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EDİTÖRDEN

Günümüz dünyası maalesef savaşlara ve şiddete teslim olmuştur. Barış kültürünün tüm toplumlarda hakim olmasına ve geliştirilmesine yönelik ihtiyaç her geçen gün daha derinden hissedilmektedir.

Şiddet, küçük yaşta öğrenilmekte, öğrenilen şiddet de başka şiddetleri doğurmaktadır. Bu nedenle çocuklara hoşgörülü olmayı, insan haklarını, doğa sevgisini, toplum içinde birlikte yaşamayı, saygı duymayı ve ötekileştirmemeyi erken yaşta öğretmek gerekir.

İkinci Dünya savaşından beri milyonlarca sivil insan iç savaşlar ve diğer çatışmalar nedeniyle yaşamını yitirmiştir. Milyarlarca dolar, insanları öldürmeye ve doğayı tahribe sebep olan silahlara harcanmaktadır. Günümüzde tüm dünyada doğaya ve insanlara daha fazla zarar verilmemesi için eğitim sisteminin, çoklu zekanın ve eleştirel düşüncenin geliştirilmesine odaklanarak barış kültürünün gelişmesine katkı sağlamalıdır.

Eğitim, yaşı ne olursa olsun her bireyin doğuştan gelen potansiyelini geliştirmenin yanı sıra kendi kendini kontrol etmeyi öğretmek ve insanların açgözlülük, öfke ve aptallık yerine cesaret, şefkat ve bilgelik gibi erdemlere sahip olabilmesi ile de ilgilidir. Eğitim, farklı gruplar arasında sıklıkla ayrışan yaşam alanlarının kesişmesine olanak tanıyarak etnik, dini, coğrafi veya ekonomik farklılıkların eşitlenmesini sağlar. Milyonlarca yaşamı ve kaynağı israf etmeye neden olan savaşları önlemeyi arzulayan insanlık, barışı inşa etmek için temel araç olarak eğitimi kullanmak zorundadır.

Barış kültürü, bireyler ve toplumlar arasında diyalog yoluyla sorunları çözmek için şiddeti reddeden, temel sorunları ele alarak çatışmaları önleyen bir dizi değer, tutum, davranış ve yaşam biçimidir. Barış, şiddetsizlik, insan hakları, demokrasi, hoşgörü, kültürlerarası anlayış ve kültürel çeşitlilik barış eğitimi ile öğretilebilir.

Barış, bir insanın diğer insanlar arasındaki farklılıkları bakarak kendisini tanımlaması ile değil, benzerlikleri görerek kendisini tanımlaması ile sağlanır.

Barış, sevginin hüküm sürdüğü yerde yeşerir.

Prof. Dr. Kılıçhan BAYAR

Baş Editör

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Cilt 4 Hakem Listesi

Etik İlkeler; Karya Journal of Health Science; yazarlar, hakemler ve editörler için rehber olarak hazırlanmış Uluslararası Tıp Dergisi Editörleri Konseyi (International Council of Medical Journal Editors/ICMJE) ve Yayın Etiği Komisyonu (Committee on Publication Ethics/COPE) kılavuzlarını temel almaktadır. İnsanlar üzerinde yapılan araştırma makalelerinde, araştırmanın ilgili Etik Kurul tarafından onaylandığı, çalışmanın Helsinki İlkeler Deklarasyonu'na (https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/) uyularak gerçekleştirildiği, çalışmaya dahil edilen gönüllülerin onamlarının ve kurum izinlerinin alındığı bilgisi "Yöntem" bölümünde açıkça belirtilmelidir. Olgu sunumlarında imzalı onam alınmalı ve "Olgu Sunumu" bölümünde açıkça belirtilmelidir. Karya Journal of Health Science'a gönderilen makalelerdeki çalışmaların Helsinki İlkeler Deklarasyonu'na uygun olarak yapıldığı, kurumsal, etik ve yasal izinlerin alındığı varsayılarak bu konuda sorumluluk kabul edilmeyecektir. Hayvanlar üzerinde yapılan çalışmalarda, araştırmada hayvan hakları Guide for the Care and Use of Laboratory Animals (www.nap.edu/catalog/5140.html) prensipleri doğrultusunda korunduğu, araştırmanın ilgili Etik Kurul tarafından onaylandığı bilgisi "Yöntem" bölünde açıkça belirtilmelidir. Yazar(lar) makale içerisindeki şekil, resim, fotoğraf, çizelge ve diğer tamamlayıcı materyalin orijinal olduğunu garanti etmelidir. Eğer makalede daha önce yayımlanmış, başkalarına ait; alıntı yazı, tablo, resim, ölçek ve benzeri materyal kullanıldı ise yazar(lar), yayın hakkı sahibi ve yazar(ların)dan yazılı izin almak ve bunu makalede belirtmekle yükümlüdür. Bu konuya ilişkin hukuki sorumluluk yazarlara aittir. Kullanılan fikir ve sanat eserleri için telif hakları düzenlemelerine uyulduğu belirtilmelidir. Makalede ticari bağlantı veya çalışma için maddi destek veren kurum (doğrudan veya dolaylı) mevcut ise yazarlar; kullanılan ticari ürün, ilaç, firma ile ticari hiçbir ilişkisinin olmadığını veya varsa nasıl bir ilişkisinin olduğunu (konsültan, diğer anlaşmalar vs.), başlık sayfasında bildirmek zorundadır. Makale yazarlar tarafından akademik intihal programından geçirilmeli ve intihal raporu sunulmalıdır. Benzerlik oranı %25'i geçmemelidir. Benzerlik raporu sonucuna göre makale; değerlendirilmek üzere alan editörüne gönderilebilir, düzeltme talebiyle yazara geri gönderilebilir veya değerlendirme aşamasına alınmadan reddedilir (benzerlik oranı %25'den fazla olan makaleler). Sorumlu yazar, tüm yazarlar adına yazının son halinden sorumludur. Yazıların bilimsel, etik ve hukuki sorumluluğu yazar(lar)a aittir. (http://www.icmje.org/about-icmje/faqs/conflict-of-interest-disclosure-forms/).Yazar(lar) "Etik ilke ve Yayın Politikası" içeriğini okumakla yükümlüdür.

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EFFECT OF EXPIRATORY MUSCLE TRAINING ON STOMATOGNATHIC SYSTEM IN PATIENTS WITH STROKE

İNMELİ HASTALARDA EKSPİRATUAR KAS EĞİTİMİNİN STOMATOGNATİK SİSTEME ETKİSİ

Ömer Dursun[1*], Tamer Çankaya[2], Erdal Dilekçi[3]

[1]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Bitlis Eren University, Bitlis, Türkiye

[2]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Bolu Abant İzzet Baysal University, Bolu, Türkiye

[3]Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Maltepe University, İstanbul, Türkiye

ABSTRACT

Objective: The aim of this study was to assess the effect of expiratory muscle training on the stomatognathic system in patients with stroke.

Method: A total of 31 patients with stroke were included in the study: 16 patients with stroke (age=66.63±8.38, height=166.38±8.59, BMI=28.09±4.81) as the control group and 15 patients with stroke (age=65.60±7.62, height=168.20±8.78, BMI=28.95±6.92) as the study group. Temporomandibular joint range of motion and dysfunction, pressure pain threshold of masticatory muscles, facial asymmetry existence, head posture, oral hygiene, oral hygiene habit, masticatory performance, intraoral pH, deglutition, and deep neck flexor muscle endurance of the patients with stroke were assessed. Assessment methods were in order by digital caliper, the Fonseca Questionnaire, algometry, labial commissure and craniocervical angle measurement, general oral health assessment index, and questionnaire, sieve test, digital pH gauge, repetitive saliva swallow test, Eating Assessment Tool, and deep neck flexor endurance test. Patients with stroke in the study group were enrolled in an expiratory muscle training program consisting of 5 sets of 10 repetitions daily for three weeks in addition to conventional physiotherapy; the control group enrolled in the conventional physiotherapy program. Patients with stroke in the study group were called twice a week to assess their compliance with the expiratory muscle training.

Results: In intragroup comparison significant increase was found in the inferior portion of the left masseter, mandibular protrusion, and a decrease in labial commissure angle and Fonseca Questionnaire score of the control group ($p<0.05$). In the study group a significant increase was observed in mandibular depression ($p<0.05$). In intragroup comparison, both groups had similar intraoral pH, masticatory performance, craniocervical angle and neck flexor muscle endurance ($p>0.05$). While significant difference was found in lateral deviation, eating assessment inventory and labial commissure angle in intergroup comparison ($p<0.05$), other parameters were similar ($p>0.05$). Improvement in labial commissure angle was in favor of the control group ($p<0.05$).

Conclusion: Expiratory muscle training might be preferred to increase mandibular lateral deviation and improve deglutition in subacute or chronic-stage patients with stroke.

Key Words: Mastication, Deglutition, Temporomandibular Joint

ÖZ

Amaç: Bu çalışmanın amacı ekspiratuar kas eğitiminin inmeli hastaların stomatognatik sistemine etkisini incelemekti.

Yöntem: Çalışmaya kontrol grubuna 16 inmeli hasta (yaş=66.63±8.35, boy=166.38±8.59, BKİ=28.09±4.81), çalışma grubuna 15 inmeli hasta (yaş=65.60±7.62, boy=168.20±8.78, BKİ=28.95±6.42) olmak üzere toplam 31 inmeli hasta dahil edildi. İnmeli hastaların temporomandibular eklem hareket açıklığı ve disfonksiyonu, çiğneme kasları ağrı eşiği, fasiyal asimetri varlığı, baş postürü, oral hijyen ve oral hijyen alışkanlıkları, çiğneme performansı, intraoral pH, yutma ve derin boyun fleksör kasları enduransı değerlendirildi. Değerlendirme yöntemleri sırasıyla; dijital kaliper, Fonseka Anketi, algometre, labial kommissür ve kranioservikal açı ölçümü, genel oral sağlık değerlendirme indeksi ve anket, elek testi, dijital pH ölçer, tekrarlı saliva yutma testi, yeme değerlendirme envanteri ve derin boyun fleksörleri endurans testiydi. Çalışma grubundaki inmeli hastalar konvansiyonel fizyoterapi programına ek olarak üç hafta süresince, haftada her gün 5 set 10 tekrardan oluşan ekspiratuar kas eğitimi programına, kontrol grubuysa konvansiyonel fizyoterapi programına alındı. Çalışma grubundaki inmeli hastalar haftada iki gün aranarak, ekspiratuar kas eğitimi programına olan uyumları değerlendirildi.

Bulgular: Grup içi karşılaştırmada kontrol grubundaki bireylerin sol masseter inferior parçası ağrı eşiklerinde ve protrüzyon hareketinde artış, labial kommissür açılarında ve Fonseka Anketi skorlarında ise azalma gözlendi ($p<0.05$). Çalışma grubunda yer alan inmeli hastaların ise mandibular depresyonunda artış bulundu ($p<0.05$). Grup içi karşılaştırmada gruplar benzer intraoral pH, çiğneme performansı, kranioservikal açı ve derin boyun fleksörleri enduransı değerlerine sahipti ($p>0.05$). Gruplar arası karşılaştırmada ise lateral deviasyon, yeme değerlendirme envanteri ve labial kommissür açısında anlamlı fark bulunurken ($p<0.05$), diğer parametreler benzerdi ($p>0.05$). Labial kommissür açısındaki iyileşme kontrol grubu lehineydi ($p<0.05$)

Sonuç: Ekspiratuar kas eğitimi subakut ya da kronik dönem inme hastalarında mandibular lateral deviasyonun arttırılmasında ve yutmanın iyileştirilmesinde tercih edilebilir.

Anahtar Kelimeler: Çiğneme, Yutma, Temporomandibular Eklem

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***Sorumlu yazar/Corresponding author:** Bitlis Eren University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Bitlis, Türkiye
[1*]Email: fztomrdrsn@gmail.com, [2]Email: tamercankaya@hotmail.com, [3]Email: erdaldilekci@gmail.com

INTRODUCTION

Stroke is defined by the World Health Organization as "caused by the interruption of the blood supply to the brain, usually because a blood vessel bursts or is blocked by a clot. This cuts off the supply of oxygen and nutrients, causing damage to the brain tissue" [1]. A variety of sensorimotor symptoms develop due to stroke [2,3].

The stomatognathic system is one of the systems affected by the stroke [4]. The stomatognathic system, consisting of the temporomandibular joint (TMJ), dental arcs, saliva glands, masticatory muscles, and cervical muscle groups, plays an active role in vital activities such as mastication, deglutition, and respiration [5]. The stomatognathic system's functionality is aided by the interrelationship between the neuromusculoskeletal and respiratory systems [5,6]. Any disruption in this dynamic interrelation triggers the cascade that results in the loss of functions of the stomatognathic system.

As mentioned above, stroke is a disease that triggers the cascade, and stomatognathic system dysfunction has developed [4]. Respiratory and orofacial dysfunction due to stroke is mainly responsible for the compromise of the stomatognathic system. Both dysfunction types cause stomatognathic system dysfunction by indirectly or directly affecting mastication and deglutition [7,8].

Orofacial dysfunction is commonly seen in post-stroke symptoms and is characterized by losses in perioral and lingual muscle strength and coordination and salivary gland function. Lack of perioral and lingual muscle strength and coordination leads to impaired mastication, diminished or impaired lip seal during mastication, and inadequate bolus transfer to the occlusal surface. Compromise in the salivary glands gives rise to impairments in the functions of the salivary glands. Considering mastication participates in the oral phase of deglutition, orofacial dysfunction may also cause impaired deglutition [7]. Similarly, respiratory dysfunction also commonly develops in patients with stroke. Respiratory dysfunction causes reductions in the contralesional diaphragm excursion, forced vital capacity, forced expiratory volume in the first second, and peak expiratory flow values [9]. Considering that peak expiratory flow is related to coughing, that comes into play in the preventing aspiration pneumonia [10].

The dynamic interrelationship between the respiratory system and the stomatognathic system has established a ground for similar and common rehabilitative approaches to the dysfunction of these systems. Expiratory muscle training (EMT), aiming to improve the dynamic coordination between the respiratory system and deglutition via strengthening the expiratory muscle, is one of the therapeutic approaches that developed in this manner [8]. The respiratory system is also related to the stomatognathic system, considering deglutition is one of the functions of the stomatognathic system [6]. However, the existing literature mainly focuses on the effect of EMT on deglutition [11,12]. From this point of view, this study aims to assess and analyze the effect of EMT on the stomatognathic system.

METHOD

A power analysis with a 95% effect size and .10±.15 tolerance was performed based on a previous study [12]. It was found that each group should at least consist of 15 individuals. A total of 31 individuals were included in the study: 16 patients as the control and 15 as the study group. Due to the COVID-19 pandemic, patient participation in the control group was prioritized. Study group enrollment began after the control group's enrollment was completed.

Individuals were included in the study if their mini-mental test score was equal to 24 or above [13], their Fonseca questionnaire score was 20 points or above [14], their stroke onset period was between 3 months and 5 years, they were diagnosed with ischemic stroke, and they were 55 years of age or older. The following individuals were excluded from the study: patients who have dysphagia due to neurological or neurodegenerative diseases except for stroke, multiple stroke stories, head or neck cancer stories, abdominal or thoracic surgery stories, accompanying neurodegenerative disease or infection, lack of a lower or upper central incisor or lateral canine tooth, and lack of masticatory performance (Figure 1).

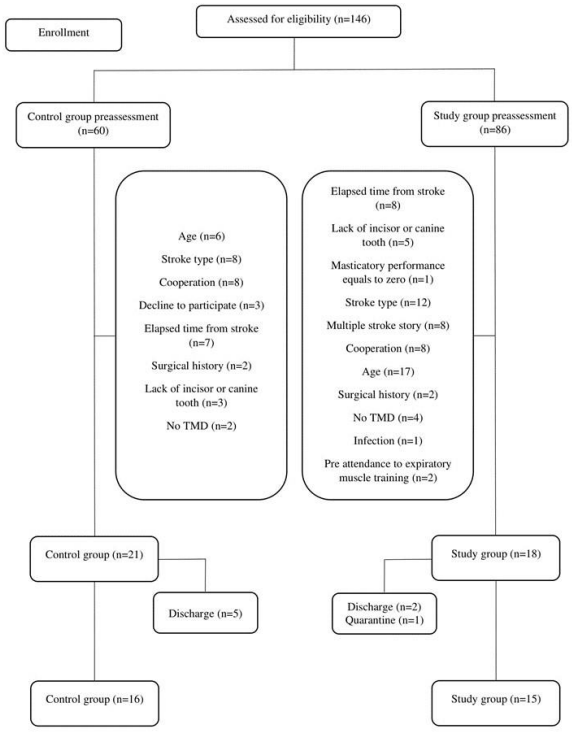

Figure 1. Study flow chart

Cognitive function, temporomandibular joint dysfunction (TMJD), TMJ range of motion, masticatory muscle pressure pain threshold, labial commissure and craniocervical angle, deglutition, masticatory performance, intraoral pH, deep neck flexor muscle endurance, and general oral health of the individuals were measured or assessed as described below.

The cognitive function of the individuals was assessed with a mini mental state examination test. The test consists of 11 items and five main areas: orientation, registration, attention and calculation, recall, and language. The total score of the test is 30 points. A total score of 24 or higher indicates no cognitive impairment [13].

The Fonseca Questionnaire was used for the assessment of TMJD. The Fonseca Questionnaire consists of ten questions. A higher total score in the questionnaire is directly proportional to the severity of the TMJD [14].

The TMJ range of motion was measured by a digital caliper. Individuals were asked to open their jaws as wide as possible for the depression motion, and then the central incisor distance was measured. Prior to lateral deviation measurement, the upper central incisor position relative to the lower central incisor was vertically marked with a biocompatible pen, and subsequently, individuals were asked to deviate their jaw as much as possible. When the deviation was achieved, a second drawing was performed. Then, the horizontal distance between the two markings was measured for one side's lateral deviation value. In protrusion motion measurement, individuals were asked to move their lower jaw as forward as possible, and then the horizontal space between the upper and lower incisors was measured [15]. The reference value for mandibular depression is 40 mm, for protrusion 6 mm, and for lateral deviation 8 mm [16].

An analogue algometer was used for pressure pain threshold measurement. The masticatory muscles' pressure pain threshold was measured bilaterally on the masseter and temporalis muscles. Four points were measured: two points in the masseter and two in the

temporalis. Measurements were repeated four times for each point starting from the masseter, with a 5-second interval between each measurement and 2 minutes between the completion of the first measurement of all areas [17].

The labial commissure angle was measured to evaluate central facial paralysis. The labial commissure angle was measured by a camera (Sony SLT- A35 16.2 megapixels) that had been secured on a tripod and was 1 m away while individuals were sitting on a chair. After individuals were positioned, photographs were taken without flashlight and printed in black and white in a 15 cm x 21 cm dimension. Bilateral chelions, glabella, and gnathion were marked, and drawings that combined the markings were made on the printed photograph. After that, the angle between these two drawings was measured with a protractor. The normal labial commissure angle is 90 degrees [18].

Head posture was assessed via craniocervical angle measurement. The craniocervical angle was measured while individuals were sitting on a chair with their heads in a natural position. The spinous process of the C7 was marked with a marker, and lateral photographs were taken by a camera (Sony SLT- A35 16.2 megapixels) and printed. The angle between the two drawings was measured with a protractor subsequently. The lower the angle, the higher the forward head posture [19].

Deglutition of the individuals was assessed with the repetitive saliva swallowing test. For the repetitive saliva swallowing test, individuals were asked to repeatedly swallow their saliva for 30 seconds. While individuals were performing the test, the number of swallows was determined with the finger positioned on the individual's hyoid bone. Values equal to or lower than two require further assessment [20].

The eating assessment tool was used for deglutition assessment. The eating assessment tool consists of 10 questions with zero-to-four-point scoring answers, and the maximum score is 40 points. The higher the total score, the higher the deglutition impairment [21].

In the sieve test that assesses masticatory performance, patients were asked to chew 20 times the pre-weighted 3 g peanut and then spit the chewed substance into a half-liter beaker. This procedure was repeated five times; after this, the substance was gathered in a beaker, stirred, and subsequently sifted through a sieve with ten mesh and 1700 µm openings. After sifting, the substance passed through the sieve, and the substance piled on the sieve was transferred to a 15-ml centrifuge tube separately. Then, both centrifuge tubes were placed in the centrifuge devices and centrifuged for 3 minutes at 1500 rpm. Both centrifuge tube volumes were calculated after the centrifuge process, after which the masticatory performance was calculated. The higher the percentage, the better the masticatory performance [22].

The intraoral pH value of the saliva was measured with a digital pH gauge (ADWA-ad12). Individuals were asked not to drink anything except water from the previous evening for the intraoral pH measurement. Samples were collected later that day between 08:00 and 12:00 a.m. Prior to saliva collection, patients were asked to rinse their mouths with water, and five minutes later, sample collection started. Patients were asked to empty the saliva ten times that had been gathered at a one-minute interval, and then intraoral pH was measured [23,24]. The average intraoral pH is 6.8 [24].

The deep neck flexor muscle endurance was assessed with an endurance test. While patients were in the supine position with their knees and hips flexed, referred to as the hook-lying position. Patients were asked to retract their chins as maximally as possible, then elevate their heads one inch and sustain in this position. One hand of the assessor was placed around the patient's neck. The chronometer was started and stopped when the patient's head touched the hand of the assessor. The longer the time, the greater the muscle endurance [25].

The individuals' oral health was evaluated with the general oral health assessment index. The general oral health assessment index consists of twelve questions assessing parameters such as mastication, deglutition, and dental integrity. A higher score correlates with higher general oral health loss. The total score of the index ranges from 12 points as the minimum score to 60 points as the maximum score [26].

Patients in both groups were enrolled in a one-hour daily conventional physiotherapy program during the study period. The conventional physiotherapy program consisted of electromuscular stimulation, neurophysiologic approaches including Brunnstrom and Bobath concepts, and exercises for lower and upper limb rehabilitation using proprioceptive neurorehabilitation techniques. Patients in the study group were further enrolled in the EMT home exercise program during the study period. EMT was applied with a Philips Respironics device. Patient-specific resistance was set via the perceived exertion scale at 13-15 points [27]. Devices were handed over to patients for daily use for three weeks after the proper resistance was set. Patients were asked to perform five sets of 10 repetitions in each test with a one-minute interval [28]. EMT was performed daily for three weeks. Compliance with the training was assessed via phone calls made twice a week [29].

Ethical Approval

This study was approved by the Bolu Abant İzzet Baysal University Clinical Research Ethics Committee (2020/54) and conducted at the İzzet Baysal Physical Therapy and Rehabilitation Training and Research Hospital. Prior to participation, individuals were verbally informed, and written consent was obtained from the participants.

Statistical Analysis

Data analysis was performed using the SPSS 22 program. Continuous variables were illustrated as average, standard deviation, and categorical variables as number and percentage. The normal distribution of the data was evaluated with the Shapiro-Wilk test. Whether or not the parametric assumptions were achieved, the independent sample t-test or Mann-Whitney U test was used for the independent group comparison, and the paired t-test or Wilcoxon signed-rank test was used for the dependent group comparison. Differences between the categorical variables were analyzed with the chi-square test. Statistically, the significance grade was determined as $p<0.05$.

RESULTS

Both groups' physical characteristics and demographic data were homogeneous (Table 1).

Table 1. Demographic data and physical characteristics of the patients

Characteristics	Control group		Study group		t	p
	Mean	SD	Mean	SD		
Age (year)	66.63	8.35	65.60	7.62	.356	.724
Height (cm)	166.38	8.59	168.20	8.78	-.585	.563
Weight (kg)	76.82	16.65	80.91	12.19	-.777	.444
BMI (kg/cm^2)	28.09	4.81	28.95	6.42	-.424	.675
Poststroke elapsed time (month)	13.00	15.82	14.80	13.16	-.343	.734

**p<0.05 independent t test; SD: Standard deviation.*

More than half of the patients had right-side stroke in both groups. Arteria cerebri media occlusion was in the foreground for both groups. Hypertension was highly observed in both groups. Antihypertensive and anticoagulant medication was 94% for the control group; for the study group, these percentages were 93% and 100%. Patients in both groups were at least in stage 3, according to the Brunnstrom stage of stroke recovery. Nearly half of the patients in the control group and more than half of the patients in the study group were in the chronic stage of the stroke. Most of the patients in the EMT group were fully compliant with the training (Table 2).

Table 2. Intergroup comparison of premorbid diseases and stroke characteristics

Characteristics		Control group		Study group		p
		n	%	n	%	
Impaired body side	Right	9	56	8	53	.870
	Left	7	44	7	47	
Affected artery	Cerebri media	15	94	10	66	.116
	Cerebri anterior	1	6	2	13	
	Cerebri posterior	-	-	3	21	
Poststroke elapsed time	6< months	7	44	3	20	.344
	≥6 months	9	56	12	80	
Hypertension	Yes	15	94	14	93	.962
	No	1	6	1	7	
Diabetes mellitus	Yes	9	56	5	33	.200
	No	7	44	10	67	
Brunnstrom stages (Upper limb)	Stage 3	13	82	8	54	
	Stage 4	1	6	3	20	
	Stage 5	1	6	3	20	
	Stage 6	1	6	1	6	
Brunnstrom stages (Lower limb)	Stage 3	9	56	3	20	
	Stage 4	4	25	8	53	
	Stage 5	3	19	4	27	
Compliance with EMT	Fully compliant	-	-	13	87	
	Partially compliant	-	-	1	6.5	
	Poorly compliant	-	-	1	6.5	

*Chi square test; *p<0.05.*

In intragroup comparison, a significant increase in pressure pain threshold of the left masseter and mandibular protrusion, a significant decline in the Fonseca Questionnaire score, and a significant improvement in the labial commissure angle were found in the control group, and a significant increase in mandibular depression of study group ($p<0.05$). Other assessed stomatognathic system parameters were similar in both groups (i.e., masticatory performance, intraoral pH) ($p>0.05$) (Table 3).

In intergroup analysis, a significant decrease was observed in the labial commissure angle in favor of the control group and a significant decrease in the eating assessment tool in favor of the study group ($p<0.05$) (Table 4).

Baseline values of depression, intraoral pH, labial and craniocervical angle, deep neck flexor muscle endurance, repetitive saliva swallow test, eating assessment tool, and general oral health assessment index were significantly different ($p<0.05$). Other assessed stomatognathic system parameters were similar in both groups (i.e., mastication, neck muscle endurance) ($p>0.05$). Because the first measurement values of the groups were different, an analysis of the difference between the first and last measurements was performed. As a result of this analysis, a significant difference was found in the right and left lateral deviation range of motions in favor of the study group ($p<0.05$). (Table 5).

DISCUSSION

The aim of this study was to assess the effect of expiratory muscle training on the stomatognathic system in patients with stroke. This study showed that EMT is a practical approach to increase mandibular lateral deviation and improve deglutition in patients with stroke.

A variety of studies report the exercise compliance of the Turkish population. In a study by Ay et al. [30] the exercise compliance rate of elderly patients with knee osteoarthritis was reported to be 62.5%. In our study, exercise compliance of patients with stroke with the EMT was high. This difference might result from exercise type and patients' symptoms.

Postural adaptations might cause alterations in mandibular condyle position. A study by Ohmure et al. [31] points out the effect of malposture (forward head posture) on mandibular condyle position. From this point of view, we hypothesized that placement of EMT to mouth might alter the mandibular condyle position, yet our hypothesis has been rejected. Considering the post-stroke elapsed time, the anterior tilt of the head turns into chronic malposture. For this reason, EMT may have fallen short in improving chronic malposture.

Passive stretching improves mandibular depression range of motion [32]. The effect of passive stretching on mandibular depression was characterized by increased mandibular depression, right and left lateral deviation range of motion in the study group. Although the range of motion of the control group was below the minimum reference values except for mandibular depression, significant improvement occurred in protrusion in the three weeks of follow-up. This might be the cumulative effect of the improvement in pressure pain threshold of the inferior portion of the left masseter and masticatory performance. Increased masticatory performance and pressure pain threshold of the inferior portion of the left masseter muscle might improve the protrusion by changing the muscular activity and functional improvement in the muscle fibers that play a role in protrusion.

A significant difference was observed in the right and left lateral deviation in the intergroup comparison of pretest and posttest values. This might be caused by increased lateral pterygoid muscle strength and coordination. Bilateral activation of the lateral pterygoid is required to place the EMT device in the mouth. The lateral pterygoid muscle also participates in contralateral deviation movements [5]. From this perspective, EMT may increase the lateral deviation.

Over the 3-week follow-up, except for the pressure pain threshold of the inferior portion of the left masseter, the pressure pain threshold of the masticatory muscles of the control group was similar. We believe that the improvement in the inferior portion of the left masseter pressure pain threshold is due to a significant decrease in the total score of the Fonseca Questionnaire.

It is stated that most of the disc displacement with reduction patients had no accompanying pain, which supports our claim [33]. The pressure pain threshold of the masticatory muscles following EMT was not improved. The type of TMJD probably played a significant role in this case. Most of the patients in our study had crepitation during mandibular depression movement, characterized by disc displacement with reduction. The effect of exercise on facial muscles is reported by Uchida et al., pointing out that exercise does not only affect the targeted muscle facial mimicry as well. The finding of Uchida et al. might be the factor for the improvement in the labial commissure angle of the control group in the three weeks of follow-up [34]. We believe this improvement might be caused by the patient's physiotherapy program and the individual exercises they perform in their free time.

Table 3. Intragroup comparison of the stomatognathic system component, functions, and questionnaires

Assessed parameters		Control group				Study group			
		First measurement	Second measurement	z	p	First measurement	Second measurement	z	p
Pressure pain threshold	Right temporalis anterior (kg/cm^2)	1.86 (1.56-2.56)	1.86 (1.66-2.60)	-.456	.648	2.3 (1.9-3.06)	2.3 (2-2.76)	-.178	.859
	Left temporalis anterior (kg/cm^2)	1.83 (1.6-2.5)	1.8 (1.7-2.63)	-.306	.759	2.3 (1.9-2.96)	2.33 (2-2.66)	-.867	.386
	Right temporalis middle (kg/cm^2)	1.91 (1.7-2.73)	1.95 (1.76-2.7)	-.223	.824	2.3 (2-3.16)	2.5 (2-2.86)	-.178	.859
	Left temporalis middle (kg/cm^2)	1.9 (1.7-2.7)	1.9 (1.8-2.73)	-.584	.559	2.3 (2-3.13)	2.43 (2-2.83)	-.446	.656
	Right masseter anterior (kg/cm^2)	1.3 (1.1-1.76)	1.3 (1.2-1.83)	-1.695	.090	1.5 (1.36-1.86)	1.5 (1.2-1.66)	-1.618	.106
	Left masseter anterior (kg/cm^2)	1.3 (1.1-1.8)	1.31 (1.2-1.8)	-1.873	.061	1.5 (1.13-1.83)	1.5 (1.1-1.66)	-1.643	.1
	Right masseter inferior (kg/cm^2)	1.24 (1.1-1.66)	1.3 (1.2-1.73)	-1.202	.229	1.4 (1.3-1.8)	1.46 (1.1-1.73)	-.867	.386
	Left masseter inferior (kg/cm^2)	1.2 (1.1-1.7)	1.3 (1.1-2.1)	-2.106	**.030***	1.5 (1.13-1.7)	1.46 (1.1-1.6)	-1.281	.2
	Depression (mm)	40.61 (31.71-55.00)	40.20 (31.44-54.88)	-.879	.379	41.42 (25.07-45.89)	42.39 (30.99-53.07)	-1.988	**.047***
Temporomandibular joint range of motion	Right lateral deviation (mm)	5.54±2.49	5.61±2.15	-.338	.740	7.44±2.04	8.09±2.34	-1.698	.113†
	Left lateral deviation (mm)	4.36 (2.99-10.23)	5.11 (3.26-9.21)	-.750	.453	7.11 (3.05-14.13)	7.37 (3.86-9.25)	-1.704	.088
	Protrusion (mm)	3.85 (1.48-9.77)	4.24 (2.02-11.76)	-2.301	**.021***	5.36 (2.21-7.66)	5.68 (3.85-7.82)	-.682	.496
Saliva pH	Intraoral pH	6.66±0.4	6.63±.34	.399	.696	6.45±.28	6.54±0.30	-1.296	.216
Mastication	Masticatory performance (%)	.13±.07	.16±.1	-1.424	.175	.24±.18	0.25±0.17	-.743	.470
Central facial paralysis	Labial commissure angle(º)	92 (89-98)	90.5 (89-95)	-2.521	**.012***	91 (83.5-93)	90 (85-92)	-1.842	.065
Head posture	Craniocervical angle (º)	29.09±11.95	30.53±11.95	-.490	.631	28.93±12.54	27.07±12.57	.838	.416
Neck muscle endurance	Deep neck flexor muscle endurance (s$^{-1)}$	27.12±11.58	27.92±10.58	-.657	.521	24.02±10.89	26.97±14.25	-1.533	.147
Deglutition	Repetitive saliva swallow test	2.5 (2-4)	3 (2-4)	-.816	.414	3 (2-6)	3 (2-6)	-1.300	.194
Temporomandibular joint dysfunction	Fonseca Questionnaire	20 (20-40)	20 (15-30)	-2.165	**.030***	25 (20-40)	25 (10-40)	-1.897	.058
Deglutition	Eating assessment tool	0 (0-5)	0 (0-5)	-1.30	.194	0 (0-6)	0 (0-4)	-1.414	.157
Oral health	General oral health assessment index	52 (34-53)	52 (34-53)	-1.00	.317	52 (46-52)	52 (46-52)	.000	1

**p<0.05; Wilcoxon signed-rank test; Paired samples t test.*

Table 4. Intergroup comparison of baseline and final values

Assessed parameters		Control group				Study group			
		First measurement	Second measurement	z	p	First measurement	Second measurement	z	p
Pressure pain threshold	Right temporalis anterior (kg/cm^2)	1.86 (1.56-2.56)	2.3 (1.9-3.06)	3.415	**<.001***	1.86 (1.66-2.60)	2.3 (2-2.76)	3.652	**<.001***
	Left temporalis anterior (kg/cm^2)	1.83 (1.6-2.5)	2.3 (1.9-2.96)	3.433	**<.001***	1.8 (1.7-2.63)	2.33 (2-2.66)	3.568	**<.001***
	Right temporalis middle (kg/cm^2)	1.91 (1.7-2.73)	2.3 (2-3.16)	3.113	**.002***	1.95 (1.76-2.7)	2.5 (2-2.86)	3.430	**<.001***
	Left temporalis middle (kg/cm^2)	1.9 (1.7-2.7)	2.3 (2-3.13)	3.053	**.002***	1.9 (1.8-2.73)	2.43 (2-2.83)	3.445	**<.001***
	Right masseter anterior (kg/cm^2)	1.3 (1.1-1.76)	1.5 (1.36-1.86)	3,909	**<.001***	1.3 (1.2-1.83)	1.5 (1.2-1.66)	3.150	**.002***
	Left masseter anterior (kg/cm^2)	1.29±.16	1.50±16	3.495	**.002***	1.31 (1.2-1.8)	1.5 (1.1-1.66)	3.107	**.002***
	Right masseter inferior (kg/cm^2)	1.24 (1.1-1.66)	1.4 (1.3-1.8)	3.660	**<.001***	1.3 (1.2-1.73)	1.46 (1.1-1.73)	3.262	**.001***
	Left masseter inferior (kg/cm^2)	1.2 (1.1-1.7)	1.5 (1.13-1.7)	3.540	**<.001***	1.3 (1.1-2.1)	1.46 (1.1-1.6)	2.777	**.005***
Temporomandibular joint range of motion	Depression (mm)	40.61 (31.71-55)	41.42 (25.07-45.89)	.004	.968	40.20 (31.44-54.88)	42.39 (30.99-53.07)	.474	.635
	Right lateral deviation (mm)	5.54±2.49	7.44±2.04	2.318	**.028***	5.61±2.15	8.09±2.34	3.077	**.005***
	Left lateral deviation (mm)	4.36 (2.99-10.23)	7.11 (3.05-14.13)	2.412	**.016***	5.11 (3.26-9.21)	7.37 (3.86-9.25)	1.996	**.046***
	Protrusion (mm)	3.85 (1.48-9.77)	5.36 (2.21-7.66)	2.016	**.044***	4.24 (2.02-11.76)	5.68 (3.85-7.82)	2.293	**.022***
Saliva pH	Intraoral pH	6.66±0.4	6.45±.28	1.640	.112	6.63±.34	6.54±0.30	.780	.441
Mastication	Masticatory performance (%)	.13±.07	.24±.18	2.108	**.049***	.16±.1	0.25±0.17	1.823	.079
Central facial paralysis	Labial commissure angle(º)	92 (89-98)	91 (83.5-93)	1.584	.113	90.5 (89-95)	90 (85-92)	2.165	**.030***
Head posture	Craniocervical angle (º)	29.09±11.95	28.93±12.54	.036	.971	30.53±11.95	27.07±12.57	.787	.438
Neck muscle endurance	Deep neck flexor muscle endurance ($s^{-1)}$	27.12±11.58	24.02±10.89	.766	.450	27.92±10.58	26.97±14.25	.211	.834
Deglutition	Repetitive saliva swallow test	2.5 (2-4)	3 (2-6)	1.059	.290	3 (2-4)	3 (2-6)	.715	.475
Temporomandibular joint dysfunction	Fonseca Questionnaire	20 (20-40)	25 (20-40)	1.981	**.048***	20 (15-30)	25 (10-40)	1.527	.127
Deglutition	Eating assessment tool	0 (0-5)	0 (0-6)	1.653	.098	0 (0-5)	0 (0-4)	2.162	**.031***
Oral health	General oral health assessment index	52 (34-53)	52 (46-52)	.000	1	52 (34-53)	52 (46-52)	.000	1

**p<0.05; Mann Whitney U test; Paired samples t test.*

Table 5. Comparison of pretest and posttest difference

Variables	Control group (Mean±standard deviation)	Study group (Mean±standard deviation)	u	p
Masticatory performance	.06±.06	.05±.03	.702	.488
Right temporalis anterior	.09±.09	.08±.11	-.763	.445
Right temporalis middle	.08±.09	.08±.11	-.385	.700
Right masseter anterior	.06±.07	.08±.07	-.721	.471
Right masseter inferior	.07±.05	.08±.07	1	1
Left temporalis anterior	.08±.09	.09±.11	-.061	.951
Left temporalis middle	.07±.06	.10±.09	-.707	.480
Left masseter anterior	.08±.08	.06±.07	-.748	.455
Left masseter inferior	.08±.06	.05±.07	-1.422	.155
Protrusion	.75±0.63	.93±.79	-.554	.580
Right lateral deviation	.61±.53	1.24±1.00	-2.162	**.042***
Left lateral deviation	.65±.76	1.45±1.24	-2.550	**.011***
Fonseca Questionnaire	3.44±3.97	4.33±6.51	-.087	.930

**p<0.05; Mann Whitney U test; Paired samples t test.*

Following EMT, the labial commissure angle was similar to the pretest value. We consider that this might be caused by the setting of the device's resistance in a patient-orientated, subjective manner. It is known that a portable expiratory pressure measurement device is used for setting the resistance of the EMT device [10].

Following the EMT, no improvement was seen in the craniocervical angle. This is because EMT did not achieve the desired effect, characterized by strengthening the muscles taking part in the malposture, specifically the anterior tilt of the head. It is mentioned that 20 minutes of steady position ends up with crepitation and recovers in double time [35]. From this point of view, the importance of timing and resistance setting of the EMT devices yields rehabilitation of the craniocervical component of the post-stroke developed malposture.

EMT is one of the preferred approaches for the rehabilitation of deglutition [11]. Following EMT, no change was observed in the repetitive saliva swallow test. This might be caused by the fact that EMT was not achieved to increase salivary synthesis by mechanical stimulation effect. It is known that mechanical stimulation results in an increased salivary flow rate [36]. Contrary to the repetitive saliva test, significant improvement was observed in the eating assessment inventory. This might be caused by the stimulation effect of the EMT device on the hyoid bone. The placement of an EMT device on the mouth resulted in hyoid elevation, according to a study by Wheeler-Hegland et al. [37].

The decline in masticatory performance following stroke was remarkable. From a shortened dental arc to orofacial dysfunction, many factors might play a role in the drastic value in the control group [38,39]. The high rate of prosthesis use and facial asymmetry in the control group might have reduced masticatory performance.

No improvement was observed in EMT aiming to improve masticatory performance by reducing the facial asymmetry rate and improving the perioral muscle strength and coordination. A similar masticatory performance was observed despite the reduction in facial asymmetry rate, pointing to the idea that the occlusal surface and dental prosthesis might be more effective on masticatory performance than the facial asymmetry rate.

It is known that mechanical stimulation results in an increased salivary flow rate [36]. From this point of view, we aimed to improve the intraoral pH by inducing mechanical stimulation by EMT. Similar intraoral pH values following EMT indicate that EMT may not be an option for intraoral pH regulation.

No improvement was observed after EMT, aiming to improve deep neck flexor muscle endurance by improving the craniocervical angle. We believe the similar craniocervical angle following the EMT is responsible for this. A negative correlation between deep neck flexor endurance and anterior tilt of the head supports our claim [40].

Limitations

The study's non-randomized nature due to the pandemic and inability to measure the maximal expiratory pressure value owing to the pandemic are the study's limitations.

CONCLUSION

Our study showed that EMT is effective when improvement was aimed in the TMJ range of motions especially for the right and left lateral deviation movements, improve deglutition, craniocervical posture, and other functions and structures of the stomatognathic system.

The effect of EMT on stomatognathic system structures and functions was assessed in detail. Although current studies exist related to the topic, our study is the first study that assesses the stomatognathic system structures and functions in a cumulatively.

Ethical Approval: *2020/54 Clinical Research Ethics Committee of Bolu Abant İzzet Baysal University*

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THE IMPORTANCE OF CLINICAL AND LABORATORY PARAMETERS OF BONE MARROW METASTASIS IN PATIENTS WITH SOLID MALIGNANCY-SINGLE CENTER EXPERIENCE

KEMİK İLİĞİ METASTAZI OLAN SOLİD MALİGNİTELİ HASTALARDA KLİNİK VE LABORATUVAR PARAMETRELERİNİN ÖNEMİ-TEK MERKEZ DENEYİMİ

Sevil Sadri*[1], Jamshid Hamdard[2], Hüseyin Saffet Bekoz[3], Aslı Çakır[4], Ömer Fatih Ölmez[2], Ahmet Bilici[2]

[1]Department of Hematology, Bursa City Hospital, Bursa, Türkiye
[2]Department of Internal Medicine, Oncology, Faculty of Medicine, İstanbul Medipol University, İstanbul, Türkiye
[3]Department of internnal Medicine, Hematology, Faculty of Medicine, İstanbul Medipol University, İstanbul, Türkiye
[4]Department of pathology Faculty of Medicine, İstanbul Medipol University, İstanbul, Türkiye

ABSTRACT

Objective: Bone marrow biopsy is an efficient and reliable diagnostic procedure for the identification of bone marrow involvement. In recent years, bone marrow examination has become more helpful in documenting the metastatic involvement of malignancies.

Method: Patients with solid tumors and anomalies in hematological parameters had their peripheral blood morphology examined at our facility. Each instance included information on the patient's peripheral blood counts, peripheral blood morphology, and prior therapies. The purpose of this study was to analyze bone marrow biopsy and aspiration for unexplained hematological abnormalities in solid cancer patients and to look into the pathological findings, clinical and hematological laboratory features, and outcomes of such patients in our facility. Additionally, we provided information on the treatment and prognosis of these patients.

Results: When compared to the group that had bone marrow biopsy involvement, the lower RDW-Cv value in the former group was shown to be statistically significant (p=0.005; p<0.01). It was determined that the difference between the fibrosis values of the groups with and without bone marrow biopsy involvement was statistically significant (p=0.016; p<0.05). It was determined to be statistically significant (p=0.002; p<0.01) that the LDH value of the group without bone marrow biopsy involvement was lower than that of the group with BM biopsy involvement. Anemia (p=0.028; p<0.05), bone metastases (p=0.001; p<0.01), bone marrow biopsy involvement in PET-CT (p=0.001; p<0.01), and peripheral smear results (p=0.001; p<0.01) all showed a statistically significant correlation.

