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ORIGINAL RESEARCH

Traditional and Complementary Medicine According to Physicians in A Tertiary Hospital in Türkiye: A Cross-Sectional Study

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Abstract

Objective: This study aims to assess the use of traditional and complementary medicine (T&CM) practices as well as the attitudes and behaviors of physicians in the health sector regarding T&CM.

Material-Method: Our study was planned as a cross-sectional observational study. The researchers created a questionnaire that was applied to the physicians working in our hospital using the facilitated sampling method of a face-to-face interview after they filled out the informed consent form. The data were evaluated using the SPSS program.

Results: A total of 236 physicians participated in the study, with a mean working experience of 6.4±7.05 years. Among the participants, 26.3% held ministry-approved T&CM certificates, predominantly for cupping therapy. Slightly more than half of the physicians (54.7%) stated that they recommend T&CM methods to their patients. While 50.4% of physicians reported insufficient scientific evidence on T&CM, 19.5% stated that T&CM methods should only be used as a last resort when modern medicine cannot offer a solution. A statistically significant correlation was found between having a ministry-approved T&CM course certificate and the participants' age and length of practice ($p<0.001$, $p<0.001$). However, there was no significant correlation between having a T&CM certificate and the participants' gender or department of medicine ($p=0.961$, $p=0.130$).

Conclusion: The results of our study indicate that although nearly half of the physicians believe there is insufficient scientific evidence supporting T&CM, slightly more than half still recommend T&CM methods to their patients.

Keywords: Traditional Medicine, Cupping Therapy, Primary Care, Complementary Therapies

INTRODUCTION

Traditional and Complementary Medicine (T&CM) refers to an approach that includes a series of practices that have been used to protect, diagnose, treat, and maintain the physical and mental health of people since ancient times and have been fed from different geographical regions and cultures.[1] Although these practices have been used throughout human history, they have remained in the background for a while due to factors such as the rapid development of modern medicine, the rise of the pharmaceutical industry, and the invention of antibiotics. However, in recent years, T&CM methods have attracted increasing interest among health professionals and physicians and have become more accepted not only in developing countries but also in developed countries.[2]

T&CM applications are widely used in Asian countries, particularly in regions such as China, Korea, Japan, and India[3-4]. In Türkiye, the use of T&CM is still developing, with a 2014 report indicating a usage rate of approximately 27%[3,5]. It is important to note that T&CM in Türkiye has a rich history dating back to ancient times, with practices such as cupping and phytotherapy being integral parts of Turkish culture. T&CM is officially recognized and regulated by the Ministry of Health, which has established guidelines to ensure its safe and effective use alongside conventional medicine.

The World Health Organisation, in its Traditional and Complementary Medicine Strategy, published between 2013-2017, emphasized the need for more dissemination of T&CM practices and more clinical studies in this field and encouraged countries to make legal arrangements in this field. In Turkiye, the Department of Traditional, Complementary and Alternative Medicine Practices was established within the Ministry of Health in 2012. Its name was changed to the Department of Traditional and Complementary Medicine Practices in 2014. In this context, several practices such as Acupuncture, Apitherapy, Phytotherapy, Hypnosis, Hirudotherapy, Homeopathy, Chiropractic,

Cupping, Larva therapy, Mesotherapy, Prolotherapy, Osteopathy, Ozone therapy, Reflexology and Music therapy are included in this field. The Ministry of Health has authorized medical doctors and dentists who have received certificates in the relevant fields, but dentists are only allowed to practice in their areas of specialization.[6]

T&CM certificates issued by the Ministry of Health in the last decade have significantly increased the interest in these practices. In recent years, physicians from different medical branches have started to obtain T&CM certificates, T&CM units have been established in hospitals, and the lack of supervision in this field has started to be regulated. However, in addition to these developments, we observe that some physicians are not interested in or criticize T&CM. Amid these developments, it has been a matter of curiosity how physicians view T&CM applications and handle patients' questions about T&CM. This study aims to investigate the perspectives, approaches, and knowledge levels of physicians working in internal, surgical, and basic sciences toward T&CM practices. Understanding healthcare providers' attitudes towards T&CM is crucial as it directly influences the integration of T&CM practices into conventional medical treatments, potentially improving patient outcomes and expanding holistic care approaches.

MATERIALS AND METHODS

Materials

Our cross-sectional observational study was conducted between July 12, 2022, and August 12, 2022. Physicians working at the Republic of Türkiye Ministry of Health Prof. Dr. Cemil Taşcıoğlu City Hospital who agreed to participate were included in the study through facilitated sampling selection. Informed consent forms were completed, and the researchers administered the questionnaire via face-to-face interviews.

Methods

The approximate number of physicians working at the Republic of Turkiye Ministry of Health Prof. Dr. Cemil Tascioglu City Hospital, where the study was conducted, is 967. The minimum sample size needed, with a 95% confidence interval and a ± 5% margin of error, is 236 participants.

The questionnaire used in our study consists of 29 questions and measures various factors, including age, gender, years of professional experience, departments in which the physicians work, attitudes and behaviors towards T&CM applications, and knowledge levels about T&CM applications. It was selected using a purposive sampling method and administered to the physicians. A pilot test was conducted with 30 participants before administering the questionnaire to the calculated sample size.

The study aims to measure the participants' level of knowledge and evaluate the relationships between factors such as age, gender, years in the profession, job description, and their knowledge level, perceptions, and behaviors regarding T&CM.

Statistical analysis

The analysis of the data was performed using SPSS v. 21 package program. The normality of continuous variables was assessed with the Kolmogorov-Smirnov test. Continuous variables with normal distribution were presented as mean ± standard deviation, and those without normal distribution were presented as median (minimum-maximum). Categorical variables were shown as frequency and percentage. The Mann-Whitney U test was used to compare two groups of continuous variables with independent samples. The Chi-square test was used for the analysis of categorical data. Bonferroni correction was applied in the evaluation of the groups. A p-value of <0.05 was considered significant.

RESULTS

71.2% (168/236) of the participants were female; the mean age was 30.7 years. 86.4% (204/236) were working in internal medicine, 7.6% (18/236) in basic medical sciences, and 5.9% (14/236)in surgery. The mean duration of active medical practice was 6.4 years. 61.8% (146/236)of the participants held a T&CM certificate, with cupping and mesotherapy being the most commonly possessed certifications (Figure 1).

A statistically significant correlation was found between the participants' age and duration of practice of medicine and the status of recommending any of the T&CM practices to their patients or relatives (p<0,005) (Table 1). A statistically significant relationship was found between attending a ministry-approved T&CM course or certificate and the age and medical experience of the participants. The mean age of those who had previously taken a T&CM course (33.8 years) was significantly lower than the mean age of those who had not taken a course (29.7) (p<0,001). The duration of medical experience of those who had taken a T&CM course was significantly shorter than those who had not (p<0,001).

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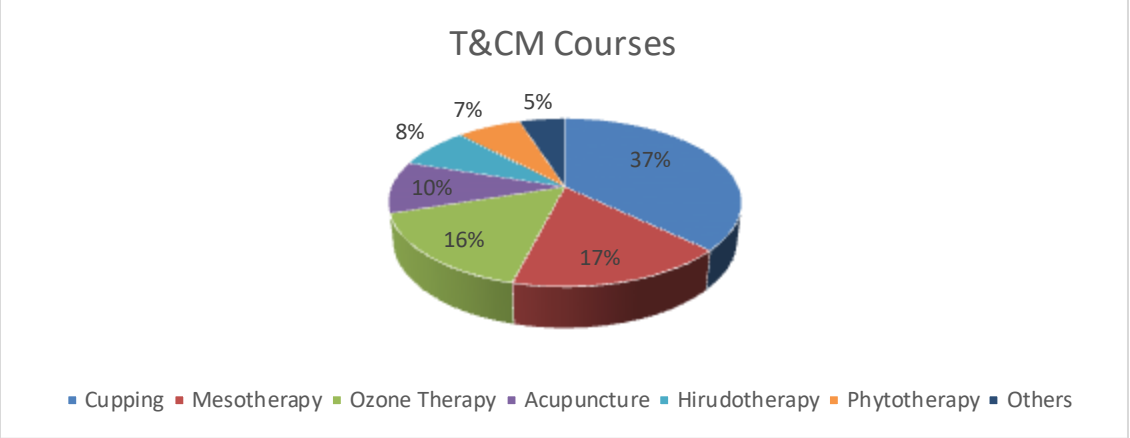

Figure 1. Distribution of the types of T&CM course certificates held by the participants

Table 1. The Relationship Between T&CM Recommendation Status and Physician's Age and Years of Medical Practice

	Have you ever recommended any of these T&CM practices to your patients or relatives?	**n**	**Mean ± SD**	**Median (Min-Max)**	**p**
Age	**Yes**	129	32,2±7,8	30(24-63)	**<0,001**
	No	107	29±3,8	28(24-53)	
How many years have you been practicing medicine?	**Yes**	129	7,7±8,5	5(1-45)	**0,002**

There was no significant relationship between having a ministry-approved T&CM course/certificate and the gender of the participants and the department in which they practiced medicine. There was a statistically significant correlation between having a ministry-approved T&CM course/certificate and the institution where the participants were working, the participants thought that T&CM practices had positive effects in terms of 'Preventive Medicine' practices, wanting to apply T&CM practices to their patients themselves, and thinking that the widespread use of T&CM practices in health centers would lead to a decrease in treatment costs. There was no statistically significant correlation between having a ministry-approved T&CM course/certificate and the participants thinking that T&CM methods could replace modern medicine (Table 2).

Table 2. The relationship between participants' T&CM certification status and some factors

		Have you attended a T&CM course/certificate program approved by the Ministry before?		**p**
		Yes	**No**	
Gender	Female	44(%26,2)	124(%73,8)	0,961
	Male	18 (%26,5)	50 (%73,5)	
In which department do you practice medicine?	Basic Sciences	3 (%16,7)	15 (%83,3)	0,130
	Internal Medicine	58 (%28,4)	146 (%71,6)	
	Surgical Medicine	1 (%7,1)	13 (%92,9)	
Do you think that T&CM practices have positive effects on 'Preventive Medicine' practices?	Yes	56 (%38,4)	90 (%61,6)	**<0,001**
	No	1 (%3,7)	26 (%96,3)	
	Indecisive	5 (%7,9)	58 (%92,1)	
Would you like to apply T&CM applications to your patients yourself besides modern medicine?	Yes	56(%36,6)	97(%63,4)	**<0,001**
	No	2 (%4,9)	39 (%95,1)	
	Indecisive	4 (%9,5)	38(%90,5)	
Will the widespread use of T&CM applications in health centers lead to a decrease in treatment costs?	Yes	49 (%41,5)	69 (%58,5)	**<0,001**
	No	3 (%7,1)	39 (%92,9)	
	Indecisive	10 (%13,2)	66 (%86,8)	
T&CM methods can replace modern medical methods	I agree	7 (%50)	7 (%50)	0,072
	No opinion	5 (%35,7)	9 (%64,3)	

**: Chi-square test*

DISCUSSION

In contemporary healthcare, the utilization of complementary and alternative medicine (CAM), also known as traditional and complementary medicine (T&CM), is increasingly serving both preventive and therapeutic purposes.[7] Although they have positive effects, considering the potential side effects, it is evident that these procedures should be carried out by healthcare personnel, particularly physicians.

Our study revealed that the average age of the participating physicians was 30.7 years and their average professional experience was 6.4 years. This demographic profile provides a clearer understanding of young physicians' views and attitudes towards T&CM. Cupping and mesotherapy were the most commonly used T&CM methods among the participating physicians. Similarly, a study conducted in Turkey reported that cupping and phytotherapy were more common among physicians compared to other methods.[7] In addition, a study conducted in Isparta found that acupuncture, phytotherapy, and cupping were the most commonly used T&CM methods among family physicians.[8] In another study conducted among primary care physicians in Turkey, cupping therapy was the best-known and most recommended treatment to patients.[9] When the level of knowledge about T&CM methods was evaluated, 12% of physicians rated their level of knowledge as low, 30.1% as medium, and 64.8% as high. These findings contrast with previous studies indicating a relatively lower level of knowledge among physicians about T&CM.[10-11] It should be noted that our study's relatively higher level of self-reported knowledge may be attributed to the fact that nearly one-fourth of our sample had T&CM certification.

In our study, 73.7% of the participants stated that they had not received training in Traditional and Complementary Medicine (T&CM), while 78% expressed a desire to receive such training. Comparable studies have shown that the rate of T&CM training among physicians has increased in recent years. In a study conducted on family physicians in Turkey, 71.6% of the participants had not received formal training, while 16% expressed a desire to receive training if given the opportunity.[9] In our study, 54.7% of physicians reported that they had recommended T&CM methods to their patients at least once. Other studies reported different rates: 48% in a study in the United States,[12] 57.9% in a study in Italy,[13] and 44.1% in Koçdaş's study.[14] Approximately 21.6% of the physicians in our study indicated that they had previously applied T&CM methods to their patients. This rate was lower compared to findings from Yüksel et al.'s study[15] and studies conducted in Canada[16] and Qatar[17], which reported 19.8% and 30.1%, respectively, for physicians who applied T&CM methods to their patients. Interestingly, our study did not find a significant correlation between the age and gender of physicians and their tendency to recommend T&CM to patients. However, similar studies have reported that female and younger physicians were more likely to recommend T&CM methods.[13,17] Furthermore, our study identified a statistically significant relationship between physicians having a Ministry-approved T&CM certification and their belief in the positive impact of T&CM methods on preventive healthcare, their willingness to administer T&CM methods to patients personally, and their perception that the widespread use of T&CM methods in healthcare centers would reduce treatment costs. Similar research has demonstrated that physicians who use T&CM methods are more likely to recommend them to their patients.[12,18-19]

In a study conducted among physicians in Italy who treat cancer and chronic disease patients, 59% of doctors accept and prescribe T&CM interventions. It was found that doctors with limited knowledge of T&CM are less likely to recommend these treatments. T&CM is most commonly used for cancer (76%), chronic disease (74%), terminal (49%), and elderly (47%) patients.[20] In our study, we found a statistically significant relationship between age, years of medical practice, and the likelihood of recommending T&CM practices to patients or relatives. Doctors with T&CM certification had more positive views compared to those without certification. Participants who believed in the positive effects of T&CM in preventive medicine were more likely to apply these practices themselves and believed that widespread use in health centers would reduce treatment costs. Both studies highlight the increasing acceptance of T&CM practices among physicians and show that education and experience levels influence these practices. This underscores the importance of T&CM education programs and regulations, which can help physicians gain more knowledge and safely offer these treatments to their patients.

Limitations of our study include the relatively small sample size and the self-reported nature of the data, which may introduce bias. Future research should aim to include larger, more diverse populations and

objective measures of T&CM knowledge and usage. Additionally, longitudinal studies could provide insight into how physicians' attitudes and practices regarding T&CM evolve over time.

CONCLUSION

In conclusion, our study reflects an increasing awareness of T&CM practices among physicians compared to previous researchs. Given the widespread use of traditional practices within the Turkish population, it is imperative to conduct further scientific research and enhance knowledge dissemination among healthcare professionals. The practical applications of our findings suggest that integrating T&CM education into medical training programs could better prepare healthcare professionals to meet the needs of patients using these practices. Just as in other countries, in Turkiye, the use of these methods should be regulated according to established standards, ensuring that healthcare professionals can administer them safely and in line with the "first, not harm" principle.

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Author contributions: Conceptualization: FB, FE, NCA, SA; Design: FB; Writing: FE, SA, FB; Investigation/Data collection: NCA, SA.

Conflict of interest: There is no potential conflict of interest relevant to this article.

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ORIGINAL RESEARCH

The Effect Of The Covid-19 Pandemic On The Interest In Supplemental Food In Türkiye: A Google Trends Analysis Study

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Abstract
Objective: This study aims to assess the impact of the COVID-19 pandemic on consumer interest in dietary supplements in Türkiye through a Google Trends analysis.
Material-Method: The search volumes of 30 selected terms were evaluated using Google Trends between March 18, 2018, and March 15, 2022.
Results: During the study period, the term with the highest search volume was 'vitamin B12'. After the declaration of the COVID-19 pandemic, search volumes for biotin, probiotics, folic acid, calcium, magnesium, iron, prebiotics, fish oil, collagen, vitamin A, multivitamins, vitamin E, lipoic acid, zinc, glutathione, selenium, vitamin C, vitamin D, iodine, melatonin, propolis, vitamin K, bromelain, and curcumin showed statistically significant increases ($p<0.005$).
Conclusion: This study demonstrates an increased interest in dietary supplements in Türkiye following the onset of the COVID-19 pandemic. The findings underscore the growing attention to dietary supplements during this period.
Keywords: COVID-19, Dietary Supplements, Google Trends

INTRODUCTION

According to the U.S. Food and Drug Administration (FDA), Dietary Supplements (DS) are products intended to supplement the diet, which differ from conventional foods.[1] The Turkish Ministry of Agriculture and Forestry defines DS as products prepared in various forms, such as capsules, tablets, lozenges, single-use powder packets, liquid ampoules, dropper bottles, and similar liquid or powder forms. These products may contain concentrated or extracted nutrients or physiologically active substances of plant, plant-based, animal origin, or similar substances, either alone or in mixtures. They supplement normal nutrition by providing additional nutrients such as vitamins, minerals, proteins, carbohydrates, fiber, fatty acids, amino acids, or other physiologically active substances beyond the standard diet.[2]

A sufficient and balanced diet is essential for growth, development, maintaining good health, preserving well-being, enhancing health, and reducing the risk of chronic diseases.[3] While DSs are used in the context of supplementing nutrition, it is emphasized that there is no need for such supplements in a diet that is already sufficient and balanced.[4] However, due to the increasing population and busy lifestyles, dietary disruptions can occur, leading to a need for food supplements.[5] Nowadays, the belief that adequate nutrition, being healthier and more energetic, treating diseases, or preventing them can be achieved through supplements that are natural, reliable, free of side effects, and easily accessible has increased the interest in dietary supplements.[6-11]

COVID-19 is a viral infectious disease. It started in the Wuhan province of China in 2019, spread globally, and was declared a pandemic by the World Health Organization in March 2020. The absence of a specific treatment for COVID-19 has led individuals to take preventive measures. Studies have observed an increasing trend in advertising dietary supplements that are believed to assist in treating and preventing COVID-19. Despite scientific evidence regarding the immune-supporting, anti-inflammatory, antioxidant, and antiviral properties of various bioactive substances, guidelines for using dietary supplements in COVID-

19 treatment do not provide specific recommendations.[12-14]

Google Trends has provided real-time indices of user-entered queries on the Google search engine daily, weekly, monthly, and yearly since 2006. The data presented indicate the intensity of user interest, specifically in a given region, for a connected term rather than the absolute volume of searches.[15] The query index offered by Google Trends is based on the query share, calculated by dividing the total volume of searches for a specific search term in a particular geographic area by the total number of queries in that region for the specified period.[16] A value of "100" (hundred) represents the day with the highest search interest in the subject, while "0" (zero) signifies that there was insufficient search volume for the subject.

In this study, the impact of the COVID-19 pandemic on consumers' interest in DSs in Türkiye was aimed to be determined through Google Trends.

MATERIALS AND METHODS

The search volumes conducted on Google Trends between March 18, 2018, and March 15, 2022, were evaluated in the study. To investigate the interest in dietary supplements, 30 search terms were determined by examining studies on COVID-19 and nutrition from pubmed.ncbi.nlm.nih.gov (Vitamin A, Vitamin D, Vitamin C, Vitamin E, Vitamin K, Vitamin B12, Folic Acid, Biotin, Calcium, Magnesium, Iron, Iodine, Zinc, Selenium, Coenzyme Q, Omega-3, Glutathione, Collagen, Lipoic Acid, Arginine, Carnitine, Curcumin, Bromelain, Black Seed, Propolis, Probiotic, Multivitamin, Melatonin, Prebiotic, Ginseng). March 15, 2020, was the boundary date to distinguish between the pre-COVID-19 and post-COVID-19 pandemic periods. Data was transferred to the Microsoft Office Excel program by filtering in the Google Trends application based on geographical location (Türkiye), search term, and language (Turkish equivalents of the terms) categories. Türkiye's weekly COVID-19 case and death numbers were obtained from the World Health Organization's (WHO) website.

