

Table 3. The antibiotics susceptibly pattern against the different *Staphylococcus species*

		S. aureus	*S. saprophyticus*	Other CNS
Ampicillin/sulbactam	Sensitive	85.7	100	69.09
	Intermediate	4.80	0	1.81
	Resistant	9.50	0	29.09
Cefoxitin	Sensitive	90.50	100	73.63
	Resistant	9.50	0	26.36
Ciprofloxacin	Sensitive	90.50	100	78.1
	Intermediate	0	0	1.81
	Resistant	9.50	0	20.00
Daptomycin	Sensitive	97.60	100	98.18
	Resistant	2.40	0	1.81
Erythromycin	Sensitive	78.60	35.71	54.54
	Intermediate	0	0	0.90
	Resistant	21.40	64.29	44.54
Fusidic Acid	Sensitive	88.10	71.42	55.45
	Intermediate	0	0	4.54
	Resistant	11.90	28.57	40
Gentamicin	Sensitive	92.90	100	87.27
	Intermediate	0	0	0.90
	Resistant	7.10	0	11.81
Clindamycin	Sensitive	78.60	71.42	76.36
	Resistant	21.40	28.57	23.63
Chloramphenicol	Sensitive	100	100	99.09
	Resistant	0	0	0.90
Linezolid	Sensitive	100	100	100
Oxacillin	Sensitive	90.50	100	78.18
	Intermediate	0	0	0.90
	Resistant	9.50	0	20.90
Penicillin-G	Sensitive	16.70	100	31.81
	Intermediate	0	0	2.72
	Resistant	83.30	0	65.45
Teicoplanin	Sensitive	100	100	100
Tetracycline	Sensitive	92.90	100	71.81
	Resistant	7.10	0	28.18
Tigecycline	Sensitive	100	100	100
Trimethoprim/Sulfamethoxazole	Sensitive	90.50	100	74.54
	Intermediate	0	0	0.90
	Resistant	9.50	0	24.54
Vancomycin	Sensitive	100	100	99.09
	Resistant	0	0	0.90

CNS exhibited high resistance to penicillin-G (58.1%) and then erythromycin (46.8%), fusidic acid (38.7%), ampicillin/sulbactam (25.8%), tetracycline (25%) and clindamycin (24.2%), the noteworthy resistance pattern of *S. saprophyticus* was shown against erythromycin (64.2%).

DISCUSSION

The frequency of urinary infection in females is considered among the most widespread condition in clinical practice,[8] previous literature emphasizes the fact that the infection occurred predominantly in women of fertility age.[18] The commonly isolated causative agents that are involved in UTIs include; *Enterobacteria, Enterococci*, *Group B streptococci*, and *Staphylococci. S. aureus* and *S. saprophyticus* have high medical importance and are isolated frequently from clinical samples, nevertheless other CNS species demonstrated great significance over the previous years.[13,19] Our study was conducted to assess the occurrence of Staphylococcal UTIs in women of reproductive age and to inspect their patterns of antimicrobial susceptibility over the past five years.

This study revealed a prevalence of 3.6% UTIs due to Staphylococcus species in women of reproductive age. The highest rate of infection was in the age group between 15 to 24 years (40%) which is inconsistent with studies conducted by Simon-Oke et al.[7] The infection with different Staphylococcus species was age-independent and variation caused by the difference in the population and sampling pattern of the study. Owing to the high number of samples isolated for outpatients, all *Staphylococcal species* showed high incidence in the outpatient group, and the infection by the species is unassociated with the patient care condition

In our study, the clinically significant isolated *Staphylococcal species* are other CNS (66.2%), *S. aureus* (25.3%), and S. saprophyticus (8.4%) were isolated from urine samples, the isolation pattern is dissimilar with other studies conducted in Nigeria,[7] Ethiopia,[10] and Iran.[16] However, it is consistent to some extent, especially in the aspect of S. aureus prevalence in the study conducted by Nahab M. et al..[20] and Mohydin M. et al..[21] *S. saprophyticus* incidence is close to the study conducted by Abate D. et al..[1] Those differences and similarities in the type and distribution of *Staphylococcal species* are accredited to the different ecological circumstances, population factors, and practices such as healthcare, socioeconomic conditions, and hygiene habits in each topographical area.

In this study, *Staphylococcus isolates* were susceptible to several antibiotics including linezolid, vancomycin (100%), and daptomycin (98.2%), the finding is consistent with the reported results by Osman O. et al..[20] Moreover, the isolates were sensitive to tigecycline (100%), chloramphenicol (99.4%), and gentamicin (89.8%), these can be explained by the fact that Turkey follows a countrywide antimicrobial control campaign on antibiotic usage which promoting rational use of medicines and thereby limiting antimicrobial resistance.

Staphylococcus species demonstrated variable resistance rates to β lactam antibiotics. While resistance to penicillin-G was (64.5%), unlike the results of a study conducted in Turkey,[22] ampicillin/sulbactam and cefoxitin resistance were (21.7%) and (19.9%) respectively, dissimilar to a study done by Abate D. et al..[1] This resistance may occur due to the ability of *Staphylococcus species* to colonize the surface and form biofilms which may lead to the exchange of resistant genes. Regarding oxacillin resistance in our study, it was remarkably low (16.3%) in comparison with other studies[16,19]. Other CNS displayed the highest oxacillin resistance (20.90%) among Staphylococcus species as they harbor the mecA gene responsible for methicillin resistance.

The isolates showed resistance to erythromycin and clindamycin, which is in line with the study carried out by Omidifar N. et al.,[16] the resistance may be due to the msrA gene which is accountable for the efflux machinery in

staphylococci and becomes stimulated after introduction to a macrolide.

While *Staphylococcal species* show low or almost no resistance to ciprofloxacin, tetracycline, fusidic acid, and trimethoprim/sulfamethoxazole, other CNS demonstrated higher resistance. However, this resistance is lower compared to the study done by Osman O. et al..[22] Some previously mentioned antibiotics are used empirically to treat UTIs, which may lead to resistance development.

CONCLUSION

In conclusion, the study highlights that *Staphylococcus species* was a significant uropathogenic, especially in women of reproductive age. These pathogens cause biofilm infections and develop decreased susceptibility to antibiotic drugs, due to the exchange of resistant genes between the members of the biofilm population. Their detection is crucial to accomplish a suitable antimicrobial treatment. Although the study results revealed a high level of susceptibility to antibiotics used, there is clear evidence of penicillin-G resistance which may suggest the production of penicillin-binding protein 2a, with low predilection for the β-lactam group. Therefore, further studies must be conducted with advanced techniques to ensure the detection of resistance genes. UTI influence the quality of life among infected women and have life-threatening consequences as infection may initiate renal damage. Therefore, the study recommends that the frequency and antibiotic susceptibility pattern of pathogens causing UTI such as *Staphylococcus species* should be monitored regularly, keeping in mind the risky patient group mentioned in our study.

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Ethical Approval

Necmettin Erbakan University, the Ethics Committee for Non-Medical and Medical Devices Research-20 January 2023 (Decision no. 2023/4166)

Peer-review

Externally and internally peer-reviewed.

Author Contributions

Concept: M.D., Design: M.D., S.R.G, S.A.A.I., Data collection or Processing: S.R.G, Analysis or interpretation: M.D., S.A.A.I., S.R.G, Literature Search: S.A.A.I., Writing: S.A.A.I.

Conflict of Interest

The authors declare that they have no conflict of interest.

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Evaluation of Current Professional Practices of Perfusionists: Survey Study

Perfüzyonistlerin Güncel Mesleki Uygulamalarının Değerlendirilmesi: Anket Çalışması

Bişar Amaç[1], Murat Ziya Bağış[2]

[1] University of Health Sciences, Sanliurfa Mehmet Akif Inan Training and Research Hospital, Department of Perfusion, Sanliurfa, Türkiye

[2] University of Health Sciences, Sanliurfa Mehmet Akif Inan Training and Research Hospital, Department of Cardiovascular Surgery, Sanliurfa, Türkiye

ORCID ID: Bişar Amaç: https://orcid.org/0000-0003-0320-4239, Murat Ziya Bağış: https://orcid.org/0000-0002-4088-7510

***Sorumlu Yazar / Corresponding Author:** Bişar Amaç, **e-posta / e-mail:** amacbisar@gmail.com

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Abstract

Aim Cardiac surgical procedures performed with extracorporeal circulation or perfusion techniques retain their importance in treating heart disease and often represent an alternative method. This survey aimed to identify and evaluate the current practice of perfusionists in cardiovascular surgery clinics in Turkey.

Material and Method This study is a prospective and descriptive etiological study. Surveys regarding the current practices of perfusionists were created as part of the study. The created surveys were sent to perfusionists in Turkey voluntarily through the application "Google Forms", and the data were collected. The data obtained from the surveys were statistically analyzed.

Results In this study, 80 perfusionists from 28 centres participated in the survey. Thirty-four participants were under 30 years old, 12 were between 31 and 35 years old, 16 were between 36 and 40 years old, and 18 were over 40 years old. Of the participants, 46 were female and 34 were male. The study collected descriptive data, information on cardiac clinics, cardiopulmonary bypass practices, use of cardioplegia, and other assistive devices.

Conclusion There have been significant advances and changes in cardiac surgery surgeries performed with cardiopulmonary bypass over approximately 70 years from the past to the present. However, we believe that there are ongoing or pending issues.

Keywords Cardiopulmonary bypass, Current Practices, Perfusionist, Survey

Özet

Amaç *Ekstrakorporeal dolaşım teknikleri veya perfüzyon teknolojisi kullanılarak gerçekleştirilen kardiyak cerrahi, kalp hastalıklarının tedavisinde önemini korumakta ve çoğu zaman alternatifi olmayan bir yöntemdir. Bu anket çalışmasında, Türkiye'de kalp damar cerrahisi kliniklerinde çalışan perfüzyonistlerin güncel uygulamamalının belirlenmesi ve değerlendirilmesi amaçlandı.*

Gereç ve Yöntem *Bu araştırma prospektif ve tanımlayıcı nitelikte etyolojik bir çalışmadır. Çalışmada, perfüzyonistlerin güncel uygulamaları ile ilgili anket soruları oluşturuldu. Oluşturulan anket soruları "Google Forms" uygulaması üzerinden Türkiye'deki perfüzyonistlere elektronik ortamda gönüllülük esasına göre gönderildi ve veriler toplandı. Anketten elde edilen veriler istatistiksel olarak analiz edildi.*

Bulgular *Yapılan bu çalışma anketine 28 merkezden toplam 80 perfüzyonist katıldı. Katılımcıların 34'dü 30 yaş ve altı, 12'si 31-35 yaş aralığında, 16'sı 36-40 yaş aralığında ve 18'sı 40 yaş üstündeydi. Katılımcıların 46'sı kadındı ve 34'ü erkekti. Bu çalışmada; tanımlayıcı veriler, kalp kliniklerine ait bilgiler, kardiyopulmoner bypass uygulamalarına ait bilgiler, kardiyopleji kullanımı ve diğer yardımcı ekipmanlara ait bilgiler elde edildi.*

Sonuç *Kardiyopulmoner bypass eşliğinde yapılan kalp cerrahisinde, geçmişten günümüze yaklaşık 70 yıllık bir süreçte önemli ilerlemeler ve değişiklikler olmuştur. Ancak hala devam eden veya çözülmesi gereken sorunlarında olduğunu düşünmekteyiz.*

Anahtar Kelimeler *Kardiyopulmoner bypass, Güncel Uygulamalar, Perfüzyonist, Anket*

INTRODUCTION

Cardiac surgery procedures performed using extracorporeal circulation techniques (cardiopulmonary bypass (CPB) in cardiac surgery) retain their importance in treating heart disease and are often an alternative method. CPB is defined as the temporary cessation of cardiac and pulmonary functions during cardiac and aortic surgical procedures and the continuation of these functions by the heart-lung machine.[1] The existence of the heart-lung machine is the result of many developments. Despite the first investigators who designed the circuit to an oxygenator outside the body and pumped it to perform intracardiac surgery are unknown, the 1885 publication by Frey and Gruber is a notable early attempt to build a gas exchange machine.[2] The primitive pump and oxygenator designs that emerged from the work of physiologists and engineers in the late 19th century were the precursors to the great work of DeBakey in developing roller pumps and of Gibbon in developing oxygenators.[2] The advent of the CPB machine and its ability to allow blood flow made open heart surgery possible in humans. On May 6, 1953, the first successful use of the heart-lung machine was performed by Dr Gibbon (John Heysham Gibbon, Jr.) on an 18-year-old woman named Cecilia Bavolek.[3]

Today, perfusionists are responsible for the management of the heart-lung machine. They also play an important role in managing extracorporeal circulation devices. Nevertheless, in the early years of CPB, the heart-lung machines were managed by surgeons (usually assistants) and laboratory technicians in research laboratories. Later, this task was gradually taken over by "technicians" from various fields trained "on the job.".4 In 1964, a group of "perfusionists" (a designation attributed to Bennett Mitchell) met, and in 1968 they formed the American Society of ExtraCorporeal Technology (AmSECT). In the late 1960s and early 1970s, the need for perfusionists increased dramatically with the advent of coronary artery surgery and more successful valve surgery.[4] In 1974 AmSECT established the American Board of Cardiovascular Perfusion (ABCP). The first undergraduate perfusion program was founded by James Dearing at Ohio State College in 1969, and Charles Reed founded the famous Texas Heart Institute School of Perfusion in 1971. In 1991, the European Cardiovascular Perfusion Board was established.[4] In Turkey, on the other hand, the law enacted in 2011 created the legal basis for the perfusionist profession.[5] However, organizational structuring in Turkey began with establishing of the Perfusionist Association in 1997.[6] Even though the development of cardiovascular perfusion historically arose from the need for CPB, the recent development of extracorporeal assist technology or perfusion technology has led to its expansion beyond the traditional field.[1,7,8] The profession of perfusionist will retain its importance soon. Developments in science and technology will bring absolute changes in the practice of the perfusionist. The qualification, knowledge, duties and responsibilities of the clinical perfusionist and the professional profile of the perfusionists are in a clear and current evolution in terms of competence.[7,8]

This review study aims to identify and evaluate the current practice of perfusionists working in cardiovascular surgery clinics in Turkey. This study is a prospective and descriptive etiological study.

MATERIALS and METHODS

This research is a prospective and descriptive etiological study. Approval was obtained from the Clinical Research Ethics Committee of Harran University for this study without drugs (date: 11.14.2022 - approval number: HRÜ/22.22.16). Voluntary informed consent was obtained from all participants prior to the study. This study was conducted under the principles of the Declaration of Helsinki.

Data Collection Tools and Data Analysis

Current practice surveys were created in this study. The created surveys were sent to the perfusionists in Turkey voluntarily in an electronic environment (on the Internet) between January 19 and February 02, 2023, using the

"Google Forms" application, and the data were collected. The data obtained from the surveys were recorded and analyzed by statistical analysis. The statistical analyzes in our study were performed using the SPSS® computer program. Frequency and percentage analyzes were performed for nominal data.

Inclusion and Exclusion Criteria

Those having the Perfusionist profession authority specified in the Law of the Republic of Turkey, numbered 1219, on the style of the practice of medicine and medical arts, and those working as active perfusionists in the public or private sector in Turkey at the time of the survey were included in the study voluntarily.