Conclusion: In conclusion, bone marrow metastasis should be considered when inexplicable hematological abnormalities, particularly unexplained anemia, and elevated RDW and LDH parameters are found in clinical practice. A bone marrow biopsy is advised for a conclusive diagnosis.

Key Words: Solid Malignancy, Bone Marrow Biopsy, Metastasis

ÖZ

Amaç: Solid tümörlerde kemik iliği biyopsisi, kemik iliği tutulumunun tanısında etkili ve kesin bir tanı yöntemidir. Son yıllarda, kemik iliği incelemesi tümörlerin metastatik tutulumunu belgelemede giderek daha kullanışlı hale gelmiştir.

Yöntem: Merkezimizde solid malignitesi olan ve hematolojik parametrelerinde anormallikleri olan hastaların periferik kan morfolojisi değerlendirildi. Hasta özellikleri; periferik kan sayımları, periferik kan morfolojisi, önceki tedavilerini dahil edecek şekilde kaydedildi. Bu çalışmanın amacı; solid kanserli hastalarda açıklanamayan hematolojik anormallikler için kemik iliği biyopsisi ve aspirasyonunu incelemek, bu tür hastaların patolojik bulgularını, klinik ve hematolojik laboratuvar özelliklerini ve sonuçlarını kurumumuzda araştırmaktı. Ayrıca bu hastaların yönetimi ve sağkalımı ile ilgili detaylar bildirildi.

Bulgular: Kemik iliği biyopsi tutulumu olmayan grupta daha düşük RDW-Cv değeri, kemik iliği biyopsi tutulumu olan gruba göre istatistiksel olarak anlamlı bulundu (p=0,005; p<0.01). Kemik iliği biyopsisi tutulumu olmayan grubun fibrozis değerinin kemik iliği biyopsisi tutulumu olan gruba göre daha düşük olması istatistiksel olarak anlamlı bulundu (p=0.016; p<0.05). Kemik iliği biyopsi tutulumu olmayan grubun LDH değerinin kemik iliği biyopsi tutulumu olan gruba göre daha düşük olması istatistiksel olarak anlamlı bulundu (p=0,002; p<0.01). Kemik iliği biyopsi tutulumu ile periferik yayma bulguları (p=0.001; p<0.01), PET-BT'de kemik iliği tutulumu (p=0.001; p<0.01), anemi (p=0.028; p<0.05) ve kemik metastazı (p=0.001; p<0.01) arasında istatistiksel olarak anlamlı ilişki bulundu.

Sonuç: Bu çalışmanın sonucunda klinik pratikte açıklanamayan hematolojik anormallikler, özellikle açıklanamayan anemi ve yüksek RDW ve LDH parametreleri saptandığında kemik iliği metastazı şüphesi düşünülmeli ve kesin tanı için kemik iliği biyopsisi önerilmektedir.

Anahtar Kelimeler: Solid Tümör, Kemik İliği Biyopsi, Metastaz

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***Sorumlu yazar/Corresponding author:** Bursa City Hospital, Department of Hematology, Bursa, Türkiye
[1*]Email: sevilsadri@hotmail.com, [2]Email: jamshidhamdard@hotmail.com, [3]Email: drhsynbkz@gmail.com, [4]Email: acakir@medipol.edu.tr,
[5]Email: omerfatih.olmez@medipol.com.tr, [6]Email: ahmetknower@yahoo.com

INTRODUCTION

Bone marrow metastases are found in 0.2%-12% of patients with solid tumors. It is most common in adults with breast, prostate, stomach, and small cell lung malignancies as well as in pediatric patients with neuroblastoma or Ewing sarcoma [1,2]. Bone marrow metastasis is a relatively uncommon occurrence, although it typically has a quickly progressing clinical course and a short survival time, which can influence the therapeutic strategy [3]. For the initial diagnosis of bone marrow metastasis in cancer, radiologic examinations using positron emission tomography (PET-CT), magnetic resonance imaging (MR), and computed tomography are the most often utilized non-invasive techniques [4]. Additionally, although bone marrow involvement can be suspected based on radiological imaging, a bone marrow biopsy is advised for a conclusive diagnosis. A bone marrow biopsy is specifically carried out to look at hematological parameter anomalies. The relatively invasive nature of this process makes it more prudent to use it when other approaches raise red flags. Anemia, thrombocytopenia, leukocytosis, elevated serum lactate dehydrogenase (LDH), and leukoerythroblastic picture are just a few of the laboratory characteristics related to bone marrow metastasis that have been highlighted in the literature, but their diagnostic significance has not yet been fully established [5].

For the accurate and conclusive diagnosis of bone marrow involvement, a bone marrow biopsy is used [6]. Examining the bone marrow has shown to be more and more helpful recently in identifying cancers that have spread to other organs. It has been proven to be more sensitive than biopsy specimen aspirate for evaluation of bone marrow, cellular morphology, cellularity, and fibrosis [7].

The current study's objectives are to assess the results of bone marrow aspiration and biopsy for unexplained hematological abnormalities in solid cancer patients, as well as to look into the pathological findings, clinical features, and hematological laboratory results of such patients at our institution. We also provided information on the treatment and survival of these patients.

METHOD

In the retrospective study, bone marrow biopsy and/or aspirations which were followed up in the oncology department with the diagnosis of solid malignancy, performed by a hematologist at İstanbul Medipol University were evaluated retrospectively. A sample was obtained from unilateral posterior iliac crest using a Jamshidi needle and employing standard technique. Based on its clinical details and morphological features, the sample was routinely stained with hematoxylin and eosin, immunohistochemical staining was performed, and reticulin and other special stains were used as needed. Bone marrow aspirates and biopsies were carried out concurrently between January 2014 and 2023 using the methods previously described. It was observed that there were more tumor cells in the bone marrow smears than there were in the bone marrow biopsies. The incidence of fibrosis, new bone formation, and necrosis were assessed in the biopsy specimens. White blood cell and platelet abnormalities, leukoerythroblastosis, anemia, and radiographic signs of bone metastases were all examined in the instances. When circulating normoblasts and a predominance of immature forms in the granulocytic series were found in the peripheral blood smear, leukoerythroblastosis was thought to be present. Leukopenia and thrombocytopenia were deemed to be indicated by values below 4,000 cells/mm^3 and 120,000 platelets/mm^3, respectively. Following a few successive processes, the pathologist successfully reached a conclusive diagnosis of the patient's metastases from an unidentified initial disease: With the use of morphological observations and, if necessary, immunohistochemical stains, we first attempted to identify the cell line of differentiation, such as carcinoma, lymphoma, melanoma, sarcoma, or germ cell. Each patient's features, such as presenting symptoms, time from start of symptoms, physical exam results, peripheral blood counts, peripheral blood morphology, diagnostic assessment, care, and survival, were noted. The following information was gathered: patient demographics, primary tumor, Eastern Cooperative Oncology Group performance status (ECOG PS), sites of involvement at the time bone marrow metastases were found, use of systemic antitumor therapy, time since diagnosis of bone marrow metastases, most common abnormality indicating a bone marrow aspiration should be performed, and survival times.

At our facility, bone marrow biopsies were carried out to assess and record the anomalies in hematological parameters. Each case included information on the patient's peripheral blood counts, peripheral blood morphology, prior therapies, and survival.

Ethical Approval

The study was approved by the research Ethics Committee of İstanbul Medipol University. Decision code:10840098-772.02-E.49752 (Date: 24.09.2020)

Statistical Analysis

At the beginning of the study, a power analysis was not performed. Responses was started with 78 cases. At the end of the study, it was determined that the parameters examined in the power analysis were medium effect size (d=0.65) in the groups, and the power of study was above 80% according to the post hoc power analysis. NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) program was used for statistical analysis. While evaluating the study data, descriptive statistical methods were used (Mean, Standard Deviation, Median, Frequency, Rate, Minimum, Maximum) along with Mann-Whitney-U test for two-group comparison with non-normal data distribution. Chi-square analysis was used to identify the relationship among qualitative data. Significance was evaluated at levels of $p<0.01$ and $p<0.05$. Pre-study strength analysis was not done for the weaknesses of the study, but 80% power analysis made over the values in the values in the groups after the study parameters.

RESULTS

In the present study, a total of 78 patients underwent bone marrow biopsy (Table 1).

Table 1. Distribution by diagnosis

Diagnosis	n	%
Prostate	10	12.8
Gastric Carcinoma	7	9
Breast Cancer	19	24.4
Lung	13	16.7
Pancreas	2	2.6
Colorectal	5	6.4
Bladder	2	2.6
Testicle	2	2.6
Ovary	3	3.8
Salivary gland	1	1.3
Uterus	4	5.1
HCC	2	2.6
GBM	3	3.8
Skin SCC	1	1.3
Head-Neck	1	1.3
Kidney	1	1.3
Thymus	1	1.3
Neuroblastoma	1	1.3

The mean diagnosis age was found to be 53.92±13.8. Leukocyte value varied between 0.73 and 20.12 10^3 /µL and the mean value was found to be 6.67 x 10^3 /µL±4.63. The hemoglobin value ranged between 6.5 to 14.7 g/dL with a mean value of 9.4±1.9. The platelet value ranged between 8 and 752x10^3 µL with a mean value of 96.78±120.69. The LDH value ranged from 141 to 3573 U/L with a median value of 300 (Table 2).

Table 2. Measurement averages

Variables	Mean±SD	Min-Max (Median)
Diagnosis Age	53.92±13.8	21-92 (55)
WBC	6.67±4.63	0.73-20.12 (5.33)
Neutrophil	4.8±3.77	0.25-18.6 (3.64)
HGB	9.4±1.9	6.5-14.7 (9.05)
PLT	96.78±120.69	8-752 (54)
MPV	10.35±1.1	7.6-13.3 (10.35)
RDWCv	17.15±3.04	11.7-25.8 (16.75)
BM Involvement Percentage	33.18±40.07	0-100 (7.5)
Ret. Fibrosis	0.69±0.84	0-3 (1)
LDH	601.91±748.7	141-3573 (300)
Calcium	8.8±0.91	6.21-10.41 (8.9)
BM Involvement Follow-Up Time (Months)	4.41±3.76	0.5-15 (4)

In the patient group with bone marrow involvement (n:39), the percentage of bone marrow involvement was 5-100 (median 70).

Evaluation of the PET-CT results of the patients revealed that 74.4% (n=58) had bone marrow involvement in PET, while 25.6% (n=20) had not. When evaluating the metastases, 66.1% (n=39) had bone metastasis, 62.7% (n=37) lymph node, 42.4% (n=25) liver, 33.9% (n=20) lung, 15.3% (n=9) brain, 13.6% (n=8) adrenal and 11.9% (n=7) peritoneal had bone metastases (Table 3).

Table 3. Distribution by metastasis type

Metastasis Type	N	%
Bone	39	66.1
LAP	37	62.7
Lung	20	33.9
Liver	25	42.4
Brain	9	15.3
Peritoneum	7	11.9
Surrenal	8	13.6

Peripheral smear evaluation performed by a hematologist prior to bone marrow biopsy revealed 51.3% (n=40) to be normal, while 48.7% (n=38) had a leukoerythroblastic picture.

79.5% (n=62) of the patients did not have pancytopenia, while only 20.5% (n=16) were pancytopenic. When examining the bone marrow biopsy results, 50% (n=39) had biopsy involvement, while 50% (n=39) did not. In line with these results, 56.9% (n=41) of the patients continued with the current treatment, while there was a change of treatment in 43.1% (n=31). Considering the final status of the patients, 66.2% (n=51) were exitus, while only 33.8% (n=26) were alive.

The parameters of age at diagnosis, diagnosis of disease, gender, leukocyte, neutrophil, hemoglobin, thrombocyte and MPV calcium values, and follow-up period did not have a statistically significant difference according to bone marrow biopsy involvement (p>0.05). The lower RDW-Cv value in the group without bone marrow biopsy involvement was found to be statistically significant compared to the group with bone marrow biopsy involvement (p=0.005; p<0.01). The fact that the fibrosis value of the group without bone marrow biopsy involvement was lower than the group with bone marrow biopsy involvement was found to be statistically significant (p=0.016; p<0.05). The fact that the LDH value of the group without bone marrow biopsy involvement was lower than the group with BM biopsy involvement was found to be statistically significant (p=0.002; p<0.01) (Table 4).

Table 4. Comparison of measurements according to BM biopsy involvement

Variables	n		Mean±SD	Min-Max (M)	p
Diagnosis Age	No	39	52.79±15.59	21-92 (55)	0.596
	Yes	39	55.05±11.84	29-85 (55)	
WBC	No	39	6.44±5.33	0.73-20.12 (4.06)	0.146
	Yes	39	6.9±3.88	2.09-16.46 (6)	
Neutrophil	No	39	4.77±4.56	0.25-18.6 (2.87)	0.129
	Yes	39	4.83±2.82	1.33-10.92 (3.96)	
HGB	No	39	9.76±2.05	6.5-14.2 (9.2)	0.098
	Yes	39	9.04±1.7	6.7-14.7 (8.8)	
PLT	No	39	118.23±154.29	8-752 (58)	0.294
	Yes	39	75.33±69.05	16-340 (50)	
MPV	No	39	10.51±1.05	8.6-12.4 (10.6)	0.140
	Yes	39	10.18±1.13	7.6-13.3 (10.1)	
RDW-Cv	No	39	16.24±2.81	11.7-25.8 (15.6)	**0.005****
	Yes	39	18.05±3.02	11.9-23.9 (17.8)	
Reticulin Fibrosis	No	39	0.44±0.55	0-2 (0)	**0.016***
	Yes	39	1±1.02	0-3 (1)	
LDH	No	39	311.96±239.41	141-1209 (227)	**0.002****
	Yes	39	1062.41±1022.81	162-3573 (768)	
Calcium	No	39	8.76±0.94	6.21-10.32 (8.95)	0.980
	Yes	39	8.84±0.88	7.72-10.41 (8.8)	
Follow-Up Time (Months)	No	39	4.2±3.83	1-10 (3)	0.875
	Yes	39	4.44±3.81	0.5-15 (4)	

*Mann Whitney U Test; *p<0.05; **p<0.01; M: Median.*

A statistically significant relationship was found between bone marrow biopsy involvement and peripheral smear findings (p=0.001; p<0.01), bone marrow involvement in PET-CT (p=0.001; p<0.01), anemia (p=0.028; p<0.05) and bone metastasis (p=0.001; p<0.01) (Table 5).

There was no statistically significant relationship between bone marrow biopsy involvement and thrombocytopenia and whether the patient reached the final status (p>0.05) (Table 4).

Table 5. The relationship between BM biopsy involvement and findings

Variables		BM Biopsy Involvement		p
		No	Yes	
Peripheral Smear Findings	N	29 (74.4%)	11 (28.2%)	**0.001****
	L	10 (25.6%)	28 (71.8%)	
Treatment	TO	34 (94.4%)	7 (19.4%)	**0.001****
	CT	2 (5.6%)	29 (80.6%)	
PetBM Involvement	No	37(94.9%)	21 (53.8%)	**0.001****
	Yes	2 (5.1%)	18 (46.2%)	
Anemia	No	7 (17.9%)	1 (2.6%)	**0.028***
	Yes	32 (82.1%)	38 (97.4%)	
Neutropenia	No	24 (61.5%)	33 (84.6%)	**0.020***
	Yes	15 (38.5%)	6 (15.4%)	
Pancytopenia	No	27 (69.2%)	35 (89.7%)	**0.024***
	Yes	12 (30.8%)	4 (10.3%)	
Bone Metastasis	No	30 (76.9%)	9 (23.1%)	**0.001****
	Yes	9 (23.1%)	30 (76.9%)	

*N: Normal; L: Leukoerythroblastic; TO: Treatment Ongoing; CT: Change in Treatment; Chi-Square Test; **p<0.01.*

DISCUSSION

The authors of the current investigation examined the clinical laboratory characteristics of this patient population as well as the efficacy and prognostic importance of osteoporosis in patients with metastatic cancer. Bone marrow is a significant metastatic site for solid tumors, even if this is not particularly common. This increases the risk of cytopenia, which in turn raises the risk of bleeding and infection [8]. Though theoretically any solid tumor could spread to the bone marrow, the most frequent cancers that do so in humans are lung, prostate, and breast cancers. Parallel to our study the most common cancer types that metastasize were determined to be breast Ca (24.49%), lung Ca (16.7%), and prostate Ca (12.8%) in the current study [9-12].

Bone marrow metastasis is an indicator of poor prognosis. An easy and quick way to detect it is bone marrow aspiration and biopsy. In cases with suspected bone marrow metastasis, biopsy is recommended for diagnosis [13].

Leukoerythroblastic picture, cytopenia and high RDW value have been accepted as indicators for bone marrow metastasis [14,15]. In the present study, high RDW value (p=0.005) and leukoerythroblastic picture in peripheral smear (p=0.0001) were significant indicators of bone marrow involvement.

Although Aksoy et al. [16] stated that low MPV value was also significant for bone marrow involvement, MPV value was not found to be statistically significant in the present study (p>0.05).

In the previous studies, high LDH and alkaline phosphatase (ALP) values and hypoproteinemia levels are considered important markers for bone marrow metastasis [9,14,15]. In the present study, ALP and protein levels could not be measured; LDH values, however, were found to be statistically significantly higher in patients with bone marrow involvement (p=0.002; p<0.01).

Many publications state that there is a significant decrease in survival rates in patients with bone marrow involvement [17,18]. Although, in the present study, the authors did not find it to be statistically significant, a large percentage (73.7%) of those with bone marrow involvement died in a short span of time (p=0.172).

Numerous studies show that leukoerythroblastic picture and fibrosis are associated with bone marrow involvement [19-21]. Parallelly, in the present study, statistically significant reticulin fibrosis is more common in patients with bone marrow involvement (p=0.016).

In their study, Kopp et al. stated that all patients with bone marrow metastases also had bone metastases [22]. Similar to this, a research performed at an Indian cancer center documented 90 bone marrow procedures carried out in cases of probable bone marrow involvement in nonhematologic malignancies. The majority of malignancies that metastasis are malignant tiny round cell tumors (Ewing's sarcoma and rhabdomyosarcoma), followed by carcinoma of the breast and prostate in 16 out of 90 individuals. Only one case of clear cell RCC metastasized to the bone marrow [12]. The present study also revealed a significantly close relationship between bone marrow metastases and bone metastases. A statistically significant correlation was found between BM biopsy involvement and bone metastasis (p=0.001; p<0.01).

The invasion of highly vascularized bone marrow and the hematogenous dissemination of circulating tumor cells are both symptoms of bone marrow metastases (BMM). They appeared as the supression of hematopoietic function, including anemia, thrombocytopenia, and aberrant coagulation [23]. Anemia was the most common reason for a bone marrow test in our study. The majority of cases for which a bone marrow examination is indicated include anemia (34.4%), according to Katiyar et al [24]. Compared to studies by authors from the Indian subcontinent, such Katiyar, who found that megaloblastic anemia was the most prevalent diagnosis, accounting for 28.1% of cases [25].

Additionally, with recent improvements in technical methods, bone scanning with PET/CT has become more crucial in the diagnosis of bone marrow metastases. In the Zhou et al. investigation, a PET/CT scan of the bone marrow samples taken from 5 patients who had bone marrow involvement validated the diagnosis of metastasis [26]. In the current study, 25.6% (n=20) of the participants exhibited PET involvement, and BM biopsy participation and PET BM involvement were found to be significantly correlated (p=0.001; p<0.01). Bone marrow biopsy is still advised for patients who may change their treatment modality, despite the fact that it is not currently regularly advised. Hematological abnormalities in solid tumors may have several sources. In order to raise suspicion, identify, and expedite the diagnosis process of bone marrow involvement, specific parameters should be given importance.

Limitations

The present study had limitations because it was retrospective, covered a variety of illness groups, and only looked at a small number of individuals. A prospective study would be helpful in this area. However, more research is need to verify this conclusion in the present era.

CONCLUSION

As a result of the current study, it is advised to suspect bone marrow metastasis whenever unexplained hematological abnormalities in particular, unexplained anemia, high RDW, and LDH parameters are found in clinical practice. A bone marrow biopsy is also advised for a definitive diagnosis.

Ethical Approval: *2020/703 Non-interventional Clinical Research Ethics Committee of İstanbul Medipol University*

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DOĞUMDA İNDÜKSİYON UYGULANMA DURUMUNUN ACİL SEZARYEN DOĞUMA ETKİSİ

THE EFFECT OF INDUCTION OF LABOR ON EMERGENCY CESAREAN DELIVERY

Hilal Bal Şaraldı[1*], Pirozhan Ekin[1], Zekiye Karaçam[2]

[1]Aydın Kadın Doğum ve Çocuk Hastalıkları Hastanesi, Aydın, Türkiye

[2]Aydın Adnan Menderes Üniversitesi, Sağlık Bilimleri Fakültesi, Ebelik Bölümü, Aydın, Türkiye

ÖZ

Amaç: Bu araştırma doğumda indüksiyon uygulanma durumunun acil sezaryen doğuma etkisini ve ilişkili durumların belirlenmesi amacıyla yapıldı.

Yöntem: Araştırma analitik-kesitsel olarak Ocak-Aralık 2022 tarihleri arasında yapıldı. Araştırma evrenini, bir kamu hastanesinde miadında doğum yapan ve gelişigüzel örnekleme yöntemi ile belirlenen 350 kadın oluşturdu. Veriler Anket Formu ile toplandı ve tanımlayıcı istatistikler, Ki-kare testi ve Lojistik Regresyon ile analiz edildi.

Bulgular: Araştırmadaki kadınların %88.9'una doğum indüksiyonu uygulandığı, indüksiyon türlerinin %42.9 oranında amniyotomi, %10.6 oranında oksitosin, %8.9 oranında prostoglandin olduğu ve kadınların %18.9'una acil sezaryen uygulandığı bulundu. Çoklu lojistik regresyon analizinde, istatistiksel olarak anlamlı bir şekilde, prostoglandin uygulananlarda acil sezaryen doğum olasılığının 10.8 kat (OR= 10.825; p<0.001), gebelik haftasının 1.72 kat (OR= 1.718; p<0.001) artırdığı, ancak öğrenim düzeyi lise ve gelir düzeyi düşük olanlarda, gelir getiren işte çalışanlarda, gebeliğini isteyenlerde ve amniyon mayide mekonyum bulunanlarda prostoglandin uygulama olasılığının daha az olduğu saptandı. Yine, oksitosin uygulananlarda amniyon mayide mekonyum bulunma olasılığının 3.9 kat (OR= 3.947; p<0.001) ve postpartum kanama olasılığı 3.2 kat (OR=3.246; p=0.015) daha fazla iken, okur-yazar olan/olmayanlarda ve gebelik haftası daha düşük olanlarda daha az olduğu saptandı. İlave olarak ilkokul/ortaokul (OR= 0.234; p=0.001) ve lise (OR= 0.133; p<0.001) eğitim düzeyi, gelir düzeyi düşük (OR= 0.467; p=0.016), sağlık güvencesi (OR= 0.372; p=0.002) ve acil sezaryen (OR= 0.072; p=0.001) olanlar ve epizyotomi uygulananlarda (OR= 0.484; p=0.024) amniyotomi uygulanma olasılığının daha az olduğu belirlendi.

Sonuç: Bu araştırma indüksiyon uygulanma sıklığının oldukça yayın olduğu ve bu durumun acil sezaryen ihtimalini artırdığı sonuçlarını açığa çıkarmıştır. Doğuma indüksiyon ile müdahalelerin azaltılması yönünde ebelerin de iş birliği ile kurum sağlık politikaları oluşturularak intrapartum bakım hizmetlerinin kanıta dayalı uygulamalara göre yürütülmesi ile anne-bebek sağlığının gelişimine katkı sağlanabilir.

Anahtar Kelimeler: Doğum İndüksiyonu, Doğum, Anne-Yenidoğan Sağlığı, Sezaryen Doğum, Ebelik

ABSTRACT

Objective: This study was conducted to determine the effect of induction of labor on emergency cesarean delivery and related conditions.

Method: The study was conducted analytically cross-sectionally between January and December 2022. The study population consisted of 350 women who gave birth at term in a public hospital and were determined by random sampling method. Data were collected using a questionnaire and analyzed using descriptive statistics, Chi-square test and Logistic Regression.

Results: It was found that 88.9% of the women in the study underwent labor induction, 42.9% of the induction types were amniotomy, 10.6% were oxytocin, 8.9% were prostoglandin, and 18.9% of the women underwent emergency cesarean section. In multiple logistic regression analysis, it was found that the probability of emergency cesarean delivery increased 10.8 times (OR=10.825; p<0.001) and the gestational week increased 1.72 times (OR=1.718; p<0.001) in those who were administered prostoglandin, but the probability of prostoglandin administration was less in those with high school education and low income level, those with income-generating jobs, those who wanted their pregnancy and those with meconium in amniotic fluid. Again, the likelihood of meconium in amniotic fluid was 3.9 times higher (OR=3.947; p<0.001) and the likelihood of postpartum hemorrhage was 3.2 times higher (OR=3.246; p=0.015) in those who were administered oxytocin, whereas it was lower in those who were literate/illiterate and those with a lower gestational week. In addition, it was found to be lower in primary/middle school (OR= 0.234; p=0.001) and high school (OR= 0.133; p<0.001) educational level, low income (OR=0.467; p=0.016), health insurance (OR=0.372; p=0.002) and emergency cesarean section (OR=0.072; p=0.001) and those who underwent episiotomy (OR=0.484; p=0.024) were less likely to undergo amniotomy.

Conclusion: This study revealed that the frequency of induction of labor was highly broadcast and this increased the likelihood of emergency cesarean section. In order to reduce interventions with induction of labor, institutional health policies can be established with the cooperation of midwives and intrapartum care services can be carried out according to evidence-based practices and contribute to the development of mother-baby health.

Key Words: Induction of Labor, Delivery, Maternal-Newborn Health, Cesarean Delivery, Midwifery

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***Sorumlu yazar/Corresponding author:** Aydın Kadın Doğum ve Çocuk Hastalıkları Hastanesi, Aydın, Türkiye

[1*]Email: hilal_bal03@hotmail.com, [2]Email: pirozhan.ekin@gmail.com, [3]Email: zkaracam@adu.edu.tr

***Bu çalışma 27-30 Nisan 2023 tarihleri arasında Bolu'da gerçekleştirilen 6. Uluslararası Koru Gebelik Doğum ve Lohusalık Kongresi'nde sözel bildiri olarak sunulmuştur.*

GİRİŞ

Doğum eylemi fizyolojik bir süreçtir. Doğum eyleminin kendiliğinden başlamadan uterus kontraksiyonlarının iatrojenik olarak uyarılmasına doğum indüksiyonu denir [1,2]. Doğum indüksiyonu, doğum eylemi yeterli ilerlemediği, uterus kontraksiyonlarının sıklığının ve şiddetinin yeterli olmadığı ya da maternal veya fetal açıdan gebeliğin hızla sonlandırılması gerekli olduğu durumlarda kullanılmalıdır [3]. Doğum indüksiyonu mekanik ve farmakolojik yöntemlerle uygulanmaktadır [4]. Mekanik yöntemler arasında balon kateter yerleştirilmesi, ekstra amniyotik salin infüzyonu, membranların sıyrılması, amniyotomi ve higroskopik dilatörlerin kullanımı, farmakolojik yöntemler arasında da prostaglandinler (oral ve vajinal) ve oksitosin kullanımı yer almaktadır [5].

Doğum indüksiyonunun başarısını öngörmede ve servikal olgunlaşmayı sağlayan ajanların kullanılıp kullanılmaması kararını vermede, serviksin durumunu değerlendirmek önemlidir. Servikal olgunlaşmayı değerlendirmek için en sık modifiye Bishop skoru kullanılmaktadır [4]. Dünya Sağlık Örgütü (DSÖ) "Pozitif Doğum Rehberinde" anne ve fetüse ilişkin bir sorun yoksa servikal dilatasyon 5 cm olmadan doğum indüksiyonu uygulamasını önermemektedir [6]. Bishop skorunda servikal dilatasyon, efesman, fetal başın yüksekliği, serviksin pozisyonu ve kıvamı değerlendirilmektedir [7,8]. Bishop skorunun altı ve daha fazla olması doğum indüksiyonun etkinliğini artırmaktadır [6].

Doğum indüksiyonunda kullanılan farmakolojik yöntemler genellikle farklılık göstermektedir. Prostoglandin E2 servikal olgunlaşmayı sağlamak için doğum indüksiyon yöntemi olarak 38. gebelik haftasından sonra uygulanabilir. Prostoglandin E2 vajinal 2.5 mg ve servikal 1.5 mg uygulamalarından 6-12 saat sonra uygulama sonlandırılmalı ve uygulamayı sonlandırdıktan 30-60 dakika sonra, oksitosin infüzyonu başlanabilmektedir [9,10]. Ülkemizde genel olarak oksitosin, 500 cc %5 dekstroz içinde 5 veya 10 ünite olarak intravenöz infüzyon şeklinde uygulanmaktadır [1]. İnfüzyona dört damla ile başlanması tavsiye edilmektedir. Oksitosinin düzenli kontraksiyon oluşturma dozu 8-12 mU/dk' dır. Maksimum güvenli doz ise 20 mU/dk'dır [10]. Oksitosin başladıktan sonra sekiz saat içerisinde uterus kontraksiyonları başlamamışsa, uygulama sonlandırılır ve gebe 12 saat dinlendirildikten sonra tekrar başlanabilir [1,10].

Doğum indüksiyonu, doğumu başlatmak veya hızlandırmak için uygulandığında, bazen istenmeyen sonuçlara neden olabilmektedir [11,12]. Prostoglandin uygulamasında gebede mide bulantısı, kusma, ishal ve hipotansiyon belirti ve bulguları görülebilir. Oksitosin uygulamasında ise doğum süresinin uzaması, sezaryen doğum, doğum sonrası kanama, uterin hipersitimülasyonu, umblikal kord prolapsusu ve hipotansiyon görülebilmektedir [1]. Yine oksitosin uygulamasında yenidoğanda hipotansiyon, sıvı retansiyonu, hipotermi, taşikardi ve fetal enfeksiyon riski de artmaktadır. Yapılan bir çalışmada oksitosin uygulanan doğumlarda bebeklerin gelecek yaşantısında bipolar bozukluk ve dikkat dağınıklığı problemlerinin olma riskinin iki veya dört kat arttığı tespit edilmiştir [13]. Bu ciddi riskler nedeniyle indüksiyon uygulama kararının dikkatli verilmesi ve sürecin dikkatli şekilde yönetilmesi gerekmektedir.

Doğum indüksiyonunun dünyada tüm gebeliklerde %20 ile %30 oranında uygulandığı bilinmektedir. Gelişmiş ülkelerde gebelerin ortalama %30'una doğum indüksiyonu uygulanmakta ve dünya genelinde bu oranlar artmaktadır. Amerika Birleşik Devletleri'nde %23, İngiltere'de %34, Finlandiya'da %31.7 ve Afrika'da %10'dan daha az doğum indüksiyonu kullanımı olduğu bildirilmiştir [14-16]. Ülkemizde ise oksitosin uygulanma oranının %60-96, amniyotomi uygulanma oranının %67-78 ve vajinal prostaglandin uygulanma oranının da %12.6 olduğu rapor edilmiştir [17-19].

Doğumda indüksiyon uygulama kararı hekim tarafından verilmektedir. Ebeler indüksiyonu hekimin yazılı istemine uygun olarak uygulamakla yükümlüdürler. Ebe indüksiyonu uygulamadan önce Bishop skorunu değerlendirmeli, gebenin bilgilendirilmiş onamını almalı ve gebeyi rahatlatmalıdır [1,3]. Ayrıca uterin hiperstümülasyon riski nedeni ile 30 dakika ara ile gebe, fetüs ve uterin kasılmalar değerlendirilmelidir. Ebeler, indüksiyon uygulama esnasında fetal kalp hızını takip etmeli, fetal kalp hızında anormallik olduğunda, indüksiyon dozu azaltılmalı ya da kesilmeli, gebe sol tarafına döndürülmeli, oksijen verilmeli ve gerekirse intravenöz sıvı desteği yapılmalıdır [1,20].

İndüksiyon uygulaması, maternal-fetal mortalite ve morbitete oranlarını etkilediği için önemli bir konudur. Kanıta dayalı uygulamalar ve anne dostu hastane uygulamaları kapsamında doğumda indüksiyon uygulamalarının rutin olarak yapılmaması önerilmektedir [21]. Ancak ülkemizde indüksiyonun çok yayın olarak kullanıldığı bilinmekte ve gözlenmektedir [1]. Diğer yandan bu konu ile ilgili literatür incelendiğinde, yeterli ulusal veriye rastlanmamaktadır. Bu nedenle daha fazla ulusal veriye gereksinim duyulmuş ve bu çalışmanın yapılmasına karar verilmiştir.

Araştırmanın Amacı ve Soruları

Bu araştırmanın amacı doğumda indüksiyon uygulanma durumu, ilişkili durumlar ve indüksiyon yöntemlerinin acil sezaryen doğuma etkisini belirlemekti.

Araştırma Soruları:

1. Doğumda kullanılan indüksiyon yöntemleri, oranları ve ilişkili durumlar nedir?

2. Doğumda kullanılan indüksiyon yöntemlerinin acil sezaryen doğum oranlarına etkisi nedir?

YÖNTEM

Araştırmanın Türü

Bu çalışma analitik-kesitsel türde bir çalışmadır.

Araştırmanın Evreni ve Örneklemi

Çalışmanın evrenini Aydın Kadın Doğum ve Çocuk Hastalıkları Hastanesinde miadında doğum yapan kadınlar oluşturdu. Bu hastanenin yıllık doğum sayısı 3558'di. Örnekleme alınması gereken en az kadın sayısı, Pınar ve Karaçam'ın 2018 yılına ait çalışmasında bildirilen amniyotomi uygulanma oranı %67.1, indüksiyon uygulanma oranı %60.0 ve vajinal prostaglandin uygulanma oranı %12.6 verilerine dayalı olarak hesaplandı. Bu verilere dayalı olarak, örnekleme alınması gereken en az birey sayısı, evreni bilinen örneklem hesabı yöntemi ile her üç uygulama için ayrı ayrı hesaplandı. Buna göre en az olması gereken örneklem hacmi, %95 güven aralığında, n=3558 ile amniyotomi uygulaması için p=0.67, q=0.33, t=1.96 (α=0.05) alınarak yapılan hesaplamada 310, indüksiyon uygulaması için p=0.60, q=0.40, t=1.96 (α=0.05) alınarak yapılan hesaplamada 334 ve prostaglandin uygulaması için p=0.13, q=0.87, t=1.96 (α=0.05) alınarak yapılan hesaplamada 166 bulundu. Araştırmanın örneklemi en yüksek örneklem hacmi (334) ve olası vaka kayıpları dikkate alınarak, gelişi güzel örnekleme yöntemi (convenience sampling) ile 350 kadın dahil edildi. Araştırmaya dahil edilme kriterleri 18-45 yaş aralığında olmak, miadında vajinal doğum yapmak üzere travay takibine alınma ve çalışmaya katılmaya gönüllü olmak olarak belirlendi. Araştırmaya alınmama kriterleri Türkçe bilmemek ve konuşmamak, görüşmeyi engelleyebilecek düzeyde fiziksel ve ruhsal sağlık sorunu olmak, Covid-19 tanısı olmak, riskli ve yüksek riskli gebeliği olmak ve araştırmanın herhangi bir aşamasında araştırmadan çıkmak istemek olarak belirlendi. Çalışma sürecinde 12 kadın anket formunu tamamlamadığı için değerlendirmeye alınmadı.

Veri Toplama Araçları

Araştırma verileri, araştırmacılar tarafından ilgili literatüre dayalı olarak oluşturulan anket formu ile toplandı [4,11,19,22,23]. Anket formunda kadınların tanıtıcı özelliklerini sorgulayan, sosyo-demografik (yaş, eğitim düzeyi, eşin eğitim düzeyi, çalışma durumu, medeni durumu, sağlık güvencesi, ikamet yeri, algılanan gelir durumu) ve obstetrik özellikleri (gebelik, canlı doğum ve yaşayan çocuk

sayıları) sorgulayan 12 soru, doğumda uygulanan indüksiyon yönetimi ve sonuçlarını sorgulayan 19 soru (gebelik haftası, doğum şekli, sezaryen doğum gerekçesi, indüksiyon uygulanma durumu, uygulanan indüksiyon yöntemi, indüksiyon uygulamaya başlama ve bitiş saati, indüksiyon uygulanmasından doğuma kadar geçen süre, amnion mai özelliği, travayda uterus kontraksiyonlarının seyri, fetal kalp atımının (FKA) durumu, doğum sırasında anne ve bebeğin sağlık durumu, acil sezaryen kararı, anne ve bebeğin sevk edilme durumu, anne ve yenidoğanda doğum komplikasyonu gelişme durumu) yer aldı. Anket formunun kapsam geçerliğinin sağlanması için alanında uzman üç kişinin görüşü alındı.

Ön Uygulama

Çalışmaya dahil edilme kriterlerine uyan doğum yapan kadınlar ile anket formunun anlaşılabilirliği ve uygulanabilirliğini geliştirmek ve görüşmenin standardizasyonunu sağlamak için 10 kadına ön uygulama yapıldı. Ön uygulama sonuçlarına dayalı olarak üç soruda yeniden düzenleme yapıldı ve araştırmacıların ortak görüşü doğrultusunda anket formuna son şekli verildi. Ön uygulamada elde edilen veriler analize alınmadı.

Verilerin Toplanması

Verilerin toplanma aşamasında tanıtıcı bilgiler kadınlar ile yüz yüze görüşme yapılarak, indüksiyon uygulama yöntemlerine ilişkin bilgiler de hasta dosyası kayıtlarından elde edildi.

Etik Onay

Araştırmanın yapılabilmesi için Aydın Adnan Menderes Üniversitesi Sağlık Bilimleri Fakültesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu'ndan etik kurul izni alındı (12.11.2021 tarih ve E-15189967 sayılı karar yazısı). Ardından verilerin Aydın Kadın Doğum ve Çocuk Hastalıkları Hastanesi'nden toplanabilmesi için Aydın İl Sağlık Müdürlüğü'nden kurum izni alındı (19.01.2022 tarih ve E-44021967). Araştırma Helsinki deklarasyonuna uygun olarak yürütüldü. Araştırmaya katılmaya gönüllü olanlara araştırma hakkında bilgilendirme yapıldı ve sözel onamları alındı. Katılımcılara araştırma sırasında toplanan kişisel bilgilerinin araştırmacılar tarafından korunacağı ve araştırmadan istedikleri zaman ayrılabilecekleri bilgisi verildi.

İstatistiksel Analiz

Çalışmadan elde edilen veriler Statistical Package for Social Science (SPSS) 20 paket programı ile analiz edildi. Araştırmada istatistiksel değerlendirme için tanımlayıcı istatistikler Ki-kare testi ve Lojistik Regresyon Analizi kullanıldı. Çalışmada araştırmanın doğum indüksiyonu bağımlı değişkenlerinin her üçü (prostaglandin, okstosin, amniotomi) için de lojistik regresyon modeli oluşturuldu. Modelin bağımsız değişkenlerini yaş, eğitim durumu, gelir düzeyi, çalışma durumu, sağlık güvencesi, canlı doğum sayısı, gebeliğin planlanma durumu, gebeliğin istenme durumu, doğumun gerçekleştiği gebelik haftası, sezaryen doğum, amniyon mayide mekonyum bulunma durumu, postpartum kanama ve epizyotomi oluşturdu. Modelin bağımlı değişkenini ise prostoglandin, oksitosin ve indüksiyon uygulanma durumu oluşturdu. İstatistiksel olarak önemlilik için $p<0.05$ değeri anlamlı kabul edildi.

BULGULAR

Araştırmaya katılan kadınların yaş ortalamasının 27.05±5.65 (min-maks:18-42) ve çoğunun (%44.9) 18-25 yaş aralığında olduğu saptandı. Kadınların %49.4'ünün ilkokul/ortaokul ve %29.7'sinin lise mezunu oldukları belirlendi. Kadınların %55.2'si ilçede yaşadığını, %12.3'ü gelir getiren bir işte çalıştığını, %68.9'u gelirinin giderden az ve %64.6'sı sağlık güvencesinin var olduğunu bildirdi. Çalışmadaki kadınların %7.7'sinin resmi nikâhının olmadığı, %44.3'ünün 1-4 yıl ve %30.6'sının 5-9 yıllık evli oldukları saptandı (Tablo 1).

Tablo 1. Kadınların sosyo-demografik özellikleri ile ilgili veriler (n=350)

Özellikler		n (%)
Yaş (yıl), (27.05±5.65) (Min-Maks: 18-42)	18-25	157 (44.9)
	26-34	141 (40.3)
	35-42	52 (14.9)
Evlilik süresi (yıl), (6.08±4.49) (Min-Maks: 1-19)	1-4	155 (44.3)
	5-9	107 (30.6)
	10-19	88 (25.1)
Eğitim düzeyi	Okuryazar değil/ Okuryazar	35 (10.0)
	İlkokul / Ortaokul	173 (49.4)
	Lise	104 (29.7)
	Yükseköğrenim	38 (10.9)
Yaşanılan yer	Köy / kasaba / mahalle	46 (13.1)
	İlçe	193 (55.2)
	İl merkezi	46 (31.7)
Çalışma durumu	Çalışmıyor	307 (87.7)
	Çalışıyor	43 (12.3)
Algılanan gelir düzeyi	Gelir giderden az	241 (68.9)
	Gelir gidere denk	90 (25.7)
	Gelir giderden fazla	19 (5.4)
Sağlık güvencesi	Yok	124 (35.4)
	Var	226 (64.6)
Evlilik durumu	Resmi nikah yok	27 (7.7)
	Resmi nikah var	323 (92.3)

Kadınların obstetrik özellikleri incelendiğinde, %26.3'ünün ilk gebeliğinin olduğu, %36.6'sının 4-7 canlı doğum yaptığı, %53.4'ünün 2-3 yaşayan çocuğunun olduğu ve %18.6'sının (n=65) kendiliğinden düşük öyküsünün bulunduğu saptandı. Ayrıca kadınların %5.1'inin (n=18) küretaj olduğu ve %0.9'unun (n=3) ölü doğum yaptığı belirlendi. Çalışmaya katılan kadınların %39.4'ü en son gebeliklerini planlanmadıklarını ve %10.0'ı istemediklerini ifade etti. Kadınların %98.3'ü 37-41 gebelik haftaları arasında doğum yapmıştı (Tablo 2).

Araştırmaya katılan kadınların %18.9'u sezaryen ile doğum yapmıştı. Sezaryen doğum yapan kadınların en sık karşılaştıkları sezaryen endikasyonlarınının fetal distres (%37.8), ilerlemeyen travay (%28.7) ve baş-pelvis uygunsuzluğu (%13.5) olduğu görüldü (Tablo 3).

Bu çalışmada kadınların %88.9'una doğum indüksiyonu uygulandığı, kullanılan indüksiyon yöntemlerinin %42.9 oranında amniyotomi, %15.5 oranında amniyotomi ve oksitosin, %10.6 oranında oksitosin ve %8.9 oranında da prostoglandin olduğu saptandı. Kadınların yaklaşık üçte birine (%29.2; n=91/311) iki ve daha fazla indüksiyon yöntemi uygulanmıştı. Çalışmadaki oksitosin uygulanan kadınların %51.2'sinde uygulama süresinin 1-3 saat ve prostoglandin uygulananların %50.8'inde uygulama süresinin 4-12 saat olduğu tespit edildi (Tablo 3).

Kadınların %7.7'sinde amniyon mayisinin mekonyumlu olduğu saptandı. Çalışmada 7≤APGAR skoru olan yenidoğan olduğu bildirilmemişti. Ancak bebeklerin %3.4 (n=12)'ünde travay sürecinde fetal distres gözlendiği ve %3.7 (n=13)'sinin yenidoğan yoğun bakım ünitesine alındığı bulundu. Ayrıca kadınların %5.4'ünde postpartum kanama gözlendiği ve vajinal doğum yapan kadınların %33.5'ine epizyotomi uygulandığı tespit edildi (Tablo 3).