Statistical Analysis

The data were analyzed using IBM SPSS (Statistical Package for Social Sciences) Statistics 22.0 software. Descriptive statistics were presented in numbers. The Kolmogorov-Smirnov test was applied to investigate the normal distribution of continuous variables. The data were analyzed using descriptive statistics, a dependent sample t-test, a Wilcoxon test, and Pearson and Spearman correlation analyses. A p-value of <0.05 was considered statistically significant in the results.

RESULTS

Table 1 presents the periods when the peak search volumes were reached for the 30 search terms included in the study.

In the week when the WHO declared a pandemic, the terms probiotic, multivitamin, and propolis reached the highest search volumes.

Throughout the 209 weeks of the study, the term with the highest search volume is vitamin B12. Vitamin B12 also had the highest search volume in the pre-pandemic period. After March 15, 2020, the highest search volume was observed in the terms 'biotin' and 'probiotic.' There was no statistically significant difference observed between the pre-pandemic and post-March 15, 2020 periods in searches for vitamin B12, carnitine, coenzyme Q, black seed, arginine, and ginseng ($p>0.05$) (Table 2).

During the COVID-19 pandemic period, the correlation between the search volumes of DS and the search term 'COVID-19,' as well as Türkiye's weekly case and death numbers, was analyzed. A moderate correlation was observed between the search volume for 'COVID-19' and the search volumes for vitamin C and propolis ($p<0.05$). In Türkiye, there was a moderate positive correlation between the weekly case numbers and the search volumes for vitamin K, vitamin B12, vitamin C, folic acid, calcium, magnesium, glutathione, bromelain, and melatonin ($p<0.05$). Moderate positive correlations were also found between the weekly death numbers in Türkiye and the search volumes for folic acid, calcium, magnesium, iron, glutathione, bromelain, and melatonin ($p<0.05$). There was a strong positive correlation between the search volume for iodine and the weekly case and death numbers in Türkiye ($p<0.05$). The search volumes for vitamin E, coenzyme Q, collagen, and prebiotics showed a positive correlation with COVID-19 search volume, Türkiye's weekly case and death numbers, while carnitine and curcumin exhibited a negative correlation with Türkiye's weekly case and death numbers (Table 3).

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Table 1. Peak periods of search volume for dietary supplements

Search term	Date range	Peak value
Selenium	01.01.2019-07.12.2019	100
Carnitine	07.07.2019-13.07.2019	100
Prebiotic	06.01.2019-12.01.2019 04.10.2020-10.10.2020	100
Folic acid	05.01.2020-11.01.2020	100
Curcumin	23.02.2020-29.02.2020	100
Probiotic	15.03.2020-21.03.2020	100
Multivitamin	15.03.2020-21.03.2020	100
Propolis	15.03.2020-21.03.2020	100
Zinc	22.03.2020-28.03.2020	100
Vitamin E	05.04.2020-11.04.2020	100
Coenzyme Q	05.04.2020-11.04.2020	100
Biotin	10.05.2020-16.05.2020	100
Fish oil	06.09.2020-12.09.2020	100
Black seed	15.11.2020-21.11.2020	100
Vitamin C	15.11.2020-21.12.2020	100
Vitamin D	29.11.2020-05.12.2020	100
Melatonin	27.12.2020-02.01.2021	100
Vitamin A	03.01.2021-09.01.2021	100
Collagen	24.01.2021-30.01.2021	100
Vitamin K	31.01.2021-06.02.2021	100
Ginseng	23.05.2021-29.05.2021	100
Glutathione	19.09.2021-25.09.2021	100
Iron	19.12.2021-25.12.2021	100
Bromelain	30.01.2022-05.02.2022	100
Arginine	06.02.2022-12.02.2022	100
Lipoic acid	13.02.2022-19.02.2022	100
Vitamin B12	27.02.2022-05.03.2022	100
Magnesium	27.02.2022-05.03.2022	100
İodine	27.02.2022-05.03.2022	100
Calcium	27.02.2022-05.03.2022	100

Table 2. COVID-19 period change in search volumes of dietary supplements

Search Term	Total (209 weeks)	Before March 15, 2020 (104 weeks)	After March 15, 2020 (105 weeks)	p
Vitamin B12	15235	7489	7746	0.177[1]
Biotin	14654	6396	8258	**<0.001**[1]
Probiotic	14651	6568	8083	**<0.001**[1]
Black seed	14266	7137	7129	0.564[1]
Folic acid	14187	6852	7335	**0.001**[1]
Calcium	13007	5748	7259	**<0.001**[1]
Magnesium	12941	5358	7583	**<0.001**[1]
Iron	12010	5607	6403	**<0.001**[2]
Prebiotic	11568	5510	6058	**0.040**[1]
Fish oil	11263	5322	5941	**<0.001**[1]
Collagen	10675	4663	6012	**<0.001**[1]
Carnitine	9876	5020	4856	0.356[1]
Vitamin A	9639	4171	5468	**<0.001**[1]
Arginine	9441	4445	4996	0.068[1]
Multivitamin	9354	3402	5932	**<0.001**[2]
Vitamin E	9301	4375	4926	**<0.001**[2]
Ginseng	9196	4646	4550	0.130[2]
Lipoic acid	8704	3785	4919	**<0.001**[1]
Zinc	7559	2925	4634	**<0.001**[2]
Glutathione	7520	2011	5509	**<0.001**[1]
Selenium	6619	2686	3933	**<0.001**[2]
Vitamin C	6472	1582	4890	**<0.001**[2]
Vitamin D	6141	2590	3551	**<0.001**[2]
Iodine	4765	1573	3192	**<0.001**[2]
Melatonin	4722	1836	2886	**<0.001**[2]
Propolis	4364	1884	2480	**<0.001**[2]
Vitamin K	3187	1424	1763	**<0.001**[2]
Bromelain	2862	489	2373	**<0.001**[2]
Coenzyme Q	2761	1373	1388	0.983[2]
Curcumin	1790	788	1002	**0.006**[2]

[1]Dependent Sample T Test, [2]Wilcoxon Test

Table 3. Correlation between dietary supplements and COVID-19 search volume, weekly number of cases and deaths

Search Term	COVID-19 search volume		COVID-19 weekly cases		COVID-19 weekly death count	
	p	r	p	r	p	r
Vitamin A	0.219[1]	-0.121	**<0.001**[1]	**0.393**	**<0.001**[1]	**0.348**
Vitamin D	0.100[2]	0.161	**0.005**[2]	**0.272**	**0.030**[2]	**0.211**
Vitamin E	0.157[2]	0.139	0.123[2]	-0.151	0.868[2]	-0.016
Vitamin K	0.065[2]	-0.181	**<0.001**[2]	**0.435**	**<0.001**[2]	**0.399**
Vitamin B12	0.089	-0.167	**<0.001**[1]	**0.438**	**0.009**[1]	**0.253**
Vitamin C	**<0.001**[2]	**0.440**	**<0.001**[2]	**0.433**	**0.002**[2]	**0.304**
Folic acid	**<0.001**[1]	**-0.368**	**<0.001**[1]	**0.582**	**<0.001**[1]	**0.476**
Biotin	**0.005**[1]	**-0.272**	**<0.001**[1]	**0.352**	**<0.001**[1]	**0.367**
Calcium	**0.001**[1]	**-0.325**	**<0.001**[1]	**0.506**	**<0.001**[1]	**0.431**
Magnesium	**0.002**[1]	**-0.300**	**<0.001**[1]	**0.486**	**<0.001**[1]	**0.444**
Iron	**<0.001**[2]	**-0.419**	**<0.001**[2]	**0.379**	**<0.001**[2]	**0.425**
Iodine	**0.007**[2]	**-0.261**	**<0.001**[2]	**0.667**	**<0.001**[2]	**0.623**
Zinc	**0.012**[2]	**0.243**	**<0.001**[2]	**0.399**	**<0.001**[2]	**0.346**
Selenium	0.977[2]	0.003	**0.002**[2]	**0.303**	**<0.001**[2]	**0.379**
Coenzyme Q	0.683[2]	-0.040	0.411[2]	0.081	0.904[2]	0.012
Fish oil	0.712[1]	0.036	**0.011**[1]	**0.248**	0.298[1]	0.103
Glutathione	0.439[1]	0.076	**<0.001**[1]	**0.555**	**<0.001**[1]	**0.498**
Collagen	0.465[1]	-0.072	0.518[1]	0.064	0.505[1]	0.066
Lipoic acid	0.065[1]	-0.181	**<0.001**[1]	**0.312**	**0.014**[1]	**0.240**
Arginine	0.165[1]	-0.137	**0.013**[1]	**0.242**	0.655[1]	0.044
Carnitine	0.548[1]	-0.069	**<0.001**[1]	**-0.375**	**<0.001**[1]	**-0.479**
Curcumin	**<0.001**[2]	**0.335**	**<0.001**[2]	**-0.568**	**<0.001**[2]	**-0.532**
Bromelain	**<0.001**[2]	**-0.398**	**<0.001**[2]	**0.589**	**<0.001**[2]	**0.504**
Black seed	**0.045**[1]	**0.196**	0.914[1]	-0.011	0.859[1]	-0.018
Propolis	**<0.01**	**0.441**	0.492	0.068	0.567[2]	0.056
Probiyotik	0.710[1]	-0.037	**0.003**[1]	**0.286**	**0.014**[1]	**0.239**
Multivitamin	**<0.001**[2]	**0.345**	**<0.001**[2]	**0.322**	0.093[2]	0.165
Melatonin	**0.04**[2]	-0.197	**<0.001**[2]	**0.443**	**<0.001**	**0.552**
Prebiotic	0.605[1]	0.051	0.328[1]	0.096	0.206[1]	0.124
Ginseng	0.889[2]	-0.014	**0.040**[2]	**0.195**	0.394[2]	0.084

[1]Pearson Correlation Test, [2] Spearman Correlation Test

DISCUSSION

The increasing understanding of 'being healthy' has heightened interest in alternative ways such as dietary supplements.[17] Research conducted in various countries has shown that the usage rates of dietary supplements range from 22% to 53%.[18] The changes in lifestyle and dietary habits during the COVID-19 pandemic have also contributed to further acceleration in the dynamic growth of the dietary supplements market.[19-21]

In Türkiye, there are 18,449 registered dietary supplement products in various forms on the 'Approved List of Dietary Supplements' by the Ministry of Agriculture and Forestry[2]. According to a study conducted by the Dietary Supplements and Nutrition Association in 2021, the usage of dietary supplements was found to be 53%. In the same survey, 71% of participants reported using dietary supplements to boost their immunity during COVID-19.[22]

We observed a statistically significant increase in search volumes for 24 out of the 30 search terms included in our study during the post-pandemic period, and this is a noteworthy finding.

In a study conducted before the pandemic, it was found that the most commonly used dietary supplement was vitamin B12.[23] In our study, it was observed that the most searched dietary supplement on Google Trends was B12. There was no statistically significant difference in search volumes between the pre-pandemic and post-pandemic periods ($p>0.05$). This may be due to the widespread awareness of the B12 vitamin among people even before the pandemic.[23] This might be because the awareness of vitamin B12 was already widespread among people before the pandemic.

Anemia is one of the common health issues.[24] The most frequent causes of anemia in adulthood are iron deficiency, B12, and folate deficiencies. Additionally, the immune system requires iron, B12, and folate to maintain its active and continuous function.[25] Vitamins A, C, E, D, fish oil, zinc, and pre/probiotics, all known for their antioxidant properties, have immune-boosting capabilities.[26]

Glutathione is an antioxidant molecule in preserving the structural and functional integrity of cells, tissues, and organ systems.[27] Lipoic acid prevents

free radical damage and regenerates vitamins E, and C.[28] Bromelain and curcumin are known for their anti-inflammatory properties.[29,30] A review has indicated that selenium and coenzyme Q may positively impact the course of COVID-19 due to their effects on oxidative stress[31]. One study presented that propolis is an effective antioxidant and anti-inflammatory agent, particularly promising for cardiometabolic health.[32] In our results, the search volumes for iron, vitamin B12, folate, vitamins A, C, E, D, fish oil, zinc, pre/probiotics, bromelain, curcumin, selenium, and propolis were significantly higher after the pandemic. The lack of a known treatment for COVID-19 and people's inclination toward health-protective approaches could be the reason for this difference.

Similar to previous studies, search volumes for calcium, magnesium, vitamins D and K, collagen, and biotin, which are preferred for strengthening the musculoskeletal system, as well as personal care products, showed a significant difference in search volume before and after the pandemic.[33-35] With the advent of COVID-19, people spending more time at home due to quarantine and isolation measures, reduced physical activity, and increased exposure to social media could be the reasons for this situation.

Melatonin is the primary neurohormone secreted by the pineal gland and regulates the sleep-wake cycle.[36] Changes in people's sleep patterns and a decrease in sleep quality during the pandemic, along with their search for a solution to this issue, could explain the difference in melatonin search volumes.

Iodine is a trace element found in hormones necessary for the functioning of the thyroid gland.[37] During the pandemic, the potential effects of iodine-containing oral and nasal sprays, as well as iodine supplements, on inflammatory processes with antiviral activity against COVID-19 have been the subject of research.[38] In our study, a difference in search volumes was also observed in the post-pandemic period.

In one study, patients with post-COVID syndrome complaining of chronic fatigue were given carnitine, as well as vitamins B, C, and D, and it was suggested that dietary supplements could be helpful for health in post-COVID syndrome.[39] Another study indicated that ginseng use might be beneficial for chronic fatigue observed after viral infections.[40] Black seed, on the other hand, is a medicinal plant believed to be good for coughs in popular culture.[41] In our study, the search volume for carnitine, ginseng, and black seed did not differ between the pre-pandemic and post-pandemic periods. This might be because individuals did not prioritize dietary supplements in a symptomatic approach.

When examining the correlation between Türkiye's weekly COVID-19 case and death numbers and DSs, moderate positive correlations were found, respectively, between the search volumes for K vitamin, B12 vitamin, C vitamin, folate, calcium, magnesium, glutathione, bromelain, melatonin, and between the search volumes for folate, calcium, magnesium, iron, glutathione, bromelain, melatonin. Iodine showed a high level of positive correlation with weekly case and death numbers. This might be due to the prominent portrayal of these preparations for their immune-boosting and virus-eliminating properties on social media.

Limitations

This study presents search results from Google for the specific terms related to dietary supplements that were identified. However, the results may differ if research were conducted using other search engines, which could influence the overall findings. Additionally, changes in individuals' internet usage habits during the pandemic and the possibility that they used different search terms beyond those identified in this study may have affected the results.

CONCLUSION

The dietary supplement market is growing globally, and there is an increasing interest in dietary supplements.

The easy accessibility of dietary supplements and the lack of information regarding their effects and potential side effects can contribute to the increasing interest in them.

Raising public awareness about dietary supplements is important for protecting and improving public health.

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ORIGINAL RESEARCH

A Comparison of the Instantaneous Effects of Spinal Manipulation and Mobilization Techniques Applied to L3 Level on Jumping, Agility and Sprint Speed in Male Volleyball Players

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Abstract
Objective: This study aims to investigate the effects of manipulation and mobilization treatments applied to the L3 segment on sportive performance to prevent performance anxiety and low performance resulting from competition stress in athletes.
Material-Method: Sixty male volleyball players aged 18 to 25 were enrolled in this randomized controlled trial. Participants were randomly assigned to one of three groups: a manipulation, a mobilization, and a control group. After completing the required warm-up program, participants underwent either manipulation or mobilization based on their assigned group. Hip range of motion, lumbar range of motion, T-Test time (seconds), 10-meter sprint time (seconds), vertical jump height (cm), and horizontal jump distance (cm) were evaluated immediately before and after the interventions.
Results: There were no significant differences between the groups regarding participants' age and height ($p>0.05$). The mobilization group had the highest mean body mass index and weight ($p=0.05$). In the intra-group analysis, statistically significant improvements were observed in the spinal manipulation group for hip external rotation, lumbar flexion, extension, T-test performance, and right lumbar flexion ($p<0.05$). In the mobilization group, significant changes were noticeable for right hip flexion, left hip abduction, hip external rotation, lumbar flexion, extension and lateral flexion, T-test performance, 10-meter sprint, and horizontal jump. Across all groups, all measures were statistically significant except for hip flexion, hip adduction, hip internal rotation, and lumbar lateral flexion ($p<0.05$).
Conclusion: Comparing the data between the groups revealed that the spinal manipulation group demonstrated superior outcomes in right hip extension, right hip external rotation, lumbar flexion, extension, T-test performance, and 10-meter sprint times compared to the spinal mobilization and control groups. We believe that pre-competition spinal manipulation interventions may offer the greatest benefit for volleyball players.
Keywords: Chiropractic, Spinal Manipulation, Spinal Mobilization, Sports Performance, Volleyball

INTRODUCTION

Volleyball is one of the world's most popular sports, played by two teams of six players and practiced by 200 million people worldwide. Jumping, landing, blocking, and spiking are specific movements of volleyball and require quick movements of the musculoskeletal system. Vertebral and biomechanical dysfunctions may impair neuroplasticity in the central nervous system (CNS), negatively impacting athletic performance. However, the application of spinal manipulative therapy (SMT) to these dysfunctional segments has been shown to enhance proprioception and motor response. A recent study has shown that a single session of spinal manipulation increases corticospinal excitability and electromyographic activity, which may lead to increased muscular strength. While some research has supported this hypothesis, others have found inconsistent results. Despite several neurophysiological hypotheses for the effects of SMT on athletes, no consensus has been established.[1-3]

Many questions have been raised about whether chiropractic treatments can enhance athletic performance, but these questions have generally remained unresolved due to the lack of studies. Although some researchers have reported that chiropractic treatment enhances athletic performance, others have reported that chiropractic

performance has no significant effect; these studies provide inadequate evidence. As a result, the role of chiropractic therapy in athletics still needs to be fully understood. Although the mechanism remains unclear, these techniques are hypothesized to increase the pain threshold and enhance motor neuron excitability by altering central perception. Despite the popularity of manipulative and mobilization techniques among athletes, this study was designed to evaluate their impact on performance, incorporating a control group and adhering to ethical considerations.[4-6]

MATERIALS AND METHODS

Study design and participants

We used a randomized controlled clinical trial model with pre-and post-test evaluation methods. Healthy licensed volleyball players between the ages of 18 and 25 were included in this study at Bahçeşehir Okyanus College Sports Hall. After the players in the study were informed in detail about the manipulation and mobilization techniques, the height, weight, and body mass indexes of the volunteers who signed the consent form were evaluated and randomly divided into three groups. The groups were the control group (n=20), the L3 spinal manipulation group (n=20), and the L3 mobilization group (n=20). During the study, pre-application evaluations were performed, followed by the manipulation and mobilization techniques, and then the pre-application evaluations were repeated instantaneously. The evaluation times were T0 (before spinal manipulation/mobilization procedure), T1 (after spinal manipulation/mobilization procedure).

A power analysis was conducted using the G*Power software (version 3.1.9.7) to determine the appropriate sample size for the study. The statistical power was represented as 1-β (with β being the probability of a Type II error). In a study by Thomas et al. (2022) that investigated the effects of manipulative treatment on lower extremity function in young professional football players, the mean and standard deviation of vertical jump data were used for comparison between the control group (34.0 ± 3.9) and the experimental group (39.3 ± 5.4) with a significance level of $\alpha = 0.05$. The power analysis, aiming for 95% power, calculated an effect size (d) of 0.5789. Based on these calculations, it was determined that a total of 51 participants would be required for this study, distributed across three groups.

In the study, the T-test was used to evaluate agility, the contact mat (SMART JUMP-AUS) was used to assess vertical jump, a photocell was used to measure a 10-meter straight sprint run, and goniometry was used to evaluate the range of motion. Horizontal jump was measured on the gym floor with the help of a tape measure.[8-12] Each evaluation was repeated three times and averaged.