RESULTS

In this study, 80 perfusionists from 28 centres participated in the survey. Thirty-four participants were under 30 years old, 12 were between 31 and 35, 16 were between 36 and 40, and 18 were over 40. Of the participants, 46 were female and 34 were male. Information on their educational attainment status, the institution they work for, and their years of employment can be found in Table 1.

Number of perfusionists in the clinic, number of perfusionists involved in the cases, presence of written CPB protocol in the clinic, make/model of cardiopulmonary machine used, type of arterial pump head of cardiopulmonary machine, type of tubing set/oxygenator used, integrated cardiopulmonary machine, presence of online blood gas/electrolyte tracking system, presence of cardiopulmonary machine, electronic venous occlusion, and information on CPB safety systems used are given in Table 2.

Table 1. Descriptive data (Demographic information)

		N	%
Number of perfusionists surveyed		80	100
Number of heart centres of participating perfusionists		28	100
Age range (Year)	**≤30**	34	42.5
	31-35	12	15
	36-40	16	20
	>40	18	22.5
Gender	**Male**	34	44.5
	Female	46	57.5
Education certificate status	**Bachelor's degree in perfusion**	20	25
	Perfusion graduate diploma	52	65
	Perfusionist authorization certificate	8	10
Institution Employed	**MH Training and Research Hospital**	54	67.5
	MH Public Hospital	8	10
	MH Heart Branch Hospital	2	2.5
	University Hospital	10	12.5
	Private Hospital	6	7.5
Working time as a perfusionist (Year)	**≤1**	10	12.5
	2-5	32	40
	6-10	14	17.5
	>10	24	30

Table 2. Cardiac clinic information			
		N	%
Number of perfusionists in the clinic	**≤1**	4	5
	2-5	36	45
	6-10	36	45
	>10	4	5
How many perfusionists enter cases in the clinic	**1 Person**	24	30
	2 Persons	56	70
Presence of written CPB protocol in the clinic	**Available**	40	50
	None	40	50
Heart-lung machine brand/model used	**Stockert S3**	6	7.5
	Stockert S5	38	47.5
	Corin C5	18	22.5
	Quantum	2	2.5
	Terumo system1	4	5
	Maquet HL 20	8	10
	Maquet HL 40	4	5
CAM artery pump head type	**Roller pump**	80	100
	Centrifugal pump	0	0
Type of tubing set/oxygenator used	**Membrane oxygenator with integrated arterial filter**	72	90
	Membrane oxygenator with non-integrated arterial filter	8	10
Presence of CAM integrated online blood gas/electrolyte tracking system	**Available**	10	12.5
	None	70	87.5
Presence of CAM electronic venous occlusion	**Available**	68	85
	None	12	15
CPB security systems used (Multiple options selected)	**Level sensor**	80	100
	Bubble sensor	54	67.5
	Flowmeter	12	15
	Pressure gauge	46	57.5
N: Number; %:Percentage ratio; CPB: Cardiopulmonary bypass; CAM: Heart-lung machine.			

The routinely used primary solution, crystalloid solution, natural colloid solution, artificial colloid solution, the content of the primary solution, the temperature at which priming is performed, the status of reduction of the crystalloid or colloid solution, and the amount of red blood cell suspension (ES) added to the primary solution, The status of changing the primary solution according to the patient's comorbidities, the routine use of the carbon dioxide flash method, the CPB initial hematocrit value (Hct), the CPB minimum initial value ACT, the frequency of active clotting time (ACT) and blood gas monitoring during CPB, and the CPB application temperature are given in Table 3.

Cardioplegia delivery method, cardioplegia delivery method/route, routinely used cardioplegia solution, combined cardioplegia use, cardioplegia frequency time, hemocondenser, cytokine filter, cell saver, extracorporeal membrane oxygenation (Extracorporeal membrane oxygenation.) membrane oxygenation=ECMO) and minimally invasive extracorporeal circulation (minimally invasive extracorporeal circulation=MiECC), the type of MiECC and the most common problems during CPB are given in Table 4.

Table 2. Cardiac clinic information

		N	%
The premium solution used routinely	**Crystalloid**	62	77.5
	Colloids	8	10
	Crystalloid-Colloid	10	12.5
The crystalloid solution used routinely	**Ringer's Lactate**	24	30
	Isolayte M	42	52.5
	Isolayte S	6	7.5
	Isotonic	6	7.5
	None	2	2.5
The natural colloidal solution used routinely	**Albumin**	12	15
	Fresh Frozen Plasma	10	12.5
	None	58	72.5
The artificial colloidal solution used routinely	**Voluven**	22	27.5
	Gelofusine	2	2.5
	Dextran 40	0	0
	Dextran 70	0	0
	None	56	70
Routine premium solution content	**Mannitol %20**	80	100
	(Multiple options selected)	80	100
	Heparin	80	100
	Cefazolin	42	52.5
	Magnesium	6	7.5
	Prednol	2	2.5
The temperature at which Prime operation is performed	Hot 37 °C	68	85
Cold 32 oC	**Cold 32 °C**	12	15
Crystalloid or colloid solution reduction status as much as the amount of ES added to the prime solution	**Yes**	52	65
	No	28	35
Prime solution change status according to the comorbidities of the patient	**Yes**	60	75
	No	20	25
Use of carbon dioxide flash method in routine	**Yes**	18	22.5
		62	77.5
CPB input Hct value	**Hct< 20%**	0	0
	Hct< 24%	18	22.5
	Hct< 28%	58	72.5
	From patient to patient	4	5
CPB minimum input ACT value	**400**	2	2.5
	450	8	10
	480	70	87.5
Frequency of ACT and blood gas monitoring during CPB	**Every 20 minutes**	34	42.5
	Every 30 minutes	44	55
	By case	2	2.5
CPB application temperature	**Normothermic**	8	10
	Hypothermic 32 oC	52	65
	Hypothermic 30 oC	14	17.5
	Hypothermic 28 oC	4	5
	Varies by case	2	2.5

N: Number; %:Percentage ratio; CPB: Cardiopulmonary bypass; ES: Erythrocyte suspension; Hct: Hematocrit; ACT: Active clotting time); NaHCO3: Sodium bicarbonate.

Table 4. Information on the use of cardioplegia and other assistive devices

			N	%
Method of applying cardioplegia	**With a pressure bag from the anaesthesia**		36	45
	By pressure bag from perfusion		24	30
	CAM's mini-pumps		20	25
Cardioplegia administration method/way	**Antegrade**		46	57.5
	Redrograde		20	25
	Antegrade - Redrograde		14	17.5
Cardioplegia solution used routinely	**Del Nido**		20	25
	(Multiple options selected)		0	0
	Plejisol (St. Thomas)		2	2.5
	Microplegia		4	5
	Blood cardioplegia		56	70
Combined use of cardioplegia	**Yes**		28	35
	No		52	65
Duration of cardioplegia frequency	**Every twenty minutes**		58	72.5
	Other		2	2.5
	Initial/Single dose		20	25
Use of hemocondenser	**Yes, routine**		6	7.5
	Yes, if there is an indication		48	60
	No		26	32.5
Using a cytokine filter	**Yes, routine**		0	0
	Yes, if there is an indication		20	25
	No		60	75
Cell-saver usage	Yes, routine		4	5
	Yes, if there is an indication		28	35
	No		48	60
ECMO usage	**Yes**		52	65
	No		28	35
If you use MiECC in cardiac surgery, what type of MiECC do you use?	**Yes**	Type I	2	2.5
		Type II	2	2.5
		Type III	0	0
		Type IV	2	2.5
	No		74	92.5
What are the most common problems during CPB? (Asked as an open-ended question)	**Failure to pull the valve**		14	17.5
	Heart not emptying		14	17.5
	Reservoir level low/insufficient		6	7.5
	Venous return problem/insufficiency		6	7.5
	Air embolism		14	17.5
	Line pressure height		14	17.5
	Hypotension		6	7.5
	Dislocation of cannulas		6	7.5

N: Number; %: Percentage ratio; CAM: Heart-lung machine; HTK: Histidine-tryptophan-ketoglutarate solution; ECMO: Extracorporeal membrane oxygenation; MiECC: Minimally invasive extracorporeal circulation; CPB: Cardiopulmonary bypass.

DISCUSSION

When the current practices of perfusionists in Turkey are studied, it is found that the practices are similar in both open heart surgery and extracorporeal circulation. This study aimed to evaluate the current practices of perfusionists. The benefits of this study include the cardiopulmonary machines used by perfusionists today, primary solutions, cardioplegia solutions used and routes of administration, CPB and safety equipment, other extracorporeal circulation devices, and evaluation of problems encountered.

In the 1980 survey of 811 perfusionists practising in North America (United States and Canada), Hessel et al.[4] evaluated the current perfusion practice 25 years after its introduction. As a result of the survey studies, they found that 68% of perfusionists received their on-the-job training, and 76% of them were certified. They found that disposable bubble oxygenators were used in more than 90% of cases, roller pumps in 94%, and arterial filters in 64%. They found that perfusionists used low-level sensors in 45% of cases, oxygen sensors in 26%, and bubble sensors in 10%. They found that two-thirds of perfusionists performed heparinization with ACT before starting CPB, most used moderate hypothermia (26-30oC), and 84% added carbon dioxide to the oxygenator; cold cardioplegia was administered in 99% of cases. Cardioplegia was administered with a pressure bag in 50% of cases (usually by an anesthesiologist).[4] In our study, we tried to determine the current practices of cardio technicians in Turkey 70 years after the introduction of CPB. Although there are serious developments and changes in current practices, it is felt that many problems still await resolution.

In the review study by Hessel et al.[9] on innovations in CPB (It examined the studies carried out between 2017-2018), he noted that some of the issues affecting innovations in CPB are temperature management, anticoagulation, perfusion administration, use of transesophageal echocardiography during CPB, optimal mean arterial pressure, vasoplegia, bleeding, perioperative anaemia, postcardiac transfusion, acute kidney injury, delirium and cognitive decline, CPB during pregnancy, pulmonary management, radial-femoral arterial pressure, gradients during CPB, prophylactic perioperative intra-aortic balloon pump, del Nido cardioplegia, antibiotic prophylaxis, and use of levosimendan in cardiac surgery.[9] In our study, it is seen that perfusionists most frequently face problems such as non-ventilation, low level, venous return, air embolism, pressure rise, and hypotension.

In the article by Kulat et al.10, the American Board (The American Society of ExtraCorporeal Technology (AmSECT)) developed 12 survey questions in 2016, and the survey questions included demographic information, education levels, years of clinical experience, recertification requirement satisfaction. and professional activity requirement satisfaction. They also stated that he conducted a survey in 2017; they stated that this survey focused primarily on perfusionist demographics and staffing issues in the respondents' operating rooms, as well as the respondents' ECMO and ventricular assist device (VAD) staffing situations. The results of both surveys noted that 38.2% and 38% of perfusionists would retire in the next 10 years, respectively. They noted that the workforce is getting older, 29% of the respondents are between 50 and 59 years old, and 15.3% are 60. They also stated positive workforce growth in clinical perfusion, however, this situation should be closely monitored in the future. They stated that supply and demand in perfusion employment are complex, and additional measurements are needed.[10] Our study shows that 77.5% of perfusionists in Turkey are in the age group of 40 years and below, and it is a young population.

It should be noted that cardioplegia solutions (e.g., del Nido) and the MiECC method are among the newest issues that concern perfusionists in CPB surgery. In our survey, we found that a small proportion of participants (approximately 25% del Nido) used single-dose cardioplegia solution, microplegia (approximately 5% microplegia), and MiECC (approximately 7.5% MiECC).

Modern cardiac perfusion technologies' main challenge is achieving optimal biocompatibility for extracorporeal circuits (ECC). Undesirable pathophysiological side effects of conventional CPB circuits on organ systems are triggered by activation of the complement system via foreign surfaces, hemodilution due to priming volume, blood-air contact, and negative and positive reservoir pressures. MiECC circuits have emerged over the last 20 years as an alternative to the more traditional ECC circuits to overcome these effects. The use of MiECC circuits is now increasing.[11] These systems offer several potential advantages by reducing the systemic inflammatory response and subsequent organ dysfunction. To be uniquely characterized as MiECC, the system's major components must include a closed CPB circuit. It should have biologically inert blood contact surfaces, reduced filling volume, a cardioplegia system, a venous bubble trap/air trap, and a blood spill management system.[11] MiECC circuits are classified into four different types with modular components. The classification of MiECC circuits provides a clear description of the different systems and also allows a clear distinction between traditional ECC and MiECC. MiECC provides a physiologically based perfusion strategy rather than just another CPB circuit or a specific product. Therefore, a multidisciplinary approach is essential. Close collaboration and teamwork between surgeons, anesthesiologists, and perfusionists are essential to safely and efficiently implement MiECC concepts.[11,12] Effective teamwork is critical for safe and high-quality care in the operating room. However, it is argued that teamwork interventions do not consistently result in the expected improvements in patient safety or surgical culture.[12] To optimize OR teamwork in a targeted, evidence-based manner, a comprehensive, theory-based assessment of barriers and facilitators from an interprofessional perspective must first be undertaken.[12] In our review study, we hypothesize that the very low rate of MiECC use is due to other reasons that are independent of the individual competencies of perfusionists.

The basic requirement for a good surgical outcome in cardiac surgery is optimal myocardium protection. Microplegia has been studied in isolated coronary artery bypass grafting, heart valve surgery, and more complex procedures. Studies demonstrating the safety and efficacy of microplegia over Buckberg cardioplegia (4:1 blood cardioplegia) revealed that the simplified microplegia technique offers several advantages over Buckberg cardioplegia without compromising myocardial protection or safety during complex, multicomponent surgery with prolonged aortic clamping times.[13] Furthermore, cardioplegia strategies used in adult cardiac surgery cannot be directly applied to pediatric hearts. Pediatric micro plegia, similar to calafiore cardioplegia used in adult cardiac surgery, offers safe myocardial protection without hemodilution. The use of concentration-dependent pediatric microplegia is new to clinical practice. Adapted to the needs of pediatric myocardium, microplegia provides a simple technique for perfusionists while avoiding hemodilution.[14] Our review study shows that microplegia is used to a very small extent (about 5%) in Turkey. We believe technological advances and developments will be much faster in perfusion applications soon. Cardioplegia is an essential and fundamental method for protecting the myocardium of patients of all ages during cardiac surgical procedures requiring cardiac arrest. Additionally, many cardioplegia solutions and application methods have been developed. The Del Nido cardioplegia solution is also increasingly used in today's practice. Del Nido Cardioplegia Solution has been used at Boston Children's Hospital for many years. It consists of a unique formulation of four parts crystalloid and one part whole blood and is typically used as a single dose. Although the formulation was originally developed for pediatric and neonatal patients, it is increasingly used in adult cardiac surgery.[15] Our study shows its use is widespread in adult cardiac surgery in Turkey. It is one of the most commonly used cardioplegia solutions after blood cardioplegia. We believe that single-dose cardioplegia solutions will soon be more widely used, and their volume will be further reduced.

CONCLUSION

Over the past 70 years, significant advances and changes in cardiac surgical procedures performed with CPB have occurred. Nonetheless, we believe that there are still persistent or pending problems. In this review study, it is clear that modern applications (single-dose cardioplegia, microplegia, and MiECC, etc.) are being used in addition to current conventional CPB methods. We believe modern applications will become more widespread, and new developments will emerge shortly.