Tablo 2. Kadınların obstetrik özellikleri (n=350)

Özellikler		n (%)
Gebelik sayısı (2.63±1.55) (Min-Maks:1-11)	1	92 (26.3)
	2-3	99 (28.3)
	4-11	159 (45.4)
Canlı doğum sayısı (2.26±1.25) (Min-Maks: 1-7)	1	115 (32.8)
	2-3	107 (30.6)
	4-7	128 (36.6)
Yaşayan çocuk sayısı (2.26±1.25) (Min-Maks: 1-7)	1	115 (32.9)
	2-3	187 (53.4)
	4-7	48 (13.7)
Kendiliğinden düşük (Min-Maks: 0-3)	Yok	285 (81.4)
	Var	65 (18.6)
Küretaj (Min-Maks: 0-5)	Yok	332 (94.9)
	Var	18 (5.1)
Ölü doğum (Min-Maks: 0-2)	Yok	347 (99.1)
	Var	3 (0.9)
Gebeliğin planlanmış olma durumu (n=350)	Planlanmamış	138 (39.4)
	Planlanmış	212 (60.6)
Gebeliğin istenme durumu (n=350)	İstenmiyor	35 (10.0)
	İsteniyor	315 (90.0)
Doğumdaki gebelik haftası (39±1.21) (Min-Maks:36-41)	36 hafta	6 (1.7)
	37-41	344 (98.3)

Çalışmaya katılan kadınların bazı özelliklerinin indüksiyon uygulanma durumuna göre dağılımı incelendiğinde, kadınların yaş grubu, gebelik ve doğum sayıları, gebeliğini planlı olma durumları bakımından indüksiyon uygulanan ve uygulanmayan kadınların benzer özellikte oldukları saptandı. Acil sezaryen olan kadınların %77.3'üne ve vajinal doğum yapan kadınların %91.3'üne indüksiyon uygulandığı ve bu farkın istatistiksel olarak anlamlı olduğu tespit edildi (χ^2=11.02; p<0.01). Ayrıca çalışmada gebeliğini istemeyen kadınların tamamına (n=35), fetal deselerasyon görülenlerin %75'ine ve bebeği yenidoğan yoğun bakım ünitesine alınan kadınların hepsine (n=13) doğum indüksiyonu uygulandığı bulundu. Yine indüksiyon uygulanan kadınların %87.6'sına epizyotomi uygulandığı ve postpartum kanama görülenlerin tamamına (%6.1; n=19) doğum indüksiyonu uygulandığı belirlendi (Tablo 4).

Çalışmada yapılan çoklu lojistik regresyon analizinde, istatistiksel olarak anlamlı bir şekilde lise eğitim ve düşük gelir düzeyinde olanlarda, gelir getiren işte çalışanlarda, gebeliğini isteyenlerde ve amniyon mayide mekonyum bulunanlarda prostoglandin uygulama olasılığının daha az olduğu saptandı. Ancak prostoglandin uygulananlarda acil sezaryen doğum olasılığının 10.8 kat (OR= 10825; p<0.001) ve gebelik haftasının 1.72 kat (OR=1.718; p<0.001) artırdığı bulundu. Yine regresyon analizi, oksitosin uygulananlarda amniyon mayide mekonyum bulunma olasılığının 3.9 kat (OR=3.947; p<0.001), postpartum kanama olasılığının 3.2 kat (OR=3.246; p=0.015) daha fazla olduğunu ve bu sonuçların istatistiksel olarak anlamlı olduğunu gösterdi. Ancak oksitosin uygulama olasılığının okur-yazar olan/olmayan eğitim düzeyine sahip kadınlarda (OR=0.327; p=0.033) ve gebelik haftası daha düşük olanlarda (OR=0.768; p=0.012) daha az olduğu saptandı (Tablo 5). İlave olarak ilkokul/ortaokul (OR=0.234; p<0.001) ve lise (OR=0.133; p<0.001) eğitiminde, gelir düzeyi düşük (OR=0.467; p=0.016) ve sağlık güvencesi (OR=0.372; p=0.002) ve acil sezaryen (OR=0.072; p<0.001) olanlar ile epizyotomi uygulananlarda (OR=0.484; p=0.024) amniyotomi uygulanma olasılığının daha az olduğu belirlendi (Tablo 5).

Tablo 3. Kadınların doğuma ilişkin özellikleri (n=350)

Özellikler		n(%)
Doğum şekli	Normal doğum	284 (81.1)
	Sezaryen doğum (travay sürecinde sezaryen kararı alınanlar)	66 (18.9)
Sezaryen endikasyonları (n=66)	Fetal distres	25 (37.8)
	İlerlemeyen travay	19 (28.7)
	Baş-pelvis uygunsuzluğu	9 (13.5)
	Oligohidroamnios	5 (7.5)
	Makrozomi	3 (4.5)
	İlerlemeyen travay/ fetal distres	3 (4.5)
	Makat geliş	2 (3.0)
Doğum indüksiyonu uygulanma durumu	Hayır	39 (11.1)
	Evet	311 (88.9)
Uygulanan indüksiyon yöntemleri (n=311)	Amniyotomi	152 (42.9)
	Oksitosin	37 (10.6)
	Prostoglandin	31 (8.9)
	Amniyotomi ve oksitosin	55 (15.7)
	Amniyotomi ve prostoglandin	27 (7.7)
	Oksitosin ve prostoglandin	2 (0.6)
	Amniyotomi, oksitosin ve prostoglandin	7 (2.0)
Prostoglandin uygulanma süresi	35-59 dakika	5 (7.4)
	1-3 saat	28 (41.8)
	4-12 saat	34 (50.8)
Oksitosin uygulanma süresi	7-59 dakika	25 (25.5)
	1-3 saat	50 (51.0)
	4-10 saat	23 (23.5)
Oksitosin miktarı (ünite / 500 cc)	5 ünite	20 (20.2)
	10 ünite	79 (79.8)
	Belirtilmemiş	36 (35.7)
Oksitosin damla sayısı / başlangıç ve devam dozları	4-6 gut/dk	12 (11.9)
	6-8 gut/dk	17 (16.8)
	10 gut/dk	36 (35.6)
İndüksiyon uygulamasından doğuma kadar geçen süre	1-59 dakika	131 (44.7)
	1-3 saat	101 (34.5)
	4-12.5 saat	61 (20.8)
Amniyon mayi özelliği (n= 350)	Berrak	323 (92.3)
	Mekonyumlu	27 (7.7)
Doğum sırası ve sonrasında bebek sağlığına ilişkin bilgiler	1. dakika ≤ 7 APGAR olan	0 (0.0)
	5. dakika ≤ 7 APGAR	0 (0.0)
	Yenidoğanın yoğun bakıma kabulü	13 (3.7)
	Travayda fetal distres	12 (3.4)
Postpartum kanama durumu (n=350)	Hayır	331 (94.6)
	Evet	19 (5.4)
Epizyotomi uygulanma durumu*	Yok	189 (66.5)*
	Var	95 (33.5)*

**Normal doğum yapan 284 kadın üzerinden hesaplanmıştır.*

Tablo 4. Kadınlara ilişkin bazı verilerin doğumda indüksiyon uygulanma durumuna göre dağılımı (n=350)

Veriler		Doğum İndüksiyonu Uygulanma Durumu n (%)		χ^2-p
		Hayır	Evet	
Yaş	18-25	22 (56.4)	135 (43.4)	$\chi2$= 3.03 p=0.22
	26-35	14 (35.9)	127 (40.8)	
	36-42	3 (7.7)	49 (15.8)	
Gebelik sayısı	1	15 (38.5)	77 (24.8)	χ^2= 5.73 p=0.05
	2	13 (33.3)	86 (27.7)	
	3-11	11 (28.2)	148 (47.6)	
Canlı doğum sayısı	1	16 (41.0)	99 (31.8)	χ^2=8.71 p=0.01
	2	17 (43.6)	90 (28.9)	
	3-7	6 (15.4)	122 (39.2)	
Planlı gebelik	Evet	23 (59.0)	189 (60.8)	χ^2= 0.04
	Hayır	16 (41.0)	122 (39.2)	p=0.82
İstenen gebelik	Evet	39 (100.0)	276 (88.7)	χ^2=4.87
	Hayır	0 (0.0)	35 (11.3)	p=0.02
Doğum şekli	Normal doğum	24 (61.5)	260 (83.6)	χ^2=11.02
	Acil sezaryen doğum	15 (38.5)	51 (16.4)	p<0.01
Doğum haftası	36 hafta	0 (0.0)	6 (1.9)	χ^2=0.76
	37- 41 hafta	39 (100.0)	305 (98.1)	p=0.38
Fetal distres	Hayır	36 (92.3)	302 (97.1)	χ^2=2.41
	Evet	3 (7.7)	9 (2.9)	p=0.12
Amniyon	Berrak	42 (100.0)	281 (91.2)	χ^2=11.02
	Mekonyumlu	0 (0.0)	27 (8.8)	p<0.01
Yenidoğanın yoğun bakıma kabulü	Hayır	39 (100.0)	298 (95.8)	χ^2=1.69
	Evet	0 (0.0)	13 (4.2)	p=0.19
Epizyotomi	Olan	17 (100.0)	78 (87.6)	χ^2=2.34
	Olmayan	0 (0.0)	11 (12.4)	p=0.12
Postpartum kanama	Olan	0 (0.0)	19 (6.1)	χ^2=2.51
	Olmayan	39 (100.0)	292 (93.9)	p=0.11

TARTIŞMA

Bu bölümde, doğumda indüksiyon uygulanma durumu, ilişkili durumlar ve acil sezaryen doğuma etkisinin incelenmesi amacıyla, doğum salonuna kabul edilen toplam 350 kadın ile yapılan çalışmadan elde edilen bulguların ilgili literatüre dayalı olarak tartışması sunuldu.

Çalışmada başlıca doğum yapan kadınların çok büyük bir bölümüne oksitosin, prostoglandin ve amniyotomi yöntemlerinden biri ya da birden fazlası ile müdahale edildiği ve bu müdahalelerin birçok değişken ve acil sezaryen ile ilişkili olduğu sonuçları elde edildi.

Bu sonuçlar, doğum sürecinde gebelere sunulan tedavi, bakım ve takip hizmetleri ile doğum komplikasyonlarını azaltma, sezaryen doğum oranlarını ve doğum hizmetlerinin sunumundaki iş yükü ve maliyeti iyileştirmeye katkı sağlayabilir.

Bu çalışmada doğum sürecindeki kadınların büyük bir bölümüne (%88.9) doğum indüksiyonu uygulandığı saptandı. McCarthy ve ark. 2022 yılında yaptığı bir çalışmada parite dikkate alınmaksızın doğuma katılan kadınların yaklaşık yarısına (%51.2) doğum indüksiyonu yapıldığını belirtmiştir [24]. Yine Çin (%14.2), Etiyopya (%20.4), İzlanda (%23.9), Amerika (%31.37) ve Avusturalya (%30.9)'da yapılan benzer çalışmalarda, bizim çalışmamızın aksine daha düşük oranlarda doğum indüksiyonu uygulandığı bildirilmiştir [25-29]. Bu sonuç ülkemizde doğum indüksiyonunun, kanıta dayalı uygulamaların ve diğer ülke sonuçlarının aksine yaygın biçimde kullanıldığını göstermesi bakımından önemlidir.

Bu çalışmada en çok kullanılan doğum indüksiyon yöntemlerinin sırasıyla amniyotomi, amniyotomi ve oksitosinin birlikte kullanılması, oksitosin ve prostoglandin olduğu bulundu. Bu konuda yapılan bir çalışmada doğum sürecindeki kadınların dörtte birinden fazlasına üçten fazla farklı doğum indüksiyon yöntemi ile müdahale edildiği bildirilmiştir [24]. Zhu ve ark. (2022) ise bizim çalışmamızdan farklı olarak en yaygın kullanılan doğum indüsiyonu yönteminin oksitosin olduğunu ve bunu amniyotominin izlediğini bildirmişlerdir. Yine bu çalışmada gebelere prostoglandinin daha az kullanıldığı rapor edilmiştir [25]. Bir başka çalışmada yaygın olarak sadece oksitosin infüzyonu uygulandığı ve ikinci sırada oksitosin ile birlikte amniyotominin kullanıldığı rapor edilmiştir [30]. Bu sonuçlar hekim tercihleri, hastane politikaları, yönteme erişim ve uygulama kolaylığı ile ilişkili olabilir.

Bu çalışmada kadınların büyük çoğunluğunda amniyotik mayinin berrak olduğu, vajinal doğum yapanların yaklaşık üçte birine epizyotomi uygulandığı ve bazı kadınlarda postpartum kanama görüldüğü saptandı. Yine çalışmamızda oksitosin uygulamasının amniyotik mayide mekonyum görülme ve postpartum kanama olasılığını artırdığı, prostoglandin uygulamasının amniyotik mayide mekonyum görülme olasılığını azalttığı, amniyotomi uygulamasının da epizyotomi uygulanma olasılığını azalttığı belirlendi. Bu konuda yapılan bir çalışmada da yıllar içinde doğum indüksiyon kullanım oranları arttıkça mekonyumlu amniyotik mayi, epizyotomi ve postpartum kanama görülme sıklığının artığı bildirilmiştir [31]. Bir diğer çalışmada ise indüksiyon ile başlayan doğumlarda, kendiliğinden başlayan doğumlara göre ciddi doğum sonu kanama insidansının daha yüksek olduğu rapor edilmiştir [32]. Başka bir çalışmada da oksitosin kullanımının epizyotomi uygulamasını artırdığı belirtilmiştir [33]. Yapılan başka bir çalışmada da doğum indüksiyonu uygulananlarda en sık görülen komplikasyonların sırası ile doğum sonu kanama ve perineal travma olduğu bildirilmiştir [26]. Bu sonuçlar indüksiyon uygulamalarının bazı olumsuz maternal ve fetal sağlık sonuçları ile ilişkili olduğunu göstermesi bakımından değerlidir.

Çalışmamızda acil sezaryen olan kadınların büyük çoğunluğuna, istenmeyen gebeliği olan kadınların tamamına, fetal distres görülen gebelerin dörtte üçüne ve yenidoğan yoğun bakım ünitesine alınan bebeklerin annelerinin tamamına doğum sürecinde indüksiyon uygulandığı saptandı. Yapılan bir çalışmada, çalışmamızdaki sonuçlara benzer şekilde doğum indüksiyonu kullanım oranı artıkça yenidoğan yoğun bakım ünitesine kabul oranlarının arttığı, ancak acil sezaryen doğumla ilişkili olmadığı bildirilmiştir [34]. Yine bu çalışma sonuçlarına benzer şekilde, diğer çalışmalarda da doğum indüksiyonu uygulanan gebelerin uygulanmayanlara göre acil sezaryene alınma oranlarının daha yüksek olduğu bildirilmiştir [26,35]. Bu sonuçlar artan sezaryen oranları ile anne-bebek sağlığı açısından indüksiyon uygulamalarının sorgulanması ve tekrar değerlendirilmesi gerekliliğini göstermektedir.

Yapılan bir çalışmada, çalışmamızdaki sonuçlara benzer şekilde doğum indüksiyonu kullanım oranı artıkça yenidoğan yoğun bakım ünitesine kabul oranlarının arttığı, ancak acil sezaryen doğumla ilişkili olmadığı bildirilmiştir [34]. Yine bu çalışma sonuçlarına benzer şekilde, diğer çalışmalarda da doğum indüksiyonu uygulanan gebelerin uygulanmayanlara göre acil sezaryene alınma oranlarının daha yüksek olduğu bildirilmiştir [26,35].

Bu çalışmada acil sezaryen olma olasılığının prostoglandin uygulananlarda daha fazla iken amniyotomi uygulananlarda daha az olduğu saptandı. Ülkemizde yapılan bir diğer çalışmada prostoglandin ile doğumuna müdahale edilen gebelerin sezaryen ile doğum yapma olasılığının oksitosine göre daha fazla olduğu rapor edilmiştir [36]. Nijerya Enugu'da yapılan bir çalışmada ise amniyotominin acil sezaryen doğum insidansını arttırmadığı bildirilmiştir [37].

Tablo 5. Kadınlara doğumda prostaglandin, oksitosin, amniyotomi ve acil sezaryen uygulama durumları ile ilgili regresyon bulguları

Değişkenler		Unstandardized B	S.E	Wald	p	Exp (B)	%95 güven aralığı	
							Alt	Üst
Prostaglandin uygulaması ile ilişkili faktörler	Lise düzeyi eğitim †	-1.403	0.425	10.901	.001	0.246	0.107	0.565
	Düşük gelir düzeyi †	-0.716	0.334	4.591	.032	0.489	0.254	0.941
	Çalışma†	-1.582	0.613	6.670	.010	0.206	0.062	0.683
	Gebelik haftası	0.541	0.136	15.824	<.001	1.718	1.316	2.244
	Acil sezaryen†	2.382	0.379	39.485	<.001	10.825	5.150	22.750
	Mekonyum†	-1.727	0.835	4.280	.039	0.178	0.035	0.913
	İstenmeyen gebelik†	-0.899	0.469	3.679	.055	0.407	0.163	1.020
Oksitosin uygulaması ile ilişkili faktörler	Okur-yazar olan / olmayan†	-1.117	0.523	4.565	.033	0.327	0.117	0.912
	Gebelik haftası†	-0.263	0.105	6.346	.012	0.768	0.626	0.943
	Mekonyum†	1.373	0.440	9.716	.002	3.947	1.665	9.356
	Postpartum kanama†	1.177	0.484	5.906	.015	3.246	1.256	8.389
Amniyotomi uygulaması ile ilişkili faktörler	İlkokul/ortaokul düzeyi eğitim†	-1.454	0.455	10.216	.001	0.234	0.096	0.570
	Lise düzeyi eğitim †	-2.019	0.472	18.320	<.001	0.133	0.053	0.335
	Düşük gelir düzeyi †	-0.762	0.315	5.849	.016	0.467	0.252	0.866
	Sağlık güvencesi solma	-0.990	0.327	9.154	.002	0.372	0.196	0.706
	Acil sezaryen†	-2.636	0.380	48.171	<.001	0.072	0.034	0.151
	Epizyotomi uygulanma†	-0.725	0.320	5.125	.024	0.484	0.259	0.907

†Dummy kodlama: olan=1. olmayan=0; Prostoglandin için Cox & Snell R Square=0.216 ve Nagelkerke R Square=0.340; Oksitosin için Cox & Snell R Square=0.066 ve Nagelkerke R Square=0.094; Amniyotomi için Cox & Snell R Square=0.245; Nagelkerke R Square=0.346.

Yapılan bir sistematik derleme ve meta-analizde de erken uygulanan amniyotominin acil sezaryen oranlarını artırdığı, ancak servikal olgunlaşmanın gerçekleşmesinden sonra rutin uygulanan amniyotominin sezaryen doğum riskini artırmadığı ve indüksiyondan doğuma kadar geçen süreyi kısalttığı rapor edilmiştir [38]. Bu sonuçlar arasındaki farklılık, çalışmalarda rapor edilen indüksiyon uygulamalarına dair bir standardizasyonun olmaması, indüksiyon türü, dozu, zamanı, süresinin uygulayıcılara göre değişmesi ile açıklanabilir.

Çalışmanın Limitasyonları

Bu araştırmanın bazı sınırlılıkları bulunmaktadır. Bunlardan biri bu çalışmanın kesitsel olarak gelişi güzel örnekleme yöntemi ile belirlenen kadınlarla yapılmış olmasıdır. Bu nedenle elde edilen sonuçlar zamana bağlı olarak değişebilir ve araştırmanın sonuçları sadece örnekleme alınan kişileri temsil etmektedir. Diğeri ise elde edilen verilerin büyük bölümü hasta dosyasından elde edilmiştir ve toplanan verilerin güvenirliği hasta dosyasındaki kayıtlı bilgiler ile sınırlıdır.

SONUÇ

Bu araştırmada indüksiyon uygulanma sıklığının oldukça yayın olduğu ve bu durumun doğumların acil sezaryen ile sonuçlanma ihtimalini artırdığı saptandıd. Yine doğum indüksiyonu uygulamanın anne ve yenidoğan sağlığına ilişkin bazı göstergeleri (mekonyum, sezaryen doğum, postpartum kanama, epizyotomi, fetal distres, yenidoğan yoğun bakıma kabul) etkilediği tespit edildi. Doğum indüksiyonu ve doğuma ilişkin gereksiz müdahalelerin azaltılması, uygulama protokollerinin geliştirilmesi, ebe ve hemşirelerin DSÖ'nün pozitif bir doğum deneyimi için intrapartum bakım önerileri doğrultusunda sağlık hizmeti sunması, intrapartum bakım hizmetlerinin kanıta dayalı uygulamalara göre yürütülmesi, intrapartum yönetim rehberlerinin geliştirilmesi ve kurumların sağlık politikaları oluşturması ile anne-bebek sağlığının gelişimine katkı sağlanabilir. Ayrıca bu konuda faklı araştırma tasarımlarında (deneysel vb.) çalışmalar yapılarak doğum indüksiyonun farklı değişkenler (emzirme oranları, pospartum kanama, doğum sonu komplikasyon yaşama vb.) üzerine etkileri araştırılabilir.

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RELATIONSHIP BETWEEN BEHAVIORAL PROBLEMS IN EARLY CHILDHOOD AND MATERNAL CHILD REARING ATTITUDES

MATERNAL ÇOCUK YETİŞTİRME TUTUMU VE ERKEN ÇOCUKLUK DÖNEMİNDEKİ DAVRANIŞ PROBLEMLERİ ARASINDAKİ İLİŞKİNİN İNCELENMESİ

Funda Evcili[1*], Muhammed Ebubekir Altun[1]

[1]Department of Health Programs, Vocational School of Health Care Services, Sivas Cumhuriyet University, Sivas, Türkiye

ABSTRACT

Objective: This study was conducted to investigate the relationship between maternal child rearing attitude and behavioral problems in early childhood.

Method: The study is a descriptive research type. The sample of the study consisted of 756 mothers with children enrolled in preschool education in public schools within the borders of city center in the 2022-2023 academic year. The data were collected with the Personal Information Form, Preschool Behavioral Problems Screening Scale (PBPSS) and Child Raising Attitude Scale (CRAS). The data were transferred to the SPSS 22.0 program and evaluated using descriptive statistical analyses and Pearson Correlation Analysis.

Results: 66.7% of the mothers and 45.6% of the fathers were between the ages of 26-35, 54.4% of the mothers and 55.6% of the fathers had undergraduate/graduate education. The mean age (months) of the children was 63.70 (5.59). The mean total score of the PBPSS was 11.63 (5.78). The scores of the mothers on the democratic, authoritarian, protective, and overly tolerant sub-dimensions of the CRAS were 10.51 (2.71); 20.01 (2.15); 21.51 (2.73); and 19.63 (2.44), respectively. In this study, it was determined that mothers with democratic parental attitudes decreased behavioral problems in children, while mothers with authoritarian, protective and overly tolerant attitudes increased behavioral problems in children ($p<0.05$). According to the data, the frequency of problematic behaviors in children increased as the age of the mother and father decreased, the age of the child decreased and the number of siblings increased ($p<0.05$).

Conclusion: Detection of behavioral problems in the preschool period enables the development and treatment of early interventions. At this point, knowing the effects of parental attitudes on behavioral problems and including parents, especially mothers, in training programs serve to raise healthy children and improve public health.

Key Words: Mother, Child, Attitude, Behavior

ÖZ

Amaç: Bu çalışma, maternal çocuk yetiştirme tutumu ve erken çocukluk döneminde sık görülen davranış problemleri arasındaki ilişkinin incelenmesi amacıyla yapıldı.

Yöntem: Araştırma, tanımlayıcı araştırma türündedir. Araştırmanın örneklemini, 2022-2023 eğitim-öğretim yılında il merkez sınırları içerisinde devlet okullarında okul öncesi eğitime kayıtlı çocuğu bulunan 756 anne oluşturdu. Veriler, Kişisel Bilgi Formu, Okul Öncesi Davranış Sorunları Tarama Ölçeği (OÖDSTÖ) ve Çocuk Yetiştirme Tutum Ölçeği (ÇYTÖ) ile toplandı. Veriler SPSS 22.0 programına aktarıldı, tanımlayıcı istatistiksel analizler ve Pearson Korelasyon Analizi kullanılarak değerlendirildi.

Bulgular: Çalışmamıza katılan annelerin %66.7'si, babaların %45.6'sı 26-35 yaşlar arasındaydı. Annelerin %54.4'ü, babaların %55.6'sı lisans/lisansüstü eğitim düzeyine sahipti. Çocukların yaş ortalaması 63.70 (5.59) aydı. OÖDSTÖ toplam puan ortalaması 11.63 (5.78) idi. Annelerin, ÇYTÖ'nün alt boyutlarından aldığı puanlar sırasıyla demokratik 10.51 (2.71); otoriter 20.01 (2.15); koruyucu 21.51 (2.73); aşırı hoşgörülü 19.63 (2.44) dü. Bu çalışmada, demokratik ebeveyn tutumuna sahip annelerin çocuklarında davranış sorunlarının azaldığı; otoriter, koruyucu, aşırı hoşgörülü tutuma sahip annelerin çocuklarında davranış sorunlarının arttığı belirlendi ($p<0.05$). Verilere göre anne ve baba yaşı azaldıkça, çocuğun yaşı küçüldükçe ve kardeş sayısı arttıkça çocuklarda problemli davranış görülme sıklığı artmaktadır ($p<0.05$).

Sonuç: Okul öncesi dönemde davranış problemlerinin saptanması, erken müdahalelerin geliştirilmesini ve tedavisini sağlamaktadır. Bu noktada, ebeveyn tutumlarının davranış sorunları üzerine etkilerini bilmenin, ebeveynleri özellikle anneleri eğitim programlarına dahil etmenin sağlıklı çocuklar yetiştirilmesine ve toplum sağlığının geliştirilmesine hizmet edeceği düşünülmektedir.

Anahtar Kelimeler: Anne, Çocuk, Tutum, Davranış

INTRODUCTION

Attitude is a positive or negative pre-reaction and evaluation tendency that an individual develops based on his/her own knowledge, motivation and experience in the face of the symbol he/she perceives. Attitude has a direct effect on behavior, emotions and thoughts. Therefore, it has 3 dimensions: behavioral, cognitive and emotional. These dimensions are not strictly separated from each other; on the contrary, they are in a constant relationship and interaction with each Therefore, it has 3 dimensions: behavioral, cognitive and emotional. These dimensions are not strictly separated from each other; on the contrary, they are in a constant relationship and interaction with each other. At the same time, these dimensions, which are consistent with each other, are defined as the elements of attitude. Therefore, it

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***Sorumlu yazar/Corresponding author:** Sivas Cumhuriyet University, Vocational School of Health Care Services, Health Programs Deparment, Sivas, Türkiye
[1*]Email: fundaevcili@hotmail.com, [2]Email: altunoglu0@gmail.com

has 3 dimensions: behavioral, cognitive and emotional. These dimensions are not strictly separated from each other; on the contrary, they are in a constant relationship and interaction with each other. At the same time, these dimensions, which are consistent with each other, are defined as the elements of attitude. The cognitive dimension is the knowledge aspect of attitude; the behavioral dimension is the expression of attitude through behavior or words; and the emotional dimension is the aspect of attitude that is expressed through feelings rather than facts. People can develop attitudes towards anything that psychologically exists for them [1-2]. Attitudes towards child rearing can also be evaluated in this context. Child-rearing attitude is a pre-reaction and evaluation tendency that predisposes the individual to behave positively or negatively towards the child [3]. Child-rearing attitude can also be defined as the tactics and behavior patterns used by parents in the socialization process of children. There are many factors (society's value judgments, beliefs, cultural and traditional teachings, parents' age, education level, income level, family type, spouse compatibility, relationships with their own parents) that directly affect parents' attitudes towards child rearing [4]. The attitudes of parents in the child-rearing process since birth are considered as one of the basic building blocks that affect the personality development, socialization processes and behaviors of children. Consistent or inconsistent behaviors of the parents towards the child affect the child's personality positively or negatively as the child takes the parent as a model, and at the same time shapes his/her behaviors [5]. While a loving attitude and parental guidance contribute to the child's acquisition of empathy, development of social skills and adaptation to community life, overly intrusive, coercive, authoritarian and indifferent parental attitudes may prevent the development of social skills and lead to the emergence of problematic behaviors in the child [6,7].

Behavior problems are adaptation problems that occur in the child's observable or measurable behaviors and usually occur as a result of negative social interactions between the child and the family. The child develops certain behaviors as a reaction to the natural difficulties brought about by the stages of development, together with the negative effects of the immediate environment. There are two types of behavior problems in children. While aggression and hyperactivity are more common in children with externalized behavior problems, anxiety, fear and attention problems are observed in children with internalized behavior problems [6-8]. Children with behavior problems are often stigmatized in society with various labels such as maladaptive, antisocial, and abnormal. If behavioral problems are not diagnosed and intervened in the early period, they may bring problems that significantly affect the child, family and society, such as tendency to crime, substance abuse at an early age, and risky sexual behaviors [9]. As in many societies, attitudes towards child rearing in Turkish society are influenced by cultural and traditional factors. When the Turkish family structure is examined, it is seen that an authoritarian, restrictive, overprotective and controlling structure emerges in general. It is noticeable that children's passive, obedient, respectful personality structures and behaviors in accordance with the rules are rewarded, but active and assertive behaviors are punished. In our society, it is generally observed that passive and obedient children develop more positive relationships with their parents, while active and assertive children experience conflicts with their families. In addition, although it has changed in recent years with the effect of living conditions, in our society, child care and child upbringing are accepted as "the mother's duty" and meeting the material needs of the house as "the father's duty" [9-11]. This shows that maternal attitudes have a great importance on the behaviors of the child in general. Studies conducted on children with behavioral problems, especially in the preschool period, reveal that mothers have inconsistent and negative attitudes in their interactions with their children [12].

Since parents' attitudes, especially mothers' attitudes towards child rearing are acquired tendencies through learning, they can be changed if they are identified like other learned characteristics [13]. If behavioral problems caused by negative child-rearing attitudes can be recognized at an early stage, if the relationship between problematic behaviors and parental attitudes can be identified, it may be possible to prevent these behaviors from settling in children's lives with the necessary interventions or early treatment may be possible to solve many problems that may be experienced in the future [8]. Based on this idea, this study aimed to determine the effect of mothers' attitudes towards child rearing on the problematic behaviors of children with preschool children. This research aims to examine the impact of mothers' parenting attitudes on common behavioral problems in early childhood. The study seeks to fill an important gap by helping us understand the contribution of family interactions to children's behavioral development. Data obtained from this study can be utilized in various ways; for example, early childhood behavioral problems can lead to long-term societal issues. Understanding the etiology of behavioral problems is crucial for intervention development and improving societal well-being. A mother's parenting attitude significantly influences the social and emotional development of children. This study aims to make a valuable contribution in understanding how the mother-child relationship takes shape. The results of this research are believed to assist professionals in the fields of child psychology and family therapy in developing more effective strategies to address behavioral problems in children.

METHOD

Purpose and Type of Research

The aim of this descriptive study was to examine the relationship between maternal child rearing attitude and behavioral problems commonly seen in early childhood.

Place and Time of the Research

The study was conducted between October-December 2022 in a province in the Central Anatolia Region in official preschool education institutions affiliated to the Provincial Directorate of National Education.

Population and Sampling

The population of the study consisted of mothers with children enrolled in official preschool education institutions within the borders of the Sivas provincial center in the 2022-2023 academic year. According to the data of the Provincial Directorate of National Education; there are 11 kindergartens in the city center between the specified dates. The total number of students enrolled in these schools is 1984. When the population is known, the number of samples was calculated as 654 with 95% reliability (with α=0.05 error) with the help of the formula used to examine the frequency of the event.

$$n = \frac{Nt^2pq}{d^2(N-1)+t^2pq}$$

Stratification were determined based on the number of kindergartens located in the city center as the stratification criterion. After stratification, disproportionate stratified sampling was performed by selecting samples from each stratum using a simple random method with varying proportions. A total of 756 mothers participated in the study, forming the sample.

Data Collection Tools

The data of the study were collected with three separate data collection tools: "Personal Information Form", "Preschool Behavioral Problems Screening Scale" and "Child Raising Attitude Scale".

Personal Information Form: In the form developed by the researchers, there are 11 questions to define the sociodemographic characteristics of children and families (child's gender, age, family's economic status, number of siblings, parents' age, parents' education level, parents' occupation, etc.).

Preschool Behavioral Problems Screening Scale (PBPSS): The scale was developed by Behar (1974) to determine behavioral problems of preschool children [14] and adapted into Turkish by Kanlıkılıçer (2005) [8]. The scale consists of 30 items and 3 sub-dimensions (Brawler / Aggressive, Being Anxious / Tearful, Being Overactive / Inattentive). Each item is evaluated as "Not Applicable" 0 points, "Sometimes Applicable" 1 point and "Definitely Applicable" 2 points. The total score of each individual is obtained by summing these scores. The 30th item, which requires expressing an opinion about whether the child has a behavior problem, is excluded from the 3 factors. The Cronbach Alpha internal consistency of the scale is 0.92. In this study, the Cronbach Alpha internal consistency of the scale was 0.82.

Child Raising Attitude Scale (CRAS): The scale was developed by Kılınç and Aral (2015) to determine the parenting attitudes of parents while raising their children in the early years [5]. The measurement tool, which can be applied individually or in groups, is organized as a four-step rating scale. Scoring of the scale is between one and four. Each item is evaluated with a score of "always" four, "often" three, "sometimes" two and "never" one. The scale consists of four sub-dimensions, namely "democratic", "authoritarian", "protective" and "overly tolerant" attitudes, and the higher the score to be obtained from each sub-dimension indicates that the characteristics contained in that dimension are also high. As a result of the analysis, it was determined that the Child Raising Attitude Scale is a valid and reliable measurement tool consisting of 25 items.

Ethical Approval

Before starting the study, the necessary permissions for the use of the scales, ethics committee approval (2022-202978) and implementation permission (2022-64412911) were obtained from the Provincial Directorate of National Education. During the data collection process, school administrators were first contacted. Through the school administrators, the mothers of the children attending preschool education were reached. The data collection tools created using Google Form were delivered to the mothers online. Mothers who read and approved the information page about the subject and purpose of the study accessed the data collection tools.

Statistical Analysis

SPSS for Windows 22.0 (IBM Corp. 2013) computer statistical package was used for all statistical procedures. In addition to descriptive statistical analysis (Mean, Standard Deviation, Frequency, Minimum, Maximum), Pearson Correlation Analysis was used to evaluate the relationships between parameters. The results were evaluated bidirectionally at 95% confidence interval and significance level p<0.05.

RESULTS

66.7% of the mothers and 45.6% of the fathers were between the ages of 26-35, 54.4% of the mothers and 55.6% of the fathers had undergraduate/graduate education. 29.8% of mothers and 94.4% of fathers were employed in an income-generating job. 89.3% of the families were nuclear families and 86.9% had a medium economic status. The mean age of the children was 63.70±5.59 months and 52% were male.

The mothers' scores on the total, being brawler/aggressive, being anxious/tearful, being overactive/inattentive sub-dimensions of the PBPSS were 11.63 (5.78); 4.11 (3.03); 4.12 (2.69); 3.39 (1.64) respectively. The scores obtained by the mothers from the democratic, authoritarian, protective, and overly tolerant sub-dimensions of the CRAS were 10.51 (2.71); 20.01 (2.15); 21.51 (2.73); and 19.63 (2.44), respectively (Table 1).

There was a statistically significant negative correlation between the mean score of the democratic sub-dimension of the CRAS and the mean scores of the total and being brawler/aggressive sub-dimensions of the PBPSS (p<0.05). There was a statistically significant positive correlation between the mean scores of the authoritarian sub-dimension of the CRAS and the mean scores of the total, being brawler/aggressive, and being anxious/tearful, sub-dimensions of the PBPSS, and a statistically significant negative correlation between the mean scores of the overactive/inattentive sub-dimension (p<0.05). There was a statistically significant negative correlation between the mean scores of the protective sub-dimension of the CRAS and the mean scores of the brawler/aggressive, hyperactive/inattentive sub-dimensions of the PBPSS, and a statistically significant positive correlation between the mean scores of the total and anxious/tearful sub-dimensions (p<0.05). A statistically significant positive correlation was found between the mean score of the over-tolerant sub-dimension of the CRAS and the total, being brawler/aggressive, and being overactive / inattentive sub-dimensions of the PBPSS (p<0.05) (Table 2).

Table 1. Total and sub-dimension mean scores of the PBPSS and the CRAS

	Scale total and sub-dimensions	Scale Min-Max	Study Min-Max	M±SD
PBPSS	Brawler /Aggressive	0-24	0-17	4.11±3.03
	Anxious /Tearful	0-26	0-15	4.12±2.69
	Overactive/Inattentive	0-8	0-8	3.39±1.64
	Total	0-58	1-29	11.63±5.78
CRAS	Democratic	6-24	6-19	10.51±2.71
	Authoritarian	7-28	10-24	20.01±2.15
	Protective	6-24	13-28	21.51±2.73
	Overly Tolerant	6-24	8-24	19.63±2.44

PBPSS: Preschool Behavioral Problems Screening Scale; CRAS: Child Raising Attitude Scale; M: Mean; SD: Standard deviation

Table 2. Correlation of total and sub-dimension scale scores

CRAS	PBPSS							
	Brawler/ Aggressive		Anxious/ Tearful		Overactive/ Inattentive		Total	
	r	p	R	p	r	p	r	p
Democratic	**-.124**	**.001**	.032	.376	.065	.074	**-.299**	**.006**
Authoritarian	**.283**	**.000**	**.252**	**.000**	**-.177**	**.000**	**.316**	**.000**
Protective	**-.142**	**.053**	**.175**	**.000**	**-.095**	**.009**	**.183**	**.000**
Overly Tolerant	**.284**	**.000**	-.230	.080	**.139**	**.000**	**.296**	**.000**

PBPSS: Preschool Behavioral Problems Screening Scale; CRAS: Child Raising Attitude Scale; r: Pearson's correlation coefficient.

There was a statistically negative correlation between mother's age and the mean scores of the total, being brawler/aggressive, being anxious / tearful sub-dimensions of the PBPSS, and between the mean scores of the protective, over-tolerant sub-dimensions of the CRAS (p<0.05). There was a statistically negative correlation (p<0.05) between father's age and the mean scores of the total and being anxious / tearful sub-dimensions of the PBPSS; and a statistically positive correlation (p<0.05) between the mean scores of the authoritarian sub-dimension of the CRAS.

There was a statistically negative correlation between child age and the mean scores of total, anxious/tearful, overactive/inattentive sub-dimension of the PBPSS (p<0.05); there was a statistically negative correlation between the mean scores of the overly tolerant sub-dimension of the CRAS (p<0.05). It was found that there was a statistically positive relationship between the number of siblings and the mean total score of the PBPSS, and a statistically negative relationship between the mean scores of the democratic and over-tolerant sub-dimensions of the CRAS (p<0.05) (Table 3).

Table 3. Correlation of scale total and sub-dimension scale scores according to some characteristics

Scales		Characterics							
		Maternal age		Paternal age		Child age (month)		Number of siblings	
		r	p	r	p	R	p	r	p
PBPSS	Brawler /Aggressive	**-.099**	**.000**	-.043	.241	.000	.895	.059	.106
	Anxious /Tearful	**-.143**	**.000**	**-.091**	**.013**	**-.105**	**.004**	.054	.137
	Overactive/Inattentive	-.033	.363	-.036	.321	**-.085**	**.020**	-.102	.005
	Total	**-.128**	**.000**	**-.075**	**.039**	**-.075**	**.038**	**.027**	**.045**
CRAS	Democratic	-.061	.093	.057	.116	.044	.223	**-.171**	**.000**
	Authoritarian	.204	.086	**.204**	**.000**	-.056	.126	-.066	.069
	Protective	**-.145**	**.000**	.216	.062	.004	.916	**-.096**	**.008**
	Overly Tolerant	**-.115**	**.002**	.096	.080	**-.081**	**.026**	-.069	.057

PBPSS: Preschool Behavioral Problems Screening Scale; CRAS: Child Raising Attitude Scale; r: Pearson's correlation coefficient.

DISCUSSION

Parenting attitudes refer to the behavioral patterns and attitudes of primary caregivers when raising children. Parenting attitudes have been categorized in various ways. [15-18]. Baumrind suggested that there are three different parenting styles and named these styles as "authoritarian", "democratic" and "permissive" [19]. Over the years, different researchers have developed Baumrind's parenting styles to include four parenting styles by dividing the "permissive parenting attitude" in Baumrind's typology into two: "authoritarian", "democratic", "permissive-tolerant", "permissive-neglectful" [20]. Since the scale used in this study measured four parental attitudes, parental attitudes were limited to democratic, authoritarian, overprotective and permissive sub-dimensions. Studies on parent-child relationships generally focus on mother-child relationships. The positive attitudes adopted by mothers are very important for the emotional and behavioral development of children [21]. In this study, the relationship between mothers' parental attitudes and behavioral problems in children was examined.

In this study, it was found that mothers' parental attitudes were associated with some behavioral problems of children. For example; it was found that in families where the mother had a democratic parental attitude, the child's brawler/aggressive behavior decreased; in families where the mother had an authoritarian parental attitude, children were more likely to be brawler/aggressive and anxious/tearful; in families where the mother had an over-indulgent parental attitude, the child's behaviors of being brawler/aggressive and being overactive/inattentive increased; in families where the mother had an overprotective parental attitude, children's brawler/aggressive, overactive/inattentive behavior decreased. Democratic parental attitude is an important factor in terms of its impact on children's behavior. In many studies it has been found that socialization levels of children raised by mothers who adopted democratic parenting style were increased [22-26]. Similarly, it was observed that children of families with democratic parenting style had the highest psychosocial adjustment scores and unconditional acceptance and respect of the parent contributed to the psychosocial development of the child [26-28]. Overly tolerant parental attitude is another negative attitude that parents adopt in the process of child rearing. Overindulgent parenting is also associated with some adolescent behavioral problems such as

conduct problems, delinquency, and aggressive-destructive behaviors [28,29].

Strict authoritarian disciplinary parenting attitudes can significantly affect the degree and rate of externalizing (e.g., hyperactivity, rule-breaking behaviors, and/or aggression) and internalizing (e.g., anxiety, deprivation, and/or depression) in children [30-33]. Another negative attitude of parents is their overprotective behavior. Parental overprotection has been consistently associated with child anxiety symptoms and disorders [28,34]. The concept of over-parenting or helicopter parenting also originates from overprotective parenting attitudes. Research on parental overprotectiveness suggests that one of the potential causes of overparenting is parental anxiety. Parental anxiety has been shown to predict parental overprotectiveness [35]. Overprotective parental attitudes lead to the formation of children who cannot make their own decisions, do not have the necessary skills to take initiative, cry their requests and are stubborn. In addition, these children who do not develop manual dexterity may often have self-confidence problems and may be clumsy [28].

Parenting age may be associated with different parenting attitudes [36]. For example, younger parents are often more relaxed and friendlier with their children, while older parents may be more authoritarian and disciplined. Or, becoming a parent at an early age may cause parents to be more indifferent to their children and inadequate in meeting their children's needs. In this study determined that as the age of the mother decreased, children's brawler/aggressive and anxious/tearful behaviors increased, and mothers had protective and overly tolerant attitudes. In addition to this, it was determined that as the age of the father increased, being anxious/tearful in children decreased, however, fathers had authoritarian attitudes. In the study conducted by Aydoğdu and Dilekmen, it was determined that the scores of democratic attitude, authoritarian attitude, overprotective attitude and permissive attitude did not differ significantly according to the age of the parents [37].