Evaluation criteria

Inclusion criteria: Being male, having signed the voluntary consent form, being between the ages of 18 and 25, being a licensed volleyball player, not using performance-enhancing supplements, and not having any contraindications to chiropractic applications.

Exclusion criteria: Having a history of orthopedic injury in the last three months, being a volleyball player for less than one year, and practicing volleyball less than three days a week.

Exclusion from the study: Volunteers who sustained any injuries during the measurements and declined to continue the study.

Intervention

Spinal manipulation: Spinal manipulation is a specialized form of manual therapy for musculoskeletal injuries and disorders that is non-invasive and hands-on. The most common type of spinal manipulation used by practitioners is low-amplitude and high-velocity thrusts (HVLA; high-velocity low-amplitude). The patient is lying on the side, in a lateral decubitus position. The knee of the lower leg is extended, and the knee of the upper leg is flexed and placed in the popliteal fossa of the lower leg. The physiotherapist places their hand on the L3 segment and rolls the patient towards them, and when the joint is locked, performs the high intensity and low amplitude (HVLA) maneuver from posterior to anterior.[13,14]

Spinal mobilization: It is a manual therapy method applied to a specific segment with low intensity and low speed, and generally, no ‘’popping’’ sound is heard after application. A rhythmic force with passive oscillations is applied to the affected segment. Vertebral mobilizations are also called "passive and oscillating movements within the range allowed by the vertebra".[15,16]

Posteroanterior mobilizations in the lumbar spine involve placing the patient's hands on their back, with the clinician's hands acting as springs. The patient lies prone with their hands either by their side or above their head, with their head turned to one side. The clinician's left hand is placed on the

patient's back, with the clinician's shoulders over the contact point. The clinician's right hand is reinforced by placing the carpus over the radial aspect of the left carpus at the base of the left index finger. Stability is maintained through grasping the clinician's palm and sustained wrist extension. The technique involves grade 1 and 2 joint oscillations for 30 seconds each, with 6 repetitions.[17]
The control group did not receive any treatment.

Warm – Up Protocol
Sports scientists and trainers are constantly searching for new ways to maximize the performance of athletes. Although different exercise protocols are constantly applied in warm-ups before competition and training, the effect of these exercises (static-dynamic stretching, resistance exercises, jumping, jogging, etc.) on jumping performance, especially in volleyball players, is not fully known. In a study conducted on female volleyball players, the effects of static and dynamic stretching on vertical jump were compared, and the two types of exercises did not outperform each other even though they increased vertical jump. Another study compared the effect of various exercises on vertical jumping in young volleyball players and showed that vertical jumping exercises were superior to other groups. In young elite volleyball players, dynamic exercises were shown to positively affect the directional change performance of volleyball players.[18,19,20]
It has been argued that pre-training warm-up programs, including static stretching exercises, reduce the risk of injury and improve athletic performance. Static stretching exercises were suggested to increase joint range of motion, reduce injury risk, and rehabilitate the muscle. However, recent studies have found that static stretching exercises decrease performance in sports involving explosive exercise. Therefore, their use in sports requiring high force output is questioned.[21]
For the factors mentioned above, the volleyball players were given a warm-up program that included dynamic stretching and vertical jumps, prepared jointly with volleyball coaches.

Randomization
Each subject was assigned a number between 1 and 60 by random lottery. Using the simple random sampling method, a number sequence was generated using the Microsoft Excel program. Groups were formed by utilizing the data in the number array.

Permission
For the study to be planned and conducted following the Principles of the Declaration of Helsinki, ethics committee approval was obtained from the Gümüşhane University Scientific Research and Publication Ethics Committee dated 29.09.2021 and numbered 2021/6.

Statistical analysis
After the data were organized in an Excel program, they were analyzed with SPSS 29.0 IBM. Categorical variables were presented with frequency and percentage values, and numerical data were presented with mean, standard deviation and median values. Since the amount of data in each group was less than 30, the data were analyzed using nonparametric tests. The Kruskal-Wallis-H Test was used to analyze the data between 3 groups, and Wilcoxon Sign Test statistics were used to analyze two separate measurements for each group. Intergroup comparisons were made with Kruskal-Wallis-H by taking the differences between the measurement times. Significance level $p<0.05$ was considered for all tests.

RESULTS
Demographic data of the groups are given in Table 1. There is no statistically significant difference between the groups regarding age (p=0.368) and height (p=0.412). However, weight (p=0.05) and BMI (p=0.019) were statistically significant. The mobilization group had the highest mean weight and BMI (Table 1).

Table 1. Demographic Characteristics of the Groups

		Age (Years)	Height (cm)	Weight (kg)	BMI (Kg / m^2)
Manipulation Group	**Mean ± St. Dev.**	20,30±1,45	189,20±6,35	82,80±9,33	23,10±1,99
	Median	20	188	80,5	23,5
Mobilization Group	**Mean ± St. Dev.**	21,35±2,41	187,10±7,76	86,00±12,09	24,50±2,61
	Median	21,0	187	83,5	24,4
Control Group	**Mean ± St. Dev.**	21,05±2,19	186,50±6,42	77,75±10,68	22,30±2,39
	Median	20	187,5	75,0	21,8
Kruskal-Wallis Test Value		2,00	1,755	5,993	7,883
	p value	0,368	0,412	**0,05**	**0,019**

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Table 2. Intragroup Comparision

		Manipulation Group				Mobilization Group				Control Group			
		T0	**T1**	**Wilcoxon**	**p**	**T0**	**T1**	**Wilcoxon**	**p**	**T0**	**T1**	**Wilcoxon**	**p**
Hip Flexion	**Right**	107,85±6,79(110)	109,2±7,14(110)	-1,245	0,213	104,70±6,05(103)	106,50±6,13(105)	-2,790	**0,005**	106,70±5,43(105,5)	106,95±5,56(105,5)	-1,169	0,242
	Left	106,95±4,41(108,5)	107,35±6,3(105)	-0,119	0,905	105,65±5,86(105)	107,00±5,80(106,5)	-2,157	0,031	106,75±4,49(106,5)	106,90±4,59(106,5)	-0,317	0,751
Hip Extension	**Right**	19,2±2,72(19)	19,8±2,37(20)	-1,086	0,278	22,05±2,82(21,5)	22,60±3,28(22)	-1,374	0,170	23,70±3,06(23)	23,95±2,44(24)	-0,714	0,475
	Left	20,1±3,22(19)	21,35±2,7(21,5)	-2,001	0,045	21,30±3,48(20,5)	22,25±3,70(22)	-1,985	0,047	24,70±4,49(25)	24,20±3,97(24,5)	-0,956	0,339
Hip Abduction	**Right**	43,40±2,19(44)	42,65±2,76(42)	-0,988	0,323	45,55±5,07(44)	47,05±4,67(45)	-2,695	0,007	43,65±3,56(44)	43,95±3,10(44)	-1,015	0,310
	Left	43,65±3,17(44)	44,55±3,07(44,5)	-1,286	0,119	44,95±4,17(44,5)	46,20±4,23(45)	-2,800	**0,005**	44,00±3,03(44)	44,10±3,23(45)	-0,446	0,656
Hip Adduction	**Right**	32,90±2,67(38)	38,05±2,52(38,5)	-0,599	0,550	38,25±2,36(38)	39,10±1,92(39)	-2,170	0,030	37,10±2,45(37)	36,90±2,31(37)	-0,036	0,972
	Left	37,90±2,49(38,5)	38,05±2,72(39)	-0,518	0,604	36,90±2,31(36,5)	37,65±1,93(38)	-1,516	0,129	37,60±1,93(38)	37,25±2,31(37)	-0,694	0,488
Hip External Rotation	**Right**	47,85±4,51(48,5)	50,10±5,14(50)	-3,057	**0,002**	49,15±3,84(50)	51,20±4,11(51,5)	-3,620	**<0,001**	47,50±2,89(47,5)	47,95±2,70(48)	-0,936	0,349
	Left	47,40±5,64(48)	49,35±6,40(49)	-2,917	**0,004**	49,55±3,33(49)	51,60±3,19(51,5)	-3,570	**<0,001**	47,55±4,63(49)	47,95±2,98(48)	-0,070	0,944
Hip Internal Rotation	**Right**	36,55±2,78(36,5)	37,40±4,31(37)	-1,517	0,129	34,80±3,87(35)	35,70±4,21(36)	-1,867	0,062	35,45±4,06(35)	35,25±2,00(35,5)	-0,634	0,526
	Left	37,15±4,12(36)	38,10±4,59(37,5	-2,175	0,030	34,45±3,97(35)	35,25±4,17(35,5	-1,978	0,048	35,00±2,15(35)	34,70±2,15(35)	-0,914	0,361
Lumbar Flexion		56,25±3,39	60,45±4,59	-3,439	**<0,001**	71,70±5,05(71)	73,70±4,82(75)	-2,803	**0,005**	68,90±4,67(70)	69,05±4,77(69,5)	-0,310	0,757
Lumbar Extension		39,80±4,05	42,90±3,19	-3,619	**<0,001**	24,35±3,45(24)	27,40±4,38(27)	-3,853	**<0,001**	25,65±3,91(24,5)	26,00±3,16(25)	-1,059	0,289
Lumbar Lateral Flexion	**Right**	32,45±2,96	34,60±2,37	-3,223	**<0,001**	29,55±3,65(30)	30,95±3,76(32)	-3,646	**<0,001**	24,15±2,13(24)	24,95±2,52(25)	-2,527	0,011
	Left	33,25±2,36	34,85±3,36	-2,128	0,033	30,30±3,93(32)	31,95±4,05(32,5)	-3,410	**<0,001**	25,05±2,33(25)	26,10±2,69(25)	-2,747	0,006
T - Test (Seconds)		9,66±0,43	9,25±0,53	-3,884	**<0,001**	9,09±0,59(9)	9,33±0,58(9,2)	-3,773	**<0,001**	9,00±0,81(8,7)	9,06±0,85(9)	-1,270	0,204
10 Meter Sprint (Seconds)		2,04±0,15	1,92±0,14	-3,684	**<0,001**	1,92±0,13(1,9)	2,07±0,12(2,1)	-3,885	**<0,001**	1,99±0,10(2)	2,00±0,11(2)	-0,205	0,837
Vertical Jump (cm)		57,40±6,99	54,85±5,69	-1,419	0,156	36,35±7,36(37)	37,65±7,88(37,5)	-2,252	0,024	40,70±5,59(40)	42,20±5,68(42)	-3,168	0,002
Horizontal Jump (cm)		199,80±15,59	204,65±16,90	-2,223	0,026	206,35±19,04(202,5)	215,80±19,05(212)	-3,929	**<0,001**	206,22±6,83(204,5)	209,60±6,93(210,5)	-2,771	0,006

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Table 3. Comparison of Differences Between Groups

Difference Analysis		Mean ± St. Dev.	Median	KW	P
Hip Flexion (Right)	**Manipulation Group**	1,35±4,28	2	5,097	0,078
	Mobilization Group	1,80±2,44	2		
	Control Group	0,25±1,74	1		
Hip Flexion (Left)	**Manipulation Group**	0,40±4,33	1,5	2,721	0,256
	Mobilization Group	1,35±2,74	2		
	Control Group	0,15±2,35	0		
Hip Extension (Right)	**Manipulation Group**	0,60±2,70	1	0,781	0,677
	Mobilization Group	0,55±1,73	1		
	Control Group	0,25±1,45	0		
Hip Extension (Left)	**Manipulation Group**	1,25±2,59	1	7,768	**0,021**
	Mobilization Group	0,95±2,01	1		
	Control Group	-0,50±1,79	0		
Hip Abduction (Right)	**Manipulation Group**	-0,75±2,95	-0,5	10,349	**0,005**
	Mobilization Group	1,50±2,01	2		
	Control Group	0,30±1,26	1		
Hip Abduction (Left)	**Manipulation Group**	0,90±2,86	1,5	3,380	0,185
	Mobilization Group	1,25±1,52	1,5		
	Control Group	0,10±1,94	0		
Hip Adduction (Right)	**Manipulation Group**	0,15±1,31	0	2,705	0,259
	Mobilization Group	0,85±1,63	1		
	Control Group	-0,20±2,04	0		
Hip Adduction (Left)	**Manipulation Group**	0,15±1,35	0	3,171	0,205
	Mobilization Group	0,75±2,20	1		
	Control Group	-0,35±2,30	-0,5		
Hip External Rotation (Right)	**Manipulation Group**	2,25±2,65	2	7,012	**0,030**
	Mobilization Group	2,05±1,43	2		
	Control Group	0,45±1,96	1		
Hip External Rotation (Left)	**Manipulation Group**	1,95±2,78	2	10,411	**0,005**
	Mobilization Group	2,05±1,50	2		
	Control Group	0,40±3,56	0		
Hip Internal Rotation (Right)	**Manipulation Group**	0,85±2,54	1	1,532	0,465
	Mobilization Group	0,90±2,05	1		
	Control Group	-0,20±3,17	0,5		
Hip Internal Rotation (Left)	**Manipulation Group**	0,95±1,79	0	5,771	0,056
	Mobilization Group	0,80±1,74	0,5		
	Control Group	-0,30±1,56	0		
Lumbar Flexion	**Manipulation Group**	4,20±3,62	4,5	16,996	**<0,001**
	Mobilization Group	2,00±2,45	2		
	Control Group	0,15±1,95	0		
Lumbar Extension	**Manipulation Group**	3,10±2,34	3	22,864	**<0,001**
	Mobilization Group	3,05±2,39	3		
	Control Group	0,35±1,53	1		
Lumbar Lateral Flexion (Right)	**Manipulation Group**	2,15±2,23	2	5,798	0,055
	Mobilization Group	1,40±0,94	2		
	Control Group	0,80±1,32	1		
Lumbar Lateral Flexion (Left)	**Manipulation Group**	1,60±3,00	3	3,635	0,162
	Mobilization Group	1,65±1,35	2		
	Control Group	1,05±1,32	1		
T-Test (Seconds)	**Manipulation Group**	-0,41±0,30	-0,4	40,075	**<0,001**
	Mobilization Group	0,25±0,13	0,2		
	Control Group	0,07±0,19	0		
10 Meter Sprint (Seconds)	**Manipulation Group**	-0,12±0,09	-0,1	38,593	**<0,001**
	Mobilization Group	0,15±0,10	0,1		
	Control Group	0,00±0,08	0		
Vertical Jump (cm)	**Manipulation Group**	-2,55±6,50	-2,5	6,521	**0,038**
	Mobilization Group	1,30±2,43	1,5		
	Control Group	1,50±1,47	2		
Horizontal Jump (cm)	**Manipulation Group**	4,85±8,80	4,5	14,897	**<0,001**
	Mobilization Group	9,45±3,39	10		
	Control Group	3,38±4,48	3		

Kruskal Wallis Test, *p<0.05.

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Table 4. Post – hoc Analysis

Post – hoc Analysis		Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
Hip Abduction (Right)	**Control – Manipulation Group**	-5,150	5,463	-,943	,346	1,000
	Control – Mobilization Group	11,975	5,463	2,192	0,28	,085
	Manipulation – Mobilization Group	-17,125	5,463	-3,135	,002	,005
Hip Extension (Left)	**Control – Manipulation Group**	14,350	5,435	2,640	,008	,025
	Control – Mobilization Group	11,375	5,435	2,093	0,36	,109
	Manipulation – Mobilization Group	2,975	5,435	,547	,584	1,000
Hip External Rotation (Right)	**Control – Manipulation Group**	11,700	5,420	2,159	0,31	,093
	Control – Mobilization Group	13,050	5,420	2,408	,016	,048
	Manipulation – Mobilization Group	-1,350	5,420	-,249	,803	1,000
Hip External Rotation (Left)	**Control – Manipulation Group**	13,775	5,455	2,525	,012	,035
	Control – Mobilization-Group	16,375	5,455	3,002	,003	,008
	Manipulation – Mobilization Group	-2,600	5,455	-,477	,634	1,000
Lumbar Flexion	**Control – Manipulation Group**	22,625	5,494	4,118	<,001	,000
	Control – Mobilization Group	12,250	5,494	2,230	,026	,077
	Manipulation – Mobilization Group	10,375	5,494	1,888	,059	,177
Lumbar Extension	**Control – Manipulation Group**	23,525	5,450	4,316	<,001	,000
	Control – Mobilization Group	21,475	5,450	3,940	<,001	,000
	Manipulation – Mobilization Group	2,050	5,450	,376	,707	1,000
T – Test (sec.)	**Control – Manipulation Group**	-22,324	5,521	-4,044	<,001	,000
	Control – Mobilization Group	12,125	5,521	2,196	0,28	,084
	Manipulation – Mobilization Group	-34,450	5,521	-6,240	<,001	,000
10 meter sprint (sec.)	**Control – Manipulation Group**	-15,575	5,519	-2,858	,004	,013
	Control – Mobilization Group	18,475	5,519	3,348	<,001	,002
	Manipulation – Mobilization Group	-34,250	5,519	-6,206	<,001	,002

When we made an intra-group comparison, we found a statistically significant difference in the manipulation group: right hip external rotation (p=0.002), left hip external rotation (p=0.004), lumbar flexion (p<0.001), lumbar extension (p<0.001), right lumbar lateral flexion (p<0.001), T-test (p<0.001), 10-meter sprint test. In the mobilization group, left hip abduction (p=0.005), right hip external rotation (p=0.004), lumbar flexion (p=0.005), lumbar extension (p<0.001), right lumbar lateral flexion (p<0.001) were statistically different. A statistically significant difference was found between left lumbar lateral flexion (p<0.001), T-test (p<0.001), 10-meter sprint (p<0.001), and horizontal jump (p<0.001) tests.

When the difference between the groups is analyzed, the left hip extension values of the manipulation and mobilization groups increased after the test, while the control group showed a decrease (p=0.021). According to the post-hoc analysis, the difference is due to the control group patients. The right hip abduction values of the control and mobilization groups increased after the test, while the manipulation group showed a decrease (p=0,005). According to the post-hoc analysis, a significant difference was found between all groups. When right hip external rotation was analyzed, post-test values of all groups increased compared to pre-test values, and the highest increase belonged to the manipulation group (p=0.03). According to the post-hoc analysis, the difference was due to the control group. When the external rotation of the left hip was examined, the post-test values of all groups increased compared to the pre-test values, and the highest increase belonged to the mobilization group (p=0,005). According to the post-hoc analysis, the difference was due to the control group. In lumbar flexion measurements, the post-test values of all groups increased compared to the pre-test values, and the highest increase was in the manipulation group (p=0,005). According to the post-hoc analysis, a difference was found between all groups. When the lumbar extension measurements were analyzed, the post-test values of all groups increased compared to the pre-test values, and the highest increase belonged to the manipulation group (p=0.005). According to the post-hoc analysis, the difference was due to the control group (Table 3).

When the 10-meter sprint, T-test, and vertical jump values were analyzed for the difference between groups, it was observed that the post-test values of the mobilization and control groups increased compared to the pre-test values. In contrast, a decrease was observed in the manipulation group (p<0,001). According to the post-hoc analysis, the difference is due to the manipulation group. When the 10-meter sprint measurements were examined, the post-test values of the mobilization and control groups increased compared to the pre-test values, while a decrease was observed in the manipulation group. The highest increase belongs to the mobilization group (p<0.001). According to the post-hoc analysis, the difference is due to the

manipulation group. Looking at the vertical jump measurements, the post-test values of the mobilization and control groups increased compared to the pre-test values, while a decrease was observed in the manipulation group. The highest increase belongs to the mobilization group ($p<0.038$). According to the post-hoc analysis, the difference is due to the manipulation group. In horizontal jump measurements, post-test values of all groups increased compared to pre-test values. The highest increase belongs to the mobilization group ($p<0,001$). According to the post-hoc analysis, the difference was due to mobilization (Table 4).