Ethical Approval

Approval was obtained from the Clinical Research Ethics Committee of Harran University for this study without drugs (date: 11.14.2022 - approval number: HRÜ/22.22.16). Voluntary informed consent was obtained from all participants prior to the study. This study was conducted under the principles of the Declaration of Helsinki.

Peer-review

Externally and internally peer-reviewed.

Authorship Contributions

Concept: B.A., M.Z.B., Design: B.A., M.Z.B., Data collection or Processing: B.A., M.Z.B., Analysis or interpretation: B.A., M.Z.B., Literature Search: B.A., M.Z.B., Writing: B.A., M.Z.B.

Conflict of Interest

The authors declare that they have no conflict of interest.

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Perfusion Index Use and Clinical Follow-ups in the Pediatric Intensive Care Unit

Çocuk Yoğun Bakım Ünitesi'nde Perfüzyon İndeksi Kullanımı ve Klinik İzlemleri

Mehmet Nur Talay[1], Özhan Orhan[2]

[1] Artuklu University, Faculty of Medicine, Department of Child Health and Diseases, Mardin, Türkiye

[2]Artuklu University, Faculty of Medicine, Department of Child Health and Diseases, Mardin, Türkiye

ORCID ID: Mehmet Nur Talay: https://orcid.org/0000-0002-7361-3823, Özhan Orhan: https://orcid.org/0000-0002-3042-6972

***Sorumlu Yazar / Corresponding Author:** Özhan Orhan, **e-posta / e-mail:** ozhan.orhan@hotmail.com.tr

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Abstract

Aim Non-invasive measurement are used as standard methods in the hemodynamic follow-up of patients in the Pediatric Intensive Care Unit (PICU). The aim of this study is to investigate the feasibility of use of the perfusion index (PI), a non-invasive marker, in critically ill patients followed up in the PICU, to compare it with other vital signs and to analyze its utility in predicting mortality.

Material and Method Critically ill patients aged 1 month to 18 years with circulatory disorder, who were followed up in the intensive care unit between 01.June.2018 and 31.December.2019, were included in the study. PI, vital signs and mortality scores were compared within the first 6 hours after the patients were admitted to the intensive care unit.

Results When the values at the time of admission were examined, it was observed that the PI values were low, the capillary refill time was long, and the lactate levels were high in patients in the dehydration-acute gastroenteritis and metabolic disease groups. The patients were grouped as those with or without signs of dehydration. A correlation analysis between 0th hour PI and capillary refill time, systolic blood pressure and lactate levels in the patient group with signs of dehydration found; a moderately strong (r=-0.53/0.11/-0.36, respectively) negative and significant ($p<0.05$) relationship. In the first 6-hour follow-up of patients who died after being admitted to the intensive care unit; the PI, systolic blood pressure and mean diastolic blood pressure values were found to be lower (0.54/84.86/45.81, respectively) compared to the discharged patients. When a ROC analysis was performed for the PI values at the time of admission of patients with signs of dehydration and death, it was found that a cutt-off value of 0.57 of PI could predict mortality with a sensitivity of 70% and a specificity of 67.9%.

Conclusion In critically ill patients followed up in the pediatric intensive care unit, PI measurement, which can be easily made and is a standard feature in many bedside monitors and pulse oximetry devices, can be used in the early detection of hemodynamic status, clinical follow-up, shock findings, and mortality estimatio, together when used with other vital signs.

Keywords Mortality, pediatric intensive care, perfusion index, vital signs

Özet

Amaç *Çocuk Yoğun Bakım Ünite'sinde (ÇYBÜ) invaziv olmayan ölçümler, hastaların hemodinamik izlemlerinde standart yöntemler olarak kullanılmaktadır. Bu çalışmanın amacı, ÇYBÜ'sinde takip edilen kritik hastalarda non-invaziv bir belirteç olan perfüzyon indeksinin (PI) kullanılabilirliğini araştırmak, diğer vital bulgularla karşılaştırmak ve mortaliteyi öngörmede kullanılabilirliğini analiz etmektir.*

Gereç ve Yöntem *01.Haziran.2018 – 31.Aralık.2019 tarihleri arasında yoğun bakımda izlenen 1 ay-18 yaş arası dolaşım bozukluğu olan kritik hasta çalışmaya dahil edildi. Hastaların yoğun bakıma alındıktan sonraki ilk 6 saat içinde PI, vital bulguları ve mortalite skorları karşılaştırıldı.*

Bulgular *0. saat değerleri incelendiğinde dehidratasyon-akut gastroenterit ve metabolik hastalık grubunda olanların PI değerleri düşük, kapiller dolum zamanı uzun ve laktat düzeyleri yüksek izlendi. Hastalar dehidratasyon bulgusu olan ve olmayan şeklinde gruplandırıldı. Dehidratasyon bulgusu olan hasta grubunda 0.saat PI ile Kapiller dolum zamanı, sistolik kan basıncı ve laktat düzeyleri arasında korelasyon analizinde; orta düzeyde (sırasıyla r=-0,53/0,11/-0,36) negatif yönde ve anlamlı ($p<0,05$) ilişki bulundu. Yoğun bakıma yatırıldıktan sonra ölen hastaların ilk 6 saatlik takibinde; taburcu edilen hastalara göre PI, sistolik kan basıncı ve diyastolik kan basıncı ortalama değerleri daha düşük (sırasıyla 0.54/84,86/45,81) bulundu. Dehidratasyon bulgusu olan ve eksitus olan hastaların sıfırıncı saat PI değerleri için ROC analizi yapıldığında 0,57 Cutt off değerinde %70 sensitivite, %67,9 spesifite ile PI'nin mortaliteyi öngörebileceği saptandı.*

Sonuç *Çocuk yoğun bakım ünitesinde takip edilen kritik hastalarda, kolayca ölçülebilen ve pek çok hasta başı monitör ve pulse oksimetre cihazında standart olarak bulunan pahalı olmayan PI ölçümü, diğer vital bulgularla birlikte hastaların hemodinamik durumu, klinik izlemleri ve şok bulgularının erken tespitinde ve mortalite tahmininde kullanılabilir.*

Anahtar Kelimeler *Mortalite, çocuk yoğun bakım, perfüzyon indeksi, vital bulgular*

INTRODUCTION

Non-invasive measurements are currently used as standard methods in the hemodynamic follow-up of patients in intensive care units. The perfusion index (PI) measures changes in peripheral perfusion by attaching a pulse oximeter to the finger. PI is a relative assessment of pulse strength. It is expressed as the ratio of the pulsatile component, which reaches the sensor in the probe with the infrared light signal and is reflected by the arterial blood, to the non-pulsatile component reflected by the venous blood and tissues. It is a measurement derived independently of oxygen saturation.[1-2] PI is an indicator of changes in microcirculation. It is a method frequently used by clinicians and anesthesiologists to predict circulatory disorders. However, it should be noted that these changes may affect local vasoconstriction.[3-4]

PI also reflects changes in peripheral blood flow, and values below 1.24 can be a marker for assessing the seriousness of a patient's status.[5] Vasomotor tone, which plays a role in the etiopathogenesis of various shock types and determines pulse pressure, is directly related to PI. The type and etiology of shock is affected by many factors such as peripheral body temperature, measurement site, patient age, use of vasoactive agents, and cardiac output.[6]

There are no clear data on normal or pathological values of PI by age in children. Studies on subjects mostly include newborn patients.[7-8] Sivaprasath et al stated that the pathological value of PI in children is below 1.15 under the age of 3, below 1.25 between the ages of 3 and 10, and below 1.55 between the ages of 10 and 12. While its non-invasive nature, ease of use and easy accessibility provide advantages, the low temperature in the measured extremity and the variability between the measurement regions limit the use of this method.[9] The aim of this study is to investigate the usability of PI, a non-invasive marker, in patients followed in the Pediatric Intensive Care Unit (PICU), compare it with other vital signs, and analyze its effectiveness and feasibility of use in predicting mortality.

MATERIALS and METHODS

In the study, 191 critically ill patients (severe dehydration, metabolic acidosis, cardiac arrest, cardiovascular surgery, postoperative follow-up, diabetic ketoacidosis, respiratory failure, or those followed on mechanical ventilation) aged between 1 month and 18 years, who were hospitalized and treated in the tertiary PICU between 01.01.2018 and 31.12.2019, were included. By performing hemodynamic monitoring immediately after hospitalization, vital signs (body temperature, pulse rate, systolic blood pressure [SBP], diastolic blood pressure [DBP], respiratory rate, oxygen saturation (sPO2), and laboratory parameters in the first 6 hours, as well as consciousness levels, Glasgow Coma Scale (GCS) score, Pediatric mortality risk score III (PRISM III) were prospectively determined. Demographic properties of the patients, PRISM III score, reason for hospitalization, history of surgery, underlying disease, mechanical ventilator monitoring, transfusion, perfusion index values, hourly vital signs from 0th hour (at admission) to 6th hour, lactate measurements and turnover/discharged information were recorded.

The perfusion index of the patients was measured using a radical-7 pulse oximeter (Masimo Radical -Masimo Corporation, Irvine, California, USA) device using Masimo signal subtraction technology and a pulse oximetry probe attached to it. The pulse oximeter was placed on the index finger of the patients. All tests were performed by the same investigator and PI data and all other data were recorded. In order to reduce the effects of motion artifact, PI readings were taken after 8-10 seconds of regular waves were shown to the patients.

Statistical analysis

The written permission was obtained from the parents of all patients. Frequency and mean criteria were used for descriptive data. Student's t test was used to compare normally distributed variables, Mann-Whitney U test for nonparametric variables and $\chi 2$ test for categorical variables, and Pearson or Spearman tests for correlation analyses. ROC

analysis was used for sensitivity and specificity.

This study was approved by Diyarbakır Gazi Yaşargil Training and Research Hospital Good Clinical Practices Ethics Committee with the date 05/10/2018 and number 155.

RESULTS

Of the 191 patients included in the study, 113 (59.1%) were male and 78 (40.9%) were female. The median age was calculated as 14 (2-211) months. the median Glasgow Coma Scale and PRISM III scores at admission were 12 and 19, respectively. The median length of hospitalization of the patients in the PICU was 93 (6-1763) hours. Ninety-one (47.6%) patients were followed on mechanical ventilation; the median duration of mechanical ventilation was 36 (2-888) hours. A total of 62 patients were followed up with high-flow nasal cannula oxygen therapy (HNCOT) from baseline or after weaning from mechanical ventilation. The median duration of stay in HNCOT was 36 hours. Vasoactive inotropic therapy was needed in 66 patients (34.5%) and the median vasotropic inotropic score (VIS) calculated as 15 (Table 1).

Patients were divided into two groups as those having diseases with signs of dehydration (sepsis, septic shock, acute gastroenteritis, metabolic acidosis, metabolic disease, diabetic ketoacidosis, cardiac diseases, renal diseases) and those having diseases without signs of dehydration (pneumonia, post operative surgery patients, intoxication, central nervous system diseases and others). Patients diagnosed with dehydration-acute gastroenteritis and met-

Table 1. Demographic data of the patients

		Patients with signs of dehydration		Patients without signs of dehydration	
		Mean±Std. Deviation	Median (IQR)	Mean±Std. Deviation	Median (IQR)
Age, (months)		40.89±54.06	14(2-211)	40.94±51.83	21 (2-200)
Vasoactive inotrope score		16.26±6.51	17(5-33)	12.22±5.94	12 (5-27)
Glasgow coma score		11.10±3.54	12(3-15)	11.90±2.66	12 (3-15)
PRISM III score		21.76±9.61	19(9-59)	29.16±7.75	17 (9-55)
Length of stay on mechanical ventilator, (hours)		106.88±176.72	36(2-888)	78.33±125.71	18 (5-600)
Time to receive high flow nasal cannula oxygen therapy (hours)		41.81±19.49	36(12-114)	37.21±33.79	24 (4-208)
Intensive care hospital stay (hours)		166.94±244.52	93(6-1763)	112.83±102.16	84 (12-600)
		n (%)		n (%)	
Gender	Male	61 (62.2)		52 (55.9)	
	Female	37 (37.8)		41 (44.1)	
Inotrope	Yes	39 (39.8)		27 (29)	
	No	59 (60.2)		66 (71)	
High flow Nasal cannula oxygen therapy	Yes	31 (31.6)		32 (34.4)	
	No	67 (68.4)		61 (65.6)	
Mechanical ventilator follow-up	Yes	43 (43.9)		48 (51.6)	
	No	55 (56.1)		45 (48.4)	
Intravenous Saline (SF)	Yes	67 (68.4)		0 (0.0)	
	No	31 (31.6)		93 (100)	
Exitus	Yes	20 (20.4)		5 (5.4)	
	No	78 (79.6)		88 (94.6)	

abolic disease had lower PI values, longer capillary refill time and higher lactate levels at 0th hour compared to patients with other diagnoses. A total of 25 patients, 20 of whom were in the group with signs of dehydration, died (Table 2).

While the 0th hour PI value was positively correlated with dehydration, it was negatively correlated with capillary refill time. Likewise, while 0th hour capillary refill time and lactate levels were positively correlated with the patients who died; There was a negative correlation between PI, systolic-diastolic blood pressures, and sPO2 values (Table 3).

In the first 6-hour follow-up of the patients, both PI and capillary refill time values improved with interventions (Figure 1).

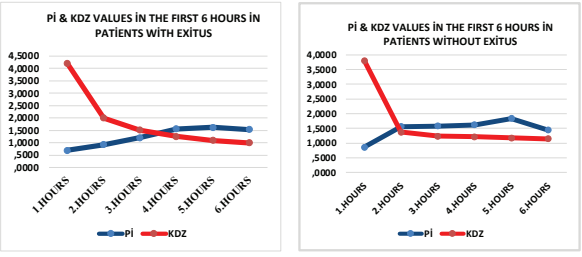

Figure 1. Perfusion index and capillary refill time changes in the first 6 hours of patients

In 67 of 98 patients with dehydration, 0.9% NaCl (SF) was loaded at a dose of 10 or 20 ml/kg. A significant improvement was observed in the PI, capillary refill time, SBP, DBP, pulse rate, sPO2, respiratory rate, and lactate levels measured at 0th hour and the values measured at the first hour (physiological saline solution) ($p<0.05$). In patients without signs of dehydration, no loading was performed; however, a significant improvement was observed in capillary refill time, SBP, pulse rate and lactate values ($p<0.05$). Surviving patients had a significant improvement in capillary refill time, SBP, sPO2, respiratory rate, and lactate level. When all patient groups were analysed, a significant improvement was observed in capillary refill time, SBP, respiratory rate, and lactate level ($p<0.05$) (Table 4).

When a ROC analysis was performed for 0th hour PI values of deceased patients with signs of dehydration, it was found that a cut-off value of 0.57 of PI predicted mortality with a sensitivity of 70% and a specificity of 67.9% (Figure 2).