Mothers' attitudes may differentiate according to the developmental period or age of the child. In our study, it was determined that as the age (in months) of the preschool child decreased, the behaviors of being anxious/tearful, overactive/inattentive increased, and mothers had overly tolerant attitudes. However, Arslan and Öğretir Özçelik found that the age of the child did not cause any difference in the sub-dimensions of authoritarian, overprotective and indifferent-inconsistent attitudes, but it caused a significant difference in the democratic attitude sub-dimension [38]. From the data, it can be thought that parents generally have more positive attitudes to protect their younger children [39].

The number of children in the family is another factor that may affect parents' attitudes towards child rearing [40]. In this study, it was found that as the number of children in the household increased, behavioral problems in children increased and democratic and overly tolerant attitudes of mothers decreased. In the study conducted by Aydoğdu and Dilekmen, it was found that there was no significant difference between the democratic attitude, authoritarian attitude and permissive attitude scores of the parents according to the number of children they had, while there was a significant difference between the

overprotective attitude scores in favor of those with only one child. Accordingly, it was determined that the overprotective attitudes of parents with one child were significantly higher than the overprotective attitudes of parents with two children [37]. Sak et al. found that parents with four or more children exhibited more authoritarian attitudes than parents with one, two and three children [11]. Özyürek and Tezel Şahin concluded that the number of children in the family did not affect parental attitudes [40]. Arslan and Öğretir Özçelik found that the number of children in the family caused significant differences in democratic, overprotective and indifferent-inconsistent attitudes, except for the authoritarian attitude [38]. In the study conducted by Altınkaynak, it was found that parents with four children had more democratic attitudes than parents with one child. [28].

Limitations

This study has some limitations. The research was conducted exclusively in public educational institutions, excluding private educational institutions. This limitation may restrict the generalizability of the findings. The study only addressed behavior problems that can be observed in preschool-aged children, not assessing similar effects of parenting attitudes on children in other age groups. The data in the study rely solely on mothers' views, which can be a subjective data source and may not provide a complete picture of children's behaviors.

CONCLUSION

In this study, it was determined that behavioral problems in children in families with democratic parental attitudes decreased, while behavioral problems in children in families with authoritarian, protective and overly tolerant attitudes increased. Based on the data, it can be said that increasing parents' awareness of the impact of their attitudes on behaviors in the process of raising children is important. Since the needs of each child vary, the dynamics of each family are also different. In this regard, it is recommended to develop intervention programs structured according to individual differences to instill positive parenting attitudes in parents. This way, behavior problems can be prevented before they arise, and existing issues can be resolved before they become more complicated. This study is aimed solely at determining mothers' attitudes towards child-rearing. It is recommended that different studies be conducted to assess fathers' attitudes towards child-rearing as well. Since this study focuses on a limited number of behavior problems that may occur in preschool-aged children, it is possible to explore research topics that include other behavior problems and examine the relationship between parenting attitudes. This study was conducted exclusively in public schools. Further research can be conducted on larger sample groups that also include private educational institutions.

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PREDICTORS OF COMPLEMENTARY AND ALTERNATIVE MEDICINE USE AMONG HEALTHCARE PROFESSIONALS DURING THE COVID-19 PANDEMIC: A QUANTITATIVE STUDY

COVID-19 PANDEMİSİ SIRASINDA SAĞLIK ÇALIŞANLARI ARASINDA TAMAMLAYICI VE ALTERNATİF TIP KULLANIMININ YORDAYICILARI: NİCEL BİR ÇALIŞMA

Aylin Bilgin[1*], Leyla Özdemir[2], Kadir Baysoy[2]

[1]Department of Nursing, Faculty of Health Sciences, Sakarya University of Applied Sciences, Sakarya, Türkiye

[2]Department of Internal Medicine Nursing, Faculty of Nursing, Hacettepe University, Ankara, Türkiye

ABSTRACT

Objective: This research was aimed to investigate the effects of need-based, enabling, and predisposing factors on the use of complementary and alternative medicine that emerged only during the COVID-19 pandemic among healthcare professionals.

Method: This study was conducted with a descriptive design. The General Self-Efficacy Scale was used to assess self-efficacy, the Coronavirus Fear Scale was used to assess fear, and the Holistic Complementary and Alternative Medicine Questionnaire was used to assess attitude. In total, 374 healthcare professionals were included. Data were collected according to the complementary and alternative medicine Healthcare Model. In the analysis of the data, mean and standard deviation (SD) are given for quantitative data and percentage is given for categorical data. In addition, multinomial logistic regression analysis was performed.

Results: 53.2% of the healthcare professionals reported the use of at least one form of complementary and alternative medicine during the COVID-19 pandemic. The use of complementary and alternative medicine showed a relationship between gender, the Coronavirus Fear Scale and the Holistic Complementary and Alternative Medicine Questionnaire scores in predisposing factors. An association between the use of complementary and alternative medicine and the occupation in enabling factors was observed. The use of complementary and alternative medicine was found related to the nature of the workplace in need-based factors. The use of complementary and alternative medicine showed no association with age, marital status, education level, working time, chronic conditions, COVID-19 diagnosis, working status and General Self-Efficacy scores of the healthcare professionals in the COVID-19 clinic.

Conclusion: This study concluded that fear associated with COVID-19 and a positive attitude toward complementary and alternative medicine resulted in increased use of complementary and alternative medicine. It was observed that the use of complementary and alternative medicine in health workers working in intensive care, female health workers and nurses was higher than the others.

Key Words: Complementary Therapies, Health Personnel, COVID-19, Self-Efficacy

ÖZ

Amaç: Bu çalışma, sağlık profesyonelleri arasında sadece COVID-19 pandemisi sırasında ortaya çıkan tamamlayıcı ve alternatif tıp kullanımına zemin hazırlayan, kolaylaştırıcı ve ihtiyaca dayalı faktörlerin etkilerini araştırmak amacıyla yapıldı.

Yöntem: Bu çalışma tanımlayıcı bir tasarımla yürütüldü. Öz yeterliği değerlendirmek için Genel Öz-Yeterlilik Ölçeği, korkuyu değerlendirmek için Koronavirüs Korku Ölçeği, tutumu değerendirmek için Bütünsel Tamamlayıcı ve Alternatif Tıp Anketi kullanıldı. Toplamda 374 sağlık çalışanı dahil edildi. Veriler, tamamlayıcı ve alternatif tıp Sağlık Modeli'ne dayalı olarak toplandı. Verilerin analizinde nicel veriler için ortalama ve standart sapma, kategorik veriler için yüzde verildi. Ayrıca, multinomial lojistik regresyon analizi yapıldı.

Bulgular: Sağlık çalışanlarının %53.2'si COVID-19 pandemisi sırasında en az bir tamamlayıcı ve alternatif tıp formu kullandığını bildirdi. Tamamlayıcı ve alternatif tıp kullanımı, zemin hazırlayan faktörlerde cinsiyet, Koronovirüs Korku Ölçeği ve Bütünsel Tamamlayıcı ve Alternatif Tıp Anketi puanları arasında bir ilişki gösterdi. Kolaylaştırıcı faktörlerde tamamlayıcı ve alternatif tıp kullanımı ile meslek arasında bir ilişki gözlendi. Tamamlayıcı ve alternatif tıp kullanımı, ihtiyaca dayalı faktörler içinde işyerinin doğasıyla ilişkili bulundu. Tamamlayıcı ve alternatif tıp kullanımı, COVID-19 kliniğinde sağlık çalışanlarının yaşı, medeni durumu, eğitim düzeyi, çalışma süresi, kronik durumları, COVID-19 tanısı, çalışma durumu ve Genel Öz-Yeterlilik Ölçeği puanları ile ilişki göstermedi.

Sonuç: Bu çalışma, COVID-19 ile ilişkili korku ve tamamlayıcı ve alternatif tıbba karşı olumlu tutumun, tamamlayıcı ve alternatif tıp kullanımının artmasına neden olduğu sonucuna varıldı. Yoğun bakımda çalışan sağlık çalışanlarında, kadın sağlık çalışanlarında ve hemşirelerde tamamlayıcı ve alternatif tıp kullanımının diğerlerine göre daha fazla olduğu görüldü.

Anahtar Kelimeler: Tamamlayıcı Tedaviler, Sağlık Personeli, COVID-19, Öz-Yeterlilik

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***Sorumlu yazar/Corresponding author:** Sakarya University of Applied Sciences, Faculty of Health Sciences, Department of Nursing, Sakarya, Türkiye
[1*]Email: aylinhelvaci94@gmail.com, [2]Email: leylaceyran@yahoo.com, [3]Email: kadir.baysoy@gmail.com

INTRODUCTION

Healthcare professionals provide all types of care to COVID-19 patients in the clinics and remain in regular direct contact with the patients [1]. The proportion of infected healthcare workers increased to 43% by 2022 [2]. Healthcare workers are a group at high risk of COVID-19 infection [3]. Healthcare professionals try to protect themselves and thus use complementary and alternative medicine (CAM). In addition, healthcare professionals had to turn to CAM due to the lack of medical treatment for COVID-19 in the early stages [2,3]. A descriptive study that evaluated the views of healthcare professionals worldwide on the COVID-19 reported that 59.6% of healthcare professionals recommended the use of CAM [4-5].

CAM is defined as treatment and protection methods that are applied in addition to modern medicine and that meet the demands of the person and provide integrity to basic medicine [6]. CAM practices by the National Unit of Complementary and Integrative Health (NCCIH) grouped as natural products (herbs, vitamins, minerals, probiotics, dietary supplements), mind and body practices (acupuncture, relaxation techniques, tai chi, qi gong, Pilates, etc.) and other methods (Ayurvedic medicine, traditional Chinese medicine, homeopathy, naturopathy, etc.) [6,7]. CAM use is affected by many factors, and there are few studies reporting that various factors such as media, educational status, and fear of disease affect CAM use [8,9].

Fear is defined as an unpleasant emotion caused by the perception of a threatening stimulus [10]. Healthcare professionals, exposed directly to COVID-19 processes, experience fear as COVID-19 is a life-threatening, constantly evolving, and changing disease [11]. Furthermore, healthcare professionals feel afraid of the possibility of contamination/infection to them and their families with COVID-19 because of the associated uncertainties about where the process will go, what is effective treatment, and widespread negative experiences in the hospitals [12]. Fear affects individuals negatively, emotionally, cognitively, and behaviorally through manifestations of anger, burnout, and depression [13]. Healthcare professionals who are at risk of infection during the pandemic take measures against the disease due to the fear of infection and its effects [14]. Few studies highlighted the more common use of complementary medicine among individuals suffering from fear of disease [9].

The extent of fear, having a significant impact on the use of CAM, is influenced by the level of self-efficacy of healthcare professionals [15]. The literature has emphasized that healthcare professionals with low self-efficacy during the COVID-19 process showed high-stress levels and faced several physical and psychosocial problems [16]. Self-efficacy is the belief of oneself about how successful an individual could be in overcoming difficult status that he/she encounters in the future [17]. Poor self-efficacy significantly reduces the productivity of healthcare professionals and negatively affects their physical and psychosocial health [18]. In addition, self-efficacy is an important indicator to evaluate an individual's self-belief and coping skills, considering the heavy workload of health professionals and the fear of infection with COVID-19.

The frequency of CAM use has been investigated by health professionals in studies conducted so far. However, as far as we know, there is no study in the literature in which the use of CAM and its predictors were examined in a holistic way within the scope of a model. Several studies have highlighted that the CAM Healthcare model is used to identify and consider multiple factors associated with CAM use [19,20]. The CAM Healthcare model addresses predisposing, enabling, and need-based factors that affect the frequency of CAM use. Predisposing factors include social structure, belief systems, demographics, attitudes, personal factors, and risk perception. Enabling factors include financial factors such as income level and nature and the availability of employment that hinders or facilitates a person's use of CAM. Need-based factors are related to perceived need and include symptom severity, illness experience, chronic illness, and working in risky settings [20]. In this direction, the undermentioned research questions were addressed in the study:

•What is the frequency of use of CAM that emerged in healthcare professionals during only the COVID-19 pandemic?

•Do enabling factors, predisposing factors, and need factors affect the CAM use that emerged among healthcare professionals during only the COVID-19 pandemic?

METHOD

Study design

A descriptive study design was used.

Participants

The healthcare professionals comprised: a) nurses, doctors, midwives, physiotherapists, laboratory technicians, medical secretaries, emergency medical technicians, radiographers, and dentists who work actively in hospitals, and (b) those who could login the online survey with a computer or a smartphone.

The snowball sampling technique was employed to reach potential healthcare professionals. The individuals were requested to distribute the online survey link among their social circles and contacts. In order to determine the number of participants to be included in the study, a priori sample size calculation was made for structural equation modeling (https://www.danielsoper.com/statcalc/calculator.aspx?id=89). It was found that the required parameter values, including the expected effect size of 0.1, the desired statistical power level of 0.95, one latent variable, 13 observed indicators, and 0.05 probability values, were a minimum sample size of 328 people. A total of 374 healthcare professionals were enrolled in this study between March and July 2021.

The dependent variables

The dependent variable was the use of CAM which emerged only during the pandemic among healthcare professionals. The use of CAM was determined through a questionnaire as "Yes, I used CAM during the COVID-19 pandemic" or "No, I did not use CAM during the COVID-19 pandemic."

The independent variables

The following factors related to the CAM Healthcare Model were assessed:

Predisposing factors: Age, gender, marital status, and education level were examined. Self-efficacy, fear of contracting COVID-19, and attitudes about CAM of healthcare professionals were evaluated using specific scales. Self-efficacy was determined using the General Self-Efficacy Scale (GSE). Fear was determined using the Coronavirus Fear Scale (FCV-19S). The attitude toward the use of CAM was determined with the Holistic Complementary and Alternative Medicine Questionnaire (HCAMQ).

Enabling factors: Occupation (nurse vs. doctor vs. midwife vs. other) and working time (< 1 year vs. 1-8 years vs. > 8 years) were evaluated to assess the enabling factors.

Need-based factors: Among these factors, chronic conditions, diagnosis of COVID-19, working place, and working status in COVID-19 clinics were evaluated.

Data Collection Tools

General Self-Efficacy Scale (GSE): The scale was revised by the same researchers in 1981, and the number of items was reduced to 10. Each statement in the scale is evaluated in four-point Likert. All items in the scale are scored positively, and the total score varies between 10 and 40. A high score indicates a greater level of overall self-efficacy. The

Turkish reliability and validity study was performed by Aypay [21] and the Cronbach alpha ranged from 0.78 to 0.91.

Coronavirus Fear Scale (FCV-19S): FCV-19S consists of seven items in total and evaluates the fear levels of individuals in the general population regarding COVID-19. Each item in the scale is evaluated in five-point Likert type. The total score, obtained by summing the answers given to each item in the scale, varies between 7 and 35. High scores show a high level of coronavirus fears experienced. The Turkish reliability and validity study was conducted by Bakioğlu, Korkmaz [13] and Cronbach alpha was determined as 0.82.

Holistic Complementary and Alternative Medicine Questionnaire (HCAMQ): The scale is composed of 11 items and is divided into two sub-dimensions: "Complementary Alternative Medicine (six items)" and "Integrative Health (five items)". Each statement in the scale is evaluated in a six-point Likert type. The total score is obtained by summing the answers given to each item in the scale, and the total score varies between 11 and 66. An increase in the HCAMQ score indicates a decrease in positive attitude toward the use of CAM. The Turkish reliability and validity study was conducted by Erci [22] and Cronbach alpha value was reported as 0.72.

Data Collection Process

The online survey was distributed through various social media platforms such as WhatsApp, Facebook, Instagram, and email. The initial part of the survey presented information about the study, and participants were required to provide consent before proceeding with the questionnaire by ticking the box labeled "I have read the information and voluntarily agree to participate in this study." The healthcare professionals who agreed to take part were then given access to the survey questions and requested to complete them. The survey typically took approximately 10-15 minutes to finish.

Ethical Approval

This study was conducted with the approval of the Non-Interventional Clinical Trials Ethics Committee of Hacettepe University (Number: 16969557-613/2021/06-37), and the principles outlined in the Revised WMA Declaration of Helsinki, 2013 were followed. The informed consent form, including the study details, was on the first page of the survey. Each participant provided their informed consent by clicking on a confirmation button before accessing the survey questions, and the questionnaire was made inaccessible to those who did not agree to participate. The participants were explicitly informed that they had the option to decline participation in the study and that all provided information would remain confidential. Additionally, the healthcare professionals were guaranteed anonymity, the freedom to withdraw from the study at any point, and the assurance that their data would be utilized solely for academic purposes. These details were outlined in the informed consent form.

Statistical Analysis

The data were analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, New York, USA). Kolmogorov Smirnov test, histogram, and Q-Q graph method were used to test the fit for normal distribution. In addition, skewness and kurtosis values were checked for compliance with the normal distribution. The skewness and kurtosis values between -1.5 and +1.5 indicate that the data are suitable for the normal distribution. Accordingly, in this study, it was found that the skewness and kurtosis values were between -1.235 and 1.324 and were suitable for normal distribution. Quantitative data are given mean and standard deviation (SD), while categorical data are presented as the number of healthcare professionals and percentage. To assess the disparities between the two groups, quantitative variables were compared using an independent samples t-test, while categorical variables were evaluated using a chi-square test. Moreover, multinomial logistic regression analysis was utilized to assess the effect of enabling factors, predisposing factors, and need factors on the use of CAM during pandemic. An odds ratio (OR) with a 95% confidence interval (CI) was utilized to determine associations between variables. The Beta (β) value was computed within the range of values for the logistic regression equation, which is used to forecast the dependent variable based on the independent variable. The Wald statistic test was used to determine whether each independent variable was statistically significant in predicting the use of CAM during pandemic. A statistically significant was the values of $p<0.05$.

RESULTS

Descriptive characteristics and comparison of data with use of CAM

The average age of healthcare professionals was 35.02 (SD=11.26) years. The majority of participants were female (76.5%) and had a bachelor's degree (52.7%). All the healthcare professionals were included in the study, primarily nurses (55.3%), doctors (27.3%), and midwives (8.3%). The working time/experience was mostly >8 years (52.4%). Healthcare professionals usually work in intensive care (21.7%) or inpatient clinics (28.3%). More than half of the participants (51.3%) had worked in COVID-19 clinics. 23.3% of healthcare professionals reported having a chronic disease. Healthcare professionals with chronic illness had hypertension (31%), chronic obstructive pulmonary disease (COPD)/Asthma (25.8%), diabetes mellitus (16%), thyroid diseases (10.3%), hyperlipidemia (6.8%), heart failure (5.7%), and coronary artery disease (4.4%). 26.5% of healthcare professionals were previously diagnosed with COVID-19 infection. The mean total score of the GSE, FCV-19S, HCAMQ was 30.90 (SD=6.49), 17.38 (SD=6.40), and 28.75 (SD=7.79), respectively (Table 1). When the relationship between sociodemographic variables and CAM use is examined, there is a difference between CAM use status according to gender, occupation, working place, FCV-19S and HCAMQ scale scores. The frequency of CAM use was higher among women, nurses, health workers working in intensive care clinics and inpatient clinics.

Use of CAM during COVID-19 pandemic by the healthcare professionals

While 53.2% of the healthcare professionals used at least one form of CAM during the pandemic, 46.8% of them used no CAM during the pandemic. The most-reported CAM approaches used during the pandemic were vitamins (38.7%), herbal therapies (30.8%), music therapy (9.0%), religious practices (8.7%), meditation (4.6%), yoga (4.1%), massage or reflexology (2.6%), and acupuncture (1.5%). As regards the source of information furnished, the healthcare professionals reported that the information regarding CAM during the COVID-19 pandemic was obtained from their friends (23.0%), social media (19.9%), and family members (18.1%). Also, healthcare professionals had benefited from articles (23.0%), seminars, congress, courses (11.5%), and in-service training (4.5%) for information on CAM during the pandemic. Reasons cited for the CAM use in the pandemic were support (32.0%), relaxation (28.2%), protection (29.3%), and treatment (10.4%) (Table 2).

Predictors of CAM use during COVID-19 pandemic

Predisposing factors

Gender was a notable predictor of the use of CAM during the pandemic, with an explanatory rate of 5.4% (OR=2.618, 95% CI=1.593-4.302, $p<0.001$). Females reported 2.618 times higher use of CAM during the pandemic than males. Education level was an important predictor of the CAM use in the pandemic, with a rate of 2.6%. There was 1.722 times higher the CAM use in the pandemic among healthcare professionals with a bachelor's degree than in those with a postgraduate degree (OR=1.722, 95% CI=1.098-2.701, $p=0.018$). FCV-19S (fear) scores were significant positive predictors of the CAM use in the pandemic and explained 2.4% of the use of CAM (OR=1.043, 95% CI=1.010-1.078, $p=0.011$). Moreover, the attitude scores evaluated with HCAMQ were important predictors for

Table 1. Descriptive characteristics of the healthcare professionals and comparison of data with use of CAM (n=374)

Variables		M	SD	CU	CNU	Test	p
Predisposing factors							
Age		35.02	11.26	34.28 (10.97)	35.86 (11.56)	1.356*	0.176
Self-efficacy (GSE)		30.90	6.49	30.54 (6.61)	31.30 (6.34)	1.139*	0.256
Fear (FCV-19S)		17.38	6.40	18.18 (6.39)	16.48 (6.31)	-2.582*	**0.010**
Attitude (HCAMQ)		28.75	7.79	27.85 (6.81)	29.77 (8.68)	2.389*	**0.017**
Predisposing factors		**n**	**%**	**CU**	**CNU**	**Test**	**p**
Gender	Male	88	23.5	31 (15.6)	57 (32.6)	14.945†	**<0.001**
	Female	286	76.5	168 (84.4)	118 (67.4)		
Marital status	Married	180	48.1	100 (50.3)	80 (45.7)	0.768†	0.381
	Single	194	51.9	99 (49.7)	95 (54.3)		
Education level	High-school graduate	15	4.0	6 (3.0)	9 (5.1)	7.349†	0.062
	Associate degree	35	9.4	21 (10.6)	14 (8.0)		
	Bachelor's degree	197	52.7	115 (57.8)	82 (46.9)		
Enabling factors		**n**	**%**	**CU**	**CNU**	**Test**	**P**
Occupation	Nurse	207	55.3	123 (61.8)	84 (48.0)	9.634†	**0.022**
	Doctor	102	27.3	43 (21.6)	59 (33.7)		
	Midwives	31	8.3	18 (9.0)	13 (7.4)		
	Other	34	9.1	15 (7.5)	19 (10.9)		
Working time	<1 year	70	18.7	39 (19.6)	31 (17.7)	1.744†	0.418
	1-8 years	108	28.9	62 (31.2)	46 (26.3)		
	>8 years	196	52.4	98 (48.7)	98 (55.4)		
Need-based factors (Chronic condicitons)							
Yes		87	23.3	49 (24.6)	38 (21.7)	0.441†	0.506
No		287	76.7	150 (75.4)	137 (78.3)		
Working status in COVID-19 clinics							
Yes		192	51.3	105 (52.8)	87 (49.7)	0.347†	0.556
No		182	48.7	94 (47.2)	88 (50.3)		
Diagnosis of COVID-19	Yes	99	26.5	60 (30.2)	39 (22.3)	2.959†	0.085
	No	275	73.5	139 (69.8)	136 (77.7)		
Working place	Intensive care unit	81	21.7	53 (26.6)	28 (16.0)	8.136†	**0.049**
	Inpatient clinic	106	28.3	56 (28.1)	50 (28.6)		
	Emergency	48	12.8	26 (13.1)	22 (12.6)		
	Policlinic	65	17.4	29 (14.6)	36 (20.6)		
	Family health center	42	11.2	21 (10.6)	21 (12.0)		
	Other	32	8.6	14 (7.0)	18 (10.3)		

*CU: Complementary and alternative medicine users during the COVID-19 pandemic; CNU: Complementary and alternative medicine non-users during the COVID-19 pandemic; GSE: General self-efficacy scale; FCV-19S: Coronavirus (Covid-19) Fear Scale; HCAMQ: Holistic complementary and alternative medicine questionnaire; M: Mean; SD: Standard Deviation; *Independent samples t-test; †Chi-square test.*

Table 2. The use of complementary and alternative medicine during the COVID-19 pandemic among healthcare professionals (n=374)

Variables		n	%
The use of CAM	Yes	199	53.2
	No	175	46.8
The type of CAM	Vitamins	151	38.7
	Herbal therapies	120	30.8
	Music therapy	35	9.0
	Religious practices	34	8.7
	Meditation	18	4.6
	Yoga	16	4.1
	Massage	10	2.6
	Acupuncture	6	1.5
Sources of information on CAM	Social media	83	19.9
	Friends	96	23.0
	Family	76	18.1
	Articles	96	23.0
	Seminar, congress, course	48	11.5
	In-service training	19	4.5
Reasons for CAM	Support	117	32.0
	Relaxation	103	28.2
	Protection	107	29.3
	Treatment	38	10.4

CAM: Complementary and alternative medicine.

the CAM use in the pandemic and explained the use of CAM during the pandemic by 2% (OR=0.968, 95% CI=0.943-0.995, p=0.019). However, age (OR=0.988, 95% CI=0.970-1.006, p=0.176), marital status (OR=0.834, 95% CI =0.555-1.252, p=0.381), and self-efficacy (OR=0.982, 95% CI=0.951-1.013, p=0.255) showed no predictive effect the CAM use in the pandemic (Table 3).

Enabling factors

The occupation was an essential estimator of the use of CAM, explaining 3.4% of the use of CAM during the pandemic. More specifically, the nurses had 2.855 times more likely to use CAM during the pandemic as compared to other healthcare professionals (OR=2.855, 95% CI=1.092-3.855, p=0.048). Working time evaluated within the scope of enabling factors was not an estimator of the use of CAM during the pandemic (p>0.05) (Table 3).

Need-based factors

The working place was a predictor for the CAM use in the pandemic and explained the use of CAM during the pandemic at 2.9%. Healthcare professionals working in intensive care units were 2.434

times more likely to use CAM during the pandemic compared to those working at other places (OR=2.434, 95% CI=1.056-5.610, p=0.037). Chronic conditions (OR=0.849, 95% CI=0.524-1.376, p=0.507), diagnosis of COVID-19 (OR=0.664, 95% CI=0.416-1.060, p=0.086), and working status in COVID-19 clinics (OR=0.885, 95% CI =0.589-1.329, p=0.556) had no predictive effect on the CAM use in the pandemic (Table 3).

Table 3. Predictors of the complementary and alternative medicine use during the COVID-19 pandemic (n=374)

Variables	B	SE	Wald	P value	OR	95% CI for OR	
Predisposing factors						**Lower**	**Upper**
Age	-0.013	0.009	1.832	0.176	0.988	0.970	1.006
Gender (reference: Male)							
Female	0.962	0.253	14.419	**0.000**	2.618	1.593	4.302
Marital status (reference: Married)							
Single	-0.182	0.208	0.767	0.381	0.834	0.555	1.252
Education level (reference: postgraduate)							
High-school graduate	-0.200	0.556	0.129	0.719	0.819	0.275	2.436
Associate degree	0.611	0.388	2.474	0.116	1.842	0.860	3.944
Bachelor's degree	0.544	0.230	5.606	**0.018**	1.722	1.098	2.701
Self-efficacy (GSE)	-0.018	0.016	1.294	0.255	0.982	0.951	1.013
Fear (FCV-19S)	0.042	0.017	6.479	**0.011**	1.043	1.010	1.078
Attitude (HCAMQ)	-0.032	0.014	5.535	**0.019**	0.968	0.943	0.995
Enabling factors							
Occupation (reference: Other)							
Nurse	0.618	0.373	4.857	**0.048**	2.855	1.092	3.855
Doctor	-0.080	0.399	0.040	0.841	0.923	0.422	2.019
Midwives	0.562	0.502	1.254	0.263	1.754	0.656	4.689
Working time (reference:> 8 years							
<1 year	0.230	0.280	0.671	0.413	1.258	0.726	2.179
1- 8 years	0.298	0.242	1.523	0.217	1.348	0.839	2.165
Need-based factors							
Chronic conditions (reference: Yes)							
No	-0.164	0.246	0.441	0.507	0.849	0.524	1.376
Diagnosis of COVID-19 (reference: Yes)							
No	-0.409	0.238	2.942	0.086	0.664	0.416	0.060
Working place (reference: Other)							
Intensive care unit	0.889	0.426	4,357	**0.037**	2.434	1.056	5.610
Inpatient clinic	0.365	0.406	0.807	0.369	1.440	0.650	3.191
Emergency	0.418	0.459	0.830	0.362	1.519	0.618	3.738
Policlinic	0.035	0.435	0.007	0.936	1.036	0.442	2.430
Family health center	0.251	0.471	0.284	0.594	1.286	0.510	3.239
Working status in COVID-19 clinics (reference: Yes)							
No	-0.122	0.207	0.347	0.556	0.885	0.589	1.329

CI: Confidence interval; OR: Odds ratio; SE: Standard error.

DISCUSSION

In this model-based study, we aimed to examine the factors that affect the use of complementary-alternative medical methods by health professionals in the COVID-19 outbreak, according to the factors in the primary three category groups; "preparing," "enabling," and "need-based" within the scope of a model. Model-based study findings provide more understandable, valid, and realistic data in the conceptual framework [23,24]. In this respect, this study, carried out according to the model with the related factors, can contribute to understanding the use of complementary-alternative medical methods and related factors.

The study showed that more than half of healthcare professionals used at least one CAM during the pandemic for support, relaxation, and protection. Additionally, healthcare professionals benefited from the use of vitamins and herbal therapies in the content of the type of CAM

during the pandemic. The literature confirms that the use of CAM is increasing during the COVID-19 process and there is a tendency towards mostly herbal products and vitamins [25,26]. Similarly, a study reported that the most used CAMs were dietary supplements (61.3%), prayer (57.9%), and herbal medicines (48.8%) during the COVID-19 process in the general population [27]. Healthcare professionals have obtained information about CAM during the pandemic from a variety of sources, including family, friends, and articles. In a study by Teke et al. (2021), 45.5% of healthcare professionals reported that they used CAM to protect themselves from COVID-19 in the last month [28]. There is currently no specific treatment for COVID-19, and thus healthcare professionals prefer to find the best way to prevent the disease, including herbal medicine, since the immune status plays an important role in COVID-19 infection [29]. Furthermore, the relationships between the immune system and the use of various types of CAM such as exercise, healthy nutrition, vitamins, and herbal products have also been demonstrated [30].

This study revealed that females use CAM during the pandemic 2.618 times more than males. These findings are consistent with previously reported findings in the general population. Studies have indicated that females used CAM more than males because they have a more positive attitude toward CAM [31,32]. Therefore, female's tendency to use traditional practices and seek support might have triggered more use of CAM during the pandemic in females. In addition to gender, the present study determined that healthcare professionals with a bachelor's degree had 1.722 times higher use of CAM during the pandemic than those with a postgraduate degree. Literature shows that a postgraduate degree is a field based on scientific foundations, and in it, modern science has priority [33,34]. Therefore, people with a postgraduate degree may move away from traditional and complementary approaches.

In this study, the mean COVID-19 fear score of healthcare workers according to FCV-19S was 17.38 (SD=6.40). Similarly, in a study conducted by Yılmaz and Uysal, the mean COVID-19 Fear Scale score in clinician nurses was determined as 20.01±6.91 and the level of fear was reported as moderate [35]. In another study, it was stated that the COVID-19 fear level in physiotherapists was moderate with 17.19±5.38 points [36]. As is seen, the literature [35,36] confirms that the COVID-19 fear level of health care professionals is moderate in this study. Fear is an important predictor of the use of CAM [9]. Our study showed that the fear level in healthcare professionals estimated the use of CAM during the pandemic at 2.9%. Similarly, Yildirim et al. (2021) reported that adults perceiving a high risk of infection and experiencing fear of the virus during the pandemic were more likely to engage in preventive behaviors [37]. Several studies have proven that fear, a characteristic emotion of infectious diseases, influences adherence to protective measures, including the use of CAM by a person against the disease [38,39]. Because of the actors such as the uncertainty about the COVID-19 process, separation from loved ones, and infecting others, it is not surprising that healthcare professionals experience fear and use CAM during the pandemic to protect themselves.

In this study, the average attitude towards the use of CAM was measured at 28.75 (SD=7.79) based on the HCAMQ. Likewise, in a study involving nurses, Gör and Duru Aşiret reported a favorable attitude towards the utilization of CAM during the COVID-19 process, scoring 22.16±6.06 [40]. This study showed that healthcare professionals with a positive attitude toward CAM tended to use more CAM during the pandemic. Similarly, Shorofi and Arbon (2017) reported a positive correlation between positive attitudes about CAM and its use [41]. Attitude is associated with an orientation toward healthy lifestyle behaviors, seeking treatment and support [42]. For this reason, higher use of CAM is an expectable behavior among healthcare professionals, who adopt a positive attitude toward CAM during this pandemic process.

In this study, the self-efficacy score of the health workers evaluated with the GSE was determined as 30.90 (SD=6.49). Similarly, in a study conducted by Özkan on intern nurses during the COVID-19 outbreak, the self-efficacy score was determined as 32.0 and it was reported to be at a good level [43]. In the current study, the self-efficacy level of healthcare workers was found to be at a good level. However, in this study, a relationship between self-efficacy level and CAM use during the pandemic could not be established. Chang et al. (2011) highlighted that self-efficacy did not show any relationship to CAM use [44]. Healthcare professionals feel inadequate and insecure due to the ever-changing patient population and treatment regimens [45]. Therefore, it is natural that there is no difference in the self-efficacy levels of healthcare professionals who try to cope with the pandemic process, and so the use of CAM during the pandemic is not affected by self-efficacy. Those with a high level of self-efficacy might have adopted different coping styles other than CAM applications in the fight against COVID-19.

Occupation and working time were evaluated within the scope of enabling factors in this study. Considering the occupation, it was revealed that nurses used CAM during the COVID-19 pandemic 2.855 times more than other healthcare professionals. A systematic review conducted by Balouchi et al. (2018) documented higher use of CAM in nurses than in other healthcare professionals [46]. Nurses have long been strong advocates of integrated care focusing on holistic mind, body, and spirit care. Furthermore, the types of CAM cover different basic care principles and are considered to be a fundamental component of care management [47]. Due to the content of education in nursing and nurses' adoption of holistic care, nurses are ordinarily more prone to the use of CAM. Besides, this study examined the working place within the scope of need-based factors. Healthcare professionals working in intensive care units were 2.434 times more likely to use CAM during the pandemic compared to those working in another place. Similar to our findings, Tracy et al. observed that critical care nurses used CAM commonly, including diet, exercise, and relaxation techniques [48]. Healthcare professionals working in intensive care units may have driven these nurses to use CAM due to their working with a heavier patient population during the COVID-19 process and having to deal more with the feeling of helplessness.

Implication to Practice

This study's findings revealed that healthcare professionals tend to turn to CAM and the importance of using CAM to increase the well-being of healthcare professionals. This study can guide the addition of CAM to strengthen the well-being of health workers, especially in extraordinary situations such as outbreaks. In addition, it should be taken into account that the fear of contracting an outbreak disease may be high, especially among healthcare workers who use CAM. Therefore, these fears must be avoided. In addition, since supplements such as vitamins are used in general, regular information bulletins by the hospital management may contribute to the use of products with proven effectiveness and safety by health professionals.

Limitations

The limitation of this study is that it was conducted by online survey. Due to pandemic conditions, data was collected online, which limited access to individuals who did not have internet access.

CONCLUSION

Overall, it can be concluded that healthcare professionals tend to use CAM during the pandemic for support, relaxation, and protection. Also, gender, education level, fear, and attitude of healthcare professionals toward CAM predicted CAM use during the pandemic within the scope of predisposing factors. Women with a bachelor's degree, with a greater level of fear, and with a positive attitude toward CAM used CAM during the pandemic more. Within the scope of enabling factors, the underlying profession predicted the use of CAM, and nurses preferred to use CAM during the pandemic more than other

healthcare professionals. Within the context of need-based factors, the workplace was also found to be a determinant of CAM use during the pandemic, and healthcare professionals working in intensive care units used CAM during the pandemic at a higher rate. It is suggested that in-service training and guides containing evidence-based CAM approaches should be prepared for all healthcare professionals and should be updated regularly in light of the daily new information in the literature.

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A HYBRID DECISION SUPPORT SYSTEM APPLICATION WITH THE ANALYTIC HIERARCHY PROCESS AND DATA MINING TECHNIQUES: DIAGNOSIS OF COVID19 WITH COMPLETE BLOOD COUNT VALUES

ANALİTİK HİYERARŞİ SÜRECİ VE VERİ MADENCİLİĞİ TEKNİKLERİYLE HİBRİT BİR KARAR DESTEK SİSTEMİ UYGULAMASI: TAM KAN SAYIMI DEĞERLERİ İLE KOVİD19 TANISI

Ahmet Bursalı[1], Aslı Suner[2*]

[1]Huawei Turkey R&D Center, Intelligent Application DC, İstanbul, Türkiye

[2]Department of Biostatistics and Medical Informatics, Faculty of Medicine, Ege University, İzmir, Türkiye

ABSTRACT

Objective: Data mining techniques have a significant impact on enhancing the precision of diagnostics based on artificial intelligence. In this research, it was aimed to develop a web-based decision support that predicts the status of a person who comes to the hospital with Covid-19 suspicion by using complete blood count results until the imaging and PCR test results are obtained.

Method: In this study, firstly data pre-processing techniques on the data set were applied, then feature selection was made using data mining approaches. After reducing the number of variables, the analytical hierarchy process method (AHP), a prominent multi-criteria decision-making approach, was utilized. Through the AHP method combined with expert opinions, the priorities of the variables determined by machine learning were ascertained, leading to the development of a decision model using publicly accessible data. A web-based application of this decision model was subsequently crafted to provide the decision support system to the end-users. Furthermore, an evaluation was conducted to gauge the usability of the decision support system and the satisfaction of its users.

Results: RFE-SVM feature selection algorithm identified seven pivotal variables: Basophil, Eosinophil, Lymphocyte, Leukocyte, Neutrophil, Platelet, and Monocyte. Consultations were held with six expert physicians spanning diverse specialties relevant to COVID-19 diagnosis decision-making with the AHP method. Out of the 42 expert users (57.1% were male, with an average age of 37.30±10.56) were evaluated the system. The System Usability Scale (SUS) score averaged 81.43±15.64, indicating high usability.

Conclusion: Consequently, this system might enable faster isolation of the patient and the commencement of preliminary treatment.

Key Words: Covid-19, Machine Learning, Imbalance Data, Feature Selection, Decision Support System, Analytic Hierarchy Process (AHP) Method

ÖZ

Amaç: Veri madenciliği teknikleri, yapay zeka temelli tanı doğruluğunu artırmada önemli bir etkiye sahiptir. Bu araştırmada, hastaneye Kovid-19 şüphesiyle gelen bir kişinin, görüntüleme ve PCR testi sonuçları elde edilene dek, tam kan sayımı sonuçları kullanılarak, Kovid-19 olma durumu hakkında tahminde bulunan bir web tabanlı karar desteği geliştirilmesi amaçlanmıştır.

Yöntem: Bu çalışmada öncelikle veri seti üzerinde veri ön işleme teknikleri uygulanmış, daha sonra veri madenciliği yaklaşımları kullanılarak özellik seçimi yapılmıştır. Değişken sayısı azaltıldıktan sonra çok kriterli karar verme yaklaşımının önde gelenlerinden analitik hiyerarşi süreci yöntemi (AHP) kullanılmıştır. Uzman görüşleri ile birleştirilen AHP yöntemiyle makine öğrenmesiyle elde edilen değişkenlerin öncelikleri belirlenmiş ve kamuya açık veriler kullanılarak bir karar modeli geliştirilmiştir. Bu karar modelinin bir web tabanlı uygulaması, daha sonra son kullanıcılara karar destek sistemi sağlamak üzere hazırlanmıştır. Ayrıca, karar destek sisteminin kullanılabilirliğini ve kullanıcı memnuniyetini ölçmek için bir değerlendirme yapılmıştır.

Bulgular: RFE-SVM özellik seçim algoritması yedi önemli değişkeni tanımlamıştır: Bazofil, Eozinofil, Lenfosit, Lökosit, Nötrofil, Trombosit ve Monosit. AHP yöntemi ile Kovid-19 tanısına karar vermeyle ilgili farklı uzmanlık alanlarından altı uzman hekim ile görüşülmüştür. 42 uzman kullanıcı (%57.1'i erkek, yaş ortalaması 37.30±10.56) sistemi değerlendirdi. Sistem Kullanılabilirlik Ölçeği (SUS) puanının ortalaması 81.43±15.64 olup, yüksek kullanılabilirliği göstermektedir.

Sonuç: Sonuç olarak, bu sistem hastanın daha hızlı izole edilmesini ve ilk tedavisinin başlatılmasını sağlayabilir.

Anahtar Kelimeler: Kovid-19, Makine Öğrenimi, Dengesiz Veri, Öznitelik Seçimi, Karar Destek Sistemi, Analitik Hiyerarşi Süreci (AHP) Yöntemi

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***Sorumlu yazar/Corresponding author:** Ege University, Faculty of Medicine, Department of Biostatistics and Medical Informatics, İzmir, Türkiye
[2*]Email: asli.suner@ege.edu.tr, [1]Email: ahmetbursali.deu@gmail.com

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INTRODUCTION

COVID-19, caused by the novel SARS CoV-2, first emerged in China and swiftly spread across the globe, posing a significant health threat [1]. From the onset of 2020, the pandemic has deeply impacted human health, global economies. and financial markets [2]. This situation has been especially challenging for countries with limited financial resources dedicated to medical testing and treatment [1]. Diagnosing COVID-19 primarily hinges on a patient's clinical and epidemiological history [3], supplemented by tests such as chest tomography (CT scan) [4]. However, the symptoms associated with COVID-19 are not exclusive, making them insufficient for a definitive diagnosis. While CT scan findings can provide insights, they are not unique to COVID-19 and lack standalone diagnostic value [5]. At present, Real-Time Polymerase Chain Reaction (RT-PCR) tests, which detect viral RNA in samples from the throat or nose, are the gold standard for diagnosing COVID-19 [6]. Yet, RT-PCR has its limitations [7]. Given the pressing need for more accurate tests, global efforts are being made to develop innovative strategies [8]. In this context, the complete blood count (hemogram), a routine blood test, has emerged as a potential diagnostic tool for COVID-19 [9]. Recent studies have delved into using hemogram data to identify potential COVID-19 cases through machine learning techniques and to predict disease outcomes [10]. The digital revolution has facilitated the processing of vast health and molecular datasets, aiming to identify patterns and meaningful correlations, with research in this domain expanding rapidly [11]. The diverse array of machine learning algorithms available necessitates the selection of the most appropriate algorithm tailored to each specific problem.

In this research, our objective was to develop a web-based decision support system capable of accurately predicting SARS-Cov-2 infections using complete blood count values. These values were sourced from a diverse patient group amenable to data sharing. We integrated the Analytic Hierarchy Process (AHP) with data mining techniques to achieve this. While the RT-PCR test remains the predominant diagnostic tool for COVID-19, our study introduces an alternative diagnostic avenue, enabling precise identification of infections based solely on complete blood count values [12]. Following data preprocessing, we deployed machine learning algorithms, streamlined the dataset by eliminating irrelevant variables through feature selection methods [13], and addressed class imbalance issues. We employed the most frequently cited machine learning classification algorithms from existing literature to pinpoint the highest-performing ones. Expert insights were incorporated into our research. To validate the significance of the identified variables, an AHP model was constructed based on expert consensus. Subsequently, an online web application was developed, centered around the most critical variable identified by this model. This tool allows healthcare professionals to make preliminary assessments about a patient's COVID-19 status using their complete blood count, even before RT-PCR test or CT scan results are available. Consequently, potential COVID-19 patients can be isolated promptly, facilitating timely initiation of treatment.

METHOD

Outlined in Figure 1, the study's overarching workflow begins with an introduction to the utilized dataset. Following data preprocessing, we addressed class imbalance issues and proceeded with feature selection to identify pivotal variables. The commonly used methods to eliminate class imbalance including random oversampling, random undersampling, smote, smote-tomeklink, adasyn algorithms were applied. The performance metrics of accuracy, sensitivity, specificity, precision and F1 score were used to compare the classification performances of the machine learning algorithms, and the execution times of these algorithms were documented.