DISCUSSION

The quadriceps femoris muscle receives its innervation from the L2, L3, and L4 spinal segments, and the femoral nerve is formed by the nerves arising from these segments. L3 is defined as the main feeder of the quadriceps femoris muscle. Sanders et al. investigated the effect of spinal manipulation applied to the L2-S1 segments on the isokinetic strength of the knee extensors and flexors in a study conducted on 21 asymptomatic participants in 2015. Although spinal manipulation was shown to increase isokinetic strength, these findings did not gain statistical value.[20] Pollard and Ward showed that spinal manipulation of the L3-L4 segment caused a short-term increase in the strength of the quadriceps femoris muscle in their study on 30 individuals between 18 and 34.[21] Grindstaff et al. compared the effect of lumbopelvic manipulation on the activation of the quadriceps femoris muscle in 42 healthy individuals and showed that the strength of the quadriceps femoris muscle increased by 3% and activation by 5% in the manipulation group.[21] Ahn et al. investigated the effect of grade III-IV spinal mobilization and TENS (Transcutaneous Electrical Stimulation) treatments applied to the L2-L3 segment on muscle strength and proprioception in their study on 26 professional volleyball players with chronic knee pain. They reported that proprioception was significantly improved only during knee extension in the LJM group, and the difference in knee extension between the groups was also significant.[22]

Spinal manipulation therapy is thought to regulate the abnormal input to the central nervous system and the processing of this abnormal input, thus ensuring the biomechanical and neural integrity of the joint complex. Another theory is that it regulates afferent information with the bombardment that occurs in mechanoreceptors after manipulation, according to Korr's stimulated segment theory.[23] To measure the effect of spinal manipulation on the cortical system and maximum voluntary contraction, Niazi et al. conducted a study with healthy individuals in 2014. They observed that the H-reflex and maximum voluntary contraction strength increased. They reported that spinal manipulation increases motor neuron excitability by stimulating low-threshold 1a afferent fibers.[24] Perry and Green showed that spinal mobilization applied to the L4-L5 segment caused changes in the peripheral nervous system in 45 healthy individuals. According to this study, spinal mobilization stimulates the dorsal periaqueductal region and the sympathetic nervous system, causing an increase in motor facilitation.[25] We expected to see the rise in sportive performance by affecting the sympathetic and central nervous system and increasing motor neuron excitability.

Team sports such as volleyball and basketball involve a lot of running, sprinting, changing direction, and jumping. The strength of the quadriceps femoris and hamstring muscles is vital for athlete efficiency and injury prevention.[26] In addition, volleyball players are exposed to much more tendon loading in simple positioning and jumping than in other sports.[27] Vertical jumps involve 49% of the knee, 28% of the hip, and 23% of the ankle involved.[28] Tsiokanos et al., in their study on 32 healthy men, measured the effect of hip extensors, knee extensors, and ankle plantar flexors on vertical jump and reported that hip and knee extensors positively affected jump values.[29] However, there was no correlation between isokinetic knee strength and sprint and T-Test values.[30] Likewise, Cronin and Hansen reported that knee extensor strength did not correlate with sprint performance in their study conducted on 26 rugby players in 2005.[31] On the other hand, Dowson et al., in their study, showed that eccentric and concentric knee extension strength had a statistically significant effect on 0-15 meters and 30-35 meters sprint measurements.[32] Olson et al. measured the impact of lumbar spinal manipulation at the L3 level on sprint performance and hip flexibility in 12 asymptomatic cyclists. Still, they did not observe an increase in hip flexion or sprint performance.[33] Previous studies on spinal manipulation have shown that lumbar spinal manipulation increases hip ROM.[34] Sandell et al. applied non-specific lumbar spinal manipulation to male runners aged between 17 and 20 years and observed an increase in hip extension.[35] Villers et al. applied lumbar facet mobilization at the L4 - L5

level to 33 participants and observed an increase in the range of motion in the segments affected by the hamstring muscle.[36] Szlezak et al. applied grade III posterior-anterior spinal mobilization to the lumbar facet joints unilaterally at a frequency of 2 Hz with 36 healthy participants and observed an increase in the straight leg raising test.[37] Vieira-Pellenz et al. evaluated the short-term effects of spinal manipulation on pain perception, spinal mobility, and height between two vertebrae in male patients with degenerative disc disease. Hip flexion and lumbar flexion increased during the passive straight leg raising test.[38] Pollard and Ward compared the effect of cervical manipulation and lumbar spinal manipulation on hip flexion range of motion. They reported that cervical manipulation increased hip flexion while no effect was observed in the lumbar manipulation group.[39] In our study, we observed an increase in hip flexion, abduction, and external rotation after spinal mobilization application, as there are examples in the literature. In addition, we observed an increase in hip external rotation after spinal manipulation application. As a result of mobilization applied at the L3 level, we observed an increase in the range of motion of these joints due to the activation of the quadriceps femoris muscle, whose primary function is to assist knee extension and secondary function is to assist hip external rotation. Still, we could not determine the reason for the difference between mobilization and manipulation. Since this study was performed in healthy individuals, we believe further studies in individuals with external rotation, abduction, and flexion limitations may give us information about this issue.

Deutschmann et al. divided 40 asymptomatic soccer players into four groups. They applied spinal lumbar manipulation to one group, sacroiliac manipulation to another group, sacroiliac, and lumbar manipulation to another group, and sham manipulation to the last group. Compared to the control group, it was observed that right and left rotation increased significantly in the lumbar manipulation group. The combination of these two techniques increased lumbar extension and right rotation. There was no flexion and lateral flexion increase in the lumbar spinal manipulation group.[40] In their literature review, Millan et al. reported that cervical manipulation momentarily increased spinal range of motion, but lumbar manipulation did not increase spinal range of motion[41]. Griffiths et al. investigated the immediate effect of thoracolumbar spinal manipulation on a range of motion in this region in 21 asymptomatic individuals. They observed an increase in the range of motion in the spinal manipulation group compared to the control and sham manipulation group.[42] In his 2015 study, Wiggett investigated the effect of cervical, lumbar, and thoracic manipulation applied to 40 ice hockey players on ice hockey puck striking speed and range of motion in the spine and observed an increase in lumbar extension and lateral flexion in the manipulation group.[43] We found significant differences in parameters other than left lumbar lateral flexion.

Stamos-Papastamos investigated the effect of lumbar manipulation and posteroanterior mobilization on the lumbar range of motion. They found no statistical significance in the lumbar range of motion in both manipulation and mobilization groups.[44] Shum et al. investigated the effect of posteroanterior grade III spinal mobilization at the L4 level on the lumbar range of motion in 19 individuals with chronic low back pain. They observed an increase in lumbar extension and flexion.[45] Chesterton et al. investigated the effect of unilateral and central posteroanterior spinal mobilization applied at the L4 - L5 level on the lumbar range of motion in 20 healthy participants. While an increase in lumbar range of motion was observed in both groups, the increase was more significant in the unilateral spinal mobilization group[46]. Sato et al. measured the immediate effect of segmental lumbar mobilization on lumbar range of motion with the help of radiography in a study with ten healthy individuals and showed that mobilization applied to the L3 - L4 segment increased lumbar range of motion. In contrast, no increase was observed in other segments.[47] Fiaad et al. conducted a study with 45 participants to investigate the effects of spinal manipulation, mobilization, and exercise on lumbar range of motion and other parameters and divided the participants into three groups. The first group received only exercise therapy, the second group received spinal manipulation and exercise therapy, and the third group received spinal mobilization and exercise therapy. It was observed that spinal manipulation applied to the L4-L5 region was superior to other groups in increasing the lumbar range of motion.[48] As examples in the literature, we observed that the posteroanterior spinal mobilization applied in our study caused an increase in lumbar flexion, extension, and lateral flexion. Although we did not perform any application in the control group, athletes were asked to exhibit maximum

performance while evaluating healthy individuals. For this reason, there may be a significant difference in the measurements in the control group before and after. This difference is related to the motivation level of the athletes. Pollard and Ward observed that spinal manipulation applied at the L3-L4 level increased the strength of the quadriceps femoris muscle and other knee extensors in 30 asymptomatic individuals.[49] Laura and Mouch aimed to measure the values of chiropractic treatment, especially spinal manipulation, in a test battery consisting of 11 physical tests used to evaluate agility, balance, kinesthetic perception, strength, and reaction speed of asymptomatic athletes. They divided the athletes into two groups manipulation and control groups. In the manipulation group, a 6.12% improvement in the total test score was observed in the control group[50]. Muller investigated the effect of lumbar spinal manipulation on 40-meter sprint speed, agility, and vertical jump in 20 female ice hockey players and observed agility, sprint speed, and vertical jump in the manipulation group.[51] Alvarenga et al. investigated the effect of spinal manipulation on bilateral asymmetry, squat, and jump in a study of 13 asymptomatic athletes and showed that spinal manipulation affected asymmetry but not jump and squat.[52] Sandell et al. applied sacroiliac manipulation to 17 running athletes aged between 17 and 20 years and observed an increase in hip extension. It was stated that this may increase the running performance of runners.[53] As seen in the literature, we observed that the lumbar spinal manipulation applied in our study increased agility and 10-meter sprint speed but had no effect on vertical and horizontal jumping.

Alhashel et al. investigated the effect of Mulligan SNAG (Sustained Natural Apophyseal Glide) mobilization technique on vertical jump at lower lumbar levels in 18 healthy participants. They reported an increase in vertical jump in the mobilization group.[54] Chi-ngai et al. investigated the effect of mobilization applied to the L2 - L3 level on hip flexor strength and torque in 24 healthy participants. They showed that spinal mobilization applied to this region led to an increase in hip flexor muscle strength and torque.[55]

Costa et al. compared the effect of static stretching and spinal manipulative therapy on the performance of golf athletes in 43 healthy golf athletes in their 2009 study and found that the spinal manipulation group was more advanced in performance.[56] Powers et al. investigated the effect of posteroanterior spinal mobilization and press-up exercise on lumbar extension and pain in 30 healthy individuals. They found that there was a decrease in pain and an increase in spinal extension in both groups but no statistical difference between them.[57] Corne divided 30 asymptomatic athletes into three groups; the first group received lumbar and spinal manipulation, the second group received only lower extremity manipulation, and the third group received lumbar spinal manipulation, pelvis and lower extremity manipulations and compared their effects on agility. There was an increase in agility parameters in all three groups, but the highest increase was realized in the third group with 1.86 seconds.[58] Thomas et al. applied spinal manipulation to 38 soccer players with an average age of 17 years to increase the strength of the lower extremities. They observed an increase in vertical jump, hand grip strength, and postural control in soccer players who received cervical and lumbosacral manipulation.[59] Lin and Piong showed that chiropractic practitioners increased the athletic performance of athletes using spinal manipulation and mobilization techniques, improved biomechanical athletic abilities, decreased risk of injury, and increased recovery speed in athletes receiving chiropractic treatment.[60]

As a result of our measurements, the manipulation application was superior to both the mobilization application and the control group in the parameters of left hip extension, right hip external rotation, lumbar flexion, lumbar extension, T-Test (seconds), 10-meter sprint (seconds). In addition, mobilization treatments were superior to those of the control group. When the right hip abduction, left hip external rotation, and vertical and horizontal jump (cm) parameters were examined, the mobilization treatment was superior to both the manipulation and the control group.

When we compared the manipulation group with the control group, data were obtained in favor of manipulation in right hip abduction. They left hip external rotation, while results were obtained in favor of the control group in vertical and horizontal jumps. When we look at the literature, both manipulation and mobilization methods contribute to athletes. However, results similar or not similar to the literature were obtained in different parameters. In our study, subjects were evaluated using 20 different parameters. No superiority was observed when manipulation and mobilization applications were compared in ten different parameters. Only six parameters (hip extension (right), hip external rotation (right), lumbar flexion, extension, T-Test

and 10 meter sprint) showed superiority in manipulation and four parameters (hip abduction (right), hip external rotation (left), vertical and horizontal jump) showed superiority in mobilization. We believe that manipulation and mobilization applied to the L3 segment in volleyball athletes may positively affect sports.

The strengths of our study are that the subjects participating in the survey were professional athletes; the groups were randomized by simple random sampling method; the groups were homogeneous since there was no statistically significant difference in the comparison of T0 data between the groups when age, height, hip flexion, hip abduction, hip adduction, hip adduction, hip external rotation, right hip internal rotation, horizontal jump parameters were examined; as a result of the literature review, the number of studies comparing manipulation and mobilization techniques in terms of sport is small. One of the weaknesses of our study is that the immediate effects of manipulation and mobilization applications were examined, and all of the participants were male.

CONCLUSION

The immediate effect of this application was examined, but the positive impact of manipulation and mobilization may be beneficial for athletes when applied before the competition and between halves. It is recommended that the study be conducted using longer application protocols, on different sports branches, on different age groups, on women, using various evaluation methods, and using different manipulation or mobilization concepts.

Conflicts of interest

The authors declare that they have no financial conflicts of interest regarding the topics included in the text.

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The sponsor wasn't involved in the research in any way that the authors are aware of, that could have affected the findings.

Authors' contributions

Conceptualization: [ICB, SHH, EBA]; Design: [ICB, SHH, EBA]; Writing: [ICB, SHH]; Investigation/Data collection: [ICB, SHH]

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ORIGINAL RESEARCH

Investigation of Antitumor Activity of Fenugreek Paste Extracts

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Abstract

Objective: Fenugreek paste, which contains fenugreek and spices, is a popular food in Kayseri and the surrounding region of Türkiye. This study aims to evaluate the antitumor effects of an extract derived from fenugreek paste in Balb/C mice bearing Ehrlich ascites tumor (EAT).

Materials and Methods: In the *in vivo* experiments, fenugreek paste extract was administered at concentrations of 200 mg/kg or 400 mg/kg. For the *in vitro* study, extract concentrations of 250, 500, and 1000 µg/mL were used. At the end of the experiment, the volume of abdominal ascites fluid was measured, and cell counts were performed.

Results: Fenugreek paste extract delayed weight gain due to EAT cell proliferation in the treatment groups and caused a significant decrease in the number of cells in the ascites fluid in the 400 mg/kg extract group (47.28×10^6) compared to the control group (67.60×10^6; p=0.041). Histopathological analysis revealed that EAT cells adhered intensely to tissues in the control group but adhered less in the treatment groups. The most significant decrease was observed in the 400 mg/kg fenugreek extract group. After 24 hours of culture, there was a substantial difference in EAT cell viability between the control group (5.9±0.2) and the treatment groups receiving 250, 500, and 1000 µg/mL of fenugreek paste extract (5.7±0.2, 5.7±0.2, and 5.6±0.1, respectively; p=0.013).

Conclusion: The study results suggested that fenugreek paste extract had an antitumor effect on EAT cells.

Keywords: Ehrlich Ascites Tumor, Fenugreek Paste, Fenugreek, Red Pepper, Garlic

INTRODUCTION

According to the World Health Organization (WHO), cancer is one of the leading causes of death worldwide. Although anticancer treatment research and development efforts are well-funded and active, cancer remains a significant threat to human health. As a result, there is a strong interest in cancer research for more effective treatments with fewer side effects[1].

Chemopreventive agents are an innovative field in cancer prevention. They are used in conjunction with pharmacological, biological, and nutritional interventions. Previous studies have shown that non-toxic fruits and vegetables contain phytochemicals [2]. It is well-established that dietary habits and nutrition play important roles in cancer prevention. Numerous epidemiological studies have shown that a diet high in vegetables and fruits reduces the risk of cancer[3]. Recently, studies have focused on naturally occurring biologically active substances, diet, and chemical cancer preventive agents in medicinal plants. Many biologically active substances exhibit chemotherapeutic activity by blocking cell cycle progression and triggering apoptotic cell death[4].

Phytochemicals derived from spices and herbs possess significant anticancer properties. The potential anticancer effect of fenugreek paste, comprising fenugreek[4,5], red pepper[6], garlic[7], and cumin[8], which is consumed in Central Anatolia in Türkiye, has not yet been studied. Fenugreek paste is commonly consumed as a food and used as a mixture in pastry production in Kayseri and the surrounding region. The mixtures obtained from companies in the province of Kayseri that produce fenugreek paste are generally similar in content. The fenugreek paste is composed of approximately 50% water and 50% herbal mixture. The herbal mixture is primarily made up of fenugreek (33%–37%), red pepper (3.5%–22.5%), garlic (5%–7%), and cumin (1%–2.5%), as well as small amounts of black pepper, allspice, ginger, coriander, clove, and cinnamon (each less than 1%). The literature provides the following percentages for the contents of fenugreek paste: The mixture consists of 40% fenugreek seed powder, 7.5% vetch flour, 2.5% wheat flour, 20% flaked red pepper (5% Kayseri, 10% Nazilli, and 5% Kahramanmaraş pepper), 30% garlic, and 0.1% dye (2/3 Pounceau 4R. E 124 + 1/3 Sunset Yellow E 120)[9,10]

Fenugreek (*Trigonella foenumgraecum* L.) is an aromatic herbaceous annual plant belonging to the Papilionaceae, a subfamily of the family Leguminosae. It is widely grown in Mediterranean countries and Asia and is one of the ancient medicinal plants of India and North Africa[11, 12]. The extracts and powders of leaves and seeds are widely used in medicinal preparations. Seeds are the main source of many elements, such as calcium, phosphorus, iron, zinc, and manganese[11, 12, 13]. Fenugreek has reportedly been used in the treatment of many diseases. It has been shown to have apoptosis-promoting and anticancer effects on breast cancer cells[4, 5].

Laboratory studies in rodents are essential for identifying cancer-causing chemicals in humans. Epidemiological studies in laboratory animals have also been one of the best methods for determining carcinogenic potential in long-term studies[14]. Various chemical agents can be administered in different ways (intraperitoneal, intravenous, or subcutaneous) to generate tumor models with multiple characteristics in experimental animals. Solid tumors are transplanted through subcutaneous, intradermal, intramuscular, intraperitoneal, or intravenous injection of cell suspensions. The transplanted tumors are similar in their early formation phases to the spontaneous tumors from which they originate. An example of this model is the Ehrlich ascites tumor (EAT)[15, 16].

Research studies aimed at developing effective cancer treatments and new methods are currently being conducted on tumors formed in experimental animals. Ehrlich and Apolant (1905) first acquired Ehrlich ascites tumor (EAT) from a female mouse with spontaneous breast adenocarcinoma. They subcutaneously transplanted tumor fragments from mouse to mouse, which eventually led to the development of an experimental tumor. In 1932, Loewenthal and Jahn managed to cultivate a liquid-growing form of this tumor in the peritoneum of mice. The tumor was named after the formation of ascites liquid and cells in the peritoneum[17, 18]. Depending on the study's purpose, EAT is used either ascites or in a solid form. The ascite fluid containing tumor cells is injected intraperitoneally into an experimental animal to obtain an ascitic form. On the other hand, a solid form is obtained by subcutaneously injecting the same fluid[15]. The study investigated the effects of fenugreek on EAT cells in both *in vivo* and *in vitro* settings.

MATERIALS AND METHODS

In this study, the appropriateness of animal practices for animal rights and animal experimentation ethics was approved by the Erciyes University, Experimental Animal Local Ethics Committee Decision dated 12.03.2014 No: 14/053. The project that the code TDK-2014-5325 was supported by Erciyes University Scientific Research Projects Unit.

Species, number, and distribution of subjects in the research

The study used 40 male Balb-c mice, eight weeks old, weighing 25-30g. The mice were divided into four groups, each containing ten mice. They were housed in temperature-controlled rooms with a constant temperature of 21°C and a 12-hour light/dark cycle. The mice were fed standard pellet feed.

Experimental procedure

The study utilized cells obtained through intraperitoneal injection of Ehrlich ascites tumor (EAT) cells into Balb/c mice, followed by the reproduction of EAT cells in a culture medium.

Plant material

The fenugreek paste was made by mixing fenugreek (35%), red pepper (5%), garlic (5%), cumin (2%), black pepper (0.5%), cloves (0.5%), coriander

(0.5%), cinnamon (0.5%), ginger (0.5%), and allspice (0.5%). The water, which makes up 50% of the paste, was excluded. A powdery fenugreek mixture was obtained by mixing the remaining ingredients. The appropriate amounts of extracts for the study were determined based on a literature review[16, 19, 20,38]. In this study, we added extracts obtained from a mixture of fenugreek at concentrations of 250, 500, and 1000 µg/mL to the culture medium of EAT cells to evaluate their *in vitro* effects. Additionally, we intraperitoneally injected fenugreek extracts at doses of 200 mg/kg and 400 mg/kg to investigate their impact on liquid tumor cells *in vivo*.