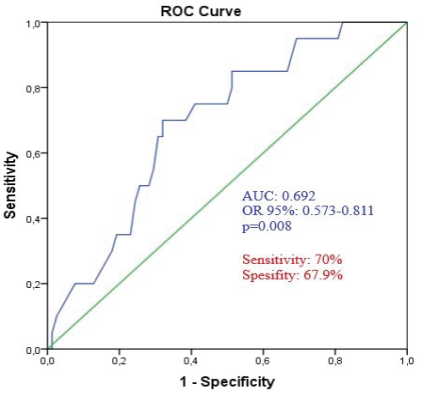

Figure 2. ROC analysis in deceased patients with signs of dehydration

Risk faktörü	AUC (95%)	Cutt off	P	Sensitivity(%) Duyarlılık	spesifity(%) Özgüllük
Exitus olanlar	0.69 (0.57-0.81)	0.69	0.008	70.0	28.2

Table 2. Vital signs with PI at 0 hour (first admission)

	PI Median (Min-Max)	Capillary refill time (sec) Median (Min-Max)	Pulse/ min Median (Min-Max	sPO2 Median (Min-Max)	Systolic Blood Pressure (mmHg) Median (Min-Max)	GCS Median (Min-Max)	PRISM III Score Median (Min-Max)	VIS score Median (Min-Max)	Length of stay on MV (hours) Median (Min-Max)	Intensive Care hospital stay (hour) Median (Min-Max)	Lactate Median (Min-Max)
All patients (n=191)	1.02 (0.09-7.60)	2 (1-5)	138 (52-216)	97 (34-100)	102 (38-201)	12 (3-15)	18 (9-59)	15 (5-33)	36 (2-888)	86 (6-1763)	2,56 (0,74-23,96)
Sepsis+ Septic shock (n=13)	1.40 (0.46-3.6)	2 (1-5)	136 (102-190)	99 (51-100)	120 (70-149)	11 (3-15)	19 (13-36)	17 (12-25)	44 (2-708)	184 (52-708)	2,95 (1,40-9,12)
Dehydration +AGE (n=26)	0.73 (0.10-2.50)	2,5 (1-5)	164 (64-216)	97 (80-100)	90 (44-151)	12 (3-15)	21 (10-48)	15 (5-25)	28 (4-560)	88 (12-1763)	2,25 (0,74-14,10)
Metabolic Disease (n=15)	0.6 (0.10-1.30)	4 (1-5)	135 (88-192)	98 (34-100)	88 (38-121)	10 (3-15)	23 (15-53)	20 (20-33)	33 (14-186)	72 (8-576)	4,86 (1,86-23,96)
Pneumonia+ Respiratory Failure (n=33)	098 (0.20-5.10)	3 (1-5)	147 (92-200)	94 (36-100)	105 (62-137)	12 (3-15)	19 (9-59)	12 (7-20)	48 (5-400)	84 (7-644)	3,06 (1,20-15,42)
Diabetic ketoacidosis (n=12)	1.45 (0.27-3.90)	2,5 (1-5)	122,5 (83-173)	100 (92-100)	105 (65-144)	15 (12-15)	15 (11-18)	17 (17-17)		30 (6-96)	2 (1,09-7,21)
Renal Diseases (n=10)	1.75 (0.18-2.10)	1 (1-3)	130 (80-164)	99 (80-100)	121 (74-201)	15 (8-15)	15 (11-20)	-	-	136 (46-1104)	1,97 (1,67-3,27)
Cardiac Diseases (n11)	0.6 (0.19-3.6)	2,00 (1- 5)	155 (113-193)	94 (86-100)	91 (85-138)	10 (8-12)	21 (16-44)	12 (5-20)	50 (4-192)	132 (8-380	2,42 (1,73-8,40)
Post Operative Surgery patients. (n=28)	1.2 (0.18-7.10)	1,5 (1-5)	132 (98-179)	98 (38-100)	98 (53-144)	12 (5-15)	18 (11-49)	10 (5-25)	8 (6-120)	91 (24-265)	2,46 (0,74-6,28)
Others (n=43)	1.10 (0.29-7.6)	1 (1-5)	138 (52-214)	96 (83-100)	110 (70-146)	12 (3-15)	17 (10-47)	12 (5-27)	71 (6-600)	84 (12-600)	2,66 (0,83-9,83)

Abbreviations: PI: Perfusion Index GCS: Glasgow Coma Scale. Prism III Score: Pediatric mortality risk.
VIS score: Vasoactive Inotrope score MV: Mechanical ventilator. AGE: Acute gastroenteritis. SpO2: Oxygen saturation

Table 3. Correlation analysis between zero hour patient groups

	Patients with signs of dehydration (n=98) and without dehydration (n=93)		Deceased (n=25) and surviving (n=166) patients	
	Spearman correlation	**p**	**Spearman correlation**	**p**
Perfusion Index	0.53	0.000[c]	-0.29	0.000[c]
Capillary refill time (sec)	-0.36	0.000[c]	0.375	0.000[c]
Systolic BP (mmHg)	0.11	0.143[c]	-0.204	0.005[c]
Diastolic BP (mmHg)	0.04	0.603[c]	-2.55	0.000[c]
Pulse (min)	-0.34	0.639[c]	0.68	0.347[c]
sPO2	-0.53	0.468[c]	-0.221	0.002[c]
Lactate	-0.36	0.624[c]	0.196	0.007[c]

In the first 6-hour follow-up of the patients, both PI and capillary refill time values improved with interventions (Figure 1).

Table 4. Comparison of 0[th] hour values and first hour values in the patient groups

		Perfusion Index		Capillary refill time (sec)		Systolic BP (mmHg)		Diastolic BP (mmHg)		Pulse(min)		sPO2		Respiratory rate		Lactate	
		Median (IQR)	P*	Median (IQR)	P*	Median (IQR)	P*	Median (IQR)	P*	Median (IQR)	P*	Median (IQR)	P*	Median (IQR)	P*	Median (IQR)	P*
Patients with signs of dehydration	Zero hour	0.64 (0.20-1.08)	<0,001	3,0 (1-5)	<0,001	99,0 (38-163)	<0,001	57 (17-89)	<0,001	141 (64-216)	0,03	98,0 (52-100)	0,06	34 (16-67)	<0,001	2,63 (0,7-26,2)	<0,001
	1st hour(SF)	0.8 (0.4-4.2)		1 (1-5)		78 (45-152)		43 (15-97)		138 (42-217)		98 (66-100)		32 (22-64)		2,1 (0,2-21,3)	
Patients without signs of dehydration. (n=93)	Zero hour	1.2 (0.3-7.6)	0,72	2 (1-5)	<0,001	107 (53-146)	0,01	58 (26-97)	0,21	138 (53-204)	<0,001	97 (63-100)	0,21	32 (18-55)	0,07	2,7 (0,7-16,1)	<0,001
	1st hour(SF)	1.4 (0.2-9.3)		1 (1-3)		102 (54-139)		56 (24-96)		130 (63-213)		98 (72-100)		30 (19-63)		1,8 (0,7-8,7)	
Deceased patients (n=25)	Zero hour	0.53 (0.29-1.1)	<0,001	5 (1-5)	<0,001	88 (38-138)	<0,001	47 (17-86)	<0,001	146 (63-193)	<0,001	92 (77-100)	0,13	34 (20-48)	<0,001	4,05 (1,1-26,3)	<0,001
	1st hour(SF)	0.52 (0.2-3.1)		2 (1-3)		76 (45-110)		40 (15-67)		140 (42-196)		96 (79-100)		35 (20-52)		2,9 (0,1-21,3)	
Surviving patients (n=166)	Zero hour	0.9 (0.2-7.6)	0,19	2 (1-5)	<0,001	105 (53-171)	0,01	59 (32-92)	0,15	138 (52-216)	0,38	98 (35-100)	0,04	32 (24-71)	0,04	2,55 (0,7-18,4)	0,01
	1st hour(SF)	1.3 (0.2-9.3)		1 (1-5)		91 (54-162)		51 24 (94)		135 (63-217)		98 (36-105)		30 (22-59)		1,82 (0,5-9,7)	

*Wilcoxon analizi uygulanmıştır. (p< 0,05 anlamlılık değeri)
BP: Blood Pressure SpO2: Oxygen saturation SF:%0.9 NaCl saline

DISCUSSION

In our study, we studied non-invasive PI measurement in patients with circulatory disorders admitted to the PICU during clinical follow-up, along with capillary refill time and other vital signs. We sought to answer the question whether it would aid in the early detection of circulatory disorders and mortality prediction in pediatric patients hospitalized in the PICU. We found that the PI value of the patients at first admission predicted mortality with a sensitivity of 70% and a specificity of 67.9%. In a literature review we could not find any clear data for normal and/or pathological values of PI in the pediatric age group. We have seen that in current studies, attempts are made to establish normal values of PI mostly in the neonatal age group.[7-9].

In our study, the mean PI value at 0th hor was low in the dehydration-acute gastroenteritis and metabolic disease groups. A low 0th hour PI value and high capillary refill time and lactate levels were considered significant. We found that PI was negatively correlated with other vital signs, especially capillary refill time.

A correlation analysis between 0th hour PI and capillary refill time, PRISM III score, and lactate levels in the patient group with signs of dehydration revealed a moderately strong, negative, significant ($p<0.05$) relationship. The PI value was lower in the SF-loaded group. In addition, a moderately negative and significant ($p<0.05$) relationship was found between the PI value and the capillary refill time in the SF-loaded and non-SF-loaded groups. We think that the mean PI value was 0.54 in the deceased patients and 1.51 in the surviving group, and that the low PI value in the patients was due to peripheral perfusion disorder, circulatory failure, and increased vascular smooth muscle tone. In a study conducted in newborns, lactate and PI were evaluated, and it was found that high lactate (4 mg/dL) and low PI values (<0.5) increased the incidence of early retinopathy and bronchopulmonary dysplasia.[10-11]

Choudhary et al. showed that PI is associated with low blood pressure and is useful in the evaluation of hemodynamic response.[12] In our study, a correlation was found between PI and capillary refill time. In addition, since PI can be measured in patients who have not developed hypotension yet, it may be useful in the evaluation of hemodynamic response and before the development of hypotension, which is a late finding of shock.

Sivaprasath et al. reported that PI is an easy, non-invasive and practical tool to predict shock in their study of 100 pediatric patients9. In a study by Van Genderen et al. in 25 healthy volunteers in adults, they monitored cardiac output, heart rate, mean blood pressure, and PI with pulse oximetry to detect changes in peripheral perfusion index during hypovolemia. In conclusion, they found that PI can be useful in detecting hypovolemia and shock long before cardiovascular deterioration occurs.[13] Capillary refill time is a useful and rapid measurement in determining the hypotension that occurs in patients and its potential consequences, particularly by determining the intravascular volume status. In our study, capillary refill time and PI show negatively correlation with perfusion status in patients who needed fluids.

In a multicenter study by Hua Wei et al., it was argued that the PI value was greater than 1.4 in adult healthy individuals and that the PI value 8 hours after resuscitation was associated with mortality within 30 days after resuscitation.[14] In a study by He et al. in adults, peripheral PI variability was demonstrated in patients with postoperative septic shock compared to the control group, and they reported sensitivity and specificity values of 65% and 92.3%, respectively, for a cut-off value of ≤0.2 for PI.[15] De Felice et al. in their study in newborns, found the AUC, sensitivity and specificity values for mortality to be 97%, 95.5% and 93.7%, respectively, for a cut-off value of 1.24 of PI.[16] In another study, the authors reported that PI may be associated with severe illness in newborns. They reported an AUC value of 0.831for a cut-off value of 0.86 of 24-hour

PI in the 60-day mortality estimate; they also reported a sensitivity of 77.78% and a specificity of 78.79%. In the same study, using the Kaplan-Meier analysis and the cut-off value, they showed that mortality was higher in patients with low PI.[17] In our study, it was determined that PI could predict mortality with an AUC of 69.2%, a sensitivity of 70%, and a specificity of 67.9% for 0.57 cut-off value in the ROC analysis performed for 0th hour PI values in patients with signs of dehydration and death. Our findings revealed different results in terms of the cut-off value in our ROC analysis to evaluate the PI value and mortality, and the results were less variable than the studies in the literature. In addition, it was observed that there was no significant PI value according to age. The PI values of the whole study population and those without signs of dehydration were 1.41±1.32 and 1.63±1.55, respectively.

CONCLUSION

In patients admitted to the PICU, the easily measurable and inexpensive PI measurement, along with other vital signs, may be useful in predicting the mortality of the patients. It is clear that further studies are needed in certain patient groups and/or more homogeneous patient groups in order to recognize dehydration and to determine its relationship with vital signs.

Limitations of the Study

Being a retrospective study and including data from a single center, are the limitations of the study. The study was conducted in a hospital in Diyarbakır province and cannot be generalized to the whole population. There are very few studies paediatric patients in terms of perfusion index. Epidemiological studies with more extensive data on this subject should be conducted.

Acknowledgements

We thank all patients who participated in the study.

Ethical Approval

The study was approved by the Diyarbakır Gazi Yaşargil Training and Research Hospital Good Clinical Practices Ethics Committee with the date 05/10/2018 and number 155. Written permission was obtained from the institution where the research was conducted. The study was carried out in accordance with the Declaration of Helsinki.

Peer-review

Externally and internally peer-reviewed.

Authorship Contributions

Concept: M.N.T., Ö.O., Design: M.N.T., Ö.O., Data Collection or Processing: M.N.T., Ö.O., Analysis or Interpretation: M.N.T., Ö.O., Literature Search: M.N.T., Ö.O., Writing: M.N.T., Ö.O.

Conflict of Interest

There is no conflict of interest in the study.

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Applicable to Family Health Centers Detection of Attitudes and Behaviors About Traditional and Complementary Medicine

Aile Sağlığı Merkezlerine Başvuranların Geleneksel ve Tamamlayıcı Tıp Hakkındaki Tutum ve Davranışlarının Saptanması

Abide Aksungur, Zeynep Belma Şenlik, Tuğba Özdemirkan

Ankara Provincial Health Directorate, Ankara, Türkiye

ORCID ID: Abide Aksungur: https://orcid.org/0000-0002-8140-0289, Zeynep Belma Şenlik: https://orcid.org/0000-0002-9125-8554 Tuğba Özdemirkan: https://orcid.org/0000-0002-9165-8136

***Sorumlu Yazar / Corresponding Author:** Abide Aksungur, **e-posta / e-mail:** abideaksungur@hotmail.com

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Abstract

Aim This study aims to determine the attitudes and behaviours of individuals aged 18 and over referred to family health centres in Ankara regarding traditional and complementary medicine practices.

Material and Method This cross-sectional study was conducted with 443 people aged 18 and over referred to family health centres in Ankara and agreed to participate in the study. The data source used was the questionnaire forms the research team developed. The questionnaire form was applied face to face.

Results All participants stated having heard about T&CM applications. A statistically significant difference was found between the status of getting information about T&CM applications regarding age and marital status. A statistically significant difference was found between the status of getting information about T&CM applications regarding age and marital status, presence of chronic disease and regular drug use. The frequency of using T&CM applications at least once in their life is 40.2%.

Conclusion This study determining the attitudes and behaviours of individuals regarding traditional and complementary medicine practices in the case of increasing frequency of use is essential in creating scientific evidence for the studies to be carried out in this field.