The performance metrics derived from the analyses were segmented into four primary categories: (i) Evaluation using the original dataset, (ii) Evaluation post-variable selection, (iii) Analysis after balancing the imbalanced dataset, and (iv) Evaluation of the balanced dataset after variable selection.

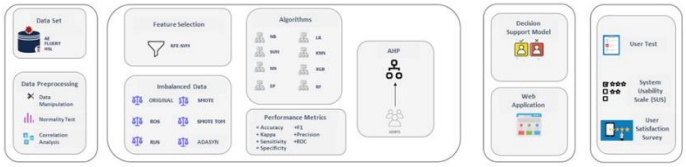

Figure 1. Workflow of the study.

To prioritize variables identified by feature selection methods, we incorporated expert opinions using the AHP formulated by Saaty in the 1970s [14]. The AHP method, tailored to the decision-maker's personal objectives, encompasses three pivotal stages: establishing a hierarchy, analyzing data priorities, and validating consistency [15]. The web application, developed using R-Shiny, was built upon the variables derived from our analyses. In testing phase of the system, we gauged its usability, user expectations, and satisfaction levels through an online survey. This survey incorporated questions crafted by our team and concluded with the "System Usability Scale (SUS)", which was adapted to Turkish in 2011, offering a subjective assessment of the software's efficacy [16].

Statistical Analysis

For user data, categorical variables were represented in frequency tables, while continuous variables were summarized using descriptive statistics. Relationships between categorical variables were explored using the chi-square test. The Shapiro-Wilk normality test assessed the distribution of numeric data. Given the non-normal distribution of the data, we employed the Mann-Whitney U test for two groups and the Kruskal-Wallis test for comparisons involving more than two independent groups. A p-value < 0.05 was considered statistically significant. Statistical analyses were performed using IBM SPSS version 25.0 statistical software.

RESULTS

Table 1 shows a comprehensive overview of the datasets utilized in this study. These datasets, sourced from an open COVID-19 cases database in Brazil [1] include contributions from three prominent institutions: Fleury Group (https://www.fleury.com.br), Albert Einstein Hospital (https://www.einstein.br), and Sírio Libanês Hospital (https://www.hospitalsiriolibanes.org.br). The data encompasses patient records from February 26, 2020 to June 30, 2020 for COVID-19 cases and control data (for individuals not diagnosed with COVID-19) spanning from November 1, 2019 to June 30, 2020. It is noteworthy that all shared patient data have been anonymized, adhering to the highest international standards and guidelines. Within the dataset, only the gender attribute is categorical, with the remainder being numerical. The datasets are devoid of any missing observations. Given the analogous distributions across the three datasets, they were amalgamated into a singular dataset. This merging aimed to facilitate more robust training on a larger, class-balanced dataset.

Table 1. Overview of the datasets used in the study

Data set	AE	FLE	HSL	COVID19
Sample size	4567	803	515	5885
Number of features	22	22	22	22
Number of class	2	2	2	2
Number of categorical feature	1	1	1	1
Number of continues feature	21	21	21	21
Percentage of missing data	0	0	0	0
Ratio of class imbalance	2.262	2.136	41.916	2.242

The dataset encompasses 20 complete blood count variables, namely: Hematocrit (%), Hemoglobin (g/dl), Platelets (x103 µl), Mean Platelet Volume (MPV) (fl), Red Blood Cells (RBC) (x106 µl), Lymphocytes (x 103 µl), Leukocytes (×103 µl), Basophils (×103 µl), Eosinophils (×103 µl), Monocytes (×103 µl), Neutrophils (×103 µl), Mean Corpuscular Volume (MCV) (fl), Mean Corpuscular Hemoglobin (MCH) (pg), Mean Corpuscular Hemoglobin Concentration (MCHC) (g/dl), Red Blood Cell Distribution Width (RBRDW) (%), %Basophils, %Eosinophils, %Lymphocytes, %Monocytes, %Neutrophils. From these, the RFE-SVM feature selection algorithm identified seven pivotal variables: Basophil, Eosinophil, Lymphocyte, Leukocyte, Neutrophil, Platelet, and Monocyte.

In terms of computational efficiency, it was observed that training durations generally exceeded testing durations. The XGB algorithm was notably the most time-intensive, with training and testing durations of 10.705 minutes and 7.239 minutes, respectively; when all variables from the original data were considered. In contrast, the LR algorithm showcased the swiftest performance, clocking in at 0.096 minutes for training and 0.080 minutes for testing on the same data subset. A significant reduction in runtime was evident post the feature selection process. For a comprehensive breakdown of the performance metrics derived from the various methodologies and algorithms employed in this study, refer to Table 2 below.

Evaluation Using the Original Dataset

Upon analyzing the original dataset, all classification models yielded accuracy scores between 0.751 and 0.782. The Kappa value fluctuated from 0.361 to 0.514, with the RF algorithm achieving the peak accuracy (0.782) and Kappa value (0.514). F1 scores spanned from 0.618 to 0.683. Notably, the NB and LR models demonstrated superior sensitivity compared to their counterparts, making them viable options for detecting true positive cases. However, they also exhibited the lowest specificity, suggesting potential bias. The RF and SVM algorithms displayed balanced sensitivity and specificity values. Overall, SVM-Radial and RF emerged as top performers for the original data.

Analysis with Feature Selection

In this approach, classification methods were compared on the original data after performing feature selection using the RFE-SVM method, as referenced by [13]. This reduced the variables from 20 to 7. The NN algorithm achieved the highest accuracy (0.695-0.778) and Kappa value (0.381-0.511). Notably, the NB and LR models demonstrated superior sensitivity, making them viable options for detecting true positive cases. Overall, standout models varied across algorithms.

Balancing the Imbalanced Dataset and Analyzing

For this approach, classification metrics were derived using five distinct imbalance data processing techniques on the original dataset:

ROS Algorithm: RF achieved the highest accuracy (0.707-0.783), while SVM-Radial led in Kappa value (0.412-0.538). Despite RF's general robustness, it showed reduced sensitivity in the ROS method, possibly due to the ROS's sample generation approach. However, RF excelled in specificity.

RUS Algorithm: RF and SVM-Radial dominated in accuracy scores (0.676-0.778). SVM-Radial had the top Kappa value, while SVM-Linear excelled in sensitivity. RF stood out in specificity.

SMOTE Algorithm: RF led in accuracy (0.675-0.775), while SVM-Radial had the highest Kappa value. SVM-Linear was the top performer in sensitivity, and RF led in specificity.

SMOTE-TOMEKLINK Approach: RF again led in accuracy (0.696-0.780) and Kappa value, LR showcased the highest sensitivity, and DT led in specificity.

ADASYN Algorithm: RF achieved the highest accuracy (0.719-0.779), SVM-Linear led in Kappa and sensitivity, while RF dominated in specificity.

Generally, RF and SVM-Radial consistently emerged as the standout models across various data balancing techniques.

Analysis on Balanced Dataset with Feature Selection

This approach examined the impact of classifier algorithms after applying imbalanced data processing techniques to the dataset post-feature selection. The variable count was again reduced from 20 to 7. Performance metrics were derived using five distinct imbalance data processing techniques:

ROS Algorithm: RF achieved the highest accuracy (0.742-0.775), while KNN led in Kappa value (0.449-0.528). RF's sensitivity was notably lower, but it excelled in specificity. SVM-Radial and RF emerged as top performers.

RUS Algorithm: SVM-Radial dominated in accuracy (0.679-0.776) and Kappa value. SVM-Linear showcased superior sensitivity, while XGB led in specificity, SVM models and RF stood out.

SMOTE Algorithm: KNN led in accuracy (0.616-0.777) and Kappa values. SVM-Radial had the highest sensitivity, and RF achieved the best specificity. SVM-Radial and RF were the standout models.

SMOTE-TOMEKLINK Approach: KNN achieved the highest accuracy (0.702-0.777) and Kappa values. LR excelled in sensitivity, while XGB had the top specificity.

ADASYN Algorithm: KNN led in accuracy (0.718-0.771) and Kappa values. LR showcased the best sensitivity, and RF dominated in specificity. LR, RF, and KNN emerged as the standout models.

In conclusion, while feature selection didn't drastically alter metrics, the ability to achieve better results with fewer variables offers significant advantages in cost and time efficiency.

AHP Method Results

In this research, the AHP method was employed to prioritize criteria for variables derived post-feature selection. For this purpose, consultations were held with six expert physicians spanning diverse specialties relevant to COVID-19 diagnosis decision-making. These specialties included public health, infectious diseases, emergency medicine, chest diseases, internal medicine, and radiology (refer to Figure 2). The experts' average age was 55.83 with a standard deviation of 6.55. ranging from 45 to 63 years.

Development of the Decision Support Model and Web Application

A web-based decision support model was developed, accessible via: http://185.106.208.185:3838 (as seen in Figure 3). Within this application, users can input blood test results for an individual. Upon clicking the "calculate" button, the system provides a predictive result and probability score for the individual's potential COVID-19 diagnosis. For user convenience, sample data entries for both COVID-19 positive and negative results are available for testing.

Figure 2 showcases steps from a sample application screenshot. In Figure 2a, data for a patient with a 59% likelihood of having COVID-19 is displayed. Conversely, Figure 2b presents a patient with a 73% probability of being healthy. The "Graphs" menu offers visual insights: users can view pie and bar charts based on the results after relevant analyses (as seen in Figure 2c). The pie chart delineates the probabilities of being COVID-negative or positive, while the bar chart illustrates the patient's specific blood result levels.

Experts who contributed to the AHP method with their expert opinions also used the system and expressed their opinions in the user survey.

Table 2. Detailed performance metrics for the implemented methods and algorithms

Method	Algoritm	Accuracy		Kappa		Sensitivity		Specificity		Precision		F1-Score		ROC	
		ALL	FS	ALL	FS	ALL	FS	ALL	FS	ALL	FS	ALL	FS	ALL	FS
ORIGINAL	NB	0.751	0.757	0.477	0.478	0.699	0.646	0.782	0.825	0.664	0.694	0.681	0.669	0.806	0.799
	SVM_L	0.778	0.771	0.508	0.492	0.594	0.585	0.892	0.886	0.772	0.759	0.671	0.661	0.818	0.814
	SVM_R	0.781	0.772	0.513	0.491	0.592	0.568	0.897	0.898	0.779	**0.773**	0.673	0.655	**0.842**	**0.830**
	LR	0.683	0.695	0.361	0.381	**0.722**	**0.713**	0.659	0.684	0.565	0.581	0.634	0.640	0.740	0.741
	KNN	0.777	0.776	0.501	0.502	0.576	0.591	0.900	0.889	0.780	0.766	0.663	0.667	0.835	0.828
	RF	**0.782**	0.768	**0.514**	0.484	0.588	0.570	**0.901**	0.890	**0.785**	0.761	0.672	0.652	0.839	0.823
	DT	0.753	0.748	0.444	0.430	0.525	0.509	0.893	0.895	0.751	0.748	0.618	0.606	0.758	0.756
	XGB	0.760	0.752	0.460	0.436	0.536	0.496	0.898	**0.910**	0.763	**0.773**	0.629	0.604	0.825	0.816
	NN	0.775	**0.778**	0.510	**0.511**	0.635	0.607	0.861	0.884	0.737	0.763	**0.683**	**0.676**	0.816	0.819
ROS	NB	0.744	0.747	0.474	0.470	0.743	0.698	0.746	0.778	0.642	0.659	0.689	0.678	0.804	0.795
	SVM_L	0.760	0.754	0.508	0.496	**0.771**	**0.772**	0.754	0.742	0.658	0.648	0.710	0.705	0.818	0.812
	SVM_R	**0.777**	0.772	**0.538**	0.527	0.763	0.756	0.786	0.782	0.687	0.681	**0.723**	**0.717**	**0.839**	**0.830**
	LR	0.707	0.742	0.412	0.474	0.765	0.762	0.671	0.730	0.588	0.634	0.665	0.692	0.775	0.806
	KNN	0.760	0.774	0.504	**0.528**	0.753	0.743	0.764	0.793	0.662	0.688	0.705	0.714	0.833	0.828
	RF	0.783	**0.775**	0.524	0.506	0.631	0.621	**0.876**	**0.869**	**0.758**	**0.745**	0.689	0.677	0.839	0.822
	DT	0.743	0.743	0.462	0.449	0.695	0.632	0.773	0.812	0.653	0.674	0.673	0.652	0.770	0.748
	XGB	0.768	0.763	0.509	0.497	0.705	0.692	0.806	0.806	0.691	0.687	0.698	0.689	0.824	0.815
	NN	0.752	**0.772**	0.471	0.522	0.661	0.729	0.808	0.799	0.679	0.690	0.670	0.709	0.830	0.698
RUS	NB	0.750	0.754	0.485	0.485	0.746	0.708	0.753	0.782	0.650	0.667	0.694	0.687	0.804	0.799
	SVM_L	0.759	0.752	0.507	0.495	**0.775**	**0.780**	0.749	0.736	0.655	0.645	0.710	0.706	0.819	0.812
	SVM_R	**0.778**	**0.776**	**0.536**	**0.532**	0.746	0.743	0.798	0.797	0.694	0.692	**0.719**	**0.716**	0.838	**0.829**
	LR	0.676	0.679	0.357	0.360	0.754	0.747	0.628	0.637	0.555	0.558	0.639	0.639	0.745	0.751
	KNN	0.759	0.772	0.504	0.522	0.760	0.737	0.758	0.793	0.659	0.687	0.706	0.711	0.830	0.824
	RF	**0.778**	0.769	0.532	0.518	0.723	0.734	**0.812**	0.791	**0.702**	0.684	0.713	0.708	**0.839**	0.820
	DT	0.746	0.741	0.470	0.450	0.713	0.658	0.766	0.792	0.652	0.661	0.681	0.659	0.771	0.748
	XGB	0.765	**0.767**	0.503	0.503	0.696	0.679	0.808	**0.822**	0.690	**0.700**	0.693	0.689	0.823	0.821
	NN	0.774	0.768	0.527	0.510	0.738	0.705	0.796	0.807	0.690	0.692	0.713	0.699	0.826	0.819
SMOTE	NB	0.743	0.751	0.471	0.479	0.738	0.705	0.747	0.780	0.642	0.663	0.687	0.683	0.805	0.796
	SVM_L	0.764	0.616	0.516	0.007	**0.775**	0.027	0.758	**0.979**	0.663	0.439	0.715	0.05	0.818	0.696
	SVM_R	0.773	0.771	**0.529**	0.523	0.757	**0.753**	0.783	0.781	0.682	0.679	**0.718**	0.714	**0.837**	**0.829**
	LR	0.675	0.664	0.355	0.333	0.754	0.737	0.626	0.619	0.553	0.543	0.639	0.625	0.744	0.733
	KNN	0.750	**0.777**	0.489	**0.536**	0.768	0.751	0.739	0.793	0.644	0.691	0.701	**0.720**	0.832	0.827
	RF	**0.775**	0.770	0.517	0.506	0.674	0.665	**0.837**	0.834	**0.718**	**0.712**	0.695	0.688	0.834	0.819
	DT	0.733	0.750	0.444	0.462	0.696	0.638	0.756	0.818	0.637	0.683	0.665	0.660	0.771	0.749
	XGB	0.762	0.762	0.496	0.491	0.690	0.664	0.806	0.823	0.686	0.697	0.688	0.680	0.823	0.808
	NN	0.757	0.773	0.502	0.525	0.772	0.734	0.747	0.798	0.653	0.690	0.708	0.711	0.821	0.711
SMOTE-TOMEKLINK	NB	0.755	0.758	0.482	0.477	0.690	0.637	0.794	0.832	0.673	0.699	**0.682**	**0.667**	0.804	0.799
	SVM_L	0.778	0.770	0.508	0.490	0.600	0.586	0.887	0.883	0.766	0.755	0.673	0.660	0.818	0.814
	SVM_R	0.778	0.772	0.506	0.491	0.588	0.570	0.895	0.897	0.775	0.772	0.668	0.656	**0.841**	**0.830**
	LR	0.696	0.702	0.385	0.390	**0.723**	**0.704**	0.680	0.701	0.581	0.591	0.645	0.643	0.748	0.749
	KNN	0.776	**0.777**	0.498	**0.504**	0.570	0.582	0.902	0.898	**0.782**	0.777	0.659	0.666	0.835	0.827
	RF	**0.780**	0.768	**0.513**	0.484	0.598	0.576	0.892	0.886	0.773	0.756	0.674	0.654	0.833	0.824
	DT	0.752	0.758	0.437	0.454	0.504	0.525	**0.904**	**0.901**	0.764	0.766	0.608	0.623	0.759	0.760
	XGB	0.757	0.750	0.453	0.427	0.533	0.479	0.895	0.916	0.757	**0.778**	0.625	0.593	0.827	0.813
	NN	0.770	0.767	0.490	0.479	0.586	0.598	0.883	0.871	0.755	0.740	0.660	0.662	0.821	0.819
ADASYN	NB	0.743	0.742	0.477	0.469	0.769	0.740	0.727	0.744	0.634	0.640	0.695	0.686	0.804	0.798
	SVM_L	0.767	0.738	0.524	0.471	**0.789**	0.784	0.754	0.710	0.663	0.624	0.721	0.695	0.819	0.810
	SVM_R	**0.779**	0.763	**0.544**	0.512	0.781	0.768	0.778	0.759	0.684	0.662	**0.729**	0.711	**0.833**	**0.827**
	LR	0.767	0.735	0.522	0.467	0.780	**0.789**	0.759	0.703	0.666	0.620	0.718	0.694	0.821	0.806
	KNN	0.753	**0.771**	0.496	**0.527**	0.778	0.765	0.737	0.775	0.646	0.676	0.706	**0.718**	0.827	0.823
	RF	0.776	0.764	0.527	0.500	0.714	0.689	**0.814**	**0.811**	**0.703**	**0.691**	0.708	0.690	0.835	0.813
	DT	0.719	0.741	0.437	0.450	0.783	0.658	0.680	0.792	0.600	0.661	0.680	0.659	0.743	0.748
	XGB	0.747	0.755	0.483	0.485	0.765	0.702	0.737	0.787	0.641	0.670	0.697	0.686	0.816	0.812
	NN	0.763	0.718	0.513	0.431	0.768	0.763	0.760	0.690	0.663	0.602	0.712	0.673	0.824	0.617

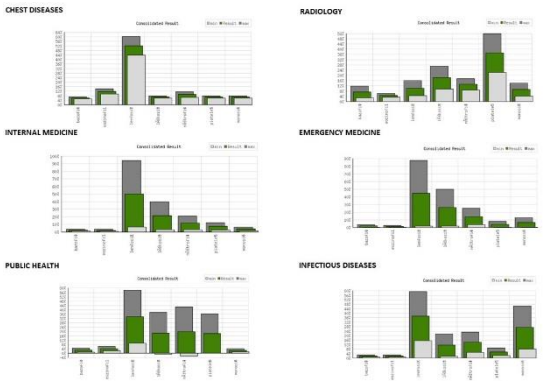

Figure 2. Criterion priorities obtained as a result of the AHP analysis.

User Test Results

The online survey form for user evaluation can be accessed at this link https://form.jotform.com/223380903422954 (as seen in Figure 4). Out of the 42 expert users who evaluated the system, 57.1% were male, with an average age of 37.30±10.56. A significant majority, 88.1%, are proficient in computer usage. Their educational backgrounds vary: 31.0% in Medicine, 21.4% in Biology/Molecular Biology/Biochemistry, 19.0% in Statistics/Mathematics, and 16.7% in Computer Science/Engineering/Programming. The System Usability Scale (SUS) score averaged 81.43±15.64, indicating high usability. There were no significant differences in SUS scores when segmented by gender, computer proficiency, or academic background (p-value=0.277; p-value=0.714; and p-value=0.731, respectively). Furthermore, 83.4% of users expressed satisfaction with the application, and 76.2% appreciated its design. These sentiments did not vary significantly based on gender, computer skills, or academic backgrounds (p-value=0.684; p-value=0.431; p-value=0.292; p-value=0.432; p-value=0.940; and p-value=0.738, respectively).

Users highlighted several positive aspects of the application: (i) The interface is user-friendly, quick, and straightforward; (ii) The cost-free nature of the application was appreciated; (iii) Users found the probability values in the results particularly useful; (iv) The application aids in determining patient triage priorities; (v) It can assist healthcare professionals in managing patients while awaiting test results; (vi) Knowing the calculated probability of a positive test result can help reduce transmission risks; (vii) Users valued the inclusion of quantitative data through mathematical modeling. However, there were some criticisms: (i) Technical terms like leukocytes and neutrophils require explanatory texts; (ii) A directly downloadable mobile app would enhance user experience; (iii) The introductory directive could be more concise. Survey participants also offered suggestions for improvement: (i) Incorporate additional variables such as age, gender, race, oxygen saturation, blood pressure, and pulse; (ii) Differentiate between patients with and without chronic diseases; (iii) Integrate with e-government systems to send results directly to patients' phones; (iv) Save time by automatically retrieving laboratory findings through integration with hospital information systems; (v) Enhance graphics with added explanations and improved visuals.

DISCUSSION

Machine learning techniques have become instrumental in medical diagnostics, offering insights into disease probabilities and risk factors based on clinical and laboratory data. These methods not only enhance diagnostic accuracy but also alleviate the workload. While data engineering techniques, including data mining and machine learning, have found success in various real-world scenarios, medical diagnostics often demand meticulous data preprocessing. Challenges like insufficient data, cognitive errors from data collection or verification discrepancies, missing observations, class imbalances, and irrelevant variables can skew diagnostic outcomes. Addressing these issues through data preprocessing before deploying data mining algorithms can significantly boost classification accuracy and overall algorithm performance.

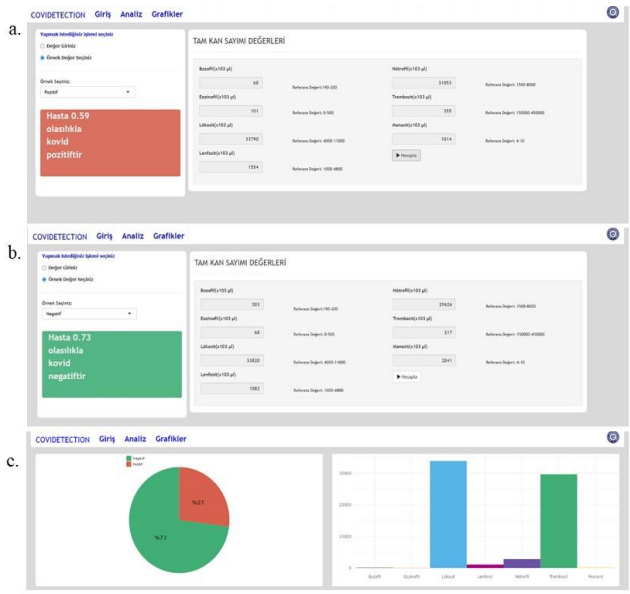

Figure 3. Screenshot of the web-based decision support model

In healthcare, class imbalances can undermine the efficacy of models trained on datasets with underrepresented classes. This imbalance has been addressed in various biomedical contexts, such as breast cancer diagnosis, gene expression data in cancer microarrays, and protein intracellular location data [17]. When considering the challenge of irrelevant variables, some studies have employed embedded feature extraction methods, as seen in research on drug response heterogeneity in Type 2 diabetes patients. In contrast, others have utilized statistical filtering methods, as in thyroid nodule identification studies [18]. Another notable research combined feature selection with cluster analysis techniques for clinical breast cancer diagnosis [19]. A study by [20] focused on developing a decision support system for predicting kidney stone types using ensemble learning. Additionally, a comprehensive study has compared the outcomes of various feature selection methods applied to clinical datasets [21].

The AHP, a subset of Multicriteria Decision Analysis (MCDA) methods, has gained global recognition across diverse sectors, including health, industry, marketing, finance, and more. Recent findings highlight its efficacy in healthcare for diagnosis, treatment prioritization, health management, and health technology assessment [22]. Prior research has emphasized the potential of AHP combined with decision tree methodologies in aiding general surgeons with decision-making in rectal cancer treatments [23,24]. Given the multifaceted nature of healthcare decision-making, AHP, a prominent MCDA method, is a preferred choice [22].

Comparing our findings with the reference study [1], a notable distinction lies in the analytical approach. While the reference utilized Python for analysis, this study employed the R programming language. Differences in utilized libraries and function parameters can influence outcomes. For instance, while the reference leveraged the scikit-learn package in Python, this study used the caret package in R. The reference ran classification algorithms 31 times, recording all results, whereas this study adopted the 10-fold cross-validation method, aiming for more consistent and trustworthy outcomes. Additionally, while the reference article analyzed three separate datasets, this study amalgamated them into one, reducing data imbalance and enhancing training quality. Overall, despite the close alignment of results between the reference and this study, our approach yielded superior outcomes in certain performance metrics.

In a study conducted on the Fleury dataset, [25] aimed to predict Covid-19 outcomes using hemogram results and age through the

Xgboost algorithm. However, the study did not address the class imbalance issue, nor did it undertake a feature selection process. Examining the Xgboost algorithm's classification performance, the accuracy was 0.80, Precision 0.756, Specificity 0.82, F1-score 0.701, and the ROC value was 0.811. In contrast, our study rectified the class imbalance and implemented feature selection, influencing the results.

Another notable study by [13] assessed the impact of feature selection (hemogram values) on Covid-19. This study utilized the Albert Einstein hospital dataset and employed the Recursive Feature Elimination method of SVM for variable selection, similar to our approach. However, their focus was primarily on variable selection, measuring the impact of these variables through statistical analyses. In our study, we gauged the influence of selected variables using machine learning algorithms.


Ege Üniversitesi Tıp Fakültesi
Biyoistatistik ve Tıbbi Bilişim Anabilim Dalı
Tel: 0 232 390 19 85
Mail: biyoistatistik@mail.ege.edu.tr

Tam Kan Sayımı Değerleri ile Kovid-19 Tanısı

Bu değerlendirme formu, TGA-2021-23066 numaralı ve "Analitik Hiyerarşi Süreci ve Veri Madenciliği Teknikleriyle Hibrit bir Karar Destek Sistemi Uygulaması Tam Kan Sayımı Değerleri ile Kovid19 Tanısı" başlıklı BAP projesinin çıktısı olan karar desteği uygulamasının son kullanıcılar tarafından değerlendirilmesi amacıyla oluşturulmuştur. Tüm soruları cevaplamanız bizim için çok önemlidir. Katkılarınız için çok teşekkür ederiz.

Sistem Kullanılabilirlik Ölçeği

Lütfen size en uygun olan seçeneği işaretleyiniz.

	1	2	3	4	5	
Bu uygulamayı sıklıkla kullanacağımı düşünüyorum. *	Katılmıyorum					Katılıyorum
Uygulamayı gereksiz ölçüde karmaşık buldum. *	Katılmıyorum					Katılıyorum
Uygulamanın kullanımını kolay buldum. *	Katılmıyorum					Katılıyorum
Uygulamayı kullanmak için teknik desteğe ihtiyaç duyabileceğimi düşünüyorum. *	Katılmıyorum					Katılıyorum
Uygulamadaki çeşitli özelliklerin birbiri ile iyi entegre edilmiş olduğunu düşünüyorum. *	Katılmıyorum					Katılıyorum
Uygulamada çok fazla tutarsızlık olduğunu düşünüyorum. *	Katılmıyorum					Katılıyorum
Pek çok kişinin uygulamayı	1	2	3	4	5	

Figure 4. Screenshot of the online survey form for user evaluation

Decision Support Systems (DSS) have gained traction in the medical field, aiding physicians in the diagnostic process. These systems enhance decision-making by offering reminders, alerts, suggestions, and interpretations [26]. Patient-specific characteristics can be input into the DSS, either by the physician, patient, or through electronic medical records, to generate tailored recommendations. In our study, we developed an online decision support model that predicts the likelihood of a patient having Covid-19. This facilitates quicker isolation and preliminary treatment for suspected Covid-19 patients while awaiting further test results. Our study stands out for its unique approach in creating a web-based decision support system using data mining with hemogram data for Covid-19 diagnosis.

Limitations

One limitation of our study is its reliance on datasets from three specific hospitals in Brazil, without incorporating data from other countries or hospitals. Furthermore, the developed application is recommendation-based, intended to complement, not replace, primary diagnostic methods for detecting Covid-19, such as PCR and Tomography.

CONCLUSION

This study underscores the significance of hemogram data in diagnosing Covid-19. While it's designed to complement existing diagnostic methods, the rapid availability of full blood count test results can provide preliminary insights into Covid-19, facilitating quicker decisions. As comprehensive research encompassing diverse datasets and methodologies, it offers valuable insights for future research. The developed web application allows researchers of varying expertise to create and utilize explainable models for predictions, providing a user-friendly, free platform with reproducible outcomes.

Ethical Approval: *Not necessary.*

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

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Author Contribution: Concept: *AS;* ***Design:*** *AS;* ***Data collecting:*** *AS, AB;* ***Statistical analysis:*** *AB;* ***Literature review:*** *AS, AB;* ***Writing:*** *AS, AB;* ***Critical review:*** *AS.*

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EVALUATION OF EATING QUALITY AFTER LAPAROSCOPIC SLEEVE GASTRECTOMY

LAPAROSKOPİK SLEEVE GASTREKTOMİ SONRASI BESLENME KALİTESİNİN DEĞERLENDİRİLMESİ

Gülşah Kaner[1], Çağla Ayer[1*], Tuba Yalçın[1]

[1]Department of Nutrition and Dietetics, Faculty of Health Sciences, İzmir Katip Çelebi University, İzmir, Türkiye

ABSTRACT

Objective: This study aims to evaluate the tolerance to different types of foods after laparoscopic sleeve gastrectomy (LSG).

Method: This cross-sectional study was carried out with a total of 77 patients aged 18-65 years. Patients were divided into three groups according to the time after LSG operation (Group 1=<6th month, Group 2=from 6th to <12th month, and Group 3=from 12th to 24th month). The quality of alimentation questionnaire was used to assess food tolerance.

Results: The mean total food tolerance score (FTS) of patients was 20.83±3.66. Total FTS showed no statistical differences between the groups (p=0.23). After LSG, a statistically significant relationship was determined between the consumption of legumes, green leafy vegetables, and other vegetables and the FTS. The FTS increased as time passed after LSG (p<0.001). Patients reported poor tolerance to red meat (53.2%) and carbohydrates such as rice (36.4%), and bread (35.1%) after LSG. Good tolerance to fish (84.4%), white meat (70.1%), and salad (62.3%) were determined. The tolerance of bread, pasta, and rice increased gradually from group 1 to group 3 (p<0.05). A low level of negative correlation was determined between abdominal pain (r=-0.263), abdominal bloating (r=-0.234), legume consumption (r=-0.297), and FTS.

Conclusion: Food tolerance for different types of food was lower in the first 6 months and increased as time passed after LSG. This situation suggests that individuals attach importance to adequate and balanced nutrition and prefer healthy food choices.

Key Words: Alimentation Questionnaire, Food Tolerance, Laparoscopic Sleeve Gastrectomy, Obesity

ÖZ

Amaç: Bu çalışma, laparoskopik sleeve gastrektomi (LSG) sonrası farklı besin türlerine toleransı değerlendirmeyi amaçlamaktadır.

Yöntem: Bu kesitsel çalışma, 18-65 yaş arası toplam 77 hastanın katılımı ile gerçekleştirilmiştir. Hastalar LSG operasyonu sonrası sürelerine göre üç gruba (Grup 1=<6. ay, Grup 2=6. aydan <12. aya kadar ve Grup 3=12. aydan 24. aya kadar) ayrılmıştır. Besin toleransını değerlendirmek için beslenme kalitesi anketi kullanılmıştır.

Bulgular: Hastaların ortalama toplam besin tolerans skoru (BTS) 20.83±3.66'dır. Toplam BTS, gruplar arasında istatistiksel olarak farklılık göstermemiştir (p=0.23). LSG sonrası baklagiller, yeşil yapraklı sebzeler ve diğer sebzelerin tüketimi ile BTS arasında istatistiksel olarak anlamlı bir ilişki saptanmıştır. LSG süresi arttıkça BTS puanı da artmıştır (p<0.001). Hastalar LSG sonrası kırmızı et (%53.2), pirinç (%36.4) ve ekmek (%35.1) gibi karbonhidratlara karşı zayıf tolerans bildirmiştir. Balık (%84.4), beyaz et (%70.1) ve salata (%62.3) toleransının iyi olduğu belirlenmiştir. Ekmek, makarna ve pirince olan tolerans 1. gruptan 3. gruba doğru kademeli olarak artmıştır (p<0.05). Karın ağrısı (r=-0.263), karın şişkinliği (r=-0.234), bakliyat tüketimi (r=-0.297) ve BTS arasında düşük düzeyde negatif korelasyon saptanmıştır.

Sonuç: Farklı besin türlerine karşı toleransın, LSG sonrası ilk 6 ayda daha düşük olduğu ve sonrasında arttığı belirlenmiştir. Bu durum bireylerin yeterli ve dengeli beslenmeye önem verdiklerini ve sağlıklı besin seçimlerini tercih ettiklerini düşündürmektedir.

Anahtar Kelimeler: Beslenme Anketi, Besin Toleransı, Laparoskopik Sleeve Gastrektomi, Obezite

INTRODUCTION

Obesity is one of the most common life-threatening diseases. It is the new epidemic of the 21st century [1]. The World Health Organization (WHO) reported that there were approximately 1.9 billion overweight and more than 650 million adults with obesity worldwide in 2016 [2]. According to the Türkiye Nutrition and Health Survey 2019, the prevalence of overweight and obesity is 23.8% to 42.0% in men and 28.5% to 33.1% in women [3].

Diet, exercise, cognitive behavioral therapy, and pharmacotherapy are some of the ways to help patients lose weight [4]. Today, it is believed that one of the most effective treatments in the fight against obesity is the bariatric surgery [5]. The ultimate aim of bariatric surgery is to lose weight and resolve obesity-related comorbidities to improve psychosocial functioning and quality of life. There are various procedures in the surgical treatment of severe obesity. Laparoscopic sleeve gastrectomy (LSG) has proven to be effective in weight loss and resolution of comorbidities [6]. According to the International Federation for the Surgery of Obesity and Metabolic Disorders, LSG was the most frequently performed procedure worldwide, followed by Roux-en-Y gastric bypass [7].

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***Sorumlu yazar/Corresponding author:** İzmir Katip Çelebi University, Faculty Health Sciences, Department of Nutrition and Dietetics, İzmir, Türkiye
[2*]Email: cagla.dalbay@gmail.com, [1]Email: kanergulsah@gmail.com, [3]Email: tubay25@gmail.com

Many patients reported food intolerance, due to the development of an unwillingness to certain types of food that can cause to vomit or dumping syndrome after bariatric surgery [8]. Food tolerance outcomes differ by type of surgery and time since surgery. LSG is considered easier than other bariatric surgeries as the pylorus is preserved [9]. LSG procedures are associated with the least number of food intolerances and generally do not cause dumping syndrome [8, 10].

Percentage excess weight loss (%EWL) and percentage of excess body mass index (BMI) loss (%EBL) are generally used to report weight loss after bariatric surgery [11]. Other often evaluated success parameters are a resolution of comorbidity and improvement in quality of life [12]. Although these are important factors to consider, we think that it is also important to evaluate food tolerance and dietary habits, as their results may affect comorbidities and quality of life. The objective of the present study was to evaluate the tolerance to different types of foods after LSG during the two postoperative years.

METHOD

This cross-sectional study was carried out with a total of 77 patients aged 18-65 years who underwent LSG between September 2019 and December 2021. According to the sample calculation formula (N=80, (confidence interval) a: 0.05, (frequency of occurrence) p: 0.5, d: 1.0), the minimum number of people to be reached was calculated as 67. 96.25% of the LSG population was reached. Patients were divided into three groups according to the time after LSG operation (Group 1=<6th month, Group 2=from 6th to <12th month, and Group 3=from 12th to 24th month). This grouping was determined according to the frequency of the patients visiting the control. Recruitment took place from a single clinic and LSG was performed by a single surgeon.

The data were obtained using a questionnaire form filled out by the research dietician through face-to-face interviews. Patients completed a questionnaire on demographics, physical activities, dietary habits, weight loss history, vitamin-mineral supplementation, gastrointestinal symptoms, food tolerance, and changes in some food consumption. The patients body composition was evaluated.

The inclusion criteria were: adults with severe obesity BMI>40 kg/m^2 or BMI>35 kg/m^2 associated with comorbidity (diabetes mellitus, hypertension, arthritis, sleep apnea). The exclusion criteria were: cardiac diseases, hypothyroidism, previous bariatric surgery, hiatus hernia, and pregnancy.

Changes in Food Consumption

We used a food frequency questionnaire to evaluate the consumption of various foods before and after the LSG. Participants completed a self-administered validated food frequency questionnaire [13]. For each food, the consumption amount after LSG was subtracted from the amount before LSG, and the change in the consumption amount was calculated. The variation of food consumption frequency results was grouped as “increase”, “decrease” or “not changed”. Trained dieticians performed the interviews.

Food Tolerance Score (FTS)

The quality of alimentation questionnaire was used to assess food tolerance. The questionnaire is divided into four parts. Part 1 evaluates satisfaction with current ability to consume food, and presents answers ranging from “very bad=1” to “excellent=5”. Part 2 has questions relating to the main food of the day, how many meals are made daily, and the patient is fed between them. This section does not enter the score. Part 3 assesses specific food tolerances. This section evaluates how well eight different types of food (red meat, white meat, salad, vegetables, bread, rice, pasta, and fish) are tolerated. In part 3, the questions refers to the ability to be able to eat certain types of food without difficulty, with some difficulty, or not being able to eat. Food tolerance is given between 0 and 16 points: for each specific type of food, 2 points if the patient can eat this type without any particular difficulty, 1 point if he/she can eat it with some difficulties, and 0 points if he/she can not eat it at all. Part 4 evaluates the frequency of vomiting or regurgitation, with a score ranging from 0 to 6. In this section, 0 indicates “daily”, 2 indicates “often (greater than twice per week)”, 4 indicates “rarely (up to twice per week), and 6 indicates “never”. Cumulatively the three sections provide an overall FTS ranging from 0-27, 27 being the highest score, referring to excellent food tolerance [14].

Anthropometric Measurements

Body composition was evaluated using the TANITA BC-532 (Tokyo, Japan) device with the bioelectrical impedance analysis measurement method. Height was measured with a 0.01 cm sensitivity stadiometer with the patient standing, feet side by side, and head in the Frankfort plane. BMI was calculated by dividing body weight (kg) by the square of height (m^2). Data collected pre and post LSG included body weight, BMI, lean body mass (LBM), and fat mass (FM) [15]. In the present study, %EWL and %EBL were also evaluated. The %EWL was defined as “lost weight / (preoperative weight - ideal body weight)”, with ideal body weight usually captured through the Metropolitan Life Tables. The %EBL was defined as “BMI points lost / (preoperative BMI - 25)” [16].

Ethical Approval

The present study was performed by the guidelines laid down in the Declaration of Helsinki and all procedures involving research study patients were approved by the İzmir Katip Celebi University Faculty of Medicine Clinical Research Ethics Committee (on 28-08-2019 and with the decision number of 382). Written informed consent was also provided from all patients.

Statistical Analysis

SPSS 25.0 (SPSS Inc., Chicago, IL, USA) statistical package program was used for the statistical evaluation of the data [17]. The mean ± standard deviation (x±SD) values were calculated, and the qualitative data were shown in numbers (n) and percentages (%). Kolmogorov Smirnov test was used to evaluate compliance of the data to normal distribution. Chi-square test, t-test in independent groups, paired sample t-test, One-Way ANOVA, and Pearson correlation were used in the evaluations. The lowest level of significance was accepted as 0.05 in all statistical tests.

RESULTS

A total of 77 patients were included in this study. The mean age was 37.83±12.23 years. Fifty-seven (74.0%) patients were women, and the mean BMI was 41.01±7.73 kg/m2. The mean total FTS of patients was 20.83±3.66. Total FTS showed no statistical differences between the groups (Group 1=20.00±3.11, Group 2=20.60±3.97, Group 3=21.88±3.73, respectively), (p=0.17). Almost all of the patients (97.4%) reported attempting to lose weight before the surgery. Consulting a dietician (83.1%), going to the gym (74.0%), and consuming herbal tea (40.3%) were the most preferred methods to lose weight. It was determined that 50.6% of patients who received dietician consultation for weight loss before the LSG did not comply with recommendations, and their FTS (20.50±3.68) was lower than those who followed the recommendations (21.15±3.41). However, the differences were not statistically significant (p=0.47) (Table 1).

The symptoms commonly reported after LSG are presented in Figure 1. Constipation (50.6%), hair loss (28.6%), and nausea/vomiting (28.6%) were commonly reported by the patients. Patients with diarrhea (24.00±1.00), reflux (21.67±3.21), and hair loss (21.36±4.13) had the highest FTS. The total FTS is statistically significantly lower in those with abdominal bloating (18.14±4.74) and abdominal pain (16.75±3.09) than those without these complaints (21.10±3.46 and 21.05±3.57, respectively) (p=0.04, p=0.02, respectively) (Figure 1).

Table 1. Patients' baseline characteristics

Variables	n	%	FTS Mean±SD	Statistics
Food tolerance score (FTS)	77	100	20.83±3.66	
Gender				
Female	57	50.6	21.00±3.78	t=0.24
Male	20	49.4	20.92±3.67	p=0.81
Groups				
1 (<6th month)	26	33.8	20.00±3.11	F=1.84
2 (6th-<12th month)	25	32.4	20.60±3.97	p=0.17
3 (12th-24th month)	26	33.8	21.88±3.73	
Body weight loss initiative before LSG				
Yes	75	97.4	20.83±3.67	t=-0.07
No	2	2.6	21.00±4.24	p=0.95
Methods for weight loss**				
Dietician counseling	64	83.1	20.89±4.50	t=0.36; p=0.72
Drug use	27	35.1	21.07±3.28	t=0.46; p=0.65
Herbal products and herbal tea	31	40.3	20.58±3.48	t=-0.48; p=0.63
Detoxes and powder mixtures	8	10.4	19.87±4.05	t=-0.77; p=0.44
Going to the gym	57	74.0	20.85±3.52	t=0.14; p=0.89
Diets found in media and internet	18	23.4	19.83±3.76	t=-1.32; p=0.19
Acupuncture	10	13.0	20.20±5.34	t=-0.58; p=0.56
Compliance with dietician recommendations before LSG				
Yes	38	49.4	21.15±3.41	t=0.73
No	26	50.6	20.50±3.68	p=0.47

**The data was shown as mean± standard deviation (SD) (p<0.05); ** More than one answer has been accepted; LSG: Laparoscopic sleeve gastrectomy*

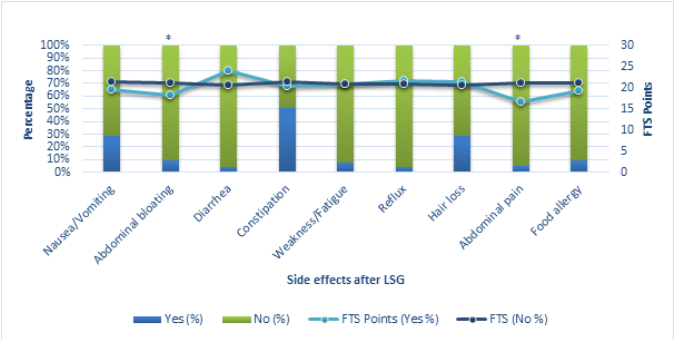

Figure 1. Side effects after LSG and its' relationship between food tolerance score
*(*p<0.05)*

Changes in food consumption after LSG and its relationship between FTS are shown in Figure 2. Patients reported a reduced consumption for pasta (90.9%), rice (89.6%), and dessert with syrup (84.4%) after LSG. However, there is an increase in the consumption of foods such as fish (46.8%), egg (47.6%), and oilseeds (39.0%). After LSG, a statistically significant relationship was determined between the consumption of legumes, green leafy vegetables, and other vegetables and the FTS. The FTS of those who did not change their legume consumption after LSG was 22.10±3.27, and the score of those who reduced their consumption was 19.88±4.01 (p=0.002). Similarly, the FTS of those who did not change their consumption of green leafy vegetables and other vegetables (21.95±3.19 and 21.64±3.82, respectively) was significantly higher than the score of those who reduced their consumption of these foods (18.76±4.12 and 17.81±3.68, respectively) (p=0.01, p=0.008, respectively) (Figure 2).