Preparation of fenugreek paste extract

The fenugreek powder (500 g) underwent three 24-hour extractions at 37°C in a shaking water bath using 70% methanol. The extracts were combined and concentrated using a rotary evaporator under vacuum at 37°C–38°C. Subsequently, the extract was lyophilized and stored at −20°C until analysis. Before use, the fenugreek paste extract was dissolved in a 5% ethanol solution.

Calculation of total phenolic content

The extract's total phenolic content was determined using the Folin-Ciocalteu method and expressed as gallic acid equivalents (GAEs)[21]. To a 10 mL container containing 6 mL of distilled water, 100 µL of sample solution and 500 µL of Folin-Ciocalteu reagent were added. After one minute, 1.5 mL of 20% aqueous Na2CO3 was added, and the mixture was diluted to 10 mL with water. The control consisted of the extract-free reagent mixture. After incubating at 25°C for 2 hours, we measured the absorbance at 760 nm and compared it with the GAE calibration curve. We calculated the total phenolic content of the substance as GAEs. We performed three parallel experiments, and the results are presented as mean values.

***In vivo* studies**

Experimental groups

Group 1, Negative control (- control): This group did not develop cancer and was fed a regular diet for 7 days. Normal saline (NS) was administered via intraperitoneal injection for 7 days.

Group 2, Positive Control (+ control): The mice in this group were intraperitoneally injected with 0.1 mL ascites fluid containing 1×10^6 EAT cells in the abdomen on day 0. From day 0, mice were intraperitoneally injected with 0.5 mL of NS for 7 days.

Group 3, 200 mg/kg: The mice in this group were intraperitoneally injected with 0.1 mL ascites fluid containing 1×10^6 EAT cells in the abdomen on day 0. From day 0, mice were intraperitoneally injected with 200 mg/kg of fenugreek paste extract for 7 days.

Group 4, 400 mg/kg: The mice in this group were intraperitoneally injected with 0.1 mL ascites fluid containing 1×10^6 EAT cells in the abdomen on day 0. From day 0, mice were intraperitoneally injected with 400 mg/kg of fenugreek paste extract for 7 days.

The study evaluated the effects of fenugreek paste extract on tumor development by monitoring daily nutrient and water consumption, weight gain, and tissue pathology. The animals' weight was measured daily to track tumor development in relation to their body weight before tumor inoculation. Additionally, macroscopic evaluations were conducted to assess general morphological appearances, including hair loss, defecation disorders, and anal lesions. On day 8, ascites fluid was collected from the abdominal cavities of all groups of mice under general anesthesia, and the anticancerogenic effect of fenugreek paste extract was assessed by cell counting. Additionally, intraperitoneal organs were taken for histopathological evaluation. For this purpose, the tissues were stained with hematoxylin and eosin.

***In vitro* studies**

Cell culture experiments

For the *in vitro* study, Dulbecco's Modified Eagle's Medium was used, which contained 10% fetal bovine serum, 100 U penicillin, and 100 mg/mL streptomycin. The fenugreek paste extract was dissolved in 0.02 mL of solvent and administered in three doses. The amount of medium and the EAT cell count were kept equal for each group. EAT cells from the stock animal were counted to determine 2.5×10^6 cells (Table 1). A total of 24 wells were seeded for each group. Accordingly, 104166 cells were seeded into each well (2.5×10^6 cells/24). The experimental groups were treated with EAT cells and extracts obtained from the fenugreek mixture at concentrations of 250, 500, and 1000 µg/mL, while only EAT cells were added to the medium in the control group. The culture dishes were then incubated for 3 and 24 hours.

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Table 1. The amounts of fenugreek extract, cells, and medium used in cell culture were recorded for each group, with 24 wells.

	Extract	Number of cells	Medium
Control	-	$2.5x10^6$ cells (1 mL)	4 mL (medium)
Group 1	1250 µg fenugreek + 0.02 mL solvent	$2.5x10^6$ cells (1 mL)	3.98 mL (medium)
Group 2	2500 µg fenugreek + 0.02 mL solvent	$2.5x10^6$ cells (1 mL)	3.98 mL (medium)
Group 3	5000 µg fenugreek + 0.02 mL solvent	$2.5x10^6$ cells (1 mL)	3.98 mL (medium)

Evaluation of EAT cells *in vitro*

Cells cultured for 3 and 24 hours were transferred to 100-µl Eppendorf tubes and then pipetted with 100 µL of Trypan blue. The culture was transferred to 100 µl Eppendorf tubes and then treated with 100 µL of Trypan blue. From the resulting cell and Trypan blue solution, a 50 µL aliquot was taken and placed into the wells of a Thoma slide. The counting area was identified using 40X objective lenses, and transparent living cells were distinguished from non-living cells containing blue dye and counted separately.

Statistical evaluation

The data were analyzed using IBM SPSS Statistics 22.0 (IBM Corp., Armonk, New York, USA). Descriptive statistics were given as the number of units (n), percentage (%), mean ± standard deviation ($\bar{x} \pm ss$), and median (25^{th} and 75^{th} percentiles). The normal distribution of numerical variables was assessed using the Shapiro–Wilk normality test and Q-Q graphs. Comparisons of the groups according to time were made by two-way analysis of variance for variables with normal distribution and multiple comparisons by performing Tukey's honest significant difference test. Intergroup comparisons were made by performing Kruskal–Wallis analysis for variables with non-normal distribution. If there was a difference due to the Kruskal–Wallis analysis, the Dunn test was used as the multiple comparison test. Wilcoxon analysis was used for intragroup comparisons for variables that did not show normal distribution. A value of $p < 0.05$ was considered statistically significant.

RESULTS

Analysis results of fenugreek

The fenugreek paste extract was analyzed for its phenolic substance content by the Department of Pharmacognosy at Erciyes University's Faculty of Pharmacy. The results showed a content of 51.832±1.632 mg GAE/g.

***In vivo* findings**

Weight tracking in experimental groups

When comparing weight gain between the experimental groups, no significant difference was observed in the negative control group. However, significant differences were observed in the positive control and experimental groups. In the positive control group, the difference between the weights on day 1 and day 4 was significant (p=0.006), and the difference increased on days 5, 6, and 7. In the groups receiving fenugreek in doses of 200 and 400 mg/kg, there was a significant difference between days 1 and 5 (p=0.001), and the difference increased on the following days. It should be noted that the experimental groups experienced significant weight gain on day 5, indicating that fenugreek delayed weight gain for one day (Table 2 and Figure 1).

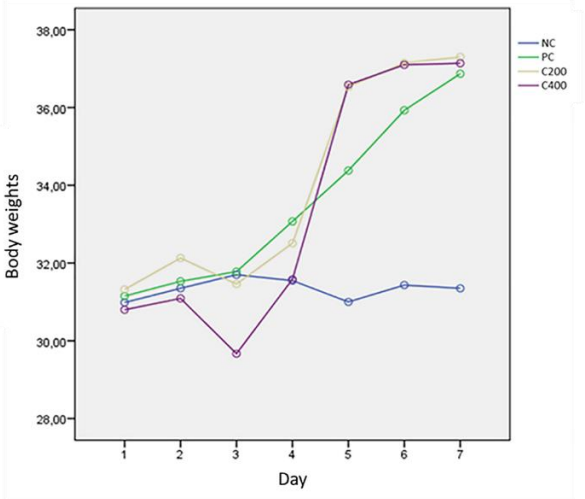

Figure 1. The daily weight tracking graph for the body weights of the experimental groups

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Table 2. The daily weight tracking results for the body weights of the experimental groups.

Groups	Day 1 M±SD	Day 2 M±SD	Day 3 M±SD	Day 4 M±SD	Day 5 M±SD	Day 6 M±SD	Day 7 M±SD
Negative control	30.98±2.3	31.35±2.3	31.70±23	31.55±2.2	31.00±2.0	31.43±2.2	31.35±2.0
Positive control	31.15±1.7	31.53±2.3	31.78±1.9	33.07±2.2	34.38±2.5	35.93±2.3	36.87±2.3
200 mg/kg	31.32±1.0	32.13±1.5	31.46±1.6	32.51±1.7	36.53±1.3	37.15±1.5	37.30±1.9
400 mg/kg	30.80±1.3	31.09±1.0	29.67±2.3	31.58±2.1	36.59±2.0	37.10±2.3	37.14±2.6

Total volume and packed volume calculations of intraperitoneal ascites fluid

At the end of the experiment, ascites fluid was extracted from the abdomen of all animals using an injector, and the total volume was calculated. The liquid was then centrifuged at 1000 rpm for 5 minutes, the supernatant fraction was discarded, and the remaining volume was calculated as the packet volume. The total volume results for the positive control and treatment groups (200 mg/kg and 400 mg/kg) were 6.4±1.9 cc, 6.7±1.7 cc, and 6.9±2.2 cc, respectively. The treatment groups had a higher total volume than the positive control group, but a lower packed volume (4.3±1.0, 4.0±1.1, and 4.2±1.7 cc, respectively). The supernatant volume was measured as 2.1±1.4, 2.7±0.9, and 3.0±1.3 cc in the positive control and treatment groups (200 and 400 mg/kg), respectively (Table 3).

Table 3. Total, packed, and supernatant volume results of ascites fluid obtained from the abdomen

Group	Total volume	Packed volume	Supernatant
Negative control	---	---	---
Positive control (n=10)	6.4±1.9 cc	4.3±1.0 cc	2.1±1.4 cc
EAT cell + 200 mg/kg fenugreek (n=10)	6.7±1.7 cc	4.0±1.1 cc	2.7±0.9 cc
EAT cell + 400 mg/kg fenugreek (n=10)	6.9±2.2 cc	4.2±1.7 cc	3.0±1.3 cc

The cells in the ascites fluid collected from the animals were counted by staining with trypan blue. The mean numbers of live cells in 1 mL were 67.60×10^6, 55.08×10^6, and 47.28×10^6, respectively, as shown in Table 4. The treatment groups showed a statistically significant decrease in live cells per 1 mL compared to the positive control group. The 400 mg/kg group had the most significant decrease ($p=0.041$).

Table 4. Mean number of cells in intraperitoneal ascites fluid in experimental groups

Group	Mean number of cells (1 mL)
Negative control	---
Positive control (n=10)	67.60×10^6
EAT cell + 200 mg/kg fenugreek (n=10)	55.08×10^6
EAT cell + 400 mg/kg fenugreek (n=10)	47.28×10^6

The reduction in ascites fluid volume in treatment groups compared to the positive control group suggests that the fenugreek paste extract may have inhibited the proliferation of EAT cells, rather than reducing the volume of the cells themselves. This is supported by the mean cell numbers presented in Table 3.

Histopathological results

On day 8, all mice in the experimental groups were subjected to intramuscular general anesthesia, and their kidney, liver organs were extracted. The intra-abdominal organs of the animals that were intraperitoneally injected with EAT cells did not exhibit any morphological differences compared to the healthy control group. Routine histopathological follow-up was performed on the extracted tissues. 5-µm-thick sections were taken and stained using the hematoxylin and eosin method. The examinations revealed normal histological features in the healthy control group tissues. In contrast, the EAT cell groups showed scattered EAT cell populations in the tissue capsule in the form of connective tissue. Upon histopathological examination of the EAT cells, it was observed that they varied in size and shape, each containing a large hyperchromatic nucleus and eosinophilic cytoplasm (Figure 2).

It was found that the EAT cells invaded the connective tissue capsule in organs of the healthy, tumor control, and treatment groups. The cells were characterized by a large hyperchromatic nucleus, eosinophilic cytoplasm, and distinct morphological features. Although the EAT cells exhibited intense

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aggregation in the tumor control group, they were individually observed surrounding the connective tissue capsule in the treatment groups (Figures 3 and 4).

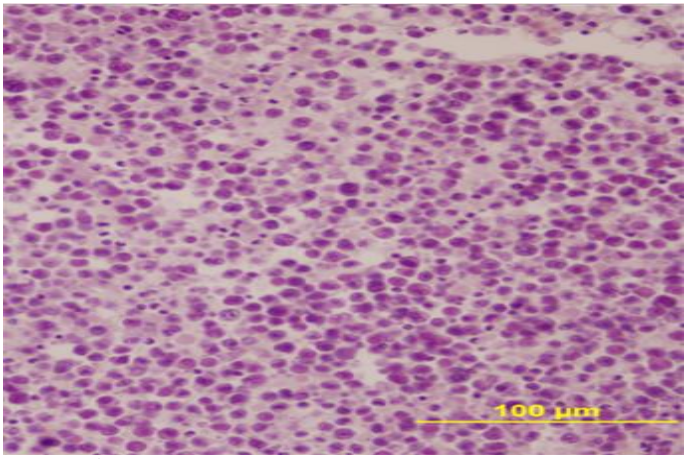

Figure 2. Histopathological view of EAT cells (H&E 40X).

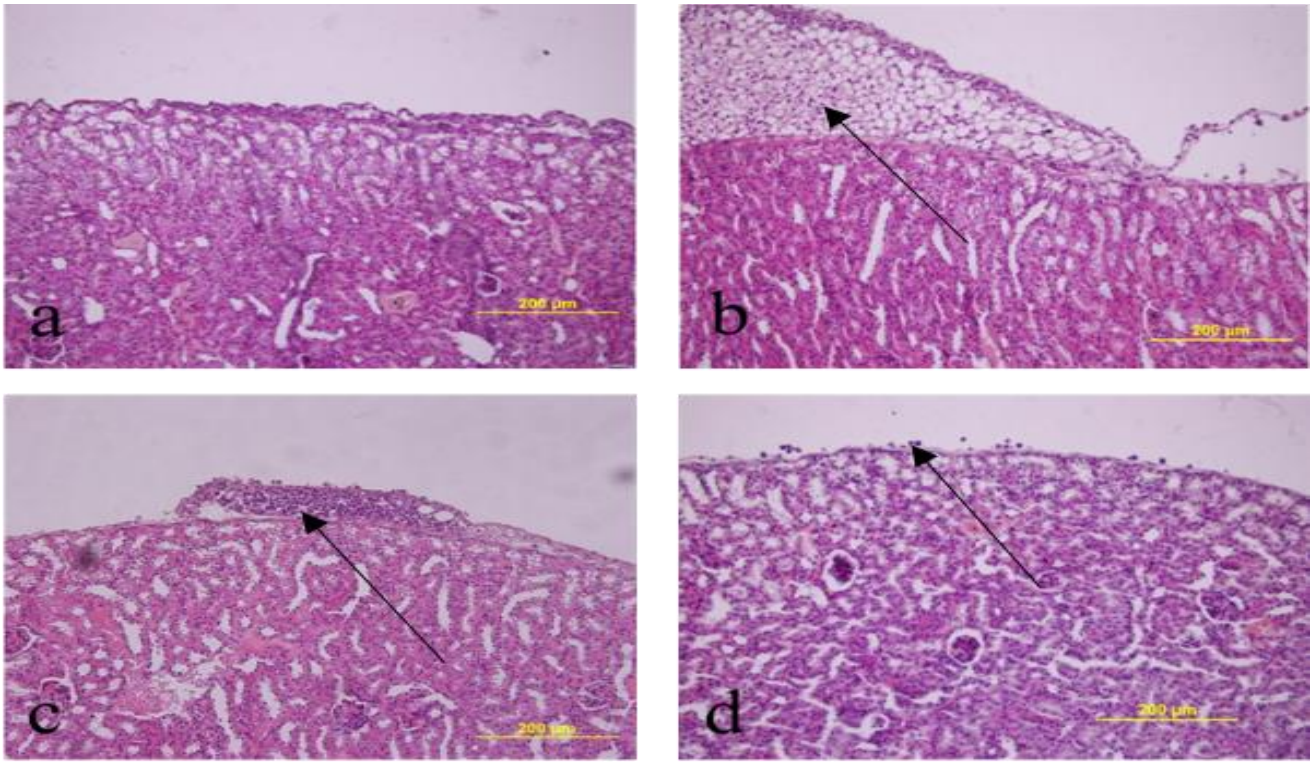

Figure 3. The histological and histopathological findings of kidney tissue in groups are presented in Figures a-d. a) The healthy control group (H&E, 20X). b) Tumor control group (H&E, 20X). c) The group that received 200 mg/kg of fenugreek (H&E, 20X). d) The group that received 400 mg/kg of fenugreek (H&E, 20X). The EAT cell, which invades the kidney capsule, is represented by the black arrow.

In vitro findings

Effect of fenugreek paste extract on cell-cultured EAT cells

The effect of fenugreek paste extract on EAT cells was evaluated *in vitro* using 3- and 24-hour culture results. A literature review of cell culture studies revealed that the extract was used at 250, 500, and 1000 µg/mL concentrations. The cell count of EAT cells was measured after incubation periods of 3 and 24 hours. Following 3 and 24 hours of cell culture in

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the positive control group, the number of living and dead cells were recorded as 5.3 ± 0.2/0.7±0.1 and 5.9±0.2/5.3±0.2, respectively. In the 250 µg/mL group, the numbers were 5.4±0.2/0.7±0.1 and 5.7±0.2/5.5±0.1, respectively. In the 500 µg/mL group, the numbers were 5.3±0.2/0.7±0.1 and 5.7±0.2/5.5±0.1, respectively. In the 1000 µg/mL group, the numbers were 5.2±0.2/0.7±0.1 and 5.6±0.2/5.7±0.1, respectively (Table 5).

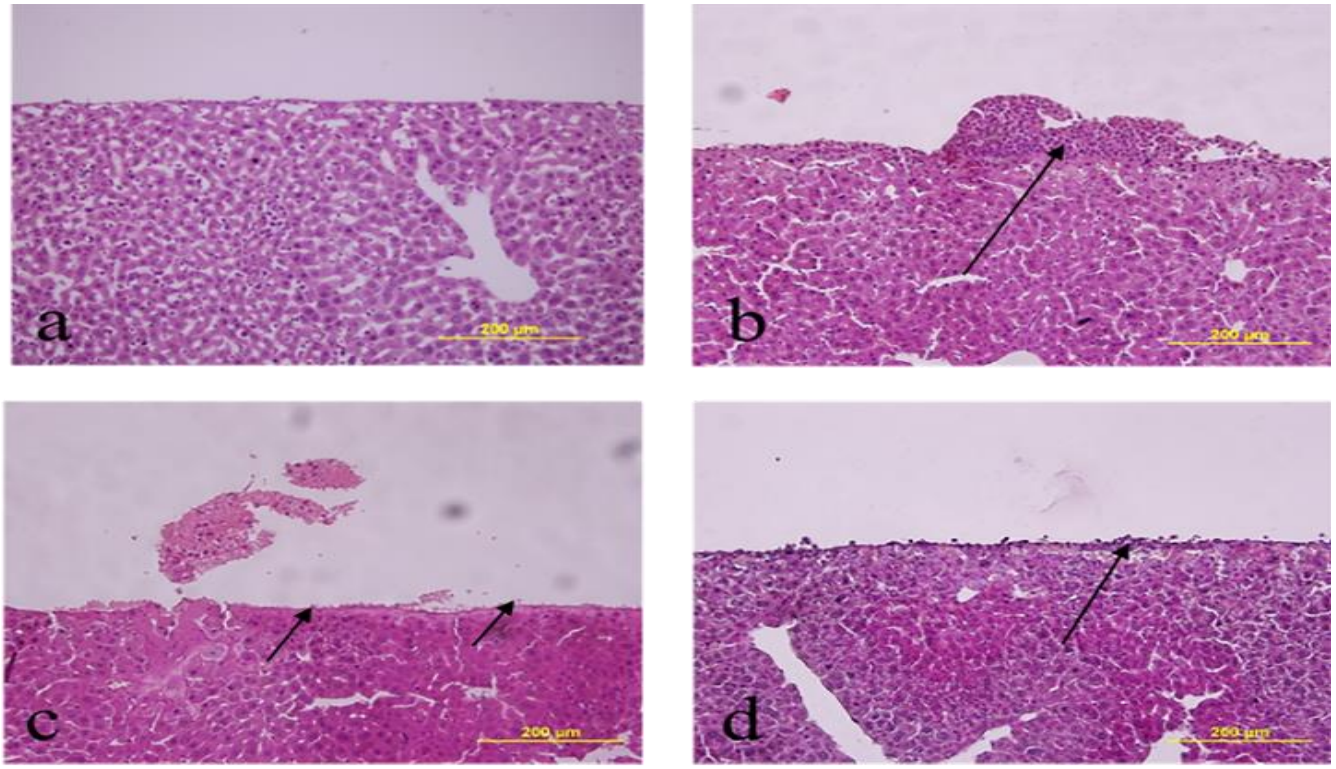

Figure 4. The histological and histopathological findings of liver tissue in in groups are presented in Figures a-d. a) The healthy control group (H&E, 20X). b) Tumor control group (H&E, 20X). c) The group that received 200 mg/kg of fenugreek (H&E, 20X). d) The group that received 400 mg/kg of fenugreek (H&E, 20X). The EAT cell, which invades the peritoneum surrounding the liver tissue by the black arrow.