Keywords Attitudes, behaviors, complementary medicine, traditional medicine

Özet

Amaç *Ankara'da, aile sağlığı merkezlerine başvuran, 18 yaş ve üstü bireylerin, geleneksel ve tamamlayıcı tıp uygulamaları ile ilgili tutum ve davranışlarının saptanmasıdır.*

Gereç ve Yöntem *Kesitsel tipte olan bu çalışma, Ankara'da aile sağlığı merkezlerine başvuran ve çalışmaya katılmayı kabul eden 18 yaş ve üzeri 443 kişi ile gerçekleştirilmiştir. Araştırmada veri kaynağı olarak araştırma ekibi tarafından geliştirilen anket formu kullanılmıştır. Anket formu yüz yüze uygulanmıştır.*

Bulgular *Katılımcıların tamamı GETAT uygulamalarını duyduğunu belirtmiştir. Yaş ve medeni durumuna göre GETAT uygulamaları hakkında bilgi alma durumu arasında istatistiksel olarak anlamlı bir fark saptanmıştır. Kronik hastalık varlığı ve düzenli ilaç kullanım durumuna göre GETAT uygulamaları hakkında bilgi alma durumu arasında istatistiksel olarak anlamlı fark saptanmıştır. Katılımcıların GETAT uygulamalarını hayatında en az bir kez kullanma sıklığı %40,2'dir.*

Sonuç *Bireylerin geleneksel ve tamamlayıcı tıp uygulamalarına ilişkin kullanım sıklığının artması durumunda tutum ve davranışlarını belirleyen bu çalışma, bu alanda yapılacak çalışmalara bilimsel kanıt oluşturması açısından önem taşımaktadır.*

Anahtar Kelimeler *Davranış, geleneksel tıp, tamamlayıcı tıp, tutum*

INTRODUCTION

According to the World Health Organization (WHO), traditional medicine is expressed as the whole of knowledge, skills and practices used for the protection, diagnoses, improvement or treatment of physical and mental illnesses as well as the maintainence of good health and that can or cannot be explained based on theories, beliefs and experiences specific to different cultures.[1] All around the world, Traditional &Complementary Medicine (T&CM) applications like acupuncture, homoeopathy, ozone therapy, oxygen therapy, mesotherapy, cryotherapy, ayurveda, phytotherapy, aromatherapy, hypnosis, massage, yoga, meditation, osteopathy, reflexology, spa therapy, thermal therapy, SPA therapy, hydrotherapy, musicotherapy, pilates have been applied in a wide range for hundreds of years despite varying from country to country and from patient to patient.[2]

It has been reported in the literature that, many factors that affect the frequency of use, such as; tradition, custom, belief, orientation to the natural, emotional and sociocultural characteristics, behaviours and attitudes, and access to T&CM applications[3-4]. The frequency of use varies between 5-86% according to countries.[4-6] In our country, the frequency of use varies according to the study group; it is reported that it varies between 18.4%-95.0% in children, 22.1-84.1% in cancer patients, 51.3%-74.3% in hypertension patients, and 34.0%-92.0% in diabetes patients.[7]

Especially in providing primary care services, T&CM applications are used increasingly being constantly affected by the needs and wishes of individuals, as well as the developments and changes in the health system worldwide and in our country.[8]

This study aims to determine the attitudes and behaviours of individuals aged 18 and over referred to family health centres in Ankara regarding traditional and complementary medicine practices.

MATERIALS and METHODS

This cross-sectional study was conducted with 443 people aged 18 and over who applied to family health centers in Ankara and agreed to participate in the study after obtaining the necessary administrative permissions and the approval of the Yenimahalle Training and Research Hospital Clinical Research Ethics Committee (11.05.2019). (2022 and decision number E-2022-32).

The population of the research consists of individuals aged 18 and over who receive health services from Family Health Units in Ankara. According to Turkish Statistical Institute 2021 data, the population of Ankara province over the age of 18 is 4,354,289.9 It is seen in the literature that the frequency of knowing T&CM applications varies. between 60-90%.[10] The sample size was calculated as 403, with a frequency of knowing T&CM practices of 60%, a deviation value of 5%, a 95% confidence interval and a design effect value of 1. A replacement sample was not collected due to non-response; The estimated sample size was increased by 10% and the target was 443 people. The first 443 people who applied to Family Health Centers within the study dates and agreed to participate in the study were included. The data source used is the survey forms developed by the research team. It was applied face to face. The first part of the survey includes questions regarding sociodemographic characteristics, the second part includes questions determining attitudes and behaviors towards T&CM practices and the factors affecting them, and the third part includes the "Attitude Scale Towards Traditional and Complementary Medicine".[11]

The attitude scale consists of 8 items and two subscales. Items 1, 5, 6 and 8 of the scale measure "attitude towards alternative medicine", and items 2, 3, 4 and 7 measure "attitude towards complementary medicine". Each item in the scale is evaluated with a score between 1 and 5 (1: I strongly disagree, 2: I disagree, 3: I am undecided, 4: I agree, 5: I completely agree. Three items in the scale are reverse coded (Items 5, 6 and 8). The total score varies between 8-40.

The higher the total score, the more positive the development attitude towards T&CM applications, and the higher the full score, the more a positive attitude towards T&CM applications develops.

In the study, scientifically accepted practices specified in the Ministry of Health regulations were questioned, and other traditional methods used among the public were excluded.[11-12]

Statistics

Research data was evaluated with IBM Statistics 22.0 SPSS package program. For statistical analysis, variables assessed with the test of conformity to a normal distribution (Kolmogorov-Smirnov/Shapiro-Wilk Tests), categorical variables presented as numbers, percentages, and continuous variables as mean±standard deviation and median (most significant, smallest value) in the descriptive findings section. In examining the relationships between nominal variables, the chi-square test was used. Non-normally distributed and ordinal variables were evaluated with the Mann-Whitney U test. Independent predictors of using T&CM applications in multivariate analysis were examined using logistic regression analysis. The possible factors determined in the previous studies such as; age, gender, marital status, employment status, occupation, income-generating job status, place of residence for a long time, alcohol use status, regular physical activity status, presence of chronic disease, perceived health status, regular drug use status were included. Hosmer Lemeshow Test was used for model fit. For statistical significance, the accepted value was $p<0.05$.

RESULTS

Sociodemographic Characteristics

The mean age of the 443 people participating in the study was 41.0±12.0 years. Of the participants, 58.7% are women, 67.5% are married, 35.7% are in high school, 43.6% have an associate degree, undergraduate and graduate degrees, 42.0% are civil servants, 36,3% of them are workers, 21.7% are housewives, students or retired. 16.3% of the participants stated that they spent their life outside the city centre for a long time, 28.0% said that they are not currently working in a job that generates income, 51.0% perceive their income level as a medium, and 41.3% perceive it nicely.

Some Characteristics of Health Status and Behaviors Affecting Health

The distribution of the participants were as follows; 31.6% still smoked, 19.0% quit smoking, 2.9% regularly consumed alcohol, 20.3% drank alcohol occasionally, 4.3% consumed alcohol before, 50.1% did not have regular physical activity, 37.7% had a diagnosed chronic disease requiring continuous medication, 1.1% had poor and 24.8% had moderate health status. When the disorders of the patients with a diagnosed chronic illness requiring ongoing drug use were questioned; 42.7% were endocrinological, metabolic and autoimmune diseases, 28.7% were circulatory system diseases, 17.7% were musculoskeletal system diseases, 6.7% ‘ were gastrointestinal system diseases, and 12% were other chronic diseases (chronic kidney failure, COPD, polycystic kidney disease, depression, breast cancer, glaucoma).

Knowledge, Attitudes and Behaviors Regarding T&CM Applications

All participants stated having heard about T&CM applications. The distribution was as follows; 15.0% cupping therapy (hijama), 13.0% acupuncture, 12.7% ozone, 12.3% hydrotherapy (leech application), 10.1% music therapy, 7.8% hypnosis, 7.8% mesotherapy, 6.7% phytotherapy, 3.2% chiropractic, 3.1% reflexology, 2.1% homoeopathy, 2.0% osteopathy, 1.7% apitherapy, 0.9% kinesiotherapy, 0.9% prolotherapy, and 0.7% maggot (larvae) application. 77.0% of the participants stated that they have received any kind of information about T&CM applications. Source of information received on T&CM practices is indicated as 27.6% environment (family, friends, neighbours), 25.8% social media/internet, 19.6% health workers, 13.6% T.V./radio, and 13.4% newspapers/books /magazine.

A statistically significant difference was found between the status of getting information about T&CM applications regarding age and marital status (p<0,05). The married, 41 years and older group are more likely to have information about T&CM applications. By gender, educational background (status), occupation, income-earning job, long-term residence, and perceived income level, no statistically significant difference existed between the quality of getting information about T&CM applications. (p>0,05).

A statistically significant difference was found between the status of getting information about T&CM applications according to the presence of chronic disease and regular drug use (p<0,05). The frequency of getting information about T&CM applications is less in those who do not have chronic illnesses and do not use regular medication. According to smoking, alcohol consumption status, regular physical activity status, and perceived health status, there was no statistically significant difference between the status of getting information about T&CM applications (p>0,05).

Table 1. Results of Logistic Regression Analysis of Factors Affecting Participants' Information on T&CM Applications, Ankara, 2022.

Factor	RR (95% GA)	p
Presence of Chronic Disease	1.9 (1.0-3.5)	0.044
Good/Very Good/Perceived Health Status Perception of Good/Very Good Health	2.7 (1.4-5.2)	0.003

Table 2. Distribution of Participants' Participation in the Propositions on the T&CM Practices Attitude Scale, Ankara, 2022.

Propositions (n=443)	**I disagree**	**I agree**	**I'm undecided**
	%*	%*	%*
1. My thoughts on T&CM are generally positive.	18.1	52.6	29.3
2. Patients should be directed to T&CM applications when the disease is incurable.	18.8	51.0	30.2
3. In case of illness of a relative, I can direct them to T&CM practices and medical treatment.	19.9	48.0	32.1
4. T&CM applications can be used in diseases that modern medicine cannot treat.	24.4	50.5	25.1
5. I think T&CM practices are quackery.	70.2	17.6	12.2
6. Only modern medicine should be used in curing diseases.	53.4	23.3	23.3
7.T&CM applications can be used to assist treatment as well as modern medicine.	18.1	60.9	21.0
8. I think it is ignorant to use T&CM apps.	71.9	15.7	12.4

The median score of the participants in the T&CM practices attitude scale is 30.0 (8.0-40.0).

Table 3. Distribution of Participants' Attitude Scale Scores According to their Status of Obtaining Information about T&CM Applications and Using T&CM Applications, Ankara, 2022.

Status of Receiving Information About T&CM Applications (n=443)	**No Information Received**	**Received Information**	**p**
The Median of the Scores Received from the Attitude Scale	25.5 (8.0- 40.0)	31.0 (8.0- 40.0)	0.001
Status of Using T&CM Applications (n=443)	Not using	Using	p
The Median of the Scores Received from the Attitude Scale	30.0 (8.0- 40.0)	32.0 (10.0- 40.0)	0.002

Those who get information about T&CM applications and those who use T&CM applications have higher attitude scores (Table 3).

Table 4. Distribution of Participants' Views on Using T&CM Applications, Ankara, 2022.

Opinions of Participants on Using T&CM Applications (n=443)	Number	%*
I have not used and do not intend to use any T&CM methods	77	17.4
I have not used T&CM methods but may wish to use them if necessary	164	37.0
I plan to use a T&CM method	24	5.4
I have used a T&CM method for the last year	51	11.5
I have used a T&CM method for over a year	47	10.6
I've used it in the past	80	18.1

The frequency of using T&CM applications at least once in their life is 40.2%. Of those having used T&CM applications; 67.7% use it regularly, 60.1% benefit from using T&CM applications, and 29.8% get partial help. Of the 329 participants who recommended T&CM applications, 57.1% recommended and 32.2% partly recommended.

52.2% of those who received information about T&CM applications stated that they had used T&CM applications at least once in their life. There is a statistically significant diffference between the status of using T&CM applications and the level of getting information about them (p<0,001). A statistically significant difference was found between using T&CM applications according to age, marital status, educational status, and occupational status (p<0,05). Married, age 41 and above, workers are more likely to use T&CM applications. By gender, place of residence for a long time, working status and perceived income level, no statistically significant difference was found between the use of T&CM applications. (p>0,05).

A statistically significant difference was found between the participants using ES&CM applications either regarding alcohol consumption or regular physical activity. (p<0,05). For those who do not consume alcohol and do not do regular physical activity, the frequency of not using T&CM applications is higher. According to smoking, presence of chronic disease, perceived health status, and frequent drug use, no statistically significant difference was found between the use of T&CM applications (p>0,05).

Table 5. Results of Logistic Regression Analysis of Factors Affecting the Participants' Use of T&CM Applications, Ankara, 2022.

Risk Factor	RR (%95 GA)	p
≥ 41 years old	2.3 (1.5-3.5)	**0.001**
to be a worker	2.4 (1.3-4.1)	**0.003**
Not Doing Regular Physical Activity	1.8 (1.2-2.7)	**0.004**

When the reasons for preferation were questioned; 16.8%, 15.8%, 13.0%, 14.6%, 10.2%, 10.2%, 9.4%, 5.0%, 5.0% of the participants stated that they preferred T&CM applications for; being useful, natural, being used it in addition to medical treatment, having fewer side effects and being safe, accelarating the healing process, the side effects of drugs, the increase of body resistance, the improvement physical appearance; and for economic and cultural reasons, respectfully.

The applications used by the T&CM users were as follows; 27.7% cupping therapy (hijama), 14.5% acupuncture, 14.1% hydrotherapy (leech application), 11.5% music therapy, 7.0% ozone application, 5.5% mesotherapy, 5.1% chiropractic, 3.9% phototherapy, 3.5% hypnosis, 2.0% homoeopathy, 2.0% kinesiotherapy, 0.8% osteopathy, 0.8% reflexology, 0.8% prolotherapy, and % 0.8 apitherapy.

The answers given to the question of which T&CM applications you would recommend were as follows; 22.6% cupping therapy (hijama), 16.5% acupuncture, 13.0% hydrotherapy (leech application), 12.1% ozone application, 9.5% music therapy, 5.8% hypnosis, 5.8% mesotherapy, 4.9% phytotherapy, 2.9% chiropractic, 1.7% reflexology, 1.4% apitherapy, 1.4% homoeopathy, 0.9% prolotherapy, 0.9% kinesiotherapy, and 0.6% osteopathy.

DISCUSSION

Although the descriptive characteristics of the participants are similar to many studies in the literature, they differ from studies conducted in rural areas, participants with lower education levels and perception of income levels, and young and elderly groups. An analysis by researchers from the National Center for Complementary and Integrative Health published in the Journal of Integrative and Complementary Medicine showed that complementary health-related visits primarily included individuals ages 45 and older. Similar to the findings of other studies, women use T&CM methods more frequently.[13-14]

The studies in the literature show that the rate of knowing T&CM methods varies between 60-90%. In the survey conducted by Odabaş et al. in 2021, the frequency of knowing at least one of the T&CM methods was reported as 81.6%.13 In another study reported that 68.5% of the participants knew T&CM methods[10]. In İzmir, 69.7% of individuals over 60 living in rural areas knew traditional and alternative methods with a similar frequency reported in a study conducted in Kayseri. The frequency of having heard about any type of T&CM applications was 98.4%.3,10,13 In our study, 77.0% of the participants stated having received information about T&CM applications. This finding is identical to the literature.

In the literature the most common sources to get information about T&CM applications are stated to be magazines, the internet, circle of friends and experts on the subject.[15-16] Similar to this, the sources of information about T&CM practices in our study are; the environment (family, friends, neighbours), social media/internet, health workers, T.V./radio, newspaper/book/magazine. Although it is pleasing that experts on the subject are preferred at the point of obtaining information, it is troubling that internet is also the preferred method to obtain information, because access to false information is as easy as accessing correct information.