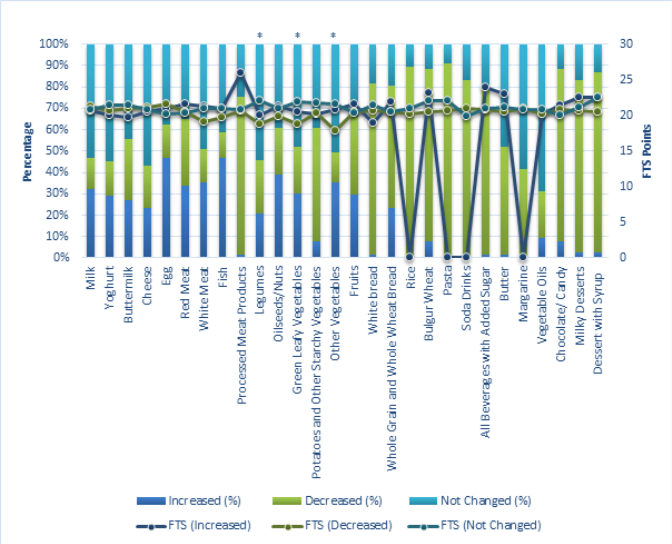

Figure 2. Changes in consumption of various foods after LSG and its' relationship between food tolerance score.
**p<0.05; **According to the post-hoc Tukey test, the difference is between legume consumption "decreased" and "unchanged" groups; **According to the post-hoc Tukey test, the difference is between the consumption of green leafy vegetables "decreased" and "unchanged" groups; **According to the post-hoc Tukey test, the difference is between the consumption of other vegetables "decreased-unchanged" and "decreased-increased" groups.*

The FTS according to groups are displayed in Table 2. When patients rated their overall satisfaction with their ability to eat at present, the score decreased as time passed after LSG. However, the differences were not statistically significant. The total score for food tolerance was 10.58±2.66 points for group 1, 12.08±2.60 points for group 2, and 13.38±2.23 points for group 3. The FTS increased as time passed after LSG, and the differences were statistically significant (p<0.001). The mean score for vomiting frequency was 4.85±1.29, 4.40±1.53, and 4.46±1.82 for the group 1, 2, and 3, respectively. However, the differences were not statistically significant. The total score of the questionnaire was 20.00±3.11, 20.60±3.97, and 21.88±3.73 for group 1, 2, and 3, respectively. Although the total score increases with the increase in the postoperative time, the difference is not statistically significant (Table 2).

Table 2. Food tolerance score according to groups

FTS	Group 1 (n=26)	Group 2 (n=25)	Group 3 (n=26)	Statistics	Total (n=77)
Satisfaction of eating ability	4.58±0.7	4.12±1.01	4.04±0.92	F=2.79 p=0.07	4.25±0.91
Food tolerance	10.58±2.66	12.08±2.60	13.38±2.23	F=8.22 p<0.001*	12.01±2.73
Frequency of vomiting	4.85±1.29	4.40±1.53	4.46±1.82	F=0.62 p=0.54	4.57±1.55
Total score	20.00±3.11	20.60±3.97	21.88±3.73	F=1.84 p=0.17	20.83±3.66
Min-Max	14-26	12-26	13-27		12-27
IQR-25	17.00	18.00	19.00	F=1.84	
IQR-50	20.50	21.00	23.00	p=0.17	
IQR-75	22.25	24.00	24.25		

**The data was shown as mean± standard deviation (SD) (p<0.05); According to the post-hoc Tukey test, the difference is between the "<6th month (Group 1)" and "12th-24th month (Group 3)"; IQR: Interquartile range.*

Patients reported poor tolerance to red meat (53.2%) and carbohydrates such as rice (36.4%), and bread (35.1%) after LSG. Good tolerance to fish (84.4%), white meat (70.1%), and salad (62.3%) was determined (Figure 3.a).

The tolerance of bread, pasta, and rice increased gradually from group 1 to group 3. According to one-way ANOVA, post hoc Tukey test revealed that the difference in food tolerance for bread, pasta and rice was between Group 1 and Group 3. (respectively p=0.01, p<0.001, p<0.001). (Figure 3. b).

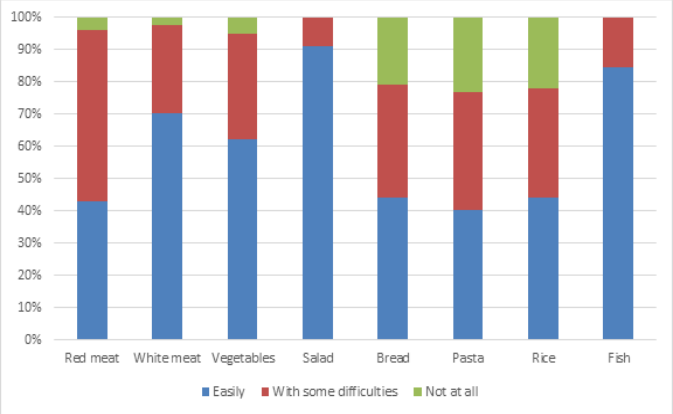

Figure 3.a. Food tolerance for different types of food after LSG

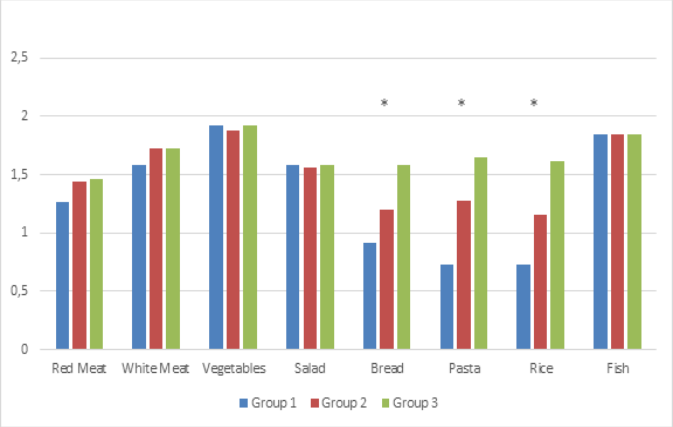

Figure 3.b. Food tolerance for different types of food after LSG
**p<0.05. **According to the post-hoc Tukey test, the difference is between the "<6th month (Group 1)" and "12th-24th month (Group 3)*

Table 3 shows the individual changes in some habits and anthropometric measurements of the patients before and after LSG. It was determined that using supplements, exercising for at least 150 minutes a week, perceive of adequate and balanced nutrition, consumption of 3 main meals, and ≥2 snacks a day increased after LSG.

Patients reported that they reduced their daily consumption of fast food and alcohol. Anthropometric measurements such as body weight, body fat percentage, fat mass, lean body mass, and BMI decreased after LSG (p<0.001). After LSG, the mean EBL (%) was 0.77±0.31 and the mean EWL (%) was 83.52±18.49 (Table 3).

Table 4 shows the factors that may affect the food tolerance of patients after LSG. As a result of the correlation, a low level of negative correlation was determined between abdominal pain (r=-0.263), abdominal bloating (r=-0.234), legume consumption (r=-0.297), and FTS.

Table 3. Changes in some habits and anthropometric measurements of patients before and after LSG

Variables	Before LSG	After LSG	Statistics
	n (%)		
Using supplements	7 (9.09%)	70 (90.91%)	t=18.49 p<***0.001****
Exercising for at least 150 minutes a week	17 (22.1%)	51 (66.2%)	t=7.05 p<***0.001****
Perceived sufficient and balanced nutrition	12 (15.58%)	56 (72.53%)	t=3.82 p<***0.001****
3 main meal	40 (51.95%)	65 (84.42%)	t=-6.98 p<***0.001****
≥2 snack	49 (63.64%)	61 (79.22%)	t=-4.67 p=***0.018****
Consuming fast food everyday	36 (46.8%)	3 (3.9%)	t=-2.43 p<***0.001****
Eating meal outside home during the week	22 (22.8%)	8 (10.4%)	t=-4.50 p<***0.001****
Alcohol consumption	26 (33.8%)	8 (10.4%)	t=-6.35 p<***0.001****
	Mean±SD		
Body weight (kg)	115.08±27.17	84.08±19.80	t=14.26 p<***0.001****
BMI (kg/m^2)	41.01±7.73	30.07±6.64	t=16.78 p<***0.001****
FM (%)	45.06±5.73	33.93±9.12	t=10.22 p<***0.001****
FM (kg)	52.20±15.64	29.39±12.95	t=-1.25 p<***0.001****
LBM (kg)	62.88±14.64	54.67±11.17	t=12.35 p<***0.001****
		Mean±SD	
%EWL		64.14±24.25	
%EBL		75.59±31.23	

**The data was shown as mean± standard deviation (SD) (p<0.05); BMI: body mass index; FM: fat mass; LBM: lean body mass; %EWL: Percentage of excess weight loss; %EBL: Percentage of excess BMI loss.*

Table 4. Correlation of factors affecting food tolerance after LSG

Variables	Food Tolerance Score	
	r	p
Abdominal pain	**-0.263***	0.021
Abdominal bloating	**-0.234***	0.041
Legume consumption	**-0.297***	0.009
Green-leafy vegetables consumption	0.196	0.088
Other vegetables consumption	0.118	0.308

**Pearson correlation analysis was performed.*

DISCUSSION

Bariatric procedures alter the anatomy and physiology of the gastrointestinal system. Alteration in the digestion and absorption of food due to gastrointestinal problems after surgery affected nutritional status, food intake, and diet quality [18]. Gastrointestinal problems may occur in more than 50% of the patients within the first year after surgery. The most common complaints are mainly nausea, vomiting, reflux, and changes in bowel movements such as diarrhea and constipation [19]. The risk of nausea and vomiting after LSG is very common and can be observed in approximately 65% of patients within the first 24 h after surgery [20]. It has been reported that hair loss can be observed in the first year after bariatric surgeries due to rapid weight loss or iron and zinc deficiency [21, 22]. In this study, the most common symptoms after LSG were constipation, hair loss, nausea, and vomiting. The frequency of vomiting was higher in the first six months.

Surgical resection of approximately two-thirds of the stomach in LSG results in a tubular shape and may restrict nutrient intake [23]. A reduction in stomach volume causes abdominal bloating and pain after food intake, which prevents required food intake, and reduces the FTS. In our study, patients with abdominal bloating and pain had significantly lower FTS, whereas patients with diarrhea, reflux, and hair loss had higher FTS. This led us to believe that individuals comply with the nutritional counseling provided by the dietician during the postoperative period.

Although bariatric surgery has shown good results in controlling obesity, patients undergoing this procedure may have difficulty adapting to food after the surgery. Food intolerance develops, and FTS decreases because of the inability to digest or absorb some nutrients after bariatric surgery [24]. Food intolerance problems are similar in the short term, regardless of the surgical technique used, but tend to improve over time. In a study by Schweiger et al., food tolerance was found to be significantly lower in the early period (3-6 months), and tolerance improved as time passed from the operation [10]. Another study, conducted by Ruiz-Tovar et al., reported food intolerance during the first postoperative year disappeared in the 5th year after LSG [25]. Similarly, in this study, food tolerance for different types of food was lower in the first 6 months and increased as time passed after LSG ($p<0.001$). Although the total score increases with the increase in the postoperative time, the difference is not statistically significant. This suggests that the symptoms improve over time due to the physiological adaptation of the gastrointestinal system and cognitive adaptation of patients [18, 26].

Evidence suggests that patients tolerate most food groups, but the results of studies examining food tolerance after bariatric surgery have been inconsistent [18, 26]. Red meat, poultry, rice, bread, pasta, dairy products, and vegetables are the most commonly reported food intolerances [26]. It has been stated that the poor tolerance of bread, cereals, red and white meat is associated with a reduced intake of these foods [27]. Poor tolerance to red meat during the first postoperative year has also been noted in other studies and was confirmed in our patients [10, 28]. However, in accordance with the results of other studies, this study showed that chicken, turkey, and fish were the easiest foods to consume after surgery [10, 28, 29]. Rice, pasta, and bread are other foods that individuals either consume with difficulty or do not consume in the first year after surgery. These results are in line with the results of Diaz-Lara et al., who examined the food tolerance of individuals after LSG [29]. Two studies evaluated individual tolerance of salads and vegetables after LSG. Both reported that the salad was tolerated with some difficulty during the first 6 months and the tolerance increased as time passed after surgery [10, 28]. In our study, good tolerance to the salad was observed. Since the majority of the participants (68%) were at least six months after the operation, it was thought that tolerance to vegetables increased. In a study evaluating the long-term food tolerance of patients after LSG, the consumption of legumes and vegetables increased in the first year after the operation following the advice of a dietician. However, most patients have problems with the digestion of these foods. On the other hand, it has been reported that five years after surgery, most patients have increased tolerance to these foods and consume more [30]. In this study, we found that the FTS of patients who reduced their consumption of legumes and vegetables also decreased after LSG. It is noteworthy that among legumes with high protein content, only lentils are recommended from the early period; in contrast, the consumption of beans and chickpeas is recommended only from the ninth month [29]. An increase in the FTS of patients after bariatric surgery improves the quality of their eating habits and weight loss [31].

A significant proportion of patients reported poor eating behavior before undergoing bariatric surgery. Skipping meals, eating out more often, and eating fast food was positively related to higher BMI, along with higher energy and fat intake [32]. Adherence to dietary and lifestyle recommendations after bariatric surgery is likely to positively affect weight loss and maintenance [33]. Patients are recommended to consume 3-6 meals per day after surgery. To prevent nausea and vomiting, attention should be paid to the portion consumed and snacks should be consumed. A study reported that the consumption of 3 main meals and at least 1 snack per day resulted in longer satiety [33]. In this study, the perception of adequate and balanced nutrition after surgery and the number of individuals consuming 3 main meals and 2 or more snacks increased.

It has been stated in the literature that there is a tendency to decrease the preference for sweet, fatty, and energy-dense foods, because of changes in taste sensation and food preferences of patients, especially in some bariatric surgery applications. However, whether the taste changes persist over the long term has not been fully evaluated [34]. Changes in taste perception and food preferences after bariatric surgery may be influenced by biological and psychological factors. A previous study reported that patients' interest in sweet and high-fat foods was reduced after the LSG [35]. In this study, patients reported a decreased consumption of desserts with syrup, along with pasta and rice. Fish, eggs, and oilseeds were defined as those whose consumption increased the most after LSG. Additionally, the number of people who consume fast food daily has decreased. This situation suggests that individuals attach importance to adequate and balanced nutrition and prefer healthy food choices.

A recently published systematic review showed that bariatric surgery provides body weight control by causing weight loss with a significant reduction in energy intake [18]. A study conducted by Silva et al. showed that patients had decreased body fat percentage, fat mass, body weight, and BMI regardless of the type of surgery performed [36]. Similarly, in this study, it was determined that there was a significant decrease in the body weight, BMI, body fat %, fat mass, and lean body mass of patients after surgery. The mean %EWL and %EBL are 64.14±24.25 and 75.59±31.23, respectively after LSG.

The mechanisms and causes of nutritional deficiencies after bariatric surgery are multifactorial. It is affected by the type of surgery, preoperative deficiencies, postoperative gastrointestinal symptoms, altered eating behavior, food intolerance, taste changes, and failure to follow dietary recommendations. Some studies have reported a significantly higher prevalence of nutrient deficiencies after LSG [37, 38]. In a study, most patients in the post-LSG period reported changing their eating habits, increasing their physical activity levels, and using supplements [39]. Nutritional supplementation is recommended in patients after bariatric surgery in Türkiye [40]. In this study, in line with the recommendation the use of nutritional supplements increased postoperatively.

Dietary therapy after bariatric surgery encompasses not only nutritional recommendations but also many recommendations regarding physical activity and alcohol consumption, promoting a healthy lifestyle [40]. Physical activity is a vital part of weight management programs aimed at increasing weight loss, maintaining ideal body weight, and preventing chronic diseases [41]. Most patients undergoing bariatric surgery have musculoskeletal problems and chronic diseases that may affect their exercise tolerance and adaptation to daily physical activity. Previous studies have highlighted the importance of exercise programs for promoting postoperative weight loss. It was observed that individuals who were physically active before and after surgery lost more weight and their quality of life increased effectively [42, 43]. Bariatric surgery patients should begin aerobic exercise for 150 min/week and be active with a long-term goal of 300 min/week [40]. In this study, the number of patients who performed sufficient physical activity during the post-surgical period increased. Consistent with our findings, Neunhaeuserer et al. reported a significant increase in physical activity during the post-LSG period [44].

Limitations

This study has limitations. Because of its cross-sectional design, changes in FTS of the same patient with time could not be examined.

In addition, we used self-reported data and our sample size is small. Since we only have bioelectrical impedance analysis in the laboratory, we could not use to measure body composition by Dual-energy X-ray absorptiometry. Future research should include a longitudinal study with follow-up. Moreover, adequate study of the long-term FTS of other bariatric surgery procedures is essential.

CONCLUSION

Food intolerance is a common condition observed after bariatric surgery. In our study, food tolerance for different types of food (especially bread, pasta and rice) was lower in the first 6 months and increased as time passed after LSG. Food tolerance increases as the consumption of foods with high fiber content, such as legumes, green leafy vegetables and other vegetables, increased. Compliance with dietitians' nutritional recommendations after LSG is important in increasing food tolerance. Individuals should attach importance to adequate and balanced nutrition and choose healthy food options.

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COMPARISON OF THE EFFECTS OF MULLIGAN MOBILIZATION TECHNIQUE COMBINED WITH CERVICAL STABILIZATION EXERCISES WITH THE EFFECTS OF CERVICAL STABILIZATION EXERCISES ALONE IN CHRONIC NECK PAIN: RANDOMIZED CONTROLLED STUDY

KRONİK BOYUN AĞRISINDA SERVİKAL STABİLİZASYON EGZERSİZLERİ İLE KOMBİNE EDİLEN MULLİGAN MOBİLİZASYON TEKNİĞİNİN ETKİLERİNİN TEK BAŞINA SERVİKAL STABİLİZASYON EGZERSİZLERİNİN ETKİLERİ İLE KARŞILAŞTIRILMASI: RANDOMİZE KONTROLLÜ ÇALIŞMA

Hikmet Kocaman[1*], Nazım Tolgahan Yıldız[1], Mehmet Canlı[2], Halil Alkan[3]

[1]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Karamanoğlu Mehmetbey University, Karaman, Türkiye

[2]School of Physical Therapy and Rehabilitation, Kırşehir Ahi Evran University, Kırşehir, Türkiye

[3]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Muş Alparslan University, Muş, Türkiye

ABSTRACT

Objective: The aim of the study was to compare the effects of Mulligan mobilization techniques applied in addition to cervical stabilization exercises on pain intensity, range of motion (ROM), cervical muscle endurance, pressure pain threshold (PPT), and quality of life compared to cervical stabilization exercises alone in individuals with chronic neck pain (CNP).

Method: Forty individuals with CNP were included in the study and randomly divided into two groups: the cervical stabilization group (SG, n=20) and the cervical stabilization-Mulligan mobilization group (SMG, n=20). The SG group only received cervical stabilization exercises for four weeks, while the SMG received Mulligan mobilization techniques for four weeks in addition to cervical stabilization exercises. Before and after the treatment programs, the subjects were evaluated in terms of pain intensity (visual analogue scale), ROM (goniometric measurement), cervical muscle endurance (endurance tests), PPT (algometric measurement), and quality of life (Short Form-36, SF-36).

Results: Significant improvements were found in all parameters in both groups after the treatment programs ($p<0.05$). In addition, there were more improvements in ROM, PPT, and SF-36 scores in SMG compared to SG ($p<0.05$).

Conclusion: The application of cervical stabilization exercises in CNP may improve pain intensity, ROM, cervical muscle endurance, PPT, and quality of life. However, it can be said that Mulligan mobilization techniques applied in addition to cervical stabilization exercises are more effective in improving ROM, PPT, and quality of life compared to cervical stabilization exercises alone in individuals with CNP.

Key Words: Neck Pain, Exercise, Manipulative Therapies, Quality of Life, Rehabilitation

ÖZ

Amaç: Çalışmanın amacı kronik boyun ağrısı (KBA) olan bireylerde servikal stabilizasyon egzersizlerine ek olarak uygulanan Mulligan mobilizasyon tekniklerinin, tek başına uygulanan servikal stabilizasyon egzersizlerine kıyasla ağrı şiddeti, eklem hareket açıklığı (EHA), servikal kas enduransı, basınç ağrı eşiği (BAE) ve yaşam kalitesi üzerindeki etkilerini karşılaştırmaktı.

Yöntem: Kırk KBA'lı bireyin dahil edildiği çalışmada bireyler rastgele servikal stabilizasyon grubu (SG, n=20) ve servikal stabilizasyon-Mulligan mobilizasyon grubu (SMG, n=20) olmak üzere iki gruba ayrıldı. SG'ye sadece dört haftalık servikal stabilizasyon egzersizleri uygulanırken, SMG'ye servikal stabilizasyon egzersizlerine ek olarak dört hafta boyunca Mulligan mobilizasyon teknikleri uygulandı. Tedavi programları öncesinde ve sonrasında bireyler ağrı şiddeti (görsel analog skala), EHA (gonyometrik ölçüm), servikal kas enduransı (endurans testleri), BAE (algometrik ölçüm) ve yaşam kalitesi (Kısa Form-36, KF-36) bakımından değerlendirildi.

Bulgular: Tedavi programları sonrasında her iki grupta da bütün parametrelerde anlamlı iyileşmeler bulundu ($p<0.05$). Ayrıca, SMG'de SG'ye kıyasla; EHA, BAE ve KF-36 skorlarında daha fazla iyileşme görüldü ($p<0.05$).

Sonuç: KBA'da servikal stabilizasyon egzersizlerinin uygulanmasıyla, ağrı şiddeti, EHA, servikal kas enduransı, BAE ve yaşam kalitesinde iyileşmeler elde edilebilir. Bununla birlikte, KBA'lı bireylerde servikal stabilizasyon egzersizlerine ek olarak uygulanan Mulligan mobilizasyon tekniğinin tek başına uygulanan servikal stabilizasyon egzersizlerine kıyasla EHA, BAE ve yaşam kalitesini iyileştirmede daha etkili olduğu söylenebilir.

Anahtar Kelimeler: Boyun Ağrısı, Egzersiz, Manipulatif Tedaviler, Yaşam Kalitesi, Rehabilitasyon

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***Sorumlu yazar/Corresponding author:** Karamanoğlu Mehmetbey University, Faculty Health Sciences, Department of Physiotherapy and Rehabilitation, Karaman, Türkiye

[1*]Email: kcmnhikmet@gmail.com, [2]Email: tolgafty@gmail.com, [3]Email: canlimehmet600@gmail.com, [4]Email: fzthalilalkan@hotmail.com

INTRODUCTION

Neck pain is one of the most common musculoskeletal problems, after low back pain [1]. It has been reported that the lifetime prevalence of neck pain, which is more common in females, increases with age and ranges between 43% and 66.7% [2]. Neck pain tends to become chronic, and neck pain lasting longer than three months is called chronic neck pain (CNP). It has been reported that half to three-quarters of individuals with neck pain experience neck pain again within 1–5 years [3]. In individuals with neck pain, the function of neck muscles and sensory receptors may be impaired. Electromyography studies have reported a decrease in the activity of deep neck flexor and extensor muscles and an increase in the activation of superficial muscles [2,4]. However, it has been reported that prolonged overactivity of superficial cervical muscles causes more muscle fatigue and tenderness, decreased muscle strength and endurance capacity, and decreased range of motion (ROM) in patients with neck pain [2,4]. Neck pain can lead to reduced work capacity and significantly increased treatment costs. Clinicians and physiotherapists are still searching for the most effective and appropriate treatments to improve the quality of life and reduce treatment costs for individuals suffering from CNP [5].

Many methods have been utilized in the conservative treatment of CNP, including analgesics, physiotherapy, education, exercise, and manual therapy [6]. Among these, exercise is considered one of the methods with high evidence value [4,7]. Among the exercises, cervical stabilization exercises (CSE) are frequently used, especially to activate deep neck muscles and reduce the overactivity of superficial muscles. Studies have reported that CSE is effective in the treatment of individuals with CNP [4,8-10]. Another treatment method with a high evidence value for neck pain is manipulation and mobilization [6,11]. Mulligan mobilization technique (MMT) is one of the mobilization techniques that can be used in the treatment of CNP. This technique aims to decrease pain and increase functionality by focusing on reducing limitations in ROM and correcting positional errors in the joint [12]. In CNP patients who underwent MMT application to the cervical region, improvements in pain-free ROM of the cervical region were recorded after the application [13]. In a randomized controlled trial, MMT was reported to improve pain and disability symptoms in CNP patients after a nine-session protocol and at one-month follow-up [14]. In another study, MMT was found to be more effective in improving pain, kinesiophobia, functional level, ROM, depression, and quality of life in elderly individuals with neck pain compared to conventional treatment [13].

In the literature, no randomized controlled study was found in which CSE and MMT were used together. Therefore, the aim of this study was to compare the effects of MMT combined with CSE and CSE alone on pain intensity, ROM, cervical muscle endurance, pressure pain threshold, and quality of life in individuals with CNP.

METHOD

Study Design

The study was designed as randomized, controlled, and single-blinded research.

Participants

The study was conducted with individuals aged between 18 and 50 years with CNP who had neck pain for more than three months (pain intensity ≥3 according to the visual analogue scale), were diagnosed with CNP by specialist physicians, and applied to a private physiotherapy clinic in FizyoKaraman for treatment. Individuals who had neck pain for at least 3 months, whose neck pain was not caused by a neurologic, rheumatologic, or psychiatric disorder, and who had not received any treatment for neck pain for the last 3 months were included in the study. Those who had undergone spinal surgery, neck pain caused by various pathologies (rheumatoid arthritis, ankylosing spondylitis, fracture, tumor, etc.), nerve root compression, a positive vertebrobasilar artery test, severe radiculopathy, osteoporosis, or osteopenia, and long-term use of corticosteroids or anticoagulants were excluded from the study. Individuals who met the inclusion criteria were randomly divided into two groups: the cervical stabilization group (SG), in which only cervical stabilization exercises were performed, and the cervical stabilization-Mulligan mobilization group (SMG), in which cervical stabilization exercises and MMT were combined. Age, gender, duration of complaint, and body mass index (BMI) were noted for all participants.

Interventions

An experienced specialist physiotherapist (HK) performed both the CSE program and MMT. All treatment programs were applied four days a week for four weeks.

Cervical Stabilization Exercise Program

The CSE program, which was created by taking into account similar studies in the literature, consisted of static, dynamic, and functional phases, respectively, taking into account the motor learning and sensory-motor integration steps [4,15,16]. Each exercise session consisted of 5-10 minutes of warm-up exercises, 30 minutes of stabilization exercises, and 5-10 minutes of cool-down exercises. Neck stretching exercises were performed during the warm-up and cool-down periods to increase the flexibility of the neck muscles. In the first phase, the exercises were performed slowly and in a controlled manner to increase motor control and kinesthetic awareness. Participants were trained in craniocervical flexion exercises at the beginning of the static phase, enabling them to achieve deep neck flexor muscle activation and minimize superficial neck flexor muscle activation. The craniocervical flexion exercise was practiced in the supine hook position using a pressurized biofeedback device (Stabilizer™, Chattanooga, USA). Exercises were performed supine, prone, crawling, sitting, and standing after cervical bracing (craniocervical flexion and deep cervical muscle contraction) was achieved. In order to ensure conscious motor control in the dynamic phase, upper and lower extremity movements were added to the cervical bracing, and exercises were performed unilaterally, bilaterally, or reciprocally in different neurodevelopmental positions with gradually increasing difficulty, respectively. The difficulty of the exercises was gradually increased according to the individuals' ability to perform and tolerate the movements correctly. Resisted isometric exercises for the cervical region were then performed using elastic bands (Thera-Band® Hygenic Corporation, Akron, OH). The resistance of the elastic bands was chosen according to the tolerance of the participants. Isometric exercises were performed in 3 sets of 8-12 repetitions per set. In the functional phase, it was aimed at gaining subconscious control of movement. In this phase, elastic bands and an exercise ball were utilized when performing the exercises. The program progressed with combined functional exercises such as extremity movements while sitting on the ball with cervical bracing, squeezing the ball between the head and the wall while standing, controlling the ball, and extremity movements with elastic bands during ball control. The exercises were performed as 10 repetitions with 10 seconds of contraction and 5 seconds of relaxation [4]. All exercises were performed under only physiotherapist supervision for four weeks.

Mulligan Mobilization Applications

MMT, which was applied in addition to cervical stabilization exercises, was performed by a physiotherapist certified in MMT with 15 years of professional experience. MMT procedures were performed with the participants sitting in a chair with their backs supported. The first intervention of MMT was the natural apophyseal glides (NAGs) between C2 and C7 (Figure 1). The second intervention was the application of sustained natural apophyseal glides (SNAGs). SNAGs, an important MMT for the cervical spine, are a full-range painless movement that is a combination of the patient's physiological movement and the gliding motion applied to the facet joint by the therapist [12]. In SNAGs, the gliding movement was continued until

the last angle of the joint with the active movement of the patient, and high pressure (overpressure) was applied at the last point (Figure 2). MMT applications were performed in 3 sets with 10 repetitions and a 15-20-second rest between sets [13,17]. All NAGs and SNAGs techniques in Mulligan mobilization applications were applied manually by an experienced and certified specialist physiotherapist for four weeks.

Figure 1. Natural apophyseal glides (NAGs)

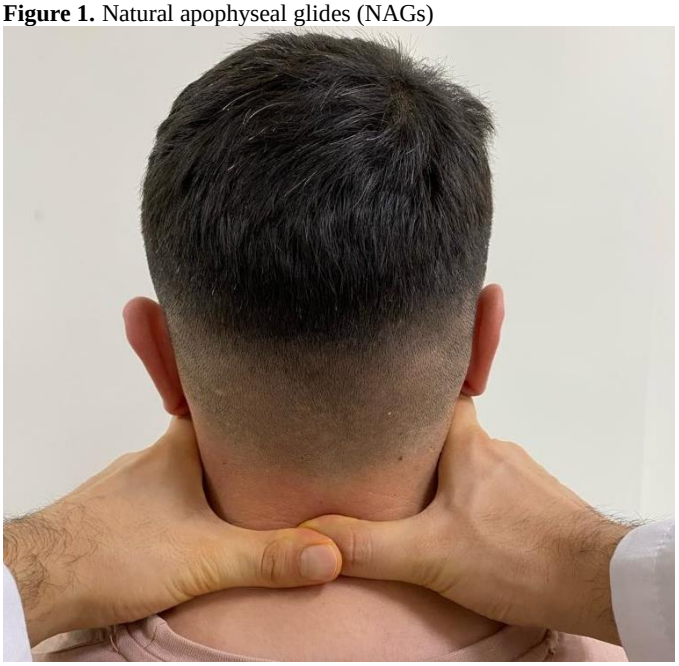

Figure 2. Sustained natural apophyseal glides (SNAGs)

Outcome Measures

Pain Intensity: The pain intensity of the participants during rest (static positions in which the head and neck are at rest) and activity (dynamic positions of the head and neck such as forward and backward bending and rotation) was assessed using a visual analogue scale (VAS). Participants were asked to mark the intensity of pain they felt on a 10-cm-long line (0 represents no pain and 10 represents severe pain). Results were recorded in cm [18]. The measurement of pain intensity with VAS has been stated to be valid and reliable [19].

Range of Motion: Cervical flexion, extension, right and left lateral flexion, and rotation movements were assessed with a universal goniometer while participants were seated with both feet on the floor, hips and knees positioned at a 90° angle, and hips resting on the back of the chair. Three measurements were made for each direction of movement, and the mean value of the measurements was taken and recorded in degrees of pain-free active ROM for each direction of movement. It has been reported that ROM measurements with a universal goniometer showed good reliability [20].

Cervical Muscle Endurance: To assess the endurance of the cervical flexor muscles, the participant was asked to perform a chin tuck and bring the chin slightly closer to the chest in the supine hook position with the hands on the belly. The examiner placed his hand under the participant's occiput to determine whether the position could be maintained. The amount of time this position could be maintained was recorded in seconds. To evaluate the endurance of the cervical extensor muscles, the participant was positioned in the prone position with his or her head hanging from the bed, and a 2 kg weight was placed on his or her head. The time this position could be maintained was recorded in seconds [17,21].

Pressure Pain Threshold: The pressure pain threshold (PPT) was measured using a digital algometer (JTech Medical Industries, ZEVEX Company) by placing the probe of the device at a 90° angle to the midpoint of the upper body of the trapezius muscle between the seventh cervical vertebra and the acromion. The probe of the device was applied by increasing the pressure until the patient felt pain, and the pressure value at which pain was felt was determined as the pain threshold. The measurement was performed three times, and the average of the values obtained was recorded as kg/cm². The evaluations were performed separately on both the right and left sides. Measurements with a digital algometer have been reported to have high reliability [22].

Quality of Life: Quality of life was assessed with the Turkish version of the Short Form-36 (SF-36) scale, the validity and reliability of which were demonstrated by Koçyiğit et al. In the SF-36, which consists of thirty-six questions and eight subscales, the physical section score (FSS) is obtained by averaging four subscales related to physical parameters, while the mental section score (MSS) is obtained by averaging the other four subscales. FSS and MSS main section scores range from 0-100, with higher scores indicating better quality of life [23].

Randomization and Blinding

The 40 individuals with CNP included in the study were randomly divided into SG (n=20) and SMG (n=20) groups using gender- and age-matched pairs randomization. Matched pairs randomization was conducted using the Research Randomizer program on the website www.randomizer.org [24]. All assessments in the groups at baseline and at the end of the four-week treatment programs were performed by the same investigator (NTY), who was blinded to the treatment groups. However, participants in the groups were not blinded to the treatment methods in the study.

Sample Size

The G*Power program (Version 3.1.9.4.3, Heinrich-Heine Universität, Düsseldorf, Germany) was utilized to determine the sample size. Based on a previous similar study [4], the effect of exercises on neck pain was calculated, yielding a total of 32 individuals according to repeated measures analysis of variance (ANOVA) within and between interactions to achieve 80% statistical power (1-β error probability) at an effect size of 0.26 with an α error level probability of 0.05. A total of 40 participants, 20 in each group, were included in the study, taking into account that approximately 20% of the participants may drop out of the follow-up.

Ethical Approval

Ethical approval for the study was obtained from the Muş Alparslan University Scientific Research and Publication Ethics Committee (Decision No. 7-2023/37). Verbal and written informed consent was obtained from all participants in the study, all stages of which were conducted in accordance with the Declaration of Helsinki. In addition, the necessary permissions were obtained from the private FizyoKaraman physiotherapy clinic where patients with CNP applied for treatment and where the study was carried out.

Statistical Analysis

Statistical analyses were performed using SPSS (IBM SPSS Statistics for Windows, Version 24.0, Armonk, NY: IBM Corp., USA) software. Descriptive analyses were given as mean and standard deviation for numerical variables whose normal distribution was checked by visual (histograms, probability plots) and analytical methods (Shapiro-Wilk and Kolmogorov-Smirnov tests). Nominal variables were expressed as numbers and percentages. An independent sample t-test was used to compare the numerical demographic data of the groups. The chi-square test was utilized to compare categorical variables. To evaluate the effects of treatments on pain intensity, cervical ROM, cervical muscle endurance, PPT, and quality of life, with group (SG, SMG) as the between-patient variable and time (pre-treatment, post-treatment) as the within-patient variable, a two-way mixed design repeated measures analysis of variance (ANOVA) was conducted. Also, pairwise comparisons, using the Bonferroni correction, were performed to analyze any significant between-group differences in change scores from baseline to the last treatment session. Partial eta squared was used as the effect size, with small (0.10), medium (0.25), and large (0.40) values considered [25]. The statistical significance level was determined as $p<0.05$.

RESULTS

Fifty-four individuals diagnosed with CNP by specialist physicians and referred to the clinic were examined for eligibility; nine did not meet the inclusion criteria, and five declined to participate in the study. Forty individuals with CNP who were eligible for the study and agreed to participate were randomly assigned to two treatment groups.

The study was completed with the full participation of all participants in the treatment and assessment programs in both groups (Figure 3).

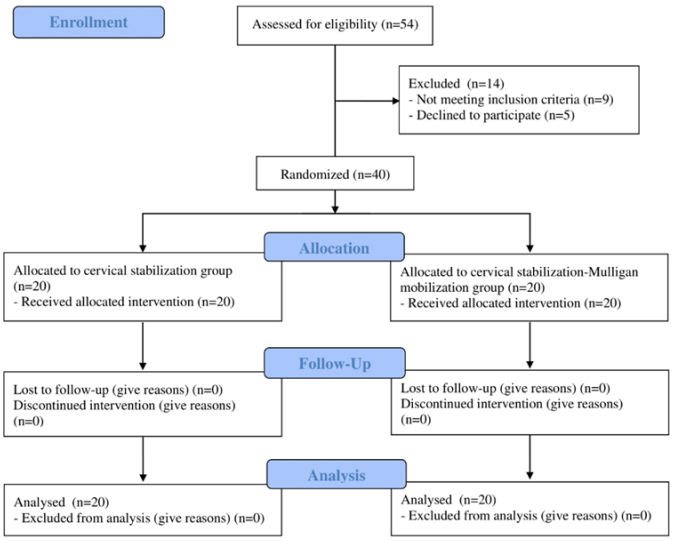

Figure 3. Study flow diagram

Demographic characteristics of the SG and SMG groups are presented in Table 1. The groups were similar in terms of demographic characteristics ($p>0.05$).

Table 1. Demographic characteristics of the groups

Variables	SG (n=20)	SMG (n=20)	p
Age (year), (Mean±SD)	49.65±9.47	47.61±12.84	0.481[a]
BMI (kg/m^2), (Mean±SD)	28.21±5.18	27.39±5.62	0.553[a]
Duration of complaint (month), (Mean±SD)	30.9±3.4	31.7±3.6	0.268[a]
Gender (n)			
Male	8	7	0.799[b]
Female	12	13	

SG: Cervical stabilization group; SMG: Cervical stabilization+Mulligan mobilization group; SD: Standard deviation; BMI: Body mass index; [a]p: Independent sample-t test; [b]p: Chi-square test.

The comparison of VAS scores of the SG and SMG groups before and after treatment is given in Table 2. When the changes within the groups over time were analyzed, it was found that the resting and activity scores of VAS decreased significantly in both groups ($p<0.05$). On the other hand, when the changes of the groups over time (Group*Time) were compared after treatment, no significant difference was found between the groups for resting and activity scores of VAS. Similar changes were observed in the resting and activity scores of VAS in both groups ($p>0.05$).

Table 3 presents a comparison of the values for ROM, cervical muscle endurance, and PPT in both the SG and SMG groups before and after treatment. Analyzing changes within each group over time, a significant increase was observed in all ROM values, as well as right and left-side PPT values, and cervical flexor and extensor muscle endurance values in both groups ($p<0.05$). Upon comparing changes over time after treatment between the groups (Group*Time), a significant difference emerged in all ROM and right and left-side PPT values ($p<0.05$). However, no significant difference was found in cervical flexor and extensor muscle endurance values ($p>0.05$). Notably, it was observed that the SMG group exhibited greater increases in all ROM values and right and left-side PPT values, while similar changes were observed in cervical flexor and extensor muscle endurance values in both groups (Table 3).

Table 4 presents a comparison of the FBP and ZBP scores of SF-36 in both the SG and SMG groups before and after treatment. Upon analyzing changes within each group over time, it was observed that both main section scores of SF-36 increased significantly in both groups ($p<0.05$). Furthermore, when comparing changes over time after treatment between the groups (Group*Time), a significant difference emerged for the main section scores of SF-36. Specifically, FBP and ZBP scores exhibited greater increases in the SMG group ($p<0.05$).

DISCUSSION

In the present study, the combination of MMT and stabilization exercises demonstrated superior effectiveness in improving cervical ROM, increasing PPT, and enhancing overall quality of life in individuals with CNP compared to stabilization exercises alone. On the other hand, MMT combined with stabilization exercises had similar effects in reducing pain intensity and increasing cervical muscle endurance compared to stabilization exercises alone.

CNP represents a significant health concern affecting a substantial portion of the general population, leading to persistent pain, limited cervical mobility, reduced strength and endurance in cervical muscles, disability, and an overall decline in quality of life. Exercise therapy for the cervical region is well-established as an evidence-based and effective approach in CNP rehabilitation. The primary objective of CSE in CNP management is to reduce the overactivity of superficial neck muscles and promote the activation of deeper muscles [16]. Previous studies [4,13,26-28] have explored various manual therapy

techniques combined with exercise therapy for CNP. In Kaya and Çelenay's study [16], a significant decrease in neck pain was reported after four weeks of CSE treatment in individuals with CNP. In the study of Farooq et al. [27] in individuals with CNP, one group received a four-week routine physiotherapy program, and the other group received Maitland mobilization techniques for four weeks in addition to routine physiotherapy. Results indicated that, although both groups experienced an important reduction in pain, the group receiving Maitland mobilization in addition to routine physiotherapy demonstrated greater improvement in pain intensity.

In a study comparing the short-term effects of combining CSE with manual therapy versus CSE alone in individuals with CNP, it was observed that pain decreased in both groups following four-week treatment programs. However, the group receiving CSE combined with manual therapy did not demonstrate superior pain reduction compared to the group receiving CSE alone [4]. Similarly, in the study by Ganesh et al. [28], individuals with CNP were divided into three groups: exercise alone, Maitland mobilization in addition to exercise, and Mulligan mobilization techniques in addition to exercise. The study's conclusion indicated that pain significantly decreased in all groups, but neither the Maitland nor Mulligan mobilization techniques proved superior to exercise alone in reducing pain. Büyükturan et al. [13] conducted a study where one group received a traditional physiotherapy program, including ROM and posture exercises, while the other group received MMT in addition to traditional physiotherapy. The researchers reported a significant reduction in pain in both groups; however, the level of pain reduction was similar between the two groups. Dynamic exercises have been reported to increase blood circulation and muscle glycogen uptake and have significant effects on pain reduction in addition to their positive effects on stability and function [28]. In the current study, the decrease in pain intensity in both groups may be explained by these effects of dynamic exercises. However, the reduction in pain intensity was similar between the two groups. These findings were consistent with the results of Ganesh et al. [28] and Çelenay et al. [4]. Based on the results of the present study, which are consistent with the results of the studies in the literature, it can be said that CSE is an effective method to reduce pain intensity in CNP patients. Furthermore, we suggest that the effects of MMT applied in combination with CSE on pain intensity compared to CSE alone in patients with CNP should be investigated in future studies with longer treatment and follow-up periods.