Table 5. The statistical evaluation involved taking the logarithm of the data obtained from the 3- and 24-hours cell culture results.

Group	Mean number of living cells±SD (3-hour)	Mean number of dead cells±SD (3-hour)	Mean number of living cells±SD (24-hour)	Mean number of dead cells±SD (24-hour)
Positive control	5.3 ± 0.2	0.7 ± 0.1	5.9 ± 0.2	5.3 ± 0.2
EAT cell + 250 µg/mL	5.4 ± 0.2	0.7 ± 0.1	5.7 ± 0.2	5.5 ± 0.1
EAT cell + 500 µg/mL	5.3 ± 0.2	0.7 ± 0.1	5.7 ± 0.2	5.7 ± 0.1
EAT cell + 1000 µg/mL	5.2 ± 0.2	0.7 ± 0.1	5.6 ± 0.1	5.7 ± 0.2

There were no significant statistical differences in dead and living cell numbers among the groups cultured for 3 hours. However, in the groups cultured for 24 hours, there were significant differences in the numbers of living cells between the positive control and 250 µg/mL (p=0.013), the positive control and 500 µg/mL (p=0.029), and the positive control and 1000 µg/mL (p=0.000). Significant differences were found in the number of dead cells between the positive control and the groups cultured with 250 µg/mL (p=0.024), 500 µg/mL (p=0.000), and 1000 µg/mL (p=0.000) for 24 hours. Additionally, significant differences were found between the 250 µg/mL and 500 µg/mL groups (p=0.033). An increase in the number of dead cells was observed with increasing

concentrations in the treatment groups. The EAT cells were imaged and photographed using a 20X objective lens in cell culture (Figure 5).

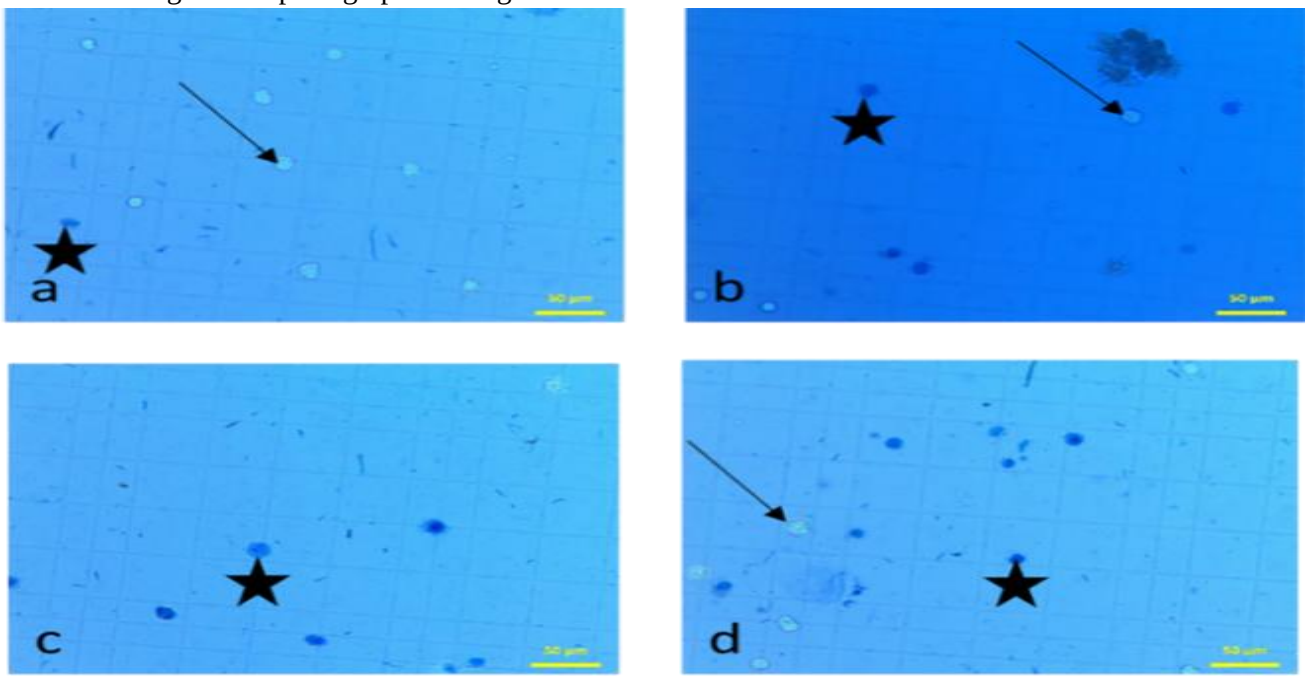

Figure 5. Images of living and dead EAT cells on the Thoma slide *in vitro* experimental groups. Arrow: Living EAT Cells, Star: Dead EAT Cells. a) Tumor control group b) 250 µg/mL fenugreek group. c) 500 µg/mL fenugreek group. d) 1000 µg/mL fenugreek group. (20X)

DISCUSSION

Flavonoids and phenolic compounds are used in cancer treatments, including chemotherapy. Phenolic compounds have been found to possess antioxidant, anti-inflammatory, and anticarcinogenic properties. Studies have demonstrated the anticarcinogenic effects of many plant species. It is believed that there may be a link between including such plants in the diet and reduced cancer rates[22]. Our study found that a fenugreek mixture, commonly consumed by locals, has antitumor effects. Fenugreek has a wide range of therapeutic applications. Studies show that the components of the extract have antioxidant effects[23, 24], as well as antidiabetic, antihypertensive, cholesterol-lowering, and anti-inflammatory effects[11, 25, 26]. Studies have reported that fenugreek extract increases apoptosis depending on dose and time[23, 27, 28]. Additionally, studies performed with the plants forming the mixture of fenugreek have reported anticarcinogenic effects. Sur et al. (2001) conducted an *in vivo* study on EAT cells, testing a fenugreek seed extract at 100- and 200-mg/kg treatment groups[17]. They reported a 70% inhibition of tumor cells compared to the control group. *In vitro* tests on cancer cells using fenugreek extract at concentrations ranging from 10-1000 µg/mL have shown a reduction in the number of living cells, particularly at concentrations ≥250 µg/mL[19]. In a separate *in vivo* study, it was found that administering 200 mg/kg of fenugreek extract intraperitoneally inhibited tumor cell proliferation by 70%[20]. Thoennissen et al. (2010) determined the dose of capsaicin, the active ingredient of red pepper, as 2 × 10-4 M in vitro. In an *in vivo* study, the amount of dose inhibiting the growth of solid tumor was 5 mg/kg/day[24]. Ban et al. (2007) investigated the effect of garlic extract on colon cancer in varying doses (30–150 µg/mL). The study found that the effective dose for SW620 colon cancer was 105 µg/mL, while for HCT116 colon cancer it was 130 µg/mL[25]. Pradeep et al. (2002) examined the effects of black pepper on melanoma cells and induced lung metastasis in mice. The study found that the active ingredient in black pepper, piperine, was present in the range of 10-100 µg/mL. A dose of 100 µg/mL was reported to be 100% effective[26]. Dwivedi et al. (2011) investigated the effect of clove extract on different cancer cell lines at 100, 200, and 300 µg/mL. They reported that the maximum cell death observed was 80% in groups administered 300 µg/mL of clove extract in a 24-hour cell culture[27]. Flores et al. (2010) reported

antitumor effects of coriander on lymphoma cells[28]. Kwon et al. (2009) investigated the effects of cinnamon extract on B16F10 and Clone M3 mouse melanoma cells through gavage and injection into the tumor. They reported that both treatments inhibited tumor growth[29] Karna et al. (2012) investigated the effect of ginger extract on prostate cancer cells. The study found that ginger extract reduced tumor volume *in vivo*. A high concentration of 1000 µg/mL was effective in shorter-term cell culture, while a low concentration of 50 µg/mL was effective in longer-term cell culture in vitro[30]. Jenny et al. (2005) evaluated the effect of an herbal mixture, including allspice extract, on lymphocytic leukemia cell line. The mixture was found to be effective at doses of 0.4 mg/mL and 1.0 mg/mL[31].

The literature review showed that the plant extracts used in fenugreek have anticarcinogenic effects. Although these plants are commonly used as spices, seasoning, aromatizers, and appetizers, they are also used as nutrients or preservatives in certain foods, such as pastrami, as in the case of the fenugreek paste used in Kayseri and Central Anatolia. These spices also have a significant place in traditional medicine. They are used in many diseases and their effects have been shown in *in vitro* and *in vivo* studies[32, 33, 34]. Phenolic compounds are secondary metabolic products commonly found in plants. Studies have shown that the phenolic content of fenugreek spices varies. Research has also been conducted on the total phenolic content of plants. In a study by Omezzine et al. (2013), the total phenolic content of fenugreek was 13.98 mg GAE/g[35]; in a study by Vega-Gálvez et al. (2009), the total phenolic content of red pepper was 43.2 mg GAE/g[36]; in a study by Chen et al. (2013), the total phenolic content of garlic was 21.27–33.96 mg GAE/g[37]; in a study by Alinian et al. (2016), the total phenolic content of cumin was 11.9–14.4 mg GAE/g[38]; in a study by Ahmad et al. (2014), the total phenolic content of cumin was 1.86–9.91 mg GAE/g [39]; in a study by Adefegha et al. (2012), the total phenolic content of clove was 0.88 mg GAE/g[40]; in a study by Tang et al. (2013), the total phenolic content of coriander was 1.73–1.38 mg GAE/g[41]; in a study by Krishnan et al. (2013), the total phenolic content of cinnamon was 11.11–12.4 mg GAE/g[42]; and in a study by Simon–Brown et al. (2016), the total phenolic content of ginger was 7.74 mg GAE/g[43]. In our study, the total phenolic content of fenugreek mixture was 51.832 ± 1.632 mg GAE/g and the phenolic content of the fenugreek mixture was higher than the phenolic content of each of the plants. The fenugreek mixture may have a higher phenolic content, which could result in greater antioxidative and anticarcinogenic effects.

This study investigates the effects of fenugreek paste extract on EAT cells *in vivo* and in vitro. The results of the *in vivo* study indicate that EAT cells administered intraperitoneally caused rapid weight gain in the control group animals, while there was a delay in weight gain in the 200- and 400-mg/kg per day fenugreek paste extract treatment groups. At the end of the experiment, a cell count was conducted by draining the ascites fluid in the peritoneum from the experimental animals using a liquid injector. The results showed a decrease in the number of living cells in the treatment groups. The weight gain and decrease in cell count observed suggest that the fenugreek paste extract inhibited the rapid growth of percutaneously injected EAT cells in the treatment groups. Histopathological examination of the tissues from the control and treatment groups showed that the EAT cells adhered more strongly to the tissues from the control group. Additionally, cancerous cell adhesion was observed in the experimental groups, particularly in the 400-mg/kg fenugreek extract treatment group. The *in vitro* findings supported the *in vivo* findings. The fenugreek paste extracts, which were increased in concentration (250, 500, and 1000 µg/mL) after 3 and 24 hours of culture, reduced the vitality rate of the EAT cells.

CONCLUSION

The study results indicate that the fenugreek paste extract, in the concentrations administered, did not completely inhibit the proliferation of EAT cells. However, it caused a decrease in the number of living cells. These findings are consistent with the literature cited above and could contribute to further research on this subject. The results suggest that the regional nutrient fenugreek may be useful in slowing down the formation and development of cancer.

Author contributions

Harun Ulger, Serife Alpa ve Tolga Ertekin designed the experiments; Serife Alpa, Ozlem Bozkurt, Seher Yilmaz, Mehtap Nisari, Gokce Seker Karatoprak ve Tolga Ertekin performed experiments and collected data; Şerife Alpa, Ozlem Bozkurt, Seher Yilmaz, Mehtap Nisari ve Tolga Ertekin perfomed analysis and Interpretation of Results; Harun Ulger, Serife Alpa ve Tolga Ertekin discussed the results and strategy; Serife Alpa, Ozlem Bozkurt, Seher Yilmaz, Mehtap Nisari, Gokce Seker Karatoprak, Tolga Ertekin, Harun Ülger final approved of the version to be published.

Conflict of Interest

There is no conflict of interest between the authors.

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ORIGINAL RESEARCH

University Students' Attitudes Towards Traditional and Complementary Medicine Practices

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Abstract

Objective: This study investigates how university students, a well-educated segment of society, perceive traditional and complementary medicine (T&CM) practices and their level of healthy lifestyle skills, and how they are related. It also aims to determine whether students' healthy living skills influence their attitudes towards T&CM practices.

Material-Method: This descriptive and cross-sectional study focused on students enrolled in three state universities. A total of 362 student datasets were analyzed. Data were gathered through an online questionnaire comprising inquiries related to students' sociodemographic features, their familiarity with T&CM, the T&CM attitude scale, and the scale assessing their healthy living skills.

Results: The study's findings, the correlation coefficient between the total scores of the students from the T&CM Attitude Scale (114.80±17.95) and the Healthy Living Skills Scale (64.29±8.79) was calculated as r=0.127. There was a positive, statistically significant ($p<0.001$) but a very weak relationship between the scales. The regression analysis showed that a one-unit increase in the healthy living skills scale resulted in a 0.2-point increase in the T&CM attitude scale.

Conclusion: The research revealed that students' attitudes towards T&CM were positive, but there was a lack of knowledge on this subject. Also, results revealed that the number of students who experienced T&CM's implementation was quite low. The capacity of behaviours, beliefs and attitudes to influence society is important. Therefore, understanding them is necessary to reach broader social consequences.

Keywords: Traditional and Complementary Medicine, Healthy Living Skills, University Student

INTRODUCTION

Societies have had different beliefs about the concepts of illness and health due to the age and conditions they lived in. These beliefs and value judgments are also determinants of disease causes and how they are dealt with. In every period, there has been a search for treatment for conditions such as illness or injury with various methods. These searches and methods constitute the basis of medical practices that can be defined as traditional medicine, which originates from folk medicine[1]. According to the World Health Organization (WHO) definition, traditional medicine is "the sum of knowledge, skills, and practices used in the prevention, diagnosis, treatment, and cure of physical and mental illnesses, based on theories, beliefs, and experiences specific to different cultures, which may or may not be explainable"[2*]

Complementary medicine is defined as "health practices that are not part of a country's own traditions or traditional medical practices and are not fully integrated into the dominant health system". In some countries, traditional medicine and complementary medicine are used interchangeably[3].

[†]When we examine the history of traditional

[*] *The term "conventional medicine" is used in the text to refer to the dominant health system.*

[†] *Traditional Indian Medicine, which emerged in the 10th century BC, meaning "science of life" in Sanskrit, and emphasizing preventive and curative health services based on sacred texts and theories.*

medicine, we commonly encounter concepts such as Ayurveda and Chinese Medicine. These systems have in common that they focus on the patient rather than the disease. Both systems approach the assessment of diseases and symptoms with a holistic balance, aiming to improve health and quality of life. Nature, order, and the elements are the starting point of health care[4]. Although the increase in orientation towards nature and the environment and the search for healing dates to ancient times, traditional and complementary medicine practices (T&CM) have increased their popularity and have become frequently used. In particular, the increasing side effects of drugs, the lack of curative treatment for many chronic diseases, the rise in drug costs, and the emergence of new diseases with microbial resistance have led the public to turn to traditional and complementary medicine[5]. On the other hand, the demand for T&CM is not necessarily directly linked to conventional medical practices. There are other factors that influence people's preferences, such as advice from the social environment, religious beliefs, or the idea that T&CM will be good for them[6,7]. This has changed the way healthcare providers view traditional medicine, and the provision of traditional and complementary treatment practices has moved from the community to service providers over time[8].

T&CM practices are effective in many areas such as preventing and treating diseases, developing solutions for mental health problems, and facing the aging population and chronic diseases. At the same time, the international market for herbal products has expanded as pharmaceutical companies have moved into this field, and the need to improve the application and safety of products has come to the fore[9]. It is crucial that such practices are supported by national and international policies to ensure safety, effectiveness, and quality control, and to determine the minimum qualifications of practitioners. In this context, at the Alma Ata Declaration (1978), WHO provided guidance to the participating countries in order to activate T&CM practices and guide countries in this regard[10]. In Turkey, the first legal regulation on traditional and complementary medicine was the "Regulation of Acupuncture Practices" published in 1991[11].

In 2014, the Ministry of Health made a new regulation with the "Regulation on ES and CBA Applications"[12] in order to determine the application methods related to human health, the practitioners of these methods, and the procedures and principles regarding their training and authorization."

With the opening of T&CM application centers for the application of these ancient methods by health professionals, the public's interest and demand for these methods have increased even more. Individuals started to seek information and treatment from health professionals by applying to application centers opened or supported by the ministry. Recently, it is thought that the increase in the tendencies towards healthy living and developing healthy life skills in society has also influenced individuals' tendency towards T&CM practices. It is believed that individuals should have complete and accurate information about these methods because they tend to seek healing and health through these methods. Therefore, revealing the current level of knowledge and determining the attitude towards these practices in society is an important issue.

As a matter of fact, it is necessary to understand the beliefs and attitudes of university students, who constitute the population group with a high level of education, on issues that may have an impact on healthy living and healthy living skills. Their beliefs, attitudes, and behaviors could influence the beliefs and attitudes of other individuals in society. Therefore, it is thought that university students' healthy living skills and attitudes that may be related to these skills should be measured[13-15]. This study primarily aims to determine the attitudes of university students toward T&CM applications and their healthy living skills. Secondly, it endeavors to specify whether university students' healthy living skills influence their attitudes toward T&CM practices.

MATERIALS AND METHODS

The population of this descriptive and cross-sectional study consisted of a total of 877 students studying in health management and health services programmes in three different state universities in Samsun, Isparta and Ankara. The research included the entire population and did not draw a sample. The study included all students who volunteered to participate from three public universities, and no exclusion criteria were applied. The questionnaire forms were collected online (google forms) between January and March 2023. Due to the difficulty in obtaining responses in the online survey, 372 students who volunteered for the survey could be reached. However, 10 questionnaires were not included in the study considering the control questions placed in the questionnaire. Therefore, the analyses were conducted on 362 survey data. To

conduct the research, necessary permissions prior to the data collection process were received (Samsun University Ethics Committee, Issue: E-59760180-044-28440 Date: 13.05.2022).

The questionnaire consists of two parts including information forms and scales. In the first part, there is a socio-demographic information form with questions to determine the age, gender, education, and household income status of the students and a T&CM information form with questions to find out whether students have information about T&CM. The second section of the study consists of the "T&CM Attitude Scale" developed by McFadden and Hernández (2010)[16], which the Turkish validity and reliability conducted by Köse et al[17] and the "Scale of Healthy Living Skills of University Students" developed by Genç and Karaman (2019)[18].