Our study is similar to many other studies, and the average scores obtained from the attitude scale are similar.[17-18] In a study in the literature, participants had lower attitudes towards T&CM.[19]

Some studies have found that those who know about T&CM have more positive attitudes towards T&CM.[20-21] In our study, the average scores of those who stated that they had received information about T&CM from the attitude scale were similarly higher.

More than half of the participants agreed with the positive propositions in the T&CM Practices Attitude Scale. Negative propositions had lower participation rates. The literature shows that the perspective towards T&CM applications shifts positively as age progresses. The positive outlook on T&CM applications obtained in this study consistent with the literature may be due to the fact that the average age of the participants is 40 years and over.[22-23]

The participants did not use and did not consider using any T&CM method in our study with a slightly higher frequency (17.4%) than in other studies.[24-25]

Frequency of use in the literature has reported to be 5-86%, but in some developed countries, it varies between 30% and 90%.[4-6,10] The popularity of use has increased in North America, Australia and Europe in recent years. It is reported that; T&CM applications are used with a frequency of 70-90% in some developed countries. The frequency is reported as; 70% in Canada, 80% in Norway, England, Italy, Germany and Japan, 49% in France and 42% in the United States. There are studies indicating that the highest frequency of T&CM use in European countries is Switzerland (48.6%) and the lowest frequency is Greece (14.8%).[26-27]

According to the 2006 national policy documents of China and Congo, 99.0% of the population uses T&CM applications Traditional and modern medicine are intertwined in 95% of hospitals in China.[28] In Malaysia the prevalence

of use has been reported as approximately 56.0% and as 73.7% in conducted in Iran. It is estimated that 80% of the population in Ethiopia and 60-79% of the people in Chad use T&CM methods. In the study conducted in Nigeria, 84.7% of the participants used T&CM methods.[17,29-30]

The frequency of use of T&CM applications in our country varies according to the study groups. For example, the frequency of use of T&CM applications was reported as 53.2% in the study by Alasırt (2021), 43.5% in the survey by Güner (2021), 48.9% in the study by Ünal (2019), 59.4% in the survey by Kocabaş et al. (2019), 60.5% in the study by Şimşek et al. (2017), 42.3% in the survey by Özyazıcıoğlu et al. (2011), 33.0% in the study by Orhan et al. (2019).[17,31-36] In this study, the frequency of using T&CM applications was determined as 40.2%. This frequency is similar to the frequencies reported in studies conducted in all countries and our country.

One of the important reasons that increase the use of T&CM is the perception that these applications do not have any harm to health. Main reasons for preferring T&CM applications in the literatüre were; considering as beneficial, feeling better physically, the thought of being safer, having fewer side effects, fearing the side effects of drugs, the accelerating the healing process, being easily accessible and low cost. In this study, similar reasons were stated as justification for use.[6,37]

Among the treatment methods included in the "T&CM Regulation", phytotherapy was the most common in the studies conducted.[38] In a study by Şahin et al. (2019) conducted with students in Balıkesir the most frequently used method was found to be music therapy. In our study, cupping therapy (hijama) was the most preferred and recommended method, differently.[15,17-18,22,36]

CONCLUSION

The frequency of use of T&CM has increased significantly in our country and around the world recently. Therefore, determining individuals' attitudes and behaviors towards traditional and complementary medicine practices in case the frequency of use increases is important in terms of providing scientific evidence for studies in this field.

As seen in this study, individuals with chronic diseases over the age of forty prefer ES and T&M applications more frequently for the following reasons; having fewer side effects, being considered safe, accelerating the healing process, fewer side effects of medications, increasing body resistance and improving physical appearance. It is seen that information about the applications is mostly obtained from close circle such as friends/neighbors/relatives and social media/internet. It is important for primary healthcare professionals to inform individuals.

Limitations of the Study

Since it was conducted on people applying to a Family Health Center, it cannot be generalized to the society.

Ethical Approval

Yıldırım Beyazıt University, Yenimahalle Education and Research Hospital ethics Commitee and following the Declaration of Helsinki (decision no: No. EtikKurul-2022-32).

Peer-review

Externally and internally peer-reviewed.

Authorship Contributions

Concept: A. A., Design: A. A., T. Ö., Z.B.Ş., Data collection or Processing: A. A., Analysis or interpretation: T. Ö., Z.B.Ş., Literature Search: A. A., T. Ö., Z.B.Ş., Writing: A. A., T. Ö., Z.B.Ş.

Conflict of Interest

The authors declare that they have no conflict of interest.

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Diş Hekimliği Öğrencileri Yapay Zeka Uygulamalarına Ne Kadar Hazır?

How Ready are Dentistry Students for Artificial Intelligence Applications?

Beyza Büyükkaya[1], Selma Altındiş[2], Fatma Cevahir[3]

[1] Sakarya Üniversitesi, Sağlık Yönetimi Anabilim Dalı, Sakarya, Türkiye

[2] Sakarya Üniversitesi, İşletme Enstitüsü, Sağlık Yönetimi Bölümü, Sakarya, Türkiye

[3] Sakarya Uygulamalı Bilimler Üniversitesi, Tıbbi Hizmetler ve Teknikler Bölümü, Sakarya, Türkiye

ORCID ID: Beyza Büyükkaya: https://orcid.org/0000-0001-9443-8932, Selma Altındiş: https://orcid.org/0000-0003-2805-5516, Fatma Cevahir: https://orcid.org/0000-0002-4834-5046

***Sorumlu Yazar / Corresponding Author:** Beyza Büyükkaya, **e-posta / e-mail:** beyza.buyukkaya@ogr.sakarya.edu.tr

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Abstract

Aim Today, artificial intelligence (YZ) is rapidly integrating into all healthcare services, including dentistry. Therefore, dentists' understanding and standards of artificial intelligence use are important in adopting this issue. This study aimed to assess dentists' readiness (awareness and understanding) of artificial intelligence applications in dentistry.

Material and Method The study was conducted using a Google survey on 259 dentistry students, aged between 18 and 30. To evaluate the readiness of the participants, the "Medical Artificial Intelligence Readiness Scale", developed by Karaca et al.1, was used. Exploratory factor analysis for the scale sets the Kaiser-Meyer-Olkin (KMO) value as 0.926 (>0.70) and the Bartlett test result as p<0.000 (p<0.05). The scale is known to have high reliability, with its Cronbach Alpha value being 0.936

Results With the analysis, it was determined that the total scores of the sub-factors of the scale (cognitive, skill, foresight, ethics) were 23.59, 27.78, 10.02 and 10.56, respectively, and dental students had a medium level of Medical Artificial Intelligence Readiness (22<71.9635<110). In addition, participants think that their participation in training and seminars on the subject is low (13.1%) and 86.9% of participants think that artificial intelligence applications will bring a different perspective to dentistry in the future.

Conclusion More research is needed to evaluate whether dental studies are readily available regarding the applications of artificial intelligence technologies in dentistry. However, in our research and other studies conducted in this field, it is essential that these technologies for dentist centers receive support from some training programs in order to gain both awareness and knowledge and skills on this subject.

Keywords Dentist and dental students, readiness status, Artificial intelligence

Özet

Amaç *Günümüzde yapay zeka (YZ) diş hekimliği dahil tüm sağlık hizmetlerine hızla entegre olmaktadır. Bu nedenle diş hekimlerinin yapay zeka kullanımına ilişkin anlayış ve farkındalıkları bu konunun benimsenmesinde önemlidir. Bu çalışma, diş hekimliği öğrencilerinin diş hekimliğindeki yapay zeka uygulamalarına ilişkin hazır bulunuşluğunu (farkındalık ve anlayışlarını) değerlendirmeyi amaçladı.*

Gereç ve Yöntem *Çalışma, yaşları 18 ile 30 yaş arasında değişen 259 diş hekimliği öğrencisi üzerinde Google anket kullanılarak gerçekleştirildi. Katılımcıların hazır bulunuşluğunu değerlendirmek amacıyla Karaca ark.1 tarafından geliştirilen "Tıbbi Yapay Zekâ Hazır Bulunuşluk Ölçeği" kullanılmıştır. Ölçeğe yönelik yapılan açımlayıcı faktör analizi Kaiser-Meyer-Olkin (KMO) değeri 0.926 (>0.70) ve Barlett testi sonucu da p<0,000 olarak bulunmuştur (p<0.05). Ölçeğin Cronbach Alpha değeri 0.936 bulunarak yüksek güvenilirliğe sahip olduğu saptanmıştır.*

Bulgular *Yapılan analiz ile ölçeğin alt faktörlerinin (bilişsel, beceri, öngörü, etik) toplam puanları sırasıyla 23.92, 27.65, 9.98 ve 10.64 olduğu ve diş hekimliği öğrencilerinin orta düzeyde (22<72.2<110) Tıbbi yapay zeka hazır bulunuşluğuna sahip olduğu saptanmıştır. Bunun yanı sıra katılımcıların konuya ilişkin eğitim ve seminere katılma durumlarının az olduğu 36'sı (%13,9) ve katılımcıların 228'i (%88) yapay zeka uygulamalarının gelecekte diş hekimliğine farklı bir perspektif kazandıracağını düşünmektedir.*

Sonuç *Diş hekimliği öğrencilerinin yapay zeka teknolojilerinin diş hekimliğindeki uygulamalarına ilişkin hazır bulunup bulunmadıklarını değerlendirmek için daha fazla araştırmaya ihtiyaç vardır. Ancak araştırmamız ve bu alanda yapılan diğer araştırmalarda diş hekimi öğrencilerine bu konudaki hem farkındalıklarının hem de bilgi-beceri kazanmaları için bazı eğitim programlarından destek almaları önerilmektedir.*

Anahtar Kelimeler *Diş hekimi ve diş hekimliği öğrencileri, hazır bulunuşluk durumu, yapay zeka*

INTRODUCTION

Günümüzde diş hekimliği ile yapay zeka (YZ) teknolojilerinin entegrasyonunda önemli gelişmeler yaşanmaktadır[2]. Farklı klinik sorunlara çözümler geliştirerek hekimlerin işini kolaylaştıran yapay zekanın tıp ve diş hekimliği disiplinlerinde devrim yaratma potansiyeline sahip olması bu entegrasyonu hızlandırmaktadır. Bu teknolojilerin gelişmesinin dental görüntü teşhisi, çürük tespiti, radyografi, patoloji ve elektronik kayıt tutma gibi birçok konuda olumlu etkileri vardır[3]. Yapay zekanın diş hekimliği uygulamalarındaki bu olumlu etkilerinin yanı sıra, teşhis doğruluğunda artış, kolay ve etkili bir tedavi planlaması, iş akışı verimliliği ve hastanın bakıma erişimini kolaylaştırma gibi avantajları da bulunmaktadır. Yapay zeka ve diş hekimliği profesyonelleri arasında sağlanan iş birliği, daha iyi hasta sonuçlarına, kişiselleştirilmiş bakıma ve diş hekimliği alanında ilerlemelere yol açmaktadır[2].

YZ, insanın yaptığı görevleri makine ve teknoloji yardımıyla gerçekleştirmeyi ifade eden genel bir terimdir. Barr ve Feigenbaum'a göre yapay zeka, "bilgisayar biliminin, insan davranışını anlama, öğrenme, akıl yürütme, problem çözme ve daha pek çok konuda zekayla ilişkilendirdiğimiz özellikleri sergileyen akıllı bir bilgisayar sistemi tasarlamak ile ilgilenen kısmıdır"[4].

YZ, diş hekimliği de dahil olmak üzere çeşitli sektörlerdeki varlığını ve önemini her geçen gün artırmaktadır3. Hatta yapay zeka ve robotik gibi otomasyoların diş hekimliğine sunduğu önemli avantajları nedeniyle diş hekimleri tarafından hızla benimsenmektedir[5]. Diş hekimliğinde YZ, klinik bileşeni yönetimsel bileşenle entegre ederek kliniğin veri tabanını kullanıp, model oluşturarak kliniğin belirli ihtiyaçlarını tahmin etmektedir. Uygulamanın sunduğu yapay zeka desteği ile (tanımlanan patolojiye, hasarın derecesine, genel sağlık durumuna ve diş hekiminin yaptığı yerel, bölgesel teşhislerine dayanarak) farklı terapötik çözümleri yanı sıra tedavi süresini, seans sayısını, maliyetini tahmin edilebilmektedir. Böylece sanal olarak hastanın tedavi planlamaları ve oluşturulan her terapötik çözüm için ödeme miktarlarının düzenlenmesi mümkün olabilir[2,4,6,7].

Ayrıca yapay zeka, diş kliniğindeki bir dizi basit görevi insana göre daha yüksek hassasiyetle, daha az personelle ve daha az hatayla gerçekleştirebilir; Yapay zeka, düzenli randevuların alınması ve koordine edilmesinden klinik tanı ve tedavi planlamasına kadar birçok konuda diş hekimlerine yardımcı olabilir[8]. Bunlara ilave olarak entegre yazılımlar sayesinde aynı hasta için farklı uzmanlık alanlarından diş hekimleri tarafından hastanın dosyasına gerçek zamanlı olarak kolayca erişilebilir, vaka hakkında tartışma yapılabilir ve daha doğru kararların alınmasına müdahale edilebilir. Bunların dışında yapay zeka tarafından klinik veriler toplanarak hastalar için elektronik belgeler kolaylıkla oluşturulabilir. Yapay zeka ameliyat sonrası endikasyonları tahmin edebilir hatta doktorların hastalara yazabileceği ilaç reçetelerini dahi önerebilir. Yapay zekanın sunduğu öngörü sayesinde özellikle karmaşık tedavilerde hız, kolaylık ve eşgüdüm (hekimler ve yapay zeka arasında) sağlanabilir. Yapay zeka içeren bazı yazılımlar, hasta bilgilerinin dijital olarak toplanmasını, muayene ve tüm kliniklerden akan bilgileri entegre edebilir. Örneğin dezenfeksiyon ve sterilizasyon adımlarının yapay zeka uygulamalarına entegre edilmesi, kullanılan malzeme ve cihazın izlenebilirliğinin sağlanması ve malzeme cihaz kullanım kayıtlarının alınıp, hastanın elektronik dosyasına entegre etmesi ve istenilen zamanda belgelenmesi mümkün olabilir. Ayrıca, malzeme tüketimine ilişkin veriler toplanarak alet kullanım miktarı, çeşitliliği, her uzmanlık alanı ve hekim için özelleştirilerek kişi ve klinik bazlı ihtiyaçlar tahmin edilebilir ve muhtemel satın almalar için öneride bulunabilir. Böylece hem hasta için gerekli malzeme ve kanıtlar hem de doğru karara ulaştıracak bir elektronik veri havuzu oluşturabilir[2,5,7].