Table 2. Comparison of pain intensity values of SG and SMG groups before and after treatment

Variables			SG (n=20)	SMG (n=20)	MD values between groups	Time	Group*Time		η2
			Mean±SD		Mean±SE	p	F	p	
VAS	During rest	BT	4.51±1.63	4.69±1.85	0.53±0.26	<0.001*	3.03	0.087	0.05
		AT	1.87±1.42	1.52±1.23					
	During activity	BT	6.95±1.94	6.61±1.72	0.19±0.24	<0.001*	0.91	0.344	0.02
		AT	2.85±1.70	2.32±1.47					

*SG: Cervical stabilization group; SMG: Cervical stabilization+Mulligan mobilization group; MD: Mean difference; SD: Standard deviation; SE: Standard error; VAS: Visual analogue scale; BT: Before treatment; AT: After treatment; η2: Effect size; p: Two-way mixed design repeated measures ANOVA; *p<0.05.*

Table 3. Comparison of ROM, cervical muscle endurance, and pressure pain threshold values of the SG and SMG groups before and after treatment

Variables			SG (n=20)	SMG (n=20)	MD values between groups	Time	Group*Time		η2
			Mean±SD		Mean±SE	p	F	p	
ROM (◦)	Flexion	BT	39.23±7.50	37.23±8.02	4.68±0.73	<0.001*	42.56	<0.001*	0.42
		AT	45.19±7.23	47.87±7.73					
	Extension	BT	30.13±5.84	29.84±5.99	4.97±0.48	<0.001*	111.30	<0.001*	0.65
		AT	35.03±5.64	39.71±6.09					
	Right lateral flexion	BT	25.55±4.41	25.35±5.02	4.46±0.37	<0.001*	149.09	<0.001*	0.71
		AT	29.61±4.44	33.87±4.15					
	Left lateral flexion	BT	25.10±3.66	24.68±4.08	5.25±0.34	<0.001*	240.51	<0.001*	0.80
		AT	28.94±3.54	33.77±3.26					
	Right rotation	BT	37.48±3.85	37.35±5.34	5.61±0.26	<0.001*	453.23	<0.001*	0.88
		AT	40.81±3.77	46.29±4.69					
	Left rotation	BT	36.77±4.20	36.81±4.65	5.22±0.38	<0.001*	192.68	<0.001*	0.76
		AT	40.58±4.32	45.84±4.03					
Cervical muscle endurance (second)	Deep cervical flexors	BT	12.46±2.31	12.85±2.34	-0.14±0.41	<0.001*	0.13	0.718	0.02
		AT	19.77±3.48	20.02±3.15					
	Deep cervical extensors	BT	15.40±2.45	15.42±2.64	0.10±0.51	<0.001*	0.03	0.862	0.01
		AT	21.99±2.92	22.11±3.15					
Pressure pain threshold (kg/cm^2)	Right upper trapezius	BT	8.25±3.01	7.86±3.17	5.19±0.69	<0.001*	44.38	<0.001*	0.69
		AT	13.02±3.08	17.82±3.09					
	Left upper trapezius	BT	8.64±3.21	7.14±3.59	5.28±0.71	<0.001*	39.28	<0.001*	0.52
		AT	14.69±2.86	18.47±3.16					

*SG: Cervical stabilization group; SMG: Cervical stabilization+Mulligan mobilization group; MD: Mean difference; SD: Standard deviation; SE: Standard error; ROM: Range of motion; BT: Before treatment; AT: After treatment; η2: Effect size; p: Two-way mixed design repeated measures ANOVA; *p<0.05*

Table 4. Comparison of PSS and MSS main section scores of the Short Form-36 scale in SG and SMG groups before and after treatment

Variables			SG (n=20)	SMG (n=20)	MD values between groups	Time	Group*Time		η2
			Mean±SD		Mean±SE	p	F	p	
Short Form-36 (point)	PSS	BT	29.03±2.60	30.71±2.98	14.79±0.79	<0.001*	121.3	0.003*	0.67
		AT	62.15±4.24	78.62±4.42					
	MSS	BT	35.69±2.87	33.93±2.61	18.27±0.82	<0.001*	102.49	0.001*	0.59
		AT	64.10±3.83	80.61±5.35					

*SG: Cervical stabilization group; SMG: Cervical stabilization+Mulligan mobilization group; MD: Mean difference; SD: Standard deviation; SE: Standard error; PSS: Physical section score; MSS: Mental section score; BT: Before treatment; AT: After treatment; η2: Effect size; p: Two-way mixed design repeated measures ANOVA; *p<0.05.*

Studies in the literature reported that CSE increased cervical ROM values in individuals with CNP [4,10,16]. In the study of Farooq et al. [27], it was noted that exercise therapy was effective in improving cervical ROM in individuals with CNP, and further increases in cervical ROM could be obtained by applying mobilization techniques in addition to exercise therapy. Another study [13] involving individuals with CNP reported that the combined application of MMT with conventional physiotherapy yielded a greater increase in cervical flexion, extension, and lateral flexion values compared to conventional physiotherapy alone. Similarly, Gautam et al. [29] found that when MMT was applied in addition to conventional physiotherapy, including isometric exercises and hot applications, it was more effective in increasing ROM compared to conventional physiotherapy alone in patients with neck pain. In the present study, in accordance with the literature, increases in cervical ROM were recorded after treatment programs in both groups in which an exercise program was applied. Moreover, the fact that the increases in ROM values were significantly higher in the SMG compared to the SG may be explained by the corrective effects of MMT on impaired arthrokinematics in the joint [12]. In light of the findings of the current study and the results in the literature, it can be concluded that CSE is effective in increasing cervical ROM values in CNP patients. In addition, further improvements in cervical ROMs can be obtained in patients with CNP by combining MMT with CSE.

Farooq et al. [27] concluded that a physiotherapy program including stretching and isometric strengthening exercises for the neck was effective in increasing cervical muscle endurance in individuals with CNP. Kuo et al. [10] applied six-week CSE exercises to individuals with CNP and reported that the cervical muscle endurance of individuals increased significantly at the end of the study. Similarly, another study [30] suggested that CSE may increase cervical muscle endurance in individuals with CNP. In a study conducted by Duymaz et al. [17] involving individuals with CNP, one group followed a home exercise program comprising ROM and stretching exercises, while the other group received MMT in addition to the home exercise program. Both groups showed increased cervical flexor muscle endurance after the treatment program; however, greater improvements in cervical muscle endurance were reported in the group that received MMT along with the exercise program compared to the group following the home exercise program alone. The authors suggested that the greater increases in cervical muscle endurance in the group that received MMT in addition to the home exercise program may have been influenced by the greater reduction in pain intensity in this group [17]. In the present study, while significant increases in cervical flexor and extensor muscle endurance were found in both groups, the amounts of increase in the groups were similar. Furthermore, the reduction in pain intensity was similar in both groups. It has been reported that the activation of deep cervical muscles may be impaired by neck pain, and the contractile capacity of the muscles may decrease [31]. Given this information, it was thought that muscle endurance may be affected by pain in CNP and that similar increases in cervical muscle endurance in the groups may be associated with similar reductions in pain intensity. Significant improvements in cervical muscle endurance can be achieved in CNP patients with CSE applications. On the other hand, it is important to investigate the effects of MMT on cervical muscle endurance compared to CSE in future studies with longer treatment and follow-up durations in order to demonstrate the possible effects of MMT on cervical muscle endurance.

Studies in the literature [4,16,32] have indicated that various exercise and manual therapy methods can provide increased PPT values in individuals with CNP. Ylinen et al. [32] found that strength and endurance exercises can increase PPT values measured from cervical muscles in individuals with CNP; in other words, they can decrease tenderness in cervical muscles. The authors also stated that PPT measurement may be a useful outcome measure for the effectiveness of rehabilitation in CNP [32]. In a study conducted on individuals with CNP [16], it was observed that the increases in PPT values measured from the upper trapezius were significantly greater in the group that received muscle relaxation training in addition to CSE compared to the group that received CSE alone. In another study [4], individuals with CNP were divided into two groups: one group received four weeks of CSE, and the other group received manual therapy consisting of Maitland and Cyriax mobilization techniques to the cervical and scapular regions for four weeks in addition to CSE. At the study's conclusion, where the PPT was measured from the upper trapezius, both groups exhibited increased PPT values, with no significant difference between them. In the present study, consistent with the literature, it was observed that both CSE alone and the combined application of CSE and MMT increased the PPT values measured from cervical muscles, in other words, decreased upper trapezius muscle tenderness. In addition, MMT combined with CSE was found to be superior in increasing PPT; that is, it was more effective in reducing muscle tenderness. This result may be explained by the knowledge that mobilization may increase the pain threshold and decrease muscle tenderness by stimulating neurophysiological mechanisms, causing hypoalgesia [33]. In individuals with CNP, an increase in PPT values of cervical muscles can be achieved with CSE treatment; however, more effective results can be obtained with the combined application of CSE and MMT.

Neck pain can reduce quality of life by negatively affecting overall health and leading to significant disability [34]. Previous studies [17,35] reported that various exercise and manual therapy methods may be effective in improving the quality of life of individuals with CNP. In a systematic review conducted by Gross et al. [36], it was reported that the application of mobilization in individuals with neck pain had positive results in reducing pain and improving quality of life and bodily functions in the short and long term. Salo et al. [35] stated that improvements in quality of life can be obtained with stretching and strengthening exercises applied to individuals with CNP. In a study involving individuals with CNP [13], greater enhancements in quality of life were observed when MMT was included along with a conventional physiotherapy program, compared to the effects of a conventional physiotherapy program alone. Another study [4] found that combining CSE with manual therapy was more effective in enhancing the quality of life compared to CSE alone. Similarly, Duymaz et al. [17] reported that MMT combined with a home exercise program was more effective in improving the quality of life in individuals with CNP compared to a home exercise program alone. In

the current study, significant increases in quality of life were recorded in both the CSE alone and CSE with MMT groups. Moreover, the improvement in quality of life was higher in the group in which MMT was applied in combination with CSE than in the group in which CSE was applied alone. The improvements in quality of life in both groups were consistent with the literature. The greater improvements in quality of life in the group that received MMT alongside CSE may be attributed to the fact that this group experienced greater improvements in ROM and PPT compared to the other group. The CSE program may improve the quality of life in patients with CNP; on the other hand, more improvements in the quality of life in patients can be achieved by combining CSE with MMT.

Limitations

The main limitation of this study was that the treatment and follow-up periods were relatively short-term, and a long-term follow-up post-treatment could not be performed. It is recommended that future research be carried out over extended treatment and follow-up periods in order to obtain more conclusive results.

CONCLUSION

The application of CSE in CNP management may improve pain intensity, ROM, cervical muscle endurance, PPT, and quality of life. However, it can be said that MMTs applied in addition to CSE are more effective in improving ROM, PPT, and quality of life compared to CSE alone in individuals with CNP. For patients with CNP, a treatment program that consists of both CSE and MMT may be more effective than CSE alone in the clinic. It should be taken into consideration that a relatively short-term treatment and follow-up program of four weeks was applied in this study. It is recommended that the present results be confirmed in further studies with longer treatment and follow-up periods.

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İMPİNGEMENT SENDROMU OLAN HASTALARDA EGZERSİZ EŞLİĞİNDE VEYA ÖNCESİNDE YAPILAN TRANSKUTANÖZ ELEKTRİK SİNİR STİMÜLASYONU (TENS) UYGULAMASININ AĞRI, EKLEM HAREKET AÇIKLIĞI VE KİNEZYOFOBİ ÜZERİNE ETKİLERİNİN KARŞILAŞTIRILMASI

COMPARISON OF THE EFFECTS OF TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION (TENS) APPLIED DURING OR BEFORE EXERCISE ON PAIN, RANGE OF MOTION, AND KINESIOPHOBIA IN PATIENTS WITH IMPINGEMENT SYNDROME

Onur Aydoğdu[1*], Nurdoğan Balcı[2,3], Hakan Telsiz[3,4] Seda Fidancı[2]

[1]Marmara Üniveristesi, Sağlık Bilimleri Fakültesi, Fizyoterapi ve Rehabilitasyon Bölümü, İstanbul, Türkiye

[2]Kocaeli Gebze Fatih Devlet Hastanesi, Kocaeli, Türkiye

[3]Marmara Üniversitesi Sağlık Bilimleri Enstitüsü, İstanbul, Türkiye

[4]Marmara Üniversitesi Eğitim ve Araştırma Hastanesi, İstanbul, Türkiye

ÖZ

Amaç: Çalışmanın amacı, omuz impingement hastalarında egzersiz esnasında veya öncesinde uygulanan TENS uygulamasının ağrı, eklem hareket açıklığı ve kinezyofobi düzeyi üzerine etkilerinin karşılaştırılmasıydı.

Yöntem: Çalışmamıza, 18-65 yaş aralığında omuz impingement tanısı alan, çalışma ve kontrol gruplarına eşit dağılacak şekilde toplam 40 hasta dahil edildi. Kontrol grubundaki hastalara (yaş=60.3±2.79 yıl; 4 erkek-16 kadın) 3 hafta boyunca toplamda 12 seans, klinikte yaygın şekilde kullanılan ultrason, TENS ve hot-pack uygulaması yapılıp hemen ardından kuvvetlendirme ve germe egzersizleri yaptırıldı. Çalışma grubundaki hastalara ise (yaş=61.0±2.38 yıl; 3 erkek-17 kadın) kontrol grubundan farklı olarak egzersiz tedavisi, TENS uygulaması ile birlikte yaptırıldı. Hastaların tedavi öncesi ve sonrası ağrı düzeyleri Vizüel Analog Skalası, eklem hareket açıklık değerleri Universal Gonyometre, kinezyofobi düzeyleri ise Tampa Kinezyofobi Skalası ile değerlendirildi.

Bulgular: Ağrı, aktif ve pasif eklem hareket açıklıkları ve kinezyofobi tedavi öncesi ve sonrası değerleri karşılaştırıldığında her iki grupta da tüm parametreler açısından istatistiksel olarak anlamlı gelişmeler bulundu (p=0.001). Parametrelerin tedavi sonrası ile öncesi arasındaki değişim farkları gruplar arasında karşılaştırıldığında, iki grup arasında kinezyofobi (p=0.033), pasif (p=0.001) ve aktif eksternal rotasyon (p=0.003) eklem hareket açıklığı değerleri açısından istatistiksel olarak anlamlı farklılık saptanırken, diğer parametreler açısından istatistiksel olarak anlamlı farklılık bulunmadı (p>0.05).

Sonuç: Çalışmamızda egzersiz sırasında yapılan TENS uygulamasının, egzersiz öncesinde yapılan TENS uygulamasına göre; kinezyofobiyi azaltma ile aktif ve pasif eksternal rotasyon açılarını artırmada daha etkili bir yöntem olduğu sonucuna varıldı.

Anahtar Kelimeler: Omuz Sıkışma Sendromu, Transkütanöz Elektriksel Sinir Stimulasyonu, Egzersiz, Fizik Tedavi Modaliteleri

ABSTRACT

Objective: The aim of our study was to compare the effects of TENS application applied during or before exercise on pain, range of motion and kinesiophobia levels in patients with shoulder impingement syndrome.

Method: A total of 40 patients diagnosed with shoulder impingement syndrome between the ages of 18-65 years were included in our study, equally distributed between intervention and control groups. Ultrasound, TENS, and hot-pack applications, which are commonly applied in clinics were done for a total of 12 sessions over 3 weeks and were immediately followed by strengthening and stretching exercises in control group (age=60.3±2.79 years; 4 male-16 female). Unlike the control group, therapeutic exercises were performed together with TENS in intervention group (age=61.0±2.38 years; 3 male-17 female). Pain and kinesiophobia levels, and range of motion values of the patients were evaluated before and after the treatment with the Visual Analog Scale, Tampa Kinesiophobia Scale, and Universal Goniometer, respectively.

Results: When the pre- and post-treatment values of pain, active and passive range of motion values, and kinesiophobia were compared, statistically significant improvements were found in all parameters in both groups (p=0.001). When the changes in the parameters before and after treatment between the groups were compared, statistically significant differences were found between the two groups in terms of kinesiophobia (p=0.033), passive (p=0.001) and active (p=0.003) external rotation range of motion values, while no statistically significant difference was found in terms of other parameters (p>0.05).

Conclusion: It was concluded that TENS application during exercise is a more effective method in reducing kinesiophobia and increasing active and passive external rotation angles compared to TENS application before exercise.

Key Words: Shoulder Impingement Syndrome, Transcutaneous Electric Nerve Stimulation, Exercise, Physical Therapy Modalities

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***Sorumlu yazar/Corresponding author:** Marmara Üniversitesi, Sağlık Bilimleri Fakültesi, Fizyoterapi ve Rehabilitasyon Bölümü, İstanbul, Türkiye
[1*]Email: onur.aydogdu@marmara.edu.tr, [2]Email: nurdogan_53_41@hotmail.com, [3]Email: hakantelsiz386@gmail.com, [4]Email: seda.kizmaz@gmail.com

GİRİŞ

Omuz ağrıları, %7 ila %30 arasında görülme sıklığı ile üçüncü sırada yer alan muskuloskeletal sistem ağrısı şikayeti olarak gösterilmektedir. Omuz ağrısına en çok sebep olan tanı, omuz impingement sendromudur [1]. İnsidansı yaşla birlikte artan omuz impingement sendromu, sıklıkla yaşamın altıncı dekatında görülür. İmpingement semptomları, bir travma sonrasında gelişebilir ve yaygın semptomlardan biri olan ağrı, genellikle haftalar ya da aylar içinde ortaya çıkabilir [2]. Neer tarafından omuz impingement sendromunu 3 evreye ayrılmıştır. İlk evre, ödem ve hemoraji evresidir. İkinci evrede kalınlaşma ve kısmi manşet yırtılması görülürken, üçüncü ve son evrede tam kat tendon yırtığı, tendon kopması ile kemik değişiklikleri spesifik bulgulardandır [3].

İmpingement sendromu gibi omuz patolojilerinde ağrılı hareketlere bağlı olarak meydana gelen kinezyofobi, hastaların günlük yaşam aktivite düzeylerini düşürerek yaşam kalitesini azaltmakta, bunun sonucunda da hastaların fiziksel ve psikolojik faktörlerle savaşmasına neden olmaktadır [4,5]. Bu tip davranışlar, kronik ağrının gelişmesi ile kısır bir döngü oluşturabilmektedir. Omuz yaralanmalarının varlığı ile ağrı eşiğinin azalması bu döngünün devam etmesine imkan tanır [6].

Omuz impingement sendromlu hastalarda tedavi seçeneği açısından, kliniklerde rutin olarak uygulanan seçeneklerden biri konvansiyonel fizyoterapi yaklaşımlarıdır. Konvansiyonel fizyoterapi uygulamalarında tedavi, sıklıkla bölgedeki yumuşak dokunun gevşetilmesi amacıyla termal uygulamalarla başlayıp elektroterapi modaliteleri ile devam eder [7]. Elektroterapi modaliteleri, ağrının azaltılması ve fonksiyonelliğin artırılması amacıyla uygulanan tedavi seçeneklerindendir. Terapatik ultrason, düşük seviye lazer tedavisi (LLLT) ve transkutanöz elektriksel sinir stimülasyonu (TENS), omuz patolojilerinde sıklıkla uygulanan modalitelerdendir [8]. TENS, kan dolaşımını artırması, ağrıyı azaltması ve hastayı egzersize hazırlaması nedeniyle omuz patolojilerinde en yaygın kullanılan modalitedir [9]. TENS'in, omuz impingement sendromlu hastalarda ağrı, fonksiyonellik ve yaşam kalitesi parametreleri üzerine olumlu etkileri olduğu gösterilmiştir [10].

Günümüzde kliniklerde kullanılan TENS cihazları, yoğunluğu 1-80 mA, frekans 1-150 Hz, dalga genişliği 50-300 usn arasında değişen dikdörtgen uyarı akımı veren modalitelerdir. Tensin, konvansiyonel TENS, akupunktur benzeri TENS, kısa yoğun TENS, patlayıcı (Burst) TENS ve modüle TENS olmak üzere 5 farklı uygulama modeli bulunmaktadır. Bunlar içinde en çok konvansiyonel TENS kullanılmaktadır [11].

Omuz impingement tedavisi kliniklerde yaygın olarak; 8 dk ultrason, 20 dk konvansiyonel TENS ve 20dk hot-pack uygulaması sonrasında kişinin ihtiyacına göre planlanan egzersizlerle yürütülmektedir. Kliniklerde TENS, egzersiz öncesinde yapışkan elektrotlar kullanılarak uygulanmaktadır [10,12-14]. Yapılan literatür çalışması sonucunda TENS'in farklı şekilde kullanımını içeren 2 makale bulunmuştur. Bu makalelerden birinde dirençli egzersiz sırasında uygulanan TENS'in sağlıklı deneklerin ağrı yoğunluğu ve fiziksel performansı üzerindeki ani etkileri araştırılmıştır [15]. Diğer makalede ise KOAH hastalığı olanlarda egzersiz sırasında akupunktur noktalarına TENS uygulanmıştır [16]. Bu makaleler impingement sendromlu hastalarda, günlük yaşam aktiviteleri sırasındaki omuz ağrısının, hastalarda harekete ve egzersize karşı korku oluşturması [5], hareket/egzersiz esnasında TENS uygulaması ile bu kısır döngünün ortadan kaldırılabilirliği varsayımını bize sunmuştur. Egzersizle birlikte yapılan TENS uygulamasının özellikle kinezyofobi başta olmak üzere ağrısı olan bireylerde farklı parametreler üzerine etkilerinin incelenmesine ihtiyaç duyulduğu düşünülmüştür.

Tüm bu bilgiler ışığında çalışmada omuz impingement sendromlu hastalarda kliniklerde rutin şekilde egzersiz öncesinde uygulanan TENS ile egzersiz esnasında yapılan TENS uygulamasının ağrı, eklem hareket açıklığı ve kinezyofobi düzeyi üzerine etkilerinin karşılaştırılması amaçlandı. Bu doğrultuda çalışmanın hipotezi, egzersiz esnasında yapılan TENS uygulamasının, egzersiz öncesinde yapılan TENS uygulamasına göre ağrı ve kinezyofobi düzeyini azaltarak eklem hareket açıklığını artırma açısından daha etkili bir yöntem olabileceğidir.

YÖNTEM

Katılımcılar

Çalışmaya, 15 Ocak-15 Haziran 2023 tarihleri arasında Gebze Fatih Devlet Hastanesi'ne gelen 18-65 yaş aralığında omuz impingement tanısı alan 40 hasta dahil edildi. Çalışmaya katılacak gönüllüler çalışma hakkında bilgilendirildi ve aydınlatılmış onam formu imzalatıldı. Aydınlatılmış onam formunun bir nüshası hastaya verildi ve istediği zaman çalışmadan çıkma hakkına sahip olduğu belirtildi. Çalışmaya 18-65 yaş arasında, uzman hekim tarafından impingement sendromu tanısı konulan, en az 1 aydır omuz ağrısına sahip, Neer ve Hawkins Testleri pozitif olan hastalar dahil edildi. Çalışmadan üst ekstremitesinden operasyon geçiren, romatoid artrit gibi sistemik rahatsızlıkları olan, ilgili yaş aralığında ve çalışmaya katılmaya gönüllü olmayan hastalar dışlandı. Ayrıca kognitif açıdan iletişim kuramayan, değerlendirme ve egzersizler sırasında problem yaşanan bireyler de çalışma dışında tutuldu.

Veri Toplama Araçları

Tedavi öncesi ve sonrası Vizüel Analog Skala (VAS) ile ağrı şiddeti, gonyometre ile omuz fleksiyon, abduksiyon, aktif ve pasif internal ve eksternal rotasyon eklem hareket açıklıkları, Tampa Kinezyofobi Ölçeği ile kinezyofobi düzeyi değerlendirildi. Ayrıca hastalara tedavi öncesi ve sonrası Neer ve Hawkins testleri uygulandı ve Ağrılı Ark Bulgusu sorgulandı.

Hasta Değerlendirme Formu: Hastaların adı, soyadı, yaşı, boyu, vücut ağırlığı, vücut kütle indeksi (VKİ), mesleği, medeni durumu, semptomları, etkilenen ekstremitesi ve dominant tarafı sorgulanarak not edildi.

Vizüel Analog Skalası (VAS): Çalışmada ağrının sorgulanması VAS kullanılarak yapıldı. VAS, 0 ile 10 arasında ağrıyı değerlendiren likert bir ölçektir. "0" ağrı yok, "10" ise olabilecek en şiddetli ağrıyı tanımlamaktadır. Tedavi öncesi ve sonrasında hastalardan 0 ile 10 arasında aktivite sırasındaki ağrısına karşılık gelen noktayı işaretlemeleri istendi [17].

Gonyometrik Eklem Hareket Açıklığı Ölçümü: Omuz fleksiyon, abduksiyon, aktif ve pasif internal ve eksternal rotasyon eklem hareket açıklıkları gonyometre ile tedavi öncesi ve sonrasında ölçüldü. Ölçümler hasta sırt üstü yatar pozisyonda iken yapıldı. Normal değer olarak fleksiyon ve abduksiyon için 0º-180º, iç ve dış rotasyon için 0º-90º referans alındı [18] (Şekil 1).

Tampa Kinezyofobi Ölçeği: Tüm hastaların hareket korkusu düzeyleri, Tampa Kinezyofobi Ölçeği ile değerlendirildi. Tampa Kinezyofobi Ölçeğinde 4 puandan oluşan likert puanlama (1: Kesinlikle katılmıyorum, 4: Tamamen katılıyorum) kullanılmaktadır. Hasta, toplam skor olarak, 17-68 arasında bir puan almaktadır. Ölçek sonucunda elde edilen toplam puanın yüksek olması, kinezyofobi düzeyinin yüksek olduğu anlamına gelmektedir. Harekete bağlı korku ve kaçınmayı değerlendiren bu ölçeğin, Türk diline adaptasyonu Yılmaz ve ark. tarafından yapılmı, ölçek geçerli ve güvenilir bulunmuştur [19].

Neer Testi: Neer testi uygulaması sırasında hasta otururken, değerlendirici fizyoterapist ayakta skapulaları stabilize etti. İnternal rotasyon ile kol pasif olarak fleksiyon ve abdüksiyon arasında eleve edildi. Bu manevra sırasında omuz impingement sendromu varlığında ağrı ortaya çıkmaktadır [20]. Bu test hastalara tedavi öncesi ve sonrası iki defa uygulandı.

Hawkins Testi: Hawkins testi sırasında hastanın kolu 90° fleksiyona, abduksiyon ve internal rotasyona getirilir. Bu manevra ile tüberkülüm majus, korakoakromial ligamentin altına itilir ve bu sayede omuz

impingement sendromu varlığında ağrı gözlemlenir [21]. Bu test de tedavi öncesi ve sonrası iki defa uygulandı.

Ağrılı Ark Bulgusu: Omuz abduksiyonu sırasında 60-120° arasında omuz ekleminde ağrı ortaya çıkıyorsa ağrılı ark bulgusu pozitiftir ve impingement varlığını gösterir [22]. Bu bulguya tedavi öncesi ve sonrası bakıldı.

Şekil 1. Hastalarda eklem hareket açıklığı değerlendirmesi

Tedavi Grupları

Çalışmaya toplamda 40 hasta alındı. Dahil edilme kriterlerine uyan impingement sendromlu hastalar, basit randomize bir şekilde (yazı-tura atılması) 20 kontrol ve 20 çalışma grubuna olacak şekilde dağıtıldı.

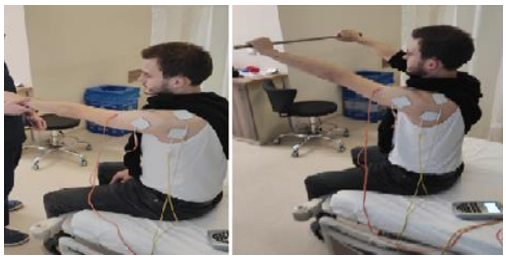
Kontrol Grubu: TENS Sonrası Egzersiz Uygulama Grubu

Hastalara 3 hafta boyunca toplamda 12 seans uygulama yapıldı. Tedavi seansları hafta içi günlerde, günde en fazla bir seans olacak şekilde düzenlendi. Hastalara klinikte yaygın şekilde kullanılan 8 dk ultrason uygulamasının ardından 20'şer dk hot-pack ve TENS uygulaması yapıldı. Hemen ardından omuz bölgesi kaslarına 20 dk süresince kuvvetlendirme ve germe egzersizleri standart bir egzersiz protokolü şeklinde uygulandı (Şekil 2).

Şekil 2. Kontrol grubunda egzersiz uygulaması

Çalışma Grubu: TENS ile Birlikte Egzersiz Uygulama Grubu

Hastalara 3 hafta boyunca toplamda 12 seans uygulama yapıldı. Tedavi seansları hafta içi günlerde, günde en fazla bir seans olacak şekilde düzenlendi. Hastalara klinikte yaygın şekilde kullanılan 8 dk ultrason uygulamasının ardından 20 dk hot-pack uygulaması yapıldı. Kontrol grubundan farklı olarak çalışma grubunda egzersiz tedavisi 20 dk boyunca TENS uygulaması ile birlikte yapıldı (Şekil 3).



Şekil 3. Çalışma grubunda TENS bağlı iken egzersiz uygulaması

Tedavi

Ultrason Uygulaması: Omuz impingement sendromlu hastalara oturma pozisyonunda, Chattanooga marka cihaz ile glenohumeral eklem çevresine 3 MHz frekanslı, tedavi dozu ortalama 1.5 w/cm² olacak şekilde 8 dk boyunca daireler çizilerek ultrason tedavisi uygulandı.

Hot Pack Uygulaması: Lokal dolaşımı artırmak için silikon dioksit ile doldurulan ve özel kazanlarda 65-90°C'de saklanan hot-pack, orta kalınlıkta bir havluya sarılarak ağrılı omuz bölgesine yerleştirildi. Hot-pack torbasının sıcaklığı hastayı rahatsız edecek düzeyde fazlaysa, ilave havlu konuldu. Hasta mahremiyetinin korunması amacıyla vücudun açık bölümleri başka bir havluyla örtüldü. Hot-pack uygulaması 20 dk sürdü [23].

TENS Uygulaması: Hastanın glenohumeral eklemindeki ağrılı bölge araya alınarak 20 dk boyunca Chattanooga marka cihaz aracılığıyla frekansı 60-120 Hz arasında, geçiş süresi 50-100 µsn olan konvansiyonel TENS uygulaması yapıldı [24] (Şekil 4).

Şekil 4. TENS uygulaması

Egzersizler: Her iki gruba standart bir egzersiz programı uygulandı. Codman (sarkaç) egzersizleri, tam hareket açıklığında wand (sopa) egzersizleri, theraband egzersizleri, izometrik egzersizler, parmak merdiveni, pasif germe egzersizleri fleksiyon, abduksiyon ve rotasyon yönünde eklem hareket açıklıklarını artırmak amacıyla 1 set, 10 tekrarlı olacak şekilde uygulandı. Egzersiz programının zorluk seviyesi, progresif şekilde düzenlendi. İlk hafta, codman (sarkaç), wand (sopa) ve parmak merdiveni egzersizleri hafif tempoda ve ağırlıksız gerçekleştirilirken; sonraki hafta orta tempoda-kısmi ağırlıkla; son hafta ise, tempolu-ağırlıkla olacak şekilde uygulandı. Theraband egzersizleri ise sırasıyla hafif, orta ve tolere edebildiği düzeyde ağır renklere geçiş yapılacak şekilde uygulandı. Hastaların tedavi programları tamamlandıktan sonra egzersizler fizyoterapist tarafından ev programı şeklinde planlanarak verildi.

Etik Onay

Çalışma Sağlık Bilimleri Üniversitesi Kocaeli Derince Eğitim ve Araştırma Hastanesi Klinik Araştırmalar Etik Kurulu tarafından onaylandı. Çalışma Kocaeli Gebze Fatih Devlet Hastanesinde gerçekleştirildi. Çalışma için gerekli kurum izin yazıları alındı (Protokol No:2022-141).

İstatistiksel Analiz

Araştırmada elde edilen verilerin analizinde, %95'lik güven aralığında, anlamlılık $p<0.05$ düzeyinde SPSS 11.5 istatistik programı kullanıldı. Verilerin normal dağılıma uygunluğu "Kolmogorow Smirnow/Shapiro Test", histogram çizimi ve normal dağılım grafikleriyle sorgulandı. Değişkenlerin incelenmesinde normal dağılım sağlanmadığı için tedavi öncesi-sonrası grup içi karşılaştırmalarda "Wilcoxon Signed Rank Test", tedavi sonrası ile öncesi arasındaki farkın gruplar arasındaki karşılaştırmalarında ise "Mann Whitney U Testi" kullanıldı.

Örneklem büyüklüğünün belirlenmesi için daha öncesinde yapılan benzer bir araştırma bulunamadığından 15 Ocak-15 Haziran 2023 tarihleri arasında çalışmaya katılmaya gönüllü olan tüm hastalar dahil edildi. Bu nedenle çalışmanın örneklemi, kolayda örnekleme yöntemi ile belirlendi ve bu doğrultuda her bir grup başına en az 20 hasta alındı.

BULGULAR

Çalışmaya 20'si çalışma grubunda, 20'si kontrol grubunda olmak üzere toplam 40 hasta dahil edildi. Kontrol grubunun %20'si erkek, %80'i kadın; çalışma grubunun %15'i erkek, %85'i kadındı. Yaş ortalaması

kontrol grubunun 60.30±2.79 yıl, çalışma grubunun ise 61.00±2.38 yıl idi. Gruplar yaş, cinsiyet ve vücut kitle indeksi açısından benzerlik gösteriyordu. Çalışmamızda hastaların 35 tanesi sağ dominant olup 26 tanesinin sağ omuzu etkilenmişti (Tablo 1).

Tedavi öncesi tüm hastaların Neer, Hawking testleri ve ağrılı ark bulguları pozitifti. Tedavi sonrasında kontrol grubunda 12, deney grubunda 14 hastanın test sonuçları negatife dönmüştü (Tablo 1).

Ağrı, aktif ve pasif eklem hareket açıklıkları ile kinezyofobi tedavi öncesi ve sonrası değerleri karşılaştırıldığında her iki grupta da tüm parametreler açısından istatistiksel olarak anlamlı gelişmeler bulundu (p=0.001). Gruplar arası parametrelerin tedavi sonrası ile öncesi arasındaki değişim farkları karşılaştırıldığında, iki grup arasında kinezyofobi (p=0.033), pasif (p=0.001) ve aktif (p=0.003) eksternal rotasyon eklem hareket açıklığı değerleri açısından istatistiksel olarak anlamlı farklılık saptanırken; ağrı (p=0.568), fleksiyon (p=0.653), abduksiyon (p=0.066), pasif (p=0.523) ve aktif internal rotasyon (p=0.692) parametreleri açısından istatistiksel olarak anlamlı farklılık bulunmadı (p>0.05) (Tablo 2, Tablo 3). Çalışma boyunca herhangi bir olumsuz durum yaşanmazken, çalışmadan çıkarılan ya da çıkmak isteyen hasta olmadı.

Tablo 1. Çalışmaya dahil edilen hastaların demografik özellikler ile klinik test sonuçlarının her iki grup açısından karşılaştırılması

Özellik	Kontrol Grubu (n=20) (Ort±SS)	Çalışma Grubu (n=20) (Ort±SS)
Cinsiyet (E/K)	4/16 (20%-80%)	3/17 (15%-85%)
Yaş (yıl)	60.30±2.79	61.00±2.38
Boy (cm)	166.30±7.24	166.75±7.34
Vücut ağırlığı (kg)	78.15±8.97	78.30±8.73
VKİ (kg/m^2)	28.31±3.32	28.32±4.20
Dominant ekstremite (sağ/sol)	18/2 (90%-10%)	17/3 (85%-15%)
Etkilenen ekstremite (sağ/sol)	12/8 (60%-40%)	14/6 (70%-30%)
Tedavi Sonrası Neer Testi (Pozitif/Negatif)	8/12	6/14
Tedavi Sonrası Hawkins Testi (Pozitif / Negatif)	8/12	6/14
Tedavi Sonrası Ağrılı Ark (Pozitif / Negatif)	7/13	6/14

Ort: Ortalama; SS: Standart Sapma; VKİ: Vücut Kütle İndeksi; E: Erkek; K: Kadın; Neer, Hawkins ve Ağrılı Ark Testleri tüm hastalarda tedavi öncesi pozitif idi.

Tablo 2. Çalışmaya dahil edilen hastaların ağrı ve kinezyofobi düzeylerinin grup içi ve gruplar arası karşılaştırılması

Parametre	Kontrol Grubu (n=20)		Çalışma Grubu (n=20)		p^2/Z
	(Ort±SS)	p^1 Z	(Ort±SS)	p^1 Z	
Ağrı TÖ	7.10±1.25	**0.001*** -3.951	6.40±1.18	**0.001*** -3.942	0.104 -1.624
Ağrı TS	1.65±1.03		1.20±0.76		0.150 -1.439
ΔFark	-5.45±1.35	-	-5.20±1.43	-	0.568 -0.571
Kinezyofobi TÖ	42.65±7.52	**0.001*** -3.378	42.95±9.57	**0.001*** -3.750	0.734 -0.339
Kinezyofobi TS	37.80±6.92		34.85±6.65		0.204 -1.271
ΔFark	-4.85±5.98	-	-8.10±5.76	-	**0.033*** -2.135

Ort: Ortalama; SS: Standart Sapma; TÖ: Tedavi öncesi; TS: Tedavi sonrası; ΔFark: Tedavi sonrası-Tedavi öncesi; p^1: Grup içi anlamlılık değeri; p^2: Gruplar arası anlamlılık değeri.

TARTIŞMA

Çalışmadan elde edilen sonuçlara göre, egzersiz sırasında yapılan TENS uygulamasının, egzersiz öncesinde yapılan TENS uygulamasına göre kinezyofobiyi azaltma, aktif ve pasif eksternal rotasyon açılarını artırma açısından daha etkili bir yöntem olduğu sonucuna varıldı. Çalışmadan elde edilen önemli bulgulardan bir diğeri ise her iki tedavi grubunun da ağrı, eklem hareket açıklığı ve hareket korkusu üzerine kayda değer düzeyde gelişmeler sağlanmasıydı. Bu bulgu, beklediğimiz bir sonuçtu. Çünkü konvansiyonel fizyoterapi programı içerisinde uygulanan yaklaşımların, özellikle omuz problemlerinde ağrıyı azaltmada ve fonksiyonelliği artırmada etkili olduğu kanıtlanmıştır [25]. Bu nedenle çalışmamızda her iki tedavi grubunda da uygulanan konvansiyonel tedavi programı daha önceki literatür çalışmaları dikkate alınarak oluşturuldu [26]. Araştırmamızda kontrol grubuna uygulanan konvansiyonel fizyoterapi programı elektrofiziksel ajanlardan sıcak ajanlar, TENS ve terapatik ultrason gibi kliniklerde en sık kullanılan fizik tedavi modalitelerini içerdi. Sonuç olarak, çalışmamızda elde edilen bu bulgu literatür ile benzerlik göstermektedir. Bu açıdan çalışmamızla paralellik gösteren İğrek ve ark.'ın yaptıkları çalışmada, impingement sendromlu hastalara TENS, terapatik ultrason ve infrared uygulamalarına ek olarak terapatik egzersizlerin yer aldığı 4 haftalık konvansiyonel fizyoterapi programı uygulanmış ve ağrı, eklem hareket açıklığı başta olmak üzere tüm parametreler üzerine olumlu etkiler elde edilmiştir [24]. Ayrıca bu araştırma da uygulanan terapatik egzersizlerin impingement sendromu tedavisinde etkili olduğu ve terapistler tarafından da yaygın olarak tercih edildiği bilinmektedir [26].

Ağrı, omuz impingement sendromlu hastalarda en önemli yakınmalardan biridir ve buna bağlı olarak güç kaybı ortaya çıkabilir. Ağrı düzeyini azaltmak, impingement sendromlu hastalarda en önemli amaçlardan biridir [25]. Yapılan bu çalışmada TENS kullanımının ağrı düzeyi üzerine etkili olduğu görüldü. Bu bulgu da yine literatürle benzerlik gösteren ve beklenen bir sonuçtu [24]. Ancak gruplar arası karşılaştırmalara baktığımızda, TENS'in tedavide uygulama şeklinin farklı olması ağrı üzerinde farklı bir etki yaratmadı. Zira, bulunan bu sonuç Menezes ve ark.'ın çalışma sonuçları ile benzerdir. Çalışmada, güçlendirme egzersizleri sırasında TENS uygulaması yapılmış ve bunun ağrı yoğunluğu üzerindeki etkisine bakılmıştır. Çalışma sonucunda egzersiz sırasında yapılan TENS uygulaması ile plasebo TENS uygulaması arasında anlamlı bir fark bulunmamıştır [15].

Her iki gruptaki hastaların kinezyofobi düzeylerinin 12 seanslık tedavi sonrasında azalmasına ek olarak, TENS uygulamasının egzersiz öncesinde uygulanmasına kıyasla, egzersiz sırasında uygulanmasının kinezyofobi düzeyini daha fazla azalttığı tespit edildi. Kinezyofobi düzeyinin her iki grupta da azalmasını, hastaların ağrı düzeylerinin azalmasına bağlamaktayız. Zira, literatürde kinezyofobi ile ağrı arasındaki ilişkiye bakılan bir çalışmada, her iki parametrenin birbiriyle ilişkili olduğu ve ağrı yoğunluğunun kinezyofobi üzerindeki etki boyutunun %19 olduğu görülmüştür [27]. Yaptığımız çalışmada da uyguladığımız tedavi ile paralel olarak ağrı yoğunluğunun azaldığı, bununla birlikte kinezyofobi düzeyinde de anlamlı oranda azalma olduğu bulundu. Öte yandan kontrol grubuna kıyasla, çalışma grubundaki hastaların kinezyofobi düzeylerinin daha fazla azalma sebebini ise, öncelikle eksternal rotasyon eklem hareket açıklığındaki artışa, ek olarak da TENS uygulaması sırasında hastanın egzersizleri ağrısız yapma olasılığına bağlamaktayız. Çünkü kronik muskuloskeletal sistem ağrısı olan bireylerde kinezyofobi düzeyinin daha limitli eklem hareket açıklığı ile ilişkili olduğu, eklem hareket açıklığındaki artışın kinezyofobi düzeyini azaltabileceği gösterilmiştir [27]. Bizim çalışmamızda da eksternal rotasyon eklem hareket açıklığı değerlerinin çalışma grubunda daha fazla gelişme gösterdiği, buna bağlı olarak kinezyofobi düzeyini azalttığı düşünülebilir. Ayrıca çalışma grubundaki hastaların egzersizler sırasında hareketleri daha rahat yapabildiğini gözlemsel olarak söyleyebiliriz. Nihai olarak bu bulgu, çalışmamızın başında kurduğumuz hipotezimizi doğrular niteliktedir.

Tablo 3. Çalışmaya dahil edilen hastaların aktif ve pasif eklem hareket açıklık değerlerinin grup içi ve gruplar arası karşılaştırılması

Parametre	Kontrol Grubu (n=20)		Çalışma Grubu (n=20)		
	(Ort±SS)	p^1 Z	(Ort±SS)	p^1 Z	p^2 Z
Fleks ATÖ	125.50±17.91	**0.001*** -3.925	131.00±14.74	**0.001*** -3.929	0.381 -0.876
Fleks ATS	164.00±9.81		167.75±8.50		0.150 -1.440
ΔFark	38.50±19.47	-	36.75±18.22	-	0.653 -0.450
Abd ATÖ	111.75±17.71	**0.001*** -3.843	122.00±19.15	**0.001*** -3.932	0.109 -1.604
AbdATS	147.75±16.17		152.00±12.81		0.427 -0.794
ΔFark	36.00±12.20	-	30.00±12.35	-	0.066 -1.841
İR PTÖ	64.25±17.86	**0.001*** -3.755	62.74±16.42	**0.001*** -3.848	0.518 -0.646
İR PTS	85.00±11.35		86.50±5.87		0.640 -0.468
ΔFark	20.75±11.03	-	23.75±12.23	-	0.523 -0.639
İR ATÖ	56.00±19.16	**0.001*** -3.744	55.25±18.02	**0.001*** -3.831	0.690 -0.399
İR ATS	82.00±13.21		82.25±8.80		0.508 -0.662
ΔFark	26.00±13.63	-	27.00±13.11	-	0.692 -0.396
ER PTÖ	48.25±16.72	**0.001*** -3.929	44.75±12.95	**0.001*** -3.934	0.396 -0.850
ER PTS	70.75±14.16		82.75±7.34		**0.002*** -3.064
ΔFark	22.50±13.52	-	38.00±11.28	-	**0.001*** -3.565
ER ATÖ	40.25±16.17	**0.001*** -3.932	36.75±14.16	**0.001*** -3.928	0.521 -0.641
ER ATS	61.25±12.01		69.50±9.01		**0.007*** -2.674
ΔFark	21.00±10.95	-	32.75±11.63	-	**0.003*** -2.949

Fleks: Fleksiyon; ATÖ: Aktif tedavi öncesi; ATS: Aktif tedavi sonrası; Abd: Abduksiyon; PTÖ: Pasit tedavi öncesi; PTS: Pasif tedavi sonrası; İR: İnternal rotasyon; ER: Eksternal rotasyon; Ort: Ortalama; SS: Standart Sapma; ΔFark: Tedavi sonrası-Tedavi öncesi, p^1: Grup içi anlamlılık değeri; p^2: Gruplar arası anlamlılık değeri.