The T&CM attitude scale is 7-point Likert-type and consists of 27 items. The scale consists of 3 sub-dimensions: "Dissatisfaction with Conventional Medicine", "Holistic Balance" and "Philosophical. Congruence with Complementary and Alternative Medicine scale doesn't have a calculated cut-off value. As the scale score increases, the positive attitude towards T&CM increases.

The Healthy Living Skills Scale for University Students is a 4-point Likert-type and consists of 21 questions. The scale consists of 4 sub-dimensions: "Importance Given to Health", "Healthy Nutrition", "Access to Health-Related Resources" and "Health Priority". The lowest score that can be achieved from the scale is 21 and the highest score is 84. As the score increases, healthy living skills increase too.

Statistical analysis

The data obtained from the research were transferred to the Stata 16 (Stata Corp LLC, US) program, codified, and analyzed. The study employed descriptive statistics (percentage, minimum-maximum, arithmetic mean, and standard deviation) in the analysis of the data. Descriptive statistics for categorical variables are shown with the number (n) and percentage (%) values and continuous variables are shown with mean ± standard deviation values. Normality tests were applied to analyze whether the data were normally distributed. Shapiro-Wilk test was used to investigate the conformity to normal distribution. In the comparison of paired groups, the Student T test was used for variables with normal distribution, and the One-Way ANOVA test (Post-hoc; Tukey) was used for comparisons of more than two groups. Mann Whitney U and Kruskal Wallis (Post-hoc; Dunnett) tests were used for data that did not conform to normal distribution. In addition, Pearson correlation analysis was used to determine the relationship between the two scales, and linear regression analysis was performed using the least squares method to determine the factors affecting the scale of attitude towards T&CM. The statistical significance level was accepted as $p<0.05$ in the analyses.

RESULTS

Table 1 presents the numerical and percentage distributions of the sociodemographic characteristics of the participating students, including gender, age, class, income, and their level of knowledge about T&CM (Table 1).

It was determined that most of the university students participating in the study were between the ages of 21 and 25 (59.67%), second-year students (31.22%), and females (65.19%). Furthermore, the data revealed that approximately one-third of the students (30.39%) did not know the meaning of evidence-based medicine and almost all of them (94.75%) did not experience any T&CM implementation.

However, more than one-third of the students (69.06%) did not know that T&CM is practiced by physicians in hospitals, but they were satisfied with the implementation of T&CM by physicians (77.07%). Lastly, it was determined that 1 out of every 8 students (12.15%) had a chronic illness that required constant medical supervision.

Within the scope of the study, descriptive statistics and correlation coefficients were calculated for the scores obtained by the students from the T&CM attitude scale and the healthy living skills scale and its sub dimensions (Table 2).

The average total score of the participants on the T&CM attitude scale is 114.80. The total score of the participants from the healthy life skills scale was calculated as 64.29. The correlation analysis revealed a statistically significant ($p=0.01$), positive but very weak (0.127) relationship between the T&CM attitude scale and the healthy living skills scale. It was determined that there was a statistically significant, positive, and moderate relationship between the sub-dimension of importance given to health and the sub-dimensions of healthy nutrition, access to health-related resources, and health priority. The analysis determined that there was a statistically significant, positive, and moderate relationship between the holistic balance sub-

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dimension of the T&CM attitude scale and the philosophical congruence with the complementary and alternative medicine sub-dimension. This study assumes that all T&CM practices are based on a holistic balance. This result corroborates this assumption (Table 2).

Table 1. Participants' Sociodemographic Characteristics, State of Having Chronic Illness, and Level of Knowledge about T&CM

c	n	%		n	%
Gender			**Know the meaning of evidence-based medicine**		
Female	236	65.19	Yes	93	25.69
Male	126	34.81	Partially	159	43.92
Age			No	110	30.39
≤20	130	35.91	**The state of having a chronic illness**		
21-25	216	59.67	Yes	44	12.15
25≥	16	4.42	No	318	87.85
Class			**Knowing that T&CM is practiced by physicians**		
1st class	69	19.06	Yes	112	30.94
2nd class	113	31.22	No	250	69.06
3rd class	90	24.86	**Satisfaction with the implementation of T&CM by physicians**		
4th class	90	24.86	Yes	279	77.07
Income			No	52	14.36
₺6.000 and below	140	38.67	No idea	31	8.56
₺6.001 - ₺8.000	86	23.76	**Experienced T&CM's implementation**		
₺8.001 - ₺10.000	57	15.76	Yes	19	5.25
₺10.001 - ₺15.000	46	12.71	No	343	94.75
₺15.001 and above	33	9.12			

₺: Turkish lira

Table 2. Descriptive Statistics and Correlation Coefficients for the Scales and Subscales

	Mean+ SD	Min-Max	1	1.1	1.2	1.3	2	2.1	2.2	2.3	2.4
1.Complementary, Alternative and Conventional Medicine Attitude Scale	**114.80±17.95**	**57-175**									
1.1.Philosophical congruence with complementary and alternative medicine	36.29±8.30	14-56	**0.759***								
1.2.Dissatisfaction with conventional medicine	30.72±10.69	10-63	**0.558***	0.049							
1.3.Holistic balance	47.58±8.58	9-63	**0.660***	**0.558***	**-0.126***						
2.Healthy Life Skills Scale in University Students	**64.29±8.79**	**27-84**	**0.127***	**0.273***	**-0.196***	**0.248***					
2.1.Importance given to health	26.04±3.65	13-32	0.063	**0.184***	**-0.199***	**0.202***	**0.862***				
2.2.Healthy nutrition	14.39±2.90	5-20	0.061	**0.192***	**-0.188 ***	**0.175***	**0.835***	**0.572***			
2.3.Access to health-related resources	13.12±2.95	5-20	**0.202***	**0.287***	-0.030	**0.183***	**0.779***	**0.518***	**0.565***		
2.4.Health priority	10.73±1.52	3-12	0.076	**0.210***	**-0.239***	**0.255***	**0.598***	**0.480***	**0.446***	**0.233***	

**Correlation is significant at the level 0.01; SD=Standart deviation*

Table 3 provides data on the comparison of the socio-demographic characteristics, the state of having a chronic illness, and knowledge levels about T&CM with the scores obtained from the sub-dimensions of the T&CM attitude scale of the students included in the study (Table 3).

It was determined that there was a statistically significant difference (p=0.044) between the gender variable and the dissatisfaction with conventional medicine sub-dimension of the T&CM attitude scale. Male students were found to have lower levels of satisfaction with conventional medicine compared to female students. It was found that there was a statistically significant difference when the sub-dimensions of philosophical congruence with complementary and alternative medicine (p=0.010) and holistic balance (p=0.014) are compared to the age variable. After the age of 25, it can be stated that students have a more positive philosophical congruence with complementary and alternative medicine and their holistic balance has improved a little more.

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It was also identified that there was a statistically significant (p=0.001) difference between the holistic balance sub-dimension of the scale and the class variable. It can be said that fourth-grade students have significantly more holistic balance than first-grade students. Among the groups, it can be stated that students with higher income groups have a more positive philosophical congruence with complementary and alternative medicine, and their holistic balance is slightly more improved.

Table 3. Comparison and Analysis of the Subscales of the T&CM Attitude Scale According to the Mean Scores

	n	%	**1.Complementary, Alternative and Conventional Medicine Attitude Scale***	1.1.Philosophical congruence with complementary and alternative medicine*	1.2.Dissatisfaction with conventional medicine**	1.3.Holistic balance**
Gender						
Female	236	65.19	114.56	36.19	30.02	48.33
Male	126	34.81	115.26	36.47	32.01	46.76
p value			*0.724*	*0.759*	***0.044***	*0.109*
Age						
1. ≤20	130	35.91	111.353	34.83	30.57	45.93
2. 21-25	216	59.67	116.02	36.85	30.51	48.65
3. 25≥	16	4.42	126.37	40.5	34.62	51.25
p value			***0.001***	***0.010***	*0.341*	***0.014***
difference between groups			***1 vs 2 p=0.047*** ***1 vs 3 p=0.004***	***1 vs 3 p=0.026***		***1 vs 2 p=0.008*** ***1 vs 3 p=0.034***
Class						
1st class	69	19.06	112.11	34.50	30.56	47.04
2nd class	113	31.22	113.79	35.743	31.85	46.19
3rd class	90	24.86	116.60	36.9	31.87	47.82
4th class	90	24.86	116.34	37.74	28.25	50.34
p value			*0.326*	*0.074*	*0.076*	***0.001***
difference between groups						***1 vs 4 p=0.040***
Income						
1.₺6.000 and below	140	38.67	115.22	35.81	31.08	48.32
2.₺6.001 - ₺8.000	86	23.76	110.18	34.73	29.90	45.54
3.₺8.001 - ₺10.000	57	15.76	115.10	37.00	29.92	48.17
4.₺10.001 - ₺15.000	46	12.71	121.08	40.39	30.76	49.93
5.₺15.001 and above	33	9.12	115.78	35.45	32.60	47.72
p value			***0.020***	***0.003***	*0.716*	***0.035***
difference between groups			***2 vs 4 p=0.008***	***2 vs 4 p=0.009***		***1 vs 2 p=0.050***
Know the meaning of evidence-based medicine						
1.Yes	93	25.69	115.34	36.80	29.18	49.35
2.Partially	159	43.92	113.547	36.45	29.66	47.43
3.No	110	30.39	116.17	35.62	33.55	46.99
p value			*0.472*	*0.572*	***0.003***	*0.081*
difference between groups					***1 vs 3 p=0.006*** ***1 vs 2 p=0.006***	
The state of having a chronic illness						
Yes	44	12.15	115.11	37.18	29.36	48.56
No	318	87.85	114.76	36.16	30.90	47.68
p value			*0.903*	*0.449*	*0.243*	*0.479*
Knowing that T&CM is practiced by physicians						
Yes	112	30.94	116.99	37.93	29.24	49.81
No	250	69.06	113.82	35.55	31.38	46.88
p value			*0.121*	***0.011***	*0.063*	***0.000***
Satisfaction with the implementation of T&CM by physicians						
1.Yes	279	77.07	115.76	36.98	29.96	48.82
2.No	52	14.36	111.38	34.48	32.69	44.21
3.No idea	31	8.56	111.903	33.12	34.22	44.54
p value			*0.174*	***0.011***	***0.020***	***0.000***
difference between groups				***1 vs 3 p=0.037***		***1 vs 2 p=0.001***
Experienced T&CM's implementation						
Yes	19	5.25	125.26	42.10	31.94	51.21
Nor	343	94.75	114.22	35.97	30.65	47.60
p for difference			***0.008***	***0.001***	*0.641*	*0.091*

**T test and Anova test **Mann Whitney U test and Kruskal-Wallis test*

It was found that there was a statistically significant (p=0.003) difference between the dissatisfaction with conventional medicine sub-dimension of the T&CM attitude scale and knowing the meaning of evidence-based medicine. Those who know the meaning of evidence-based medicine have lower levels of dissatisfaction with conventional medical practices than those who are partially familiar and those who are not familiar at all. Since evidence-based medicine forms the basis of conventional medicine, it is expected that those who are familiar with these practices will have lower levels of dissatisfaction. It was found that there was a statistically significant difference (p=0.000) between the status of knowing that T&CM is practiced by physicians and the sub-dimension of holistic balance. The analysis revealed that there was a statistically significant difference between satisfaction with the implementation of T&CM by physicians, and the sub-dimensions of holistic balance (p=0.000) and dissatisfaction with conventional medical practices (p=0.020). Moreover, the study found that there was a statistically significant difference between the experience of T&CM's implementation and the philosophical congruence with complementary and alternative medicine (p=001). Lastly, no significant difference was found between the sub-dimensions of the T&CM attitude scale according to the state of having a chronic illness.

Information on the comparison of the sociodemographic characteristics of the students participating in the study with the scores they received from the sub-dimensions of the healthy living skills scale is presented in Table 4.

Table 4. Comparison and Analysis of the Subscales of the Healthy Living Skills Scale According to the Mean Scores

	n	**%**	**2.Healthy Life Skills Scale in University Students****	2.1.Importance given to health**	2.2.Healthy nutrition**	2.3.Access to health-related resources *	2.4.Health priority**
Gender							
Female	236	65.19	64.51	26.06	14.33	13.173	10.93
Male	126	34.81	63.873	25.99	14.49	13.031	10.35
p value			*0.798*	*0.937*	*0.286*	*0.664*	***0.042***
Age							
1. ≤20	130	35.91	62.35	25.45	13.90	12.4	10.59
2. 21-25	216	59.67	65.16	26.32	14.57	13.43	10.82
3. 25≥	16	4.42	68.18	26.93	15.81	14.81	10.62
p value			***0.002***	*0.077*	***0.009***	***0.000***	*0.706*
difference between groups			**1 vs 2 p=0.007 1 vs 3 p=0.021**		**1 vs 3 p=0.024**	**1 vs 2 p=0.004 1 vs 3 p=0.005**	
Class							
1st class	69	19.06	63.05	25.55	14.01	12.86	10.62
2nd class	113	31.22	63.66	25.73	14.23	13.16	10.53
3rd class	90	24.86	62.34	25.25	13.833	12.52	10.73
4th class	90	24.86	67.96	27.588	15.44	13.86	11.06
p value			***0.000***	***0.000***	***0.000***	***0.018***	*0.125*
difference between groups			**1 vs 4 p=0.001**	**1 vs 4 p=0.001**	**1 vs 4 p=0.005**	**3 vs 4 p=0.012**	
Income							
₺6.000 and below	140	38.67	64.87	26.26	14.47	13.29	10.84
₺6.001 - ₺8.000	86	23.76	63.31	25.39	14.12	13.09	10.69
₺8.001 - ₺10.000	57	15.76	64.57	26.47	14.33	12.98	10.78
₺10.001 - ₺15.000	46	12.71	64.08	25.76	14.82	12.89	10.63
₺15.001 and above	33	9.12	64.15	26.42	14.24	13.09	10.39
p value			*0.538*	*0.391*	*0.408*	*0.919*	*0.868*

**T test and Anova test **Mann Whitney U test and KruskalWallis test*

The study determined that there was a significant difference (p=0.042) between the health priority sub-dimension of the healthy living skills scale and the gender variable. It can be said that women give more importance to health priority. A significant difference appeared when the sub-dimensions of healthy nutrition (p=0.009) and access to health-related resources (p=0.000) of the healthy living skills scale are compared to the age variable. It can be said that students aged 25 and over attach more importance to healthy nutrition than students aged 20 and under. Similarly, it can be said that both students aged 25 and over and students aged 20-25 are more advantageous than students aged 20 and

below in terms of accessing healthy resources.

It was determined that there was a significant difference (p=0.000, p=0.000, and p=0.018, respectively) between all sub-dimensions of the healthy living skills scale (except the health priority sub-dimension) with the grade variable. It can be said that fourth-grade students attach more importance to health and healthy nutrition than first-grade students. Similarly, it can be stated that fourth-grade students are more advantageous in terms of accessing health-related resources than third-grade students.

The least squares method was used to determine the factors affecting the attitude scale towards T&CM. The results of the linear regression analysis using the ordinary least squares method are presented in Table 5.

Table 5. Regression Analysis of University Students' T&CM Attitude Scale

T&CM	Coefficient	Std. Err.	t
Healthy Life Skills Scale in University Students	0.233	0.108	2.15*
Age	0.521	0.359	1.45
Knowing that T&CM is practiced by physicians	1.640	2.193	0.75
Experienced T&CM's implementation	8.580	4.420	1.94*
Know the meaning of evidence-based medicine (yes,partially)	-3.625	2.107	-1.72**
_cons	90.248	9.704	9.30

**p<0.05, **p<0.1; Number of Obs.=362; F(5,356)= 3.53; Prob > F = 0.003; R-squared = 0.047; Adj R-squared = 0.033*

Results of the regression analysis stated that having experienced T&CM's implementation before increased the score obtained from the T&CM attitude scale by an average of 8.5 points. Additionally, it was found that a one-unit increase in the healthy living skills scale caused a 0.2-point increase in the T&CM attitude scale. In addition, students who know the meaning of evidence-based medicine had an average score of 3.6 points lower on the T&CM attitude scale compared to those who did not know about evidence-based medicine. It was determined that the variables in the model explained approximately 3% of the change in the T&CM attitude scale (Table 5). In this regard, it was determined that it is necessary to investigate the attitude towards T&CM with more different variables.

DISCUSSION

This study, aimed to examine the knowledge of university students about T&CM and their healthy living skills, concluded that 94.75% of the students did not experience any T&CM implementation. It was also determined that approximately one third of the students (30.39%) did not have knowledge about evidence-based medicine. It was determined that the average total score they received from the T&CM attitude scale was 114.80 and the total score the participants received from the healthy life skills scale was 64.29.

In various studies conducted in this field in Turkey, the utilization rates of T&CM methods were 39.3%, 56.5%, 53.2%, and 65.9%[19-22]. Similarly, in a study conducted abroad, the rate of participants using T&CM methods was found to be 75%[22]. In the research conducted by Bayer and Uzuntarla (2022) among individuals with a chronic disease over the age of 65, it was found that 61.2% of the patients used the T&CM method[24]. Likewise, another study discovered that a large part of Europe and America tends to use various T&CM methods[25]. These studies clearly demonstrate the need to investigate these methods due to the increasing interest in T&CM methods.

Our study found that approximately one-third of the students (30.39%) didn't know the meaning of evidence-based medicine. The fact that the students participating in the study are in the young population group and have not encountered many health problems may be the reason for their low interest in T&CM methods. As a matter of fact, in a study carried out by Öcal Kırsoy (2022) and colleagues on university students, the rate of students using T&CM was found to be 22.1%[26]. In our study, the rate of students who have experienced T&CM's implementation was 5.25%.

Furthermore, this study found that the average total score of the participants on the T&CM attitude scale was 114.80. The examination of the distribution of

scores according to the sub-dimensions of the scale determined that the sub-dimension of dissatisfaction with conventional medicine had the lowest mean score of 30.72, while the score obtained from the holistic balance sub-dimension had the highest mean score of 47.58. The mean score of the philosophical congruence with complementary and alternative medicine sub-dimension was calculated as 36.29. In a study conducted with the same scale, the total score of the T&CM attitude scale was 103.99, the sub-dimension of dissatisfaction with conventional medicine was 29.95, the sub-dimension of holistic balance was 44.15 and the sub-dimension of philosophical congruence with complementary and alternative medicine was 29.88. These results are consistent with our results[19]. In another study, the total score of the T&CM attitude scale was 115.78, the sub-dimension of dissatisfaction with conventional medicine was 35.54, the sub-dimension of holistic balance was 44.7 and the sub-dimension of philosophical congruence with complementary and alternative medicine was 35.54[19].

In a study conducted by Özkan and Aca (2020) with the same scale, the total score of the students from the healthy life scale was 69.52. In our study, the total score of the participants from the healthy living skills scale was revealed to be 64.29 [27].

This study conducted among university students found that there was a statistically significant difference (p=0.044) between the gender variable and the dissatisfaction with conventional medicine sub-dimension of the T&CM attitude scale. Male students were found to have lower levels of satisfaction with conventional medicine compared to female students. Another study conducted on students found that the attitude of female students towards T&CM methods was significantly positive[26].

Existing studies didn't reveal a significant relationship between age and the T&CM attitude scale[20-22]. Our study found that students had a more positive attitude towards complementary medicine as age increased. On the other hand, another study conducted among university students determined that students' attitudes changed positively as age decreased. In said study, parallel to our results found that students' interest in T&CM increased with the rise in their grades. Furthermore, in line with the results of our study, the study determined that the approach to T&CM use was positively affected by increasing income levels[26]. Since T&CM applications are not reimbursable, they are typically paid for out-of-pocket, which suggests a correlation with income. However, there are also studies that found no significant relationship between T&CM use and income level[22].

Studies conducted in the field generally stated that individuals' attitudes toward T&CM use are positive[20,21]. Similar to our study, some studies spotted that although students do not have sufficient knowledge about T&CM, they tend to use T&CM, albeit low[26].