Dolayısıyla diş hekimliğinde yapay zeka uygulamaları aracılığı ile hem hastalıkların erken teşhisi,[4,9,10,11], doğru tanı[5,8] ve etkili tedaviye önemli katkı sunabilir[3,5] hem de zaman ve maliyet tasarrufu[4,8,9,12,13] sağlanabilir. Diş hekimliğinde yapay zeka, yüksek kaliteli hasta bakımıyla klinisyenlere fayda sağlamakta ve öngörülebilir bir sonuç üreterek

karmaşık protokolleri basitleştirmektedir. Sunduğu tüm kolaylıklar ve avantajlar nedeniyle hem yapay zeka uygulamaları hızla gelişmekte hem de kullanıma girmektedir8. Dolayısıyla çok yakın zamanda yapay zekanın bugünün diş hekimleri tarafından kullanılan bir araç olarak pratikte sorumlu bir şekilde kullanmaya hazırlamak önemlidir. Bu bağlamda alan yazında diş hekimliğinde yapay zeka kullanımına ilişkin bilgi düzeyi, tutum, farkındalık ve hazır bulunuşlukları üzerine yapılan çalışmalar, bu alandaki çabaları göstermektedir[14,15,16]. Örneğin Murali ark.[14] Hindistan'da diş hekimliği öğrencileri ve diş hekimlerinin yapay zekanın ağız tıp ve radyoloji alanında olası uygulamalarına ilişkin bilgi, tutum ve algılarını değerlendirmesi amacıyla yaptıkları çalışmada 460 katılımcıdan çoğunluğunun yapay zeka (%94,13) ve çalışma prensibi (%73,30) hakkında fikirlerinin olduğu saptanmıştır.

Abdullah ark.[15] Pakistan'ın İslamabad ve Rawalpind şehirlerindeki özel pratisyenlerin yapay zeka hakkındaki bilgi ve farkındalıklarını incelemeyi amacıyla yaptıkları çalışmada ise katılımcıların yalnızca %27,4'si yapay zekanın farkında olduğunu %54,8'inin ise farkında olmadığını belirtmiştir.
Krishnaprakash ark.[16] Hindistan Yenepoya Diş Hekimliği Fakültesi Halk Sağlığı Diş Hekimliği Bölümünde diş hekimlerinin ağız sağlığı ve koruyucu diş hekimliğinde robotik ve YZ'ye yönelik bilgi, tutum ve algılarını değerlendirilmesi amacıyla yapılan çalışmada 161 katılımcıdan 133'ü (%82,6) diş hekimliğinde robotik ve YZ'yi duyduğu ancak yalnızca 78'i (%48,4) robotik ve YZ arasındaki farkların farkındaydı. Ayrıca yapılan bu araştırmada personelin bilgi ve tutumunun stajyer, lisansüstü ve özel pratisyen hekimlerden anlamlı derecede yüksek olduğu tespit edilmiştir.
Sonuç olarak nesnelerin interneti, büyük veri, bulut teknolojileri, artırılmış gerçeklik, robot teknolojileri ve üç boyutlu yazıcılar Endüstri 4.0'ın temel bileşenlerinin yaygınlık kazandığı günümüz dünyasında hem ağız ve diş sağlığı işlevlerinde hem de koruyucu diş hekimliğinde yeni dijital yöntemlerin kullanımı hızla artıyor[17,18].Diş hekimliğinde yapay zeka ve dijital teknolojinin hızla ilerlemesi, diş hekimliği eğitimcilerinin geleceğin profesyonellerini yapay zekayı pratikte sorumlu bir şekilde kullanmaya hazırlamayı gerektirmektedir[19].

Çok yakın gelecekte bugünün diş hekimliği öğrencileri yarının hekimleri olarak gerek uygulamaları kısa sürede hatasız ve etkili yapmak için gerekse de sorunları ele almak için yapay zekaya ilişkin bilgi ve becerilerini geliştirmeye ihtiyaç duyacaklar[5,17]. Buna karşın günümüzde geleneksel diş hekimliği müfredatının YZ hakkında çok sınırlı bilgi içermesi ve bu tür eğitimlerin yaygınlığı ve diş hekimliği öğrencilerinin YZ bilgi düzeyi belirsizliğini korumaktadır[17]. Bu düşünceden hareketle çalışma, diş hekimliği öğrencilerinin yapay zeka teknolojisinin diş hekimliğindeki uygulamalarına ilişkin hazır bulunuşluğunu (farkındalık ve anlayışlarını) değerlendirmeyi amaçladı.

GEREÇ ve YÖNTEM

Yapay zekanın (YZ) sağladığı kolaylıklar ve sunduğu fırsatlar nedeniyle diş hekimlerinin bu konudaki tutum ve bilgi düzeyleri, bu teknolojilerin pratiğe geçmesinde önem kazanmaktadır. Bu çalışma, diş hekimliği öğrencilerinin yapay zeka teknolojisinin diş hekimliğindeki uygulamalarına ilişkin hazır bulunuşluğunu (farkındalık ve anlayışlarını) değerlendirmeyi amaçladı.

Araştırma diş hekimliği fakültesinde öğrenim gören 259 öğrencinin katılımıyla gerçekleştirilmiştir. Sakarya Üniversitesi Etik Kurulu'nun 13.09.2023 tarih ve E--000-0 sayılı yazılarıyla araştırmanın uygunluğuna dair izin alınmıştır. Veri toplama aracı olarak iki bölümden oluşan bir anket formu kullanılmıştır. Anket birinci bölümünde katılımcıların tanımlayıcı bilgilerinden oluşan sosyo-demografik sorularından oluşmaktadır. İkinci bölümde, Karaca ark.[1] tarafından nitel bir yöntemle çeşitli uzmanlardan görüş alınarak geliştirilen "Tıbbi Yapay Zekâ Hazır Bulunuşluk Ölçeği" yer almaktadır. Bu ölçek tıp fakültesi öğrencileri ile çalışılarak geliştirilmiş ve tıbbi yapay zeka hazır bulunuşluk düzeyini saptamaya yöneliktir. Ölçek bilişsel, beceri, öngörü ve etik olmak üzere 4 faktörden ve 22 soru-

dan oluşmaktadır. Bilişsel alt faktörü en düşük 8 en yüksek 40 puan; beceri alt faktörü en düşük puan 8 en yüksek 40 puan; öngörü alt faktörü en düşük 3 en yüksek 15 puan; etik alt faktörü en düşük 3 en yüksek 15 puan; toplamda en düşük 22 en yüksek değer 110 puan alınabilmektedir. Ölçekten elde edilecek skorun yüksekliği tıbbi yapay zeka hazır bulunuşluğunun da yüksekliği anlamına gelmektedir. Ölçekler, 5'li likert (kesinlikle katılmıyorum, katılmıyorum, fikrim yok, katıl

in istatistiksel analizinde IBM SPSS Statistics 22 programından yararlanılmıştır. Normallik dağılımını belirlemek için Kolmogorov-Smirnov testi yapılmıştır. Bu da çarpıklık basıklık koşullarını sağlamadığını göstermektedir (p<.05). Bu nedenle verilerin analizinde non-parametrik testlerden Mann-Whiyney U testi ve Kruskal Wallis-H testi yanı sıra tanımlayıcı istatistiksel yöntemler (frekans, yüzdelik dağılım) ve kullanılmıştır. Veriler %95 güven düzeyinde analiz edilmiştir.

Ölçeğin Açımlayıcı Faktör Analizi

Örneklem büyüklüğünün faktör analizi yapılabilmesi için yeterli olup olmadığının belirlenmesi amacıyla yapılan Kaiser-Meyer-Olkin (KMO) testinin yüksek olması ölçekteki her bir değişkenin diğer değişkenler tarafından mükemmel şekilde tahmin edilebileceği anlamına gelmektedir[20]. Elde edilen KMO değeri tavsiye edilen (0,70) değerin üzerinde bulunması değerlendirilebilir olarak kabul edilmektedir[20,21,22,23.] Değerlerin sıfıra yakın olması, korelasyon katsayısı dağılımında bir dağınıklık olduğunu gösterdiğinden değerlere dayalı yorum yapılabilirliğini olumsuz olarak etkilemektedir[20]. Bartlett testi sonucunun anlamlı olabilmesi için p<0.05 değerini sağlaması gerekmektedir[20,24]. Karaca ark.[1] geliştirdikleri "Tıbbi Yapay Zekâ Hazır Bulunuşluk Ölçeği"nin 22 maddesi açımlayıcı faktör analizine tabi tutulmuştur. Kaiser-Meyer-Olkin (KMO) değeri 0.926 ve Barlett testi sonucu da p<0,000 (df:231) olarak bulunmuştur (Tablo 1).

Tablo 1. Tıbbi yapay zekâ hazır bulunuşluk ölçeğinin açımlayıcı faktör analizine ilişkin test sonuçları

KMO ve Bartlett Testi		
Kaiser-Meyer-Olkin Örneklem Ölçüm Değer Yeterliliği		0.926
Bartlett Testi	Ki-Kare	3366,674
	sd.	231
	sig.	0.000

Veri Toplama Aracının Geçerlilik ve Güvenilirlik Analizi

Güvenirlik test sonucunda Cronbach alfa değeri 0 ile 1 arasında bir değer almaktadır. Değerin genel kabul gören güvenirlik düzeyi %70 (0.70) olmakla birlikte değerin 1'e yaklaşmasıyla güvenirlik oranı artmaktadır[25]. Karaca ark.[1] geliştirdikleri "Tıbbi Yapay Zekâ Hazır Bulunuşluk Ölçeği"nin Cronbach alfa değerini 0,877 olarak tespit etmişlerdir. Araştırmamızda yaptığımız ölçeğin güvenirlik düzeyi sonuçları Tablo 2'de görülmektedir. Tabloda görüldüğü üzere araştırmada kullanılan ölçeğin Cronbach Alpha değeri 0.936 olarak bulunduğundan her iki analizde de görüldüğü üzere ölçeğin yüksek güvenirliğe sahip olduğu söylenebilmektedir.

Tablo 2. Veri toplama aracının güvenilirliği

	İfade Sayısı	Cronbach Alpha
Bilişsel Faktör	8	0.870
Beceri Faktör	8	0.901
Öngörü Faktörü	3	0.752
Etik Faktörü	3	0.806
Tıbbi Yapay Zekâ Hazır Bulunuşluk Ölçeği	22	0.936

BULGULAR

Çalışma grubunun %37.1'ini (96 kişi) erkekler, %62.9'unu da (163 kişi) kadınlar oluşturmaktadır. Öğrencilerin %36.7'sinin yaşı 20 yaş ve altı olmakla birlikte %58.3'ü ailesiyle birlikte yaşamaktadır. Katılımcıların tamamı devlet üniversitesinde okumaktadır. Çalışmaya katılan öğrencilerin yalnızca %41.3'ü yapay zeka uygulamalarıyla ilgili

olduğunu belirtirken katılımcıların sadece %86.1'inin yapay zeka uygulamaları ile ilgili herhangi bir seminer veya eğitime katılmadığı saptanmıştır. Katılımcıların %88'i yapay zeka uygulamalarının gelecekte diş hekimliğine farklı bir perspektif kazandıracağını düşünmektedir. Çalışmaya katılan öğrencilerin çoğunluğu (%88.8) yapay zeka uygulamalarının ileride diş hekimleri mesleğine kolaylık sağlayacağını düşünmektedir (Tablo 3).

Tablo 3. Katılımcıların sosyo-demografik özellikleri (n=137)

	Değişken	Sayı	Yüzde
Cinsiyet	Kadın	163	62.9
	Erkek	96	37.1
Yaş	20 yaş altı	95	36.7
	21-24	147	56.8
	25 yaş üstü	17	6.6
Diş hekimliği fakültesinde kaçıncı sınıfta öğrenim görmektesiniz?	1-3. sınıf	132	51
	4. sınıf	57	22
	5. sınıf	69	26.6
	Mezun	1	0.4
Kiminle yaşıyorsunuz?	Ailemle	151	58.3
	Arkadaşımla	49	18.9
	Yalnız	36	13.9
	Yurtta	23	8.9
Ailenizin gelirini nasıl değerlendirirsiniz?	Gelir Giderden Az	32	12.4
	Gelir Gidere Eşit	162	62.5
	Gelir Giderden Fazla	65	25.1
Yapay zeka uygulamaları ile ilgili misiniz?	Evet	107	41.3
	Hayır	152	58.7
Yapay zeka uygulamaları ile ilgili herhangi bir seminer veya eğitime katıldınız mı?	Evet	36	13.9
	Hayır	223	86.1
Yapay zeka uygulamaları gelecekte diş hekimliğine farklı bir perspektif kazandıracaktır.	Katılıyorum	228	88
	Katılmıyorum	6	2.3
	Fikrim Yok	25	9.7
Yapay zeka uygulamaları ileride diş hekimleri mesleğine kolaylık sağlayacaktır.	Katılıyorum	230	88.8
	Katılmıyorum	6	2.3
	Fikrim Yok	23	8.9
Yapay zeka uygulamaları gelişse de diş hekimliği uygulamalarının mesleksel sanat olduğunu ve diş hekimlerinin hep önemli kalacağını düşünüyorum.	Katılıyorum	207	79.9
	Katılmıyorum	23	8.9
	Fikrim Yok	29	11.2

Katılımcıların sadece %19.3'ü (50 kişi) veri bilimindeki temel kavramları tanımlayabileceğini belirtmişlerdir. Katılımcıların %12.8'i (33 kişi) yapay zekânın temel kavramlarını ve terminolojisini tanımlayabileceğini belirtmişlerdir. Katılımcıları %12'si (31 kişi) sağlık alanındaki yapay zekâ uygulamalarının hangi soruna nasıl bir çözüm sunduğunu açıklayamadığını belirtmişlerdir. Katılımcıların %66.4'ünün (172 kişi) yapay zekânın eğitim, hizmet ve araştırma amaçlı kullanılmasını değerli buldukları tespit edilmiştir. Katılımcıların sadece %8.8'i (23 kişi) yapay zekâ teknolojisinin yaratabileceği fırsat ve tehditleri ön göremediklerini belirtmişlerdir. Katılımcıların %58.3'ünün (151 kişi) sağlık verilerini hukuki ve etik normlara uygun biçimde kullanabildikleri tespit edilmiştir (Tablo 4).