Omuz impingement sendromunda aktif ve pasif omuz eklem hareket açıklığı ölçümleri sırasında, abdüksiyon ve özellikle iç rotasyonda kısıtlılıklar saptanabilir. Bu yönde yapılan omuz eklem hareketleri, kompresyon ve ağrıyı artıracağından hastalar genellikle kollarını hareket ettirmekten kaçınırlar [28]. Bu nedenle çalışmamızda, fleksiyon ve abdüksiyon ölçümlerine ek olarak, iç ve dış rotasyon sırasındaki normal eklem hareket açıklığı değerleri aktif ve pasif olarak incelendi. Her iki grupta da tüm yönlerde hem aktif hem pasif eklem hareket açıklıklarında anlamlı düzeyde artış saptandı. Bilek ve ark. yaptıkları çalışmada, TENS ve HVPS (Yüksek Voltaj Kesikli Akım) akımlarının normal eklem hareket açıklığı üzerindeki etkilerini incelemişlerdir. Sonuç olarak, ikisinin de etkili olduğunu ancak HVPS akımının daha etkili olduğunu belirtmişlerdir [29]. Kul ve ark. tarafından yapılan çalışmada, omuz impingement sendromu olan hastalarda kinesiotape ve konvansiyonel fizik tedavi uygulamaları karşılaştırılmıştır. Çalışma sonucunda konvansiyonel fizik tedavi grubunda tüm açılarda belirgin bir şekilde iyileşme bildirilmiştir [30]. Bu çalışma sonuçları da bizim sonuçlarımızla uyumlu görünmektedir. Son olarak Çelik ve ark.'ın yapmış olduğu çalışmada, konservatif tedaviye ek olarak farklı iki egzersiz programı karşılaştırılmıştır. Çalışma sonucunda 90° ve üzeri wand egzersizlerinin eklem hareket açıklığını artırmada etkili olduğu bulunmuştur [31]. Literatürle benzer şekilde, çalışmada tedavi programı içerisinde wand egzersizleri, fleksiyon ve abduksiyon yönlerinde 90° üzerine çıkacak şekilde hastalara uygulandı ve grup içi karşılaştırmalara bakıldığında eklem hareket açıklığı değerlerinde anlamlı düzeyde iyileşmeler sağlandı.

Egzersiz esnasında uygulanan TENS modalitesinin ağrı, kinezyofobi ve eklem hareket açıklığı gibi hastanın primer şikayetleri üzerine etkilerinin incelendiği çalışmamız, literatürde bildiğimiz kadarıyla yapılan ilk çalışmadır. TENS modalitesinin egzersiz sırasında uygulanmasının, kliniklerde rutinde uygulanan egzersiz öncesinde yapılmasına kıyasla, özellikle kinezyofobi ve eksternal rotasyon açılarına kayda değer düzeyde katkı sağlaması çalışmamızın güçlü yönlerindendir.

Çalışmanın Limitasyonları

Çalışmamızda bazı limitasyonlar bulunmaktadır. Bunlardan ilki ve en önemlisi, çalışmamızda bir power analiz istatistik yöntemi uygulanmamış olmasıdır. Bu doğrultuda örneklem büyüklüğü kolayda örneklem yöntemi ile belirlenmiş olsa da, dahil edilen hasta sayısının yeterli olup olmadığı açık değildir. Ek olarak kadın ve erkek cinsiyetine göre dağılım eşit değildir. Bu durum, iyileşme düzeyleri açısından farklılık oluşturmuş olabilir.

SONUÇ

Çalışmamızda elde edilen bulgulara göre, TENS modalitesinin egzersiz sırasında yapılması, egzersiz öncesinde yapılmasına göre kinezyofobi düzeyi ve eksternal rotasyon eklem hareket açıklığı açısından daha etkili bir yöntemdir.

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HÜNNAP (Z. JUJUBA)'IN SAĞLIK ETKİLERİNE YÖNELİK BİR İÇERİK ANALİZİ

A CONTENT ANALYSIS ON THE HEALTH EFFECTS OF *JUJUBE (Z. JUJUBA)*

Betül Üner Yılmaz[1*], Muhammet Ali Cebirbay[2], Nazan Aktaş[2]

[1]Muğla Sıtkı Koçman Üniversitesi, Sağlık Bilimleri Fakültesi, Beslenme ve Diyetetik Bölümü, Muğla, Türkiye

[2]Selçuk Üniversitesi Sağlık Bilimleri Fakültesi, Beslenme ve Diyetetik Bölümü, Konya, Türkiye

ÖZ

Türkiye'de hünnap meyvesi olarak bilinen Z. jujuba'nın fenolik bileşenleri ve ikincil metabolit içeriklerinin beslenme ve sağlık etkileri son yıllarda sıkça araştırılmaktadır. Bu nedenle çalışmada hünnap meyvesinin fenolik bileşikler ve ikincil metabolitler açısından sağlık etkileri araştırılmaya çalışıldı. Çalışmada içerik analizi yöntemi kullanılarak Pubmed, Sciencedirect, ClinicalKey, Cochrane Library gibi bilimsel temelli veri tabanları aracılığıyla "Ziziphus jujuba" veya "Jujube" ve "Health effects" anahtar kelimelerini bir arada içeren 2013-2023 yılları arasında yayımlanmış, tam metin erişilebilen çalışmalar içerik analizi yöntemi kullanılarak araştırmacılar tarafından hazırlanan "Ziziphus Jujubanın Sağlık Üzerine Etkileri Yayın Değerlendirme Formu" ile değerlendirildi. Formda makalenin adı, yayın yılı, araştırma tipi, meyvenin kullanım şekli, araştırma değişkenleri, çalışma materyali ve çalışmanın sonucuna dair bilgileri elde etmeye yönelik maddeler yer almaktaydı. 2013-2023 yılları arasında 677 yayınlanmış çalışma mevcuttu. Bu çalışmaların %5.0'ı (n=34) içerik analizi çalışmamıza uygundu ve kabul edilmişti. Araştırma tipi in vitro (%47.1) ve in vivo (%52.9) olarak belirlendi. Yapılan 18 in vivo çalışmanın tümü randomize kontrollü çalışmaydı. Hünnap meyvesinin çalışmalarda en sık %67.6 ile ekstraksiyon formunun kullanıldığı belirlendi. İncelenen çalışmalarda kullanılan diğer formlar ise %17.6 doğal, %5.9 şurup, %2.9 bal formu ve %5.9 toz formuydu. Sağlık etkilerinin araştırılma sıklığı incelendiğinde birinci sırada %29.4 ile antikanserojen etki yer alırken, %14.7 ile kalp damar hastalıkları, %14.7 ile nörolojik hastalıklar, %8.8 ile karaciğer hastalıkları, %5.9 ile gastrointstinal sisteme etkisi ve %5.9 ile diyabet üzerine etkilerinin araştırıldığı saptandı. Çalışmamıza hünnabın 2013-2023 yılları arasında yapılmış ve sağlık etkilerinin araştırıldığı çalışmalar dahil edildi. Çalışmamıza dahil edilen 34 çalışmanın tamamında meyvenin farklı formlarının olumlu sağlık etkileri oluşturduğu gösterildi. Hünnap ile ilgili çalışmaların büyük çoğunluğu ülkemiz de dahil olmak üzere derleme niteliğinde olup; klinik çalışmaların sayısının yeterli olmadığı görüldü. Hünnap meyvesinin sağlık üzerine etkilerinin daha iyi değerlendirilebilmesi için, hayvan ve insan çalışmalarının arttırılmasına ihtiyaç vardır.

Anahtar Kelimeler: Ziziphus Jujuba, Terapötik, Antikanserojen, Flavonoid

ABSTRACT

The nutritional and health effects of phenolic components and secondary metabolite contents of Z. jujuba, known as jujube in Turkey, have been frequently investigated in recent years. For this reason, the health effects of Z. jujuba in terms of phenolic compounds and secondary metabolites were investigated in this study. In the study, using the content analysis method, it was published between 2013-2023, which includes the keywords "Ziziphus jujuba" or "Jujube" and "Health effects", through scientific databases such as Pubmed, Sciencedirect, ClinicalKey, Cochrane Library, full-text accessible The studies were evaluated with the "Effects of Ziziphus Jujuba on Health Publication Evaluation Form" prepared by the researchers using the content analysis method. In the form, there are items to obtain information about the name of the article, the year of publication, the type of research, the use of the fruit, the research variables, the study material and the result of the study. There are 677 published studies between 2013-2023. 5.0% (n=34) of these studies were suitable for our content analysis study and were accepted. The study type was determined as in vitro (47.1%) and in vivo (52.9%). All 18 in vivo studies are randomized controlled trials. It was determined that the extraction form of jujube fruit was used most frequently with 67.6% in the studies. Other forms used in the studies examined are 17.6% natural, 5.9% syrup, 2.9% honey form and 5.9% powder form. Among the health effects, anticarcinogenic effect ranked first with 29.4%, cardiovascular diseases with 14.7%, neurological diseases with 14.7%, liver diseases with 8.8%, effects on the gastrointestinal system with 5.9% and diabetes with 5.9% were determined. In our content analysis study, studies conducted between 2013 and 2023 and investigating the health effects of Z. jujuba were included. In all of the 34 studies included in our study, it has been shown that different forms of the fruit have positive health effects. Most of the studies on Z. jujuba, including our country, are in the nature of compilation; The number of clinical studies was found to be insufficient. In order to better evaluate the effects of Ziziphus jujuba fruit on health, studies on experimental animals and humans need to be increased.

Keywords: Ziziphus Jujube, Health Effect, Therapeutic, Flavonoid

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[*]**Sorumlu yazar/ Corresponding author:** Muğla Sıtkı Koçman Üniversitesi, Sağlık Bilimleri Fakültesi, Beslenme ve Diyetetik Bölümü, Muğla, Türkiye
[*1]Email: betuluner@mu.edu.tr, [2]Email: acebirbay@selcuk.edu.tr, [3]Email: naktas@selcuk.edu.tr

GİRİŞ

Rhamnaceae ailesi 57 cins ve 950 tür içeren, özellikle tropik bölgelerde olmak üzere çeşitli ekolojik koşullara uyum sağlama yeteneği sayesinde dünya çapında yetiştirilebilen bir bitkidir. *Rahmence* ailesinin cinslerinden biri olan *Ziziphus* cinsi içerisinde 58 tür bulunmaktadır. *Ziziphus* cinsi, dikenli çalılar ya da küçük ağaçlar şeklinde yetişmektedir [1]. *Ziziphus* ağacı kış aylarında yapraklarını döken Nisan-Mayıs ayları arasında tekrar çiçek açan; meyveleri genellikle Eylül-Ekim ayları arasında olgunlaşan, dikenli bir ağaçtır. Hünnap olarak da bilinen *Z. jujuba* ilk yeşil renkte olup daha sonra yavaş yavaş koyu kırmızı renge dönüşen, tek çekirdekli, şekli oval veya küresel, koyu kırmızı renkli yüzeyli ve düzensiz kırışıklıklara sahip bir meyvedir. Meyvenin ekzokarbi ince, mezokarbi kahverengi veya açık kahverengi, etli, yumuşak, şeker açısından zengin ve yağlı yapısı bulunmaktadır. Ayrıca diğer bitki türlerine göre içerik, büyüklük, koku, lezzet ve olgunlaşma süresi farklılık göstermektedir [1-3]. Orta Doğu, Güney Afrika ve Güney Amerika'da *Ziziphus* cinsine ait *Z. jujuba, Z. mauritiana, Z. nummularia, Z. spina-christi* ve *Z. xylopyrus* olmak üzere beş türün kültüvatif yöntemlerle yetiştiriciliği yapılmaktadır [1].

Hünnap meyvesinin bileşiminde ortalama %80-83 nem, %17 karbonhidrat, %0.76-1.8 yağ asitleri, %0.8 aminoasit ve %1.3 diyet lifi içerdiği belirtilmektedir [4,5]. Hünnap meyvesi içeriğindeki diyet lifi sayesinde tokluk süresinin uzamasıyla enerji alımının kontrol edilmesine ve kan glikozunun düzenlenmesine yardımcı olmaktadır. Hünnapta bulunan başlıca karbonhidratlar glikoz, fruktoz, sükroz, rhamnoz ve sorbitoldür. Meyvenin içerisinde asparajin, prolin, arjinin, alanin, serin gibi farklı amino asit türleri bulunmaktadır [3,4]. Hünnap içeriğindeki yağların %68.5-72.4'ünü doymamış yağlar oluşturmakta, yağ asidi dağılımı ise oleik, linoleik, palmitik ve palmitoleik asit şeklindedir [3-5]. Özellikle C vitamini başta olmak üzere A vitamini, tiamin, riboflavin gibi B grubu vitaminleri ve Mg, P, K, Na ve Zn gibi mineralleri de içermektedir [3,4]. Uygun koşullarda taze hünnap meyvesinin raf ömrü 15 gün olarak belirlenmiştir [6]. Hünnap meyvesinin temel aktif bileşiklerinin flavonoidler olduğu kabul edilmektedir.

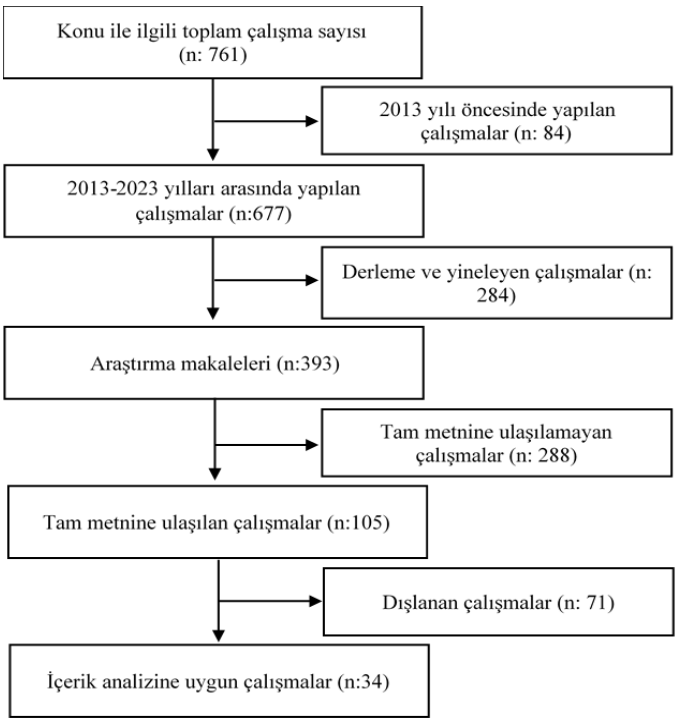
Yüksek düzeyde kateşin, epikateşin ve rutin gibi flavonoidleri içermektedir [7]. İkincil metabolit açısından zengin bir meyve olan 20 çeşidi hünnap türünün analiz edildiği bir çalışmada [8], kateşin, rutin, kersetin, luteolin, spinozin, gallik asit ve klorojenik asit başta olmak üzere 13 farklı çeşit flavonoid ve fenolik asidin tespit edildiği, bunun 12'sinin meyvelerde bulunduğu belirtilmiştir. Buna karşın Wojdyla ve ark.'ın [4] yaptığı bir çalışmada hünnap meyvesinde diğer çalışmaların aksine fenolik asitlere rastlanmadığı belirtilmiştir. Hünnaptaki flavonoidler, çeşit ve olgunluk düzeyine göre önemli ölçüde değişebilmektedir. Hünnap meyvesinin olgunlaşması ile azalan flavonoid içeriği azalan antioksidan aktivitesi ile ilişkilendirilmiştir [3]. Bir araştırmada, hünnap meyvesinin olgunlaşması sırasında meydana gelen kabuk rengi değişikliğinin flavonoidler, karotenoidler ve antosiyanin seviyelerindeki değişikliklerden kaynaklandığı gösterilmiştir [9]. Hünnap meyvesinin olgunlaşmasının 8 evrede incelendiği bir başka çalışmada tüketime sadece 7. ve 8. evrelerde uygun olan hünnap meyvesinin olgunlaştıkça protein, flavonoid içeriklerinin ve antioksidan aktivitelerinin azaldığı kaydedilmiştir [10].

Hünnap Kuzey Çin'de geleneksel tıp çerçevesinde yaygın olarak antitümör, nöroprotektif ve antiinflamatuar amacının yanında uykusuzluk ve ülser tedavisinde kullanılmıştır. Ayrıca solunum sistemi, gastrointestinal sistem, kardiyovasküler ve genitoüriner sistem hastalıklarının tedavisinde sıklıkla tercih edilmiştir [11]. İslami düşünceye sahip düşünürlerin kaynaklarında ise müshil, kan dolaşımını iyileştirici, enfeksiyonu azaltıcı olarak kullanıldığı bilgisi yer almaktadır [12]. Hünnap meyvesinin anemi ve hematolojik hastalıklarda kullanılmasının bileşiminde bulunan flavonoid, triterpenoid ve polisakkaritlerden kaynaklanabileceği belirtilmektedir [13]. Günümüzde, toksisitesi ile ilgili yeterli kanıt literatürde yer almamakla birlikte; *Ziziphus* cinsi bitkilerin meyvesinin yanında yaprak gibi diğer kullanım ve tüketim şekillerinin antiinflamatuar, antidiyaretik, antidepresan, antikanser, antibakteriyel, antidiyabetik, antioksidan hepoto koruyucu ve sedatif etkilerinin olduğu bildirilmektedir [1,3,11].

Bu çalışmanın amacı hünnap meyvesinin (*Z. jujuba)* sağlık üzerine etkilerinin insan ve hayvan modelleri kullanılarak yapılan deneysel araştırmaların içerik analizi yöntemi ile incelenerek ortaya çıkarılmasıdır.

YÖNTEM

Bu araştırmada hünnap meyvesinin sağlık üzerine etkilerinin nicel yöntemler arasında yer alan içerik analizi yöntemi kullanılmıştır. İçerik analizi meta analiz, meta sentez (tematik içerik analizi) ve betimsel içerik analizi olmak üzere üç alt başlık altında toplanabilmektedir. İçerik analizi, bağımsız nicel çalışmalar gözden geçirilerek genel eğilimleri belirlenmesine olanak tanıyan bilimsel bir yaklaşım yolu olarak gösterilebilmektedir [14]. İçerik analizi araştırma sorusunun seçimi, örneklem seçimi, tarama sonuçlarından elde edilen araştırma verilerinin işlenmesi, kodlanması, temaların bulunması, kodların ve temaların düzenlenmesi, bulguların tanımlaması ve yorumlanması aşamalarıyla tamamlanmaktadır [15]. Bu çalışmada ilk aşamada "hünnap meyvesinin sağlık etkileri nedir?" sorusuna yanıt aranmaya çalışıldı. Daha sonra belirlenen tarama ve seçim ölçütlerine göre kodlamalar yapıldı ve bu bağlamda çeşitli temalara ulaşıldı. Bu aşamadan sonra veriler düzenlendi, gruplandı ve uygun olduğu durumlarda veriler sayısal hale getirilerek tablo olarak sunuldu, elde edilen bulgular yorumlandı. Çalışmada kullanılan makaleler Web of Science, Pubmed, Sciencedirect, ClinicalKey, Cochrane Library elektronik veri tabanları taranarak elde edildi. Çalışmada kullanılacak makaleleri belirleyebilmek için araştırmacılar tarafından bazı tarama ve seçim ölçütleri belirlendi. Tarama ölçütleri olarak "*Ziziphus Jujuba*" veya "Jujube" ve "Health effects" anahtar kelimelerini bir arada içeren 2013-2023 yılları arasında yayınlanmış ve tam metin erişilebilen insan ve hayvanlarda yürütülen deneysel çalışmalar dahil edildi. Veriler, araştırmacılar tarafından hazırlanan Yayın Değerlendirme İçerik Analizi Formu ile toplandı (Ek 1). Çalışmaların seçimi için literatür tarama ve inceleme akış şeması Şekil 1'de gösterildi.



Şekil 1. Verilerin seçimi için literatür tarama ve inceleme akış şeması

Makaleler formda yer alan tema ve kod listesine göre analiz edildi. Çalışmanın kapsamındaki temalar; yayınlandığı yıl, araştırma modeli, kullanım şekli, araştırma değişkenleri, çalışma materyali ve çalışmanın değişkenler üzerindeki sonuçlarına göre belirlendi. Bu temalara göre

araştırmacılar tarafından tablolaştırılan makaleler karşılaştırılarak, her bir araştırmacı tarafından aynı makaleye ulaşılıp ulaşılmadığı kontrol edidi. Farklı veri tabanlarından tekrar eden çalışmalar dikkate alınmadı. Bu şekilde araştırmanın güvenirliği ve iç geçerliliği sağlanmaya çalışıldı.

İçerik analizine dair elde edilen veriler IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp programı ile analiz edildi ve değerlendirildi.

BULGULAR

Belirlenen tarama ölçütlerine göre yapılan ilk tarama sonucunda elektronik bilimsel tarama veri tabanlarında konu ile ilgili 2013-2023 yılları arasında yayınlanmış toplam 761 makaleye ulaşıldı. Bazı makalelerin derleme çalışması olduğu ve veri tabanlarında tekrar ettiği belirlendi. Tam metin erişilemeyen ve içerik analizi çalışmamıza uymayan makaleler çıkarılarak toplam 34 makale çalışma kapsamına alındı. İçerik analizi çalışmamıza dahil edilen araştırmalar ve nitelikleri Tablo 1'de gösterildi.

Tablo 1. Araştırmaya dahil edilen araştırmalar ve nitelikleri

Araştırma No	Araştırma Tipi	Kullanım Şekli	Etki	Materyal/Değişken	Sonuç
Sun ve ark., 2013 [16]	İn vitro	Meyve Ekstratı	Antikanserojen	İnsan kanser hücresi (Meme kanseri)	Doza bağlı kanser hücrelerinin büyümesini inhibe ettiği gösterilmiştir.
Chen ve ark., 2014 [17]	İn vitro	Meyve Ekstratı	Nörodejeneratif	İnsan hücresi (Nöroendokrin hücreleri)	Hücrelerin büyümesini indüklediği gösterilmiştir.
Qiao ve ark., 2014 [18]	İn vitro	Meyve Ekstratı	Antikanserojen	İnsan kanser hücresi (Karaciğer ve Meme kanseri)	Hepatosellüler kanser hücreleri Hepg2 ve meme kanseri hücrelerinin MCF-7 büyümelerini inhibe ettiği gösterilmiştir.
Choi ve ark., 2015 [19]	İn vitro	Meyve Ekstratı	Nörolojik hastalıklar	İnsan hücresi (Nöroendokrin hücreleri)	Oksidatif stresi azaltarak nöral hücre canlılığını arttırdığı gösterilmiştir.
Han ve ark, 2022 [20]	İn vitro	Meyve	Gastrointestinal sistem	İnsan hücresi (İnsan bağırsak mikrobiyotası)	Bağırsak mikrobiyota bileşimini ve metabolik fonksiyonları düzenlediği gösterilmiştir.
Moon ve ark., 2019 [21]	İn vitro	Meyve Ekstratı	Cilt dokusu	İnsan hücresi (İnsan epidermisi)	İnsan epidermisindeki mantar tirozinaz aktivitesini inhibe ettiği gösterilmiştir.
Tran ve ark., 2019 [22]	İn vitro	Meyve Ekstratı	Antikanserojen	İnsan kanser hücresi (Rahim ağzı, Meme kanseri ve Lösemi)	Antikanserojen etki gösterdiği belirtilmiştir.
Jiang ve ark., 2019 [23]	İn vivo	Meyve Ekstratı	Alerjik reaksiyonlar	Fare	Alerjik yanıt yolunda sitokin üretimini baskıladığını ve bunun da alerji semptomlarının önlenmesi veya hafifletilmesiyle sonuçlandığı gösterilmiştir.
Sabzghabaee ve ark., 2013 [24]	İn vivo	Meyve Tozu	Kardiyovasküler	İnsan	Serum lipid profili üzerinde olumlu potansiyel etkileri olabileceği gösterilmiştir.
Aafi ve ark., 2022 [25]	İn vivo	Meyve Şurubu	Cilt dokusu	İnsan	Hünnap şurubunun yüzdeki hiperpigmentasyonu tedavi etmek için etkili ve güvenli olduğu gösterilmiştir.
Rajaei ve ark., 2020 [26]	İn vitro	Meyve Ekstratı	Antibakteriyel	Patojen Bakteri (*E. coli ve S. aureus*)	Antimikrobiyal olduğu gösterilmiştir. Antimikrobiyal aktivitenin, Escherichia coli ve Staphylococcus aureus'a karşı gözlendiği belirtilmiştir.
Bao ve ark., 2021 [27]	İn vitro	Meyve	Antikanserojen	İnsan kanser hücreleri (Kolorektal kanseri)	Kanser hücrelerine karşı güçlü antioksidan ve sitotoksisite etki gösterdiği belirtilmiştir.
Miao ve ark., 2019 [28]	İn vitro	Meyve Ekstratı	Antibakteriyel	Patojen Bakteri (Staphylococcus aureus)	Staphylococcus aureus biyofilmlerinin oluşumunu etkili bir şekilde önleyebileceği gösterilmiştir.
Liang ve ark, 2020 [2]	İn vitro	Meyve Ekstratı	Antikanserojen	İnsan Kanser hücresi (Kolorektal kanseri)	Antikanserojen etkiler gösterebileceği göstermiştir.
Abedini ve ark., 2016 [29]	İn vitro	Meyve Ekstratı	Antikanserojen	İnsan kanser hücresi (Rahim ağzı ve Meme kanseri)	Hünnap meyvesinin, kanser hücresi canlılığını doza ve zamana bağlı bir şekilde önemli ölçüde inhibe ettiği gösterilmiştir.
Hoshyar ve ark., 2015 [30]	İn vivo	Meyve Ekstratı	Antikanserojen	Sıçan	Meme kanserinde sitotoksik etki gösterdiği belirtilmiştir.
Dabaghian ve ark., 2018 [31]	İn vitro	Meyve Ekstratı	Antikanserojen	İnsan kanser hücreleri (Tiroid kanseri)	Tiroid karsinomu C643 hücre hatları üzerinde anti-proliferatif ve apoptotik etkiler gösterdiği ve bir antikanser ajanı olarak potansiyel faydalı olabileceği gösterilmiştir.
Periasamy ve ark., 2015 [32]	İn vivo	Meyve	Antikanserojen	Fare	Kolon kanserinde hiperplaziden displaziye ve nihayetinde adenokarsinom ve kansere ilerlemesini geciktirebileceği sonucuna varılmıştır.

Cheng ve ark., 2019 [33]	İn vitro	Meyve Balı	Antikanserojen	İnsan kanser hücreleri (Karaciğer kanser)	Insan hepatoselüler karsinoma HepG2 hücresinde apoptozu indüklediği gösterilmiştir.
Zhu ve ark., 2022 [34]	İn vitro	Meyve Ekstratı	İştah mekanizması	İnsan hücreleri (İnsan iştah yolakları)	İştahın düzenlenmesine yardımcı olduğu gösterilmiştir
Yazdanpanah ve ark., 2017 [7]	İn vivo	Meyve	Diyabet etkisi	İnsan	Glikoz ve lipid metabolizması üzerine olumlu etkiler sağladığı gösterilmiştir
Farhadnejad ve ark., 2022 [35]	İn vivo	Meyve	Diyabet etkisi	İnsan	Kan yağlarında anlamlı düzeyde azalma kaydedilirken, antropometrik ölçümlerde anlamlı bir fark olmadığı belirtilmiştir.
Mohebbati ve ark., 2018 [36]	İn vivo	Meyve Ekstratı	Kardiyovasküler	Sıçan	Hipertansiyonun önlenmesinde potansiyel yararlı etkilere sahip olduğunu gösterilmiştir.
Hosseini ve ark., 2019 [37]	İn vivo	Meyve Ekstratı	Kardiyovasküler	Sıçan	Kardiyak rehabilitasyon için önemli düzeyde iyileşmeler sağlamıştır.
Maddahi ve ark., 2021 [38]	İn vivo	Meyve Şurubu	Karaciğer hastalıkları	İnsan	Öksürük, yaşam kalitesi ve karaciğer hasarını anlamlı düzeyde iyileştirdiği gösterilmiştir.
Shen ve Li, 2014 [39]	İn vivo	Meyve Ekstratı	Karaciğer hastalıkları	Fare	Alkolik karaciğer hastalığı tedavisinde pozitif etkiye sahip olduğu gösterilmiştir.
Huang ve ark., 2017 [40]	İn vivo	Meyve Ekstratı	Karaciğer hastalıkları	Fare	Oksidatif stresi ve enflamasyonu önleyerek asetaminofen kaynaklı karaciğer hasarına karşı güçlü olumlu etkileri olduğu saptanmıştır.
Chen ve ark., 2013 [41]	İn vitro	Meyve Ekstratı	Nörolojik hastalıklar	İnsan hücreleri (PC12 hücreleri)	PC12 hücreleri üzerinde olumlu etki göstermiştir.
Rabiei ve ark., 2014 [42]	İn vivo	Meyve Ekstratı	Nörolojik hastalıklar	Sıçan	Hafıza ve davranış bozuklukları üzerinde onarıcı etkilere sahip olduğunu ve alzheimer hastalarının tedavisinde yararlı etkileri olabileceğini düşündürmektedir.
Chi ve ark., 2015 [43]	İn vivo	Meyve	Kronik yorgunluk	Sıçan	Antioksidan etki göstererek semptomların düzelmesini sağladığı gösterilmiştir.
Yi ve ark., 2022 [44]	İn vivo	Meyve Ekstratı	Gastrointestinal sistem	Fare	Metabolik profilleri ve bağırsak florasını değiştiren dalak eksikliğinin Z. Jujuba ekstraktı ile etkili bir şekilde giderilebileceği ortaya koyulmuştur.
Resim ve ark., 2020 [45]	İn vivo	Meyve Ekstratı	Nörolojik hastalıklar	Sıçan	Erektil disfonksiyonlu hastalarda pelvik cerrahi sonrasında Z. Jujuba ekstraktının antioksidan ve antifibrotik etki göstererek nörolojik iyileşmede fayda sağladığı belirlenmiştir.
Mostafa ve Labban, 2013 [46]	İn vivo	Meyve Tozu	Kardiyovasküler	İnsan	Vücut ağırlığı, kolesterol ve trigliseritte anlamlı düzeyde azalmalar sağladığı gösterilmiştir.
Ghanbari-Niaki ve ark., 2022 [47]	İn vivo	Meyve Ekstratı	Kardiyovasküler	Sıçan	Kalp hastalığı için olumlu sonuç verdiği gösterilmiştir.

Araştırma makaleleri yayınlandığı yıl, araştırma tipi, kullanım şekli, etki, materyali ve değişkenler olarak temalara ayrıldı. Araştırma makalelerinin temalarına göre dağılımı Tablo 2'de gösterildi.

Makaleler yayımlanma yıllarına göre incelendiğinde; en çok çalışmanın 2019 ve 2022 (%17.6) yılında yapıldığı saptandı. Araştırma tipi in vitro (%47.1) ve in vivo (%52.9) olarak belirlendi. İn vivo çalışmaların tümü randomize kontrollü çalışma olup; 6 (%33.3) insan, 7 (%38.9) sıçan, 5 (%27.8) fare çalışması mevcuttu.

Çalışmalarda hünnabın farklı kullanım şekilleri söz konusuydu. En sık ektraksiyon (%67.6) şeklinde kullanılırken en nadir kullanımının bal (%2.9) olduğu görüldü. Makaleler yayımlanma yıllarına göre incelendiğinde; en çok çalışmanın 2019 ve 2022 (%17.6) yılında yapıldığı saptandı.
Araştırma tipi in vitro (%47.1) ve in vivo (%52.9) olarak belirlendi. İn vivo çalışmaların tümü randomize kontrollü çalışma olup; 6 (%33.3) insan, 7 (%38.9) sıçan, 5 (%27.8) fare çalışması mevcuttu. Çalışmalarda hünnabın farklı kullanım şekilleri söz konusuydu. En sık ektraksiyon (%67.6) şeklinde kullanılırken en nadir kullanımının bal (%2.9) olduğu görüldü.

Araştırma makaleleri değişkenler açısından incelendiğinde %24.9'unun meyvenin antikanserojen etkisi üzerine yapıldığı görüldü. Bu çalışmalardan 8'inin in vitro çalışması olduğu belirlendi. İn vitro çalışmaların %37.5'inde hünnabın çoklu kanser hücreleri üzerine etkisi incelenirken; çalışmaların %62.5'inde sadece bir kanser hücresi

üzerindeki etkisinin araştırıldığı görüldü (Tablo 2). Antikanserojen etkinin bakıldığı çalışmaların özellikleri Tablo 3'te verildi.

Tablo 2. Araştırmaların temalara göre dağılımı

Araştırma Tipi	n	%
İn vitro	16	47.1
İn vivo	18	52.9
Kullanım Şekli	n	%
Doğal formu (Meyve)	6	17.6
Ekstrakt	23	67.6
Şurup	2	5.9
Bal	1	2.9
Toz	2	5.9
Değişkenler	n	%
Antibakteriyel etki	2	5.9
Antikanserojen etki	10	29.4
Gastrointestinal sisteme etkisi	2	5.9
Cilt dokusuna etkisi	2	5.9
Kalp damar hastalıklarına etkisi	5	14.7
Diyabet ve kan glukozuna etkisi	2	5.9
İştah üzerine etkisi	1	2.9
Karaciğer hastalıkları/hasarına etkisi	3	8.8
Nörolojik hastalıklara etkisi	5	14.7
Yorgunluk ve uyku durumuna etkisi	1	2.9
Alerjik reaksiyonlara etkisi	1	2.9
Çalışma Materyali	n	%
İnsan	6	17.6
Fare	5	14.7
Sıçan	7	20.6
İnsan kanser hücresi	8	23.5
İnsan hücresi	6	17.6
Patojen bakteri	2	5.9

Tablo 3. Antikanserojen etkinin araştırıldığı çalışmaların özellikleri

Araştırma Tipi	n	%
İn vitro	8	80.0
İn vivo	2	20.0
Kullanım Şekli	n	%
Doğal formu (meyve)	2	20.0
Ekstrakt	7	70.0
Bal	1	10.0
Çalışma Materyali	n	%
Fare	1	10.0
Sıçan	1	10.0
İnsan kanser hücresi	8	80.0
Antikanserojen Etkinin Bakıldığı İnsan Kanser Hücreleri	n*	%
MCF-7 meme kanseri hücresi	5	35.7
HepG2 karaciğer kanseri hücresi	2	14.3
HeLa ve OV2008 rahim ağzı kanseri hücresi	2	14.3
HL-60 lösemi hücresi	1	7.1
Caco-2 ve LoVo kolorektal kanser hücresi	3	21.4
C643 tiroid kanseri hücresi	1	7.1

**Bazı çalışmalar ile birden fazla insan kanser hücresi üzerinde çalışıldığı için "n" değerinin çalışma sayısından büyük olması kabul edilmiştir.*

Vücut ağırlığı denetimi ve diyabet üzerine etkilerinin literatürde sıkça vurgulandığı hünnap meyvesinin; belirlenen ölçütlere göre yapılan tarama sonucunda diyabet ile ilgili randomize kontrollü iki (%5.9) çalışma olduğu belirlendi. Bu iki çalışma da insanlarda yapıldığı ve meyvenin doğal formunun kullanıldığı belirlendi (Tablo 2).

TARTIŞMA

Hünnabın 2013-2023 yılları arasında yapılmış ve sağlık üzerine olan etkilerinin araştırıldığı çalışmalar dahil edildi. Çalışmamıza dahil edilen 34 çalışmanın tamamında meyvenin farklı formlarının olumlu sağlık etkiler oluşturduğu gösterilmiştir. Hünnap meyvesinin tüketim miktarı ile ilgili herhangi bir toksisite belirtilmezken, sağlık etkileri dolayısıyla günlük diyet planı içerisine dahil edilmesi tavsiye edilmektedir [1]. Hünnap meyveleri içerisinde bulunan flavonoidlerin antimikrobiyal etki sağladığı düşünülmektedir [48]. Hünnap ekstraktının patojen bakteri oluşumunu etkili bir şekilde önleyebileceği, bakteriyel pH ortamını iyileştirebileceği ve reaktif oksijen türlerinin ve flavonoidlerin hidrofobik etkisini ortadan kaldırabileceği yapılan bir araştırma ile gösterilmiştir [28]. Çalışmamıza dahil edilen iki çalışmada hünnabın flavonoid ekstratının in vitro olarak *Escherichia coli* ve *Staphylococcus aureus* biyofilmlerine karşı olumlu etki sağladığı görülmüştür [26,28].

Hünnap meyvesinin içeriği dolayısı ile güçlü bir antioksidan kapasiteye sahip olduğu çalışmalarla gösterilmiştir. Bu etkisini deoksiribo nükleik asit (DNA) hasarını önleyebilmesi, hücre içi reaktif oksijen türleri (ROS) oluşumunu azaltabilmesi, demir iyonu indirgeyici antioksidan güç (FRAP) ve 1,1-Difenil-2-pikrilhidrazil (DPPH) radikal yakalama aktivitesi sayesinde gerçekleştirdiği düşünülmektedir [27,49]. Bu etkileri sayesinde antikanserojen etki de göstermektedirler. Özellikle triterpenik asitlerden betulinik asit antitümör ve antikarsinojenik etkileri nedeniyle araştırmacılar ve sağlık ürünleri için önemli hale gelmiştir [50]. Hünnap, kanser hücrelerinin çoğalmasını baskılamakta, apoptozu arttırmakta ve proliferasyonda azalma sağlamaktadır [3]. Yapılan birçok çalışma ile meyvenin rahim ağzı, meme, kolon, kolorektal, tiroid ve karaciğer gibi kanser türlerinde olumlu sonuçlar oluşturabileceği gösterilmiştir [2,10,29-33,51]. Çalışmaya dahil edilen, meyvenin antikanserojen etkisi üzerine yapılan çalışmaların tamamı meme kanseri hücresi MCF-7, karaciğer kanseri hücresi HepG2, rahim ağzı kanseri hücreleri HeLa ile OV2008, lösemi hücresi HL-60, kolorektal kanser hücreleri Caco-2 ile LoVo ve tiroid kanseri hücresi C643 üzerine olumlu etkileri olduğu belirlenmiştir [2,16,18,22].

Literatürde yer alan kanıtlar, hünnabın biyoaktif bileşiklerinden kaynaklanan gastrointestinal sistemi koruyucu özelliğinin olduğunu göstermektedir [52,53]. Hünnap meyvesinin bağırsak florasının iyileştirilmesinde anlamlı olumlu etkileri olduğu çalışmalarla gösterilmiştir [20,44]. Hünnap meyvesinin antioksidan özellikleri ve yüksek polifenolik içeriği sayesinde farklı dozlarının hipolipidemik, anti-obezite ve antidiyabetik özelliklerine sahip olduğu belirlenmiştir [7,24,34,35,46,54]. Ayrıca hipertansiyon ve diğer kalp hastalıklarının iyileştirilmesinde olumlu anlamlı sonuçlar sağladığı yapılan çalışmalar ile gösterilmiştir [36,37,47]. Hünnabın karaciğer fonksiyonu üzerinde herhangi bir olumsuz etki göstermediği çalışmalarla gösterilmiştir [38-40,55]. Yapılan bazı çalışmalarla karaciğer hasarı ve hastalıkları üzerine olumlu sonuçlar oluşturduğu raporlanmıştır [38-40].

Hünnabın nörolojik fonksiyonlar üzerine olumlu etkileri çalışmalar ile gösterilmiştir. Hünnabın, nöronal hücreleri nörotoksin stresine karşı koruma, nöronal farklılaşmayı uyarma, nörotrofik faktörlerin ekspresyonunu artırma, hafızayı ve öğrenmeyi teşvik etme dahil olmak üzere nöroprotektif aktivitelere sahip olduğu raporlanmıştır [42,56]. Çalışmamıza dahil edilen araştırma makalelerinde hünnabın nöroendokrin hücreler, nörodejeneratif hastalıklar ve sinir hasarı üzerinde olumlu etkileri olduğuna dair sonuçların varlığı belirlenmiştir [17,19,41,45]. Ayrıca hünnap, yorgunluk ve uykusuzluk için sıkça kullanılan ürünler arasında yer almaktadır. Bu durumun saponin içeriğinden kaynaklandığı düşünülmektedir. Yapılan bazı çalışmalar ile hünnap meyvesinin uyku bozukluğu ve yorgunluğu olumlu şekilde etkileyebileceği gösterilmiştir [43,57].

SONUÇ

Hünnap meyvesinin sağlık üzerine etkilerinin içerik analizi yöntemi ile incelendiği bu araştırmada 2013-2023 yılları arasında yürütülen çalışma sayısının niceliksel olarak hızlı bir artış gösterdiği belirlense de konuyla ilgili yapılan araştırmaların sınırlı sayıda olduğu görülmektedir. Hünnap meyvesinin sağlık üzerine etkilerine bakıldığında en çok antikanserojen özelliğinin araştırıldığından bahsedilebilir. Meyvenin sağlık etkilerine yönelik olumlu sonuçlarını destekleyen daha büyük ölçekli ve süreli kontrollü deneysel çalışmaların yürütülmesine ihtiyaç duyulmaktadır. Özellikle hünnap ile ilgili çalışmaların büyük çoğunluğu ülkemiz de dahil olmak üzere derleme niteliğinde olup; klinik çalışmaların sayısı yeterli değildir. Hünnap meyvesinin sağlık üzerine etkilerinin daha iyi değerlendirilebilmesi için, hayvan ve insan çalışmalarının arttırılmasına ihtiyaç vardır.

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Ek 1. Ziziphus Jujubanın Sağlık Üzerine Etkileri Yayın Değerlendirme İçerik Analizi Formu

ZİZİPHUS JUJUBANIN SAĞLIK ÜZERİNE ETKİLERİ YAYIN DEĞERLENDİRME İÇERİK ANALİZİ FORMU		
1.	Makale No:	
2.	Yayınlandığı Yıl:	
3.	Araştırma Tipi:	1. İn Vitro Çalışma
		2. İn Vivo Çalışma
4.	Ziziphus Jujubanın Kullanım Şekli:	1. Doğal Formu
		2. Ektraksiyonu
		3. Şurubu
		4. Balı
5.	Değişkenler	1. Antibakteriyel etki
		2. Antikanserojen etki
		3. Gastrointestinal sisteme etkisi
		4. Cilt dokusu üzerine etkisi
		5. Kalp damar hastalıklarına etkisi
		6. Diyabet ve kan glukozu üzerine etkisi
		7. İştah üzerine etkisi
		8. Karaciğer hasarı/hastalıklarına etkisi
		9. Nörolojik hastalıklar üzerine etkisi
		10. Yorgunluk ve uyku durumu üzerine etkisi
		11. Alerjik reaksiyonlara etkisi
6.	Çalışma Materyali:	1. İnsan
		2. Fare
		3. Sıçan
		4. İnsan kanser hücresi
		5. İnsan hücresi
		6. Patojen bakteri
7.	Antikanserojen Etkinin Bakıldığı İnsan Kanser Hücreleri	1. MCF-7 meme kanseri hücresi
		2. HepG2 karaciğer kanseri hücresi
		3. HeLa ve OV2008 rahim ağzı kanseri hücresi
		4. HL-60 lösemi hücresi
		5. Caco-2 ve LoVo kolorektal kanser hücresi
		6. C643 tiroid kanseri hücresi
8.	Çalışmanın Sonucu:	1. Z. Jujuba olumlu etki yaratmıştır
		2. Z. Jujuba herhangi bir etki yaratmamıştır
		3. Z. Jujuba olumsuz etki yaratmıştır