Tablo 4. Ölçek ifadelerinin özellikleri (n=137)

	Değişken	Sayı	Yüzde
Veri bilimi konusundaki temel kavramları tanımlayabilirim.	Kesinlikle Katılmıyorum	10	3,9
	Katılmıyorum	35	13,5
	Fikrim Yok	164	63,3
	Katılıyorum	48	18,5
	Kesinlikle Katılıyorum	2	0,8
İstatistik bilimi hakkında temel kavramları tanımlayabilirim.	Kesinlikle Katılmıyorum	9	3,5
	Katılmıyorum	50	19,3
	Fikrim Yok	143	55,2
	Katılıyorum	53	20,5
	Kesinlikle Katılıyorum	4	1,5
Yapay zekâ sistemlerinin nasıl eğitildiğini açıklayabilirim.	Kesinlikle Katılmıyorum	17	6,6
	Katılmıyorum	74	28,6
	Fikrim Yok	141	54,4
	Katılıyorum	24	9,3
	Kesinlikle Katılıyorum	3	1,2
Yapay zekânın temel kavramlarını ve terminolojisini tanımlayabilirim.	Kesinlikle Katılmıyorum	16	6,2
	Katılmıyorum	72	27,8
	Fikrim Yok	138	53,3
	Katılıyorum	30	11,6
	Kesinlikle Katılıyorum	3	1,2
Sağlıkta yapay zekâ uygulamalarının kullanılmasıyla elde edilen verileri doğru analiz edebilirim.	Kesinlikle Katılmıyorum	14	5,4
	Katılmıyorum	44	17
	Fikrim Yok	130	50,2
	Katılıyorum	67	25,9
	Kesinlikle Katılıyorum	4	1,5

Yapay zekâ ile ilgili araçların ve uygulamaların işlevlerini ve özelliklerini ayırt edebilirim.	Kesinlikle Katılmıyorum	8	3,1
	Katılmıyorum	38	14,7
	Fikrim Yok	140	54,1
	Katılıyorum	72	27,8
	Kesinlikle Katılıyorum	1	0,4
Yapay zekânın çalışma mantığına uygun iş akışı organize edebilirim.	Kesinlikle Katılmıyorum	5	1,9
	Katılmıyorum	46	17,8
	Fikrim Yok	116	44,8
	Katılıyorum	84	32,4
	Kesinlikle Katılıyorum	8	3,1
Sağlıkta yapay zekâ uygulamalarının geliştirilmesi için verinin; toplama, analiz, değerlendirme ve güvenliğinin önemini ifade edebilirim.	Kesinlikle Katılmıyorum	6	2,3
	Katılmıyorum	29	11,2
	Fikrim Yok	120	46,3
	Katılıyorum	98	37,8
	Kesinlikle Katılıyorum	6	2,3
Yapay zekâ uygulamalarına dayalı bilgileri mesleki bilgimle birleştirerek kullanabilirim.	Kesinlikle Katılmıyorum	3	1,2
	Katılmıyorum	34	13,1
	Fikrim Yok	85	32,8
	Katılıyorum	125	48,3
	Kesinlikle Katılıyorum	12	4,6
Sağlık hizmeti sunumunda yapay zekâ teknolojilerini etkin ve verimli biçimde kullanabilirim.	Kesinlikle Katılmıyorum	2	0,8
	Katılmıyorum	34	13,1
	Fikrim Yok	100	38,6
	Katılıyorum	115	44,4
	Kesinlikle Katılıyorum	8	3,1
Yapay zekâ uygulamalarını amacına uygun şekilde kullanabilirim.	Kesinlikle Katılmıyorum	2	0,8
	Katılmıyorum	26	10
	Fikrim Yok	85	32,8
	Katılıyorum	131	50,6
	Kesinlikle Katılıyorum	15	5,8
Bilgi ve iletişim teknolojilerini kullanarak bilgiye erişebilir, değerlendirebilir, kullanabilir, paylaşabilir ve yeni bilgiler oluşturabilirim.	Kesinlikle Katılmıyorum	2	0,8
	Katılmıyorum	25	9,7
	Fikrim Yok	89	34,4
	Katılıyorum	133	51,4
	Kesinlikle Katılıyorum	10	3,9
Sağlık alanındaki yapay zekâ uygulamalarının hangi soruna nasıl bir çözüm sunduğunu açıklayabilirim.	Kesinlikle Katılmıyorum	3	1,2
	Katılmıyorum	28	10,8
	Fikrim Yok	132	51
	Katılıyorum	89	34,4
	Kesinlikle Katılıyorum	7	2,7

Yapay zekânın eğitim, hizmet ve araştırma amaçlı kullanılmasını değerli bulurum.	Kesinlikle Katılmıyorum	4	1,5
	Katılmıyorum	15	5,8
	Fikrim Yok	68	26,3
	Katılıyorum	130	50,2
	Kesinlikle Katılıyorum	42	16,2
Sağlık hizmet sunumunda kullanılan yapay zekâ uygulamalarını hastaya açıklayabilirim.	Kesinlikle Katılmıyorum	3	1,2
	Katılmıyorum	22	8,5
	Fikrim Yok	97	37,5
	Katılıyorum	121	46,7
	Kesinlikle Katılıyorum	16	6,2
Sağlık alanında karşılaşılan probleme uygun yapay zekâ uygulamasını seçebilirim.	Kesinlikle Katılmıyorum	4	1,5
	Katılmıyorum	23	8,9
	Fikrim Yok	108	41,7
	Katılıyorum	114	44
	Kesinlikle Katılıyorum	10	3,9
Yapay zekâ teknolojisinin sınırlılıklarını açıklayabilirim.	Kesinlikle Katılmıyorum	6	2,3
	Katılmıyorum	30	11,6
	Fikrim Yok	135	52,1
	Katılıyorum	84	32,4
	Kesinlikle Katılıyorum	4	1,5
Yapay zekâ teknolojisinin güçlü ve zayıf yönlerini açıklayabilirim.	Kesinlikle Katılmıyorum	5	1,9
	Katılmıyorum	23	8,9
	Fikrim Yok	117	45,2
	Katılıyorum	104	40,2
	Kesinlikle Katılıyorum	10	3,9
Yapay zekâ teknolojisinin yaratabileceği fırsat ve tehditleri ön görebilirim.	Kesinlikle Katılmıyorum	4	1,5
	Katılmıyorum	19	7,3
	Fikrim Yok	107	41,3
	Katılıyorum	118	45,6
	Kesinlikle Katılıyorum	11	4,2
Sağlık verilerini hukuki ve etik normlara uygun biçimde kullanabilirim.	Kesinlikle Katılmıyorum	5	1,9
	Katılmıyorum	19	7,3
	Fikrim Yok	84	32,4
	Katılıyorum	127	49
	Kesinlikle Katılıyorum	24	9,3
Yapay zekâ teknolojilerini kullanırken etik ilkelere uygun hareket edebilirim.	Kesinlikle Katılmıyorum	1	0,4
	Katılmıyorum	12	4,6
	Fikrim Yok	73	28,2
	Katılıyorum	141	54,4
	Kesinlikle Katılıyorum	32	12,4
Sağlıkta yapay zekâ teknolojilerinin kullanımı ile ilgili hukuki düzenlemeleri takip edebilirim.	Kesinlikle Katılmıyorum	4	1,5
	Katılmıyorum	31	12
	Fikrim Yok	105	40,5
	Katılıyorum	110	42,5
	Kesinlikle Katılıyorum	9	3,5

Yapılan analiz ile ölçeğin alt faktörlerinin (bilişsel, beceri, öngörü, etik) toplam puanları sırasıyla 23.92, 27.65, 9.98 ve 10.64 olduğu tespit edilmiştir. Faktörlerin standart sapma değerleri 1 ile 5 değerleri arasındadır (Tablo 5.)

Tablo 5. Tanımlayıcı istatistikler ve faktörlerin güvenliği

Faktör	Ortalama	ss	Skewness	Kurtosis
Bilişsel	23.92	4.51	-0,652	1,281
Beceri	27.65	4.82	-0,684	0,824
Öngörü	9.98	1.86	-0,395	0,909
Etik	10.64	2.01	-0,483	0,566
Tıbbi Yapay Zekâ Hazır Bulunuşluk Ölçeği	72.2	11.23	-0,78	1,874
Ölçeğin ideal puan aralığı: Bilişsel Faktör min:8 max:40; Beceri Faktör min:8 max:40; Öngörü Faktörü min:3 max:15; Etik Faktör min:3 max:15; Toplam min:22 max:110.				

Tablo 6'da yer alan analiz sonucuna göre diş hekimliği öğrencilerine yapay zeka teknolojilerinin diş hekimliğindeki uygulamalarına ilişkin hazır bulunuşluğuna yönelik uygulanan ölçeğin alt faktörlerinin sınıf değişkenine göre istatistiksel olarak anlamlı bir farklılık gösterdiği tespit edilmiştir (p>0,05).

Tablo 6. Sınıf değişkeni ile tıbbi yapay zekâ hazır bulunuşluk ölçeğinin toplam puan ortalamalarının karşılaştırılması (n=137)

Faktörler	Sınıf	Ortalama Puan	p
Tıbbi Yapay Zekâ Hazır Bulunuşluk Ölçeği	1., 2. ve 3. Sınıf (n:132)	130.27	KW: 0.006 p: 0.997
	Hazır Bulunuşluk Ölçeği	129.33	
	5. Sınıf (n:69) ve Mezun (n:1)	130.03	
Ölçeğin ideal puan aralığı: Bilişsel Faktör min:8 max:40; Beceri Faktör min:8 max:40; Öngörü Faktörü min:3 max:15; Etik Faktör min:3 max:15; Toplam min:22 max:110.			

Tablo 7'de yer alan Mann Whitney U test sonucuna göre diş hekimliği öğrencilerinin yapay zeka teknolojisinin diş hekimliğindeki uygulamalarına ilişkin hazır bulunuşluğunun cinsiyete göre istatistiksel olarak anlamlı bir farklılık göstermediği tespit edilmiştir (p>0,05).

Tablo 7. Cinsiyet değişkeni ile tıbbi yapay zekâ hazır bulunuşluk ölçeğinin toplam puan ortalamalarının karşılaştırılması (n=137)

Faktörler	Sınıf	Ortalama Puan	p
Tıbbi Yapay Zekâ Hazır Bulunuşluk Ölçeği	Kadın (n:163)	136.82	MWU: 6713 p: 0.056
	Erkek (n:96)	118.43	
Ölçeğin ideal puan aralığı: Bilişsel Faktör min:8 max:40; Beceri Faktör min:8 max:40; Öngörü Faktörü min:3 max:15; Etik Faktör min:3 max:15; Toplam min:22 max:110.			

TARTIŞMA

Yapay zekanın (YZ) sağlık hizmetlerine entegrasyonu yıllar geçtikçe ivme kazanmaktadır. Ancak diş hekimlerinin diş hekimliği uygulamalarında yapay zeka kullanımına ilişkin anlayış ve farkındalık düzeyleri bu konunun benimsenmesinde önemlidir. Hiç kuşkusuz çok yakın gelecekte diş hekimleri ve gelecekte birer diş hekimi olacak olan öğrenciler, yapay zeka teknolojilerin kullanımı hatta üretilmesinde önemli bir aktör olarak rol alacaklardır. Hatta bu teknolojileri kullanmak ve üretmek için öncelikli olarak belirli istek ve gerekli yetkinliklere sahip olmaları gerekeceği açıktır. Çünkü gerek yeni teknolojiler ile üretilen hizmetlerin benimsenmesi gerekse de bu hizmetlerin üretilmesinde tetikleyici bir fonksiyon üstlenmesi için onların bu teknolojilere hazır olmaları son derece önemlidir. Diş hekimliği öğrencilerinin yapay zeka teknolojisinin diş hekimliğindeki uygulamalarına ilişkin bilgi sahibi olup olmadığına yönelik yapılan çalışmalardan6,26,27,28,29 sadece Özel ve Büyükçavuş'un29 yaptıkları çalışmada diş hekimliği öğrencilerinin bu konuda bilgi eksikliklerinin olduğunu saptamışlar iken diğer çalışmalar diş hekimliği öğrencilerinin bu konuda bilgi sahibi olduğunu tespit etmişlerdir. Bizim çalışmamızda ise öğrencilerin kısmen bilgi sahibi olduğu saptanmıştır. Sur ark.30 orta Hindistan'daki diş hekimleri arasında radyolojik teşhis için yapay zekanın geleceğine ilişkin bilgi, tutum ve algılarına yönelik 250 diş hekiminin katılımıyla gerçekleştirdikleri araştırmalarında katılımcıların %68'i zaten yapay zeka kavramına aşina olduğunu, %69'u diş teşhisleri yapmak için yapay zekayı kullanmayı beklediklerini belirtmişlerdir. Katılımcıların

%51'inin yapay zekanın ana işlevinin karmaşık radyografik taramaların yorumlanması olacağını düşündükleri ve %63'ünün yapay zekanın Hindistan'da bir geleceği olacağı konusunda hemfikir oldukları tespit edilmiştir. Fernandes ark.26 tarafından Hindistan'ın Kuzey Gujarat kentindeki diş hekimliği lisans öğrencileri arasında yapay zeka ile ilgili bilgi, tutum ve uygulamaların değerlendirilmesi amacıyla yaptıkları çalışmalarında 558 öğrenciden %64,1'i yapay zeka konusunda temel bilgiye sahip olduğu tespit edilmiştir. Diş hekimliği öğrencilerinde %33,3'ü yapay zekanın teşhis yeteneğinin bir diş hekiminin klinik deneyiminden çok daha iyi olduğunu kabul ettiği ve öğrencilerin %53,6'sı Hindistan'da yapay zekanın geleceğine yönelik olumlu algıya sahip oldukları tespit edilmiştir. Yüzbaşıoğlu'nun28 Türk diş hekimliği öğrencilerinin yapay zekaya yönelik tutum ve algılarını değerlendirmek ve yapay zekanın diş hekimliğinde kullanımına ilişkin görüşleri hakkında bilgi vermek amacıyla 1103 öğrencinin katılımıyla gerçekleştirdiği araştırmasında katılımcıların yaklaşık %48,40'ının yapay zeka teknolojileri hakkında temel bilgiye sahip olduğu, yalnızca %10,6'sının yapay zeka ile ilgili herhangi bir bilgi kaynağının olmadığı tespit edilmiştir.

Çalışmamızda katılımcıların %88'i yapay zeka uygulamalarının gelecekte diş hekimliğine farklı bir perspektif kazandıracağını düşünmektedir. Çalışma sonuçlarımıza benzer şekilde Karan-Romero ark.[31] tarafından Peru Metropolitan Lima'daki üniversite öğrencilerinin diş hekimliğinde yapay zeka kullanımına ilişkin tutum ve algılarını değerlendirmek amacıyla 200 diş hekimliği öğrencisinin katılımıyla gerçekleştirdikleri araştırmalarında da katılımcı öğrencilerin %86'sının yapay zekanın diş hekimliğinde büyük ilerlemelere yol açacağı konusunda hemfikir olduğunu belirtirken katılımcıların %45'i yapay zekanın gelecekte diş hekimlerinin yerini alacağına katılmadığı saptanmıştır. Ayrıca katılımcılar yapay zeka kullanımının lisans ve lisansüstü eğitimlerin bir parçası olması gerektiğine sırasıyla %67 ve %72 oranlarla katıldıklarını belirtmişlerdir.

Yüzbaşıoğlu'nun[28] bu konuda yaptığı çalışmada katılımcıların %85,70'i yapay zekanın diş hekimliğinde devrim yaratacağına katıldığını ancak %28,60'ı yakın gelecekte yapay zekanın diş hekiminin yerini alabileceğine katılmadığını belirtmiştir. Ayrıca katılımcıların %74,60'ı ve %79,80'i yapay zeka ile ilgili konuların sırasıyla lisans ve lisansüstü diş hekimliği eğitimine dahil edilmesi konusunda hemfikir olduğunu saptanmıştır. Bu alanda yapılan diğer bazı araştırmalarda da[1, 14, 27, 28, 29, 31, 32] diş hekimliği lisans ve yüksek lisans eğitim müfredatında yapay zekaya yer verilmesi gerektiğinden bahsedilmiştir.

SONUÇ

Sonuç olarak diş hekimliği müfredatında yapay zeka uygulamaları, ağız sağlığı hizmetlerinin sunumunu geliştirerek ideal hizmet uygulamalarına fayda sağlayabilir. Ancak pratik açıdan değerlendirilmesi gereken çeşitli pratik ve etik zorlukları vardır[33]. Dolayısıyla da diş hekimliğinde yapay zeka uygulamalarının diş hekimliği öğrencilerine bu konudaki hem farkındalıklarının hem de bilgi-beceri kazanmaları için bazı eğitim programlarına eklenmesi ve mezunların bu uygulamaları etik ve sorumlu bir şekilde kullanmaları için son derece önemlidir[33].

Etik Onay

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