Our study found that students aged 25 and over attach more importance to healthy nutrition than students aged 20 and under. Another study conducted in the field yielded similar results[28].Similar results were obtained in our study in parallel with the studies in which it was determined that there was no difference between students' healthy living skills according to income levels. In the studies, no significant differences were found according to gender[27,28].

CONCLUSION

This research, undertaken to uncover the healthy living skills of university students, their attitudes towards T&CM, and the link between them, discovered that the level of healthy living skills of the students was at a medium level. It is determined that although the students lacked knowledge about T&CM, their attitudes on this subject were positive. However, the relationship between students' attitudes towards T&CM and their healthy living skills was found to be very weak. In this context, it was determined that the power of students' healthy living skills to explain their attitudes toward T&CM was very weak.

University students, who constitute both the educated and young population groups of society, have the potential to influence society with their behaviors, beliefs, and attitudes. Therefore, we believe that it is beneficial to reveal the knowledge levels and attitudes of society on issues that directly concern their health.

The fact that T&CM practices are not yet included in evidence-based practices and are demanded is a matter of debate. However, the state of not being evidence-based does not always negatively affect the choice of treatment. The demand for T&CM and the opening of relevant polyclinics in hospitals are examples of this. However, this study estimated that students who know the meaning of evidence-based medicine had lower scores on the T&CM attitude scale. Therefore, the fact that there is an increasing demand necessitates an in-depth investigation of

which segment of society is demanding it. This conclusion is also a recommendation for future studies.

Main points

- The majority of university students do not have detailed information about T&CM applications.
- The independent variables in this study were found to be insufficient in determining the factors affecting students' T&CM attitudes.
- It can be said that students' healthy living skills and T&CM attitudes are at a moderate level.
- Since the use of T&CM applications has increased recently, it is thought that it would be important to conduct similar studies at certain time intervals.

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ORIGINAL RESEARCH

The Effect of Complementary and Alternative Treatment Methods Applied by Women in Postmenopausal Period on Their Menopausal Symptoms and Quality of Life

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Abstract

Objective: This study was carried out to determine the complementary and alternative treatment methods used by women in the postmenopausal period and their effects on menopausal symptoms and quality of life.

Material-Method: This study was designed as a cross-sectional and correlational study, and it was conducted at a Family Health Center in a province in the Southeast Anatolia Region of Türkiye between March and August 2018. The sample consisted of 259 postmenopausal women aged 45-60 registered at the Family Health Center. Data were collected using the Personal Information Form, the Menopause Rating Scale, and the Short-Form 36 (SF-36) Quality of Life Scale. The face-to-face interview technique was employed for data collection. Descriptive statistics, Pearson's correlation coefficient, and multiple linear regression (MLR) analyses were used to analyze the data.

Results: It was determined that 77.6% of the women in the postmenopausal period used complementary and alternative treatment methods to reduce menopausal symptoms. The analysis revealed that as postmenopausal women increasingly utilized nutrition, vitamins, and minerals as complementary and alternative medicine methods, their physical role limitations, a subdimension of quality of life, decreased ($\beta = -0.359$; $p < 0.05$). Additionally, physical functioning, another subdimension of quality of life, improved with the increased use of mind-body techniques as a complementary and alternative medicine method ($\beta = 0.273$; $p < 0.05$).

Conclusion: Nutritional, vitamin, and mineral treatments were significant predictors of physical role limitations in postmenopausal women, which is a subdimension of quality of life. Similarly, mind-body techniques were found to be significant predictors of physical functioning.

Keywords: Alternative, Complementary, Menopausal Symptoms, Postmenopause, Quality of Life

INTRODUCTION

Menopause, a significant phase in the lives of many women worldwide, is characterized by ovarian failure and follicular arthritis. Menopause is a period in which the level of estrogen hormone decreases, the menstrual period permanently stops, and reproduction ability is lost, as well as ovaries lose their function.[1] This period is the beginning of aging in women and a natural part of women's reproductive life.[2] In addition, some women may experience psychological, physiological, social, and physical changes during this period.[3] Women in the menopausal period generally experience symptoms affecting daily life activities and quality of life, such as hormonal changes, hot flashes, sweats, sleep disorders, vaginal dryness, poor memory, anxiety, and depression, as well as important health problems such as heart disease and osteoporosis.[4,5] The studies have shown that symptoms experienced by women in the menopausal period affect their health-related quality of life.[6-8] Within increasing life expectancy, women spend approximately one-third of their lives in the postmenopausal period. This fact indicates that more emphasis should be placed on menopausal symptoms experienced during this period.[9]

Although Hormone Therapy (HT) has positive

effects on menopausal symptoms[10], many women refuse or discontinue treatment because of their adverse and negative effects.[11,12] Therefore, many women seek alternative therapies that they can trust to reduce unpleasant symptoms and improve their quality.[13,14] Complementary and alternative medicine (CAM) may have the potential to relieve acute menopausal symptoms and improve the long-term well-being of women in the menopausal period.[15,16]

In the study investigating the use of CAM in menopausal women in Canada, it was stated that 91% of women used CAM for menopausal symptoms. It has been stated that the most commonly used methods are vitamins, relaxation techniques, yoga/meditation, soy products, and prayer. Among these methods, mental healing, relaxation techniques, therapy, and reiki are reported to be the most useful applications.[17]

It has been stated that 89.7% of the post-menopausal women who used HT and then quit in the UK used one or more CAM methods in the subsequent period to reduce menopausal complaints. The most commonly used CAM methods to relieve vasomotor symptoms (VMS) are regular exercise, herbal/homeopathic remedies, Cimicifuga racemosa, phytoestrogens, behavioral/lifestyle approach, diet change, meditation/yoga, and relaxation/ brisk breathing.[5]

In a study investigating the prevalence of CAM use for VMS and other menopausal symptoms in Australian women aged 40-65, the prevalence of CAM use for VMS and other symptoms was reported to be 13.22% and 32.23%, respectively. The most commonly used CAM methods for VMS were reported to be phytoestrogens, evening primrose oil, and ginseng, respectively. In contrast, fish or cyrillic oil, glucosamine, and valerian were reported as the most commonly used CAM methods for other menopausal symptoms.[18]

Studies have shown that CAM methods have significant effects on alleviating menopausal symptoms and improving quality of life.[19,20]

Although many studies have been conducted on CAM use during the menopausal period,[5,17-20] this is the first study investigating the effects of CAM on postmenopausal symptoms and quality of life in Türkiye. Accordingly, this study was carried out to determine the use of complementary and alternative treatment methods by postmenopausal women and their effects on menopausal symptoms and quality of life.

MATERIALS AND METHODS

Research design

The study was designed as a cross-sectional and correlational study.

Research place and time

The study was conducted in a Family Health Center (FHC) in a province in Türkiye's Southeastern Anatolia Region between March and August 2018.

Population and sample

The study population consisted of 1025 women aged 45-60 registered at the Family Health Center (FHC). No specific sampling method was employed, and the final sample included 259 women who met the inclusion criteria.

Inclusion Criteria: Being between the ages of 45-60, having no menstruation for at least a year, having no severe physical and psychological disease, receiving no HT for the last six months, entering the menopause naturally, volunteering to participate in the study.

Data Collection

In the data collection, the Personal Information Form prepared by the researchers, the Menopause Rating Scale (MRS), and the Short Form 36 (SF-36) Quality of Life Scale were used. In the Personal Information Form, socio-demographic information of the participants such as age, gender, education, income, marital status, disease status, smoking; obstetric and gynecological histories such as first gestational age, number of pregnancies, number of deliveries, first menstrual age, last menstruation date; menopausal histories such as the age of menopause, the meaning of menopause, experiencing menopause complaints, and used methods to reduce complaint sand the use of CAM methods were questioned. The data on CAM methods were collected under four headings such as 1. Herbal therapies, 2. Nutritions-vitamins-minerals therapies, 3. Mind-body techniques, 4. Other methods.

Menopause Rating Scale (MRS): The MRS was developed in 1992 by Schneider et al.[21] to measure the severity of menopausal symptoms in German and was later adapted to English.[22] The Turkish reliability and validity study of the MRS was conducted by Gürkan in 2005 in Türkiye. It is a 4-point likert type scale and consists of 11 items. The lowest score obtained from the scale is 0, while the highest score is 44. The increase in the total score obtained from the scale shows the increase in the severity of the complaints. The scale consists of three sub-dimensions somatic symptoms,

psychological symptoms, and urogenital symptoms. In the factor analysis performed by Gürkan, 3. and 11. items were found to be in the different groups (in somatic complaints in the original). Therefore, Gürkan suggested that using sub-group analysis or making evaluations based on the total score obtained from the scale were included in different subgroups in new studies using the scale. Therefore, an assessment was made based on the total score for this study. The overall Cronbach's Alpha reliability coefficient of the MRS is 0.84. In this study, Cronbach's Alpha reliability coefficient was 0.93**.**

Short Form 36 (SF-36) Quality of Life Scale: SF-36 was developed by Ware and Sherbourne.[24] The scale does not have a total score. The scale consists of 36 items and provides the measurement of 8 dimensions. These dimensions are physical functioning (10 items), social functioning (2 items), role limitations due to physical problems (4 items), role limitations due to emotional problems (3 items), mental health (5 items), energy/vitality (4 items), pain (2 items) and general perception of health (5 items). The weighted scores obtained from the questions, including the sub-scales of the SF-36, are summed, and the physical (physical health component summary scale-PCS) and Mental (mental health component summary scale-MCS) Health Summary Value is obtained. The summary values are expressed as continuous variables ranging from 0 to 100; "0" indicates poor health, and "100" indicates well-being. On the scale, physical functioning, physical role, and pain are predominant in calculating physical health status, while mental role and mental functioning are predominant in calculating mental health status.

General health, vitality, and social functioning similarly contribute to calculating both health conditions. The scale's items of 1, 6, 7, 8, 9a, 9d, 9e, 9h, 11b, 11d are reverse scored. The scale makes evaluations based on the last four weeks. The reliability and validity studies for the Turkish version were performed by Koçyiğit et al.[25] Cronbach's alpha reliability coefficients for each sub-dimension in the Turkish reliability of the scale were calculated as follows. Physical functioning: 0.75, Physical role limitations: 0.76, Pain: 0.76, General health perception: 0.76, Vitality: 0.73, Social functioning: 0.75, Mental role limitations: 0.76, Mental health: 0.76. In this study, Cronbach's alpha reliability coefficients for SF-36 quality of life sub-dimensions were as follows. Physical functioning: 0.89, Physical role limitations: 0.83, Pain: 0.89, General health perception: 0.54, Vitality: 0.48, Social functioning: 0.70, Mental role limitations: 0.83, Mental health: 0.87.

Data Collection

The pre-application of the questionnaire was carried out with ten postmenopausal women from a different province population. The data collected from the pre-application were not included in the study. Then, 1025 women aged 45-60 who were registered to the FHC were called by phone and asked whether they were in the postmenopausal period or not and whether they met the inclusion criteria or not. Women in the postmenopausal period and meeting the inclusion criteria were invited to the FHC. The women who cannot be reached by phone were called for at least three different times. Twenty-six women who met the inclusion criteria were not included in the study because they did not want to participate in the study, 24 women who met the inclusion criteria were not included in the study because they could not be contacted, and 11 women who met the inclusion criteria were not included in the study because they did not answer many questions. The study was carried out with 259 women who met the inclusion criteria. The researchers interviewed the women at the FHC five days a week. They were informed about the objective of the study, and informed consent was obtained from each participant. The questionnaire was given to 259 women who agreed to participate in the research and met the inclusion criteria, and they filled out the questionnaire under supervision. The data were collected using a face-to-face interview technique. The average time to complete the interview was 20-25 minutes.

Ethical Statement

The study was designed according to the Helsinki Declaration. Ethical committee approval was obtained from the University's Non-Interventional Ethics Committee (Date: 15.02.2018, No: 82), and written permission was also obtained from the institution where the study was conducted (02.04.2018, number 120). In addition, informed consent was obtained from all participants who volunteered to participate in the study.

Data analysis

The data were analyzed using the SPSS 15.0 (Chicago, IL, USA) software package. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were calculated for variables related to socio-demographic characteristics, menopause, and CAM usage. Pearson's correlation

coefficient was used to examine the relationship between quality of life subscales and CAM methods. A multiple linear regression model included Independent variables associated with quality of life sub-dimensions. The regression analysis treated herbal therapies, nutritional/vitamin/mineral therapies, mind-body techniques, and other methods as dummy variables. A statistical significance level of $\alpha<0.05$ was set for inclusion in the regression equation. Cronbach's alpha coefficient was calculated to assess the internal consistency of the scales.

RESULTS

The mean age of the postmenopausal women was 55.21±5.28. It was determined that 33.6% of the women were not literate, 21.6% were literate, 23.9% were primary school graduates, 15.1% were middle school graduates, and 5.8% were high school graduates. 74.1% of the women were married, 91.5% of them were not employed, 63.7% of them lived in nuclear families, 58.3% of them had income levels that were lower than their expenses, 65.3% of them had health insurance, 64.5% of them had any chronic disease. In addition, 81.5% of the menopausal women did not smoke, 15.4% of them had last menstruation one year ago, 24.7% of them had previous menstruation 1-2 years ago, 39.0% of them had last menstruation 2-5 years ago, 20.9% of them had previous menstruation five years ago or before. The mean age of marriage of the women was 17.39±2.61, the mean age for first pregnancy was 18.47±2.58, the mean number of pregnancies was 5.05±2.20, the mean number of delivery was 4.43±1.78, the mean number of living children was 4.31±1.68, the mean first menstruation age was 12.83±1.18.

When we evaluated the characteristics of the women in the study for menopause and the use of CAM methods, the mean menopausal age was 51.66±4.27), 37.5% of them perceived menopause as a natural process, 98.1% of them had menopausal complaints, and 93.1% of them had not received HT previously to alleviate the symptoms of menopause. In addition, 77.6% of the postmenopausal women used CAM methods to reduce menopausal complaints, 50.7% of them used CAM methods for one year or shorter, 23.4% of them had reduced complaints after using CAM methods, 35.8% of them used CAM methods because they did not want to use medication. When the CAM methods used by the women using CAM methods were examined, 35.8% of them consumed balm tea as a herbal treatment, 35.3% of them were fed with low salty/spicy foods as nutritions-vitamins-minerals treatments, 57.7% of them made handiworks as mind-body techniques (knitting, etc.), and 38.8% of them did religious practices such as prayer, 56.7% of them often took warm showers as other methods (Table 1).

When we examined the quality of life sub-dimensions and menopausal symptoms of the postmenopausal women, the mean score of them on the physical functioning subscale, which is the sub-dimension of the quality of life scale, was 50.65±21.93, their mean score on the physical role limitations subscale was 37.74±39.58, and their mean score on the pain subscale was 41.77±22.13, their mean score on the general health perception subscale was 36.52 ± 15.25, their mean score on the vitality subscale was 40.03±14.50, their mean score on the social functioning subscale was 56.66±25.79, their mean score on the mental role limitation subscale was 44.91±43.16, and their mean score on the mental health subscale was found to be 50.77±96.00. In addition, their mean score on total menopause symptoms was 28.15±4.65 (Table 2).

When the frequencies of experiencing menopausal symptoms by the postmenopausal women in the study were analyzed, 44.4% of them experienced very severe hot flashes and sweating, 32.1% of them experienced a severe and very severe heart problem, 35.5% of them had severe sleep problems, 24.7% of them experienced very severe malaise, 26.3% of them experienced very severe nervousness, 28.6% of them experienced severe anxiety/worry, 35.1% of them experienced severe physical and mental fatigue, 12.8% of them had experienced severe and very severe sexual problems, 18.9% of them had experienced very severe urinary problems, 21.2% of them had experienced severe vaginal dryness and 44.0% of them had severe joint and muscle disorders (Table 3).

In the postmenopausal women, there were significant positive relationships between taking any herbal treatment as a CAM method and physical functioning ($r = 0.261$), physical role limitations ($r = 0.171$), mental role limitations ($r = 0.126$), and MHS ($r = 0.153$) ($p <.05$). There were significant positive relationships between receiving nutritions-vitamins-minerals supplementation as a CAM method and physical functioning ($r = 0.235$) and physical role limitations ($r = 0.119$) ($p <.05$).

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Table 1. Characteristics of the women in terms of menopause, the use of alternative and complementary therapies

Variables		n	%
Menopausal Age		51.66±4.27 (min-max=40.00-61.00)	
What does menopause mean?			
	A natural process	97	37.5
	Aging	88	34.0
	Menstruation	27	10.4
	Female Characteristics	17	6.6
	Fertility	12	4.6
	No answer	18	6.9
Having menopausal complaints			
	Yes	254	98.1
	No	5	1.9
Having a Previous Hormone Therapy			
	Yes	18	6.9
	No	241	93.1
Using CAM methods			
	Yes	201	77.6
	No	58	22.4
Herbal Treatments[a] (n=201)			
	Melissa tea	72	35.8
	Chamomile tea	53	26.4
	Oregano tea	47	23.4
	Linden tea	40	19.9
	Green tea	35	17.4
	Sage tea	29	14.4
	Licorice root	14	6.9
	St. John's Wort Tea	13	6.4
Nutritions-Vitamins-Minerals Therapies[a](n=201)			
	Vegetable and fruit weighted nutrition	79	39.3
	Low salt/spicy nutrition	71	35.3
	Calcium tablets	46	22.9
	Mangesium tablets	36	17.9
	Calcium containing nutrition (Milk and milk products, vegetable etc.)	34	16.9
	Vitamin capsules		
	Fish Oil/ Omega-3	31	15.4
	Phytoestrogen tablets	17	8.4
	Phytodiet (Soy, lentil, chickpeas, bean, peas, etc.)	10	5.0
	Selenium tablets	7	3.5
		6	3.0
Mind-Body Techniques [a](n=201)			
	Handcraft (Knitting etc.)	116	57.7
	Religious practices (Prayer, etc.)	78	38.8
	Listening to Music	25	12.4
	Massage	19	9.5
	Dreaming	12	6.0
	Breathing Exercises	11	5.5
	Aromatherapy	3	1.5
	Other	4	2.0
Other Methods [a](n=201)			
	Frequently Taking Warm Showers	114	56.7
	Drinking Plenty Amount of Water	96	47.7
	Allocating time for oneself for resting	57	28.4
	Regular sleeping	53	26.4
	Preferring cotton and thin clothes	46	22.9
	Drinkinh cold beverages	29	14.4
	Washing own face	27	13.4
	Distraction	18	9.0
	Regular Physical Exercising	17	8.5
	Going to Thermal Springs	16	8.0
Duration of CAM Usage (n=201)			
	1 year or shorter	102	50.7
	>1 year -2 years	44	21.9
	3 years	28	13.9
	4 years	20	10.0
	Stating no date	7	3.5
Benefiting from CAM(n=201)			
Not beneficial		83	41.3
Relaxed Psychcologically		66	32.8
Reduced complaints		47	23.4
Complaints Disappeared		5	2.5
Reason for Using CAM(n=201)			
	No desire to use drugs	72	35.8
	To improve life quality	56	27.9
	They are easily reachable	27	13.4
	They are cheap	22	10.9
	They have less side effects	13	6.5
	Higher trust to these methods compared to drugs	9	4.5
	No reason was stated	2	1.0

[a]More than one choice was selected.

Table 2. Life quality subdimensions and menopausal symptoms scores

Life Quality Subdimensions	Mean ± SD	Min-Max
Physical Functioning	50.65±21.93	.00-100.00
Physical Role Limitations	37.74±39.58	.00-100.00
Pain	41.77±22.13	.00-100.00
General Health Perception	36.52±15.25	.00-80.00
Vitality	40.03±14.50	5.00 -75.00
Social Functioning	56.66±25.79	.00-100.00
Mental Role Limitations	44.91±43.16	.00-100.00
Mental Health	50.77±96.00	8.00-96.00
Summarized Health Values		
Mental Health Status-MHS	35.11±8.40	13.80-57.69
Physical Health Status-PHS	39.77±11.31	21.78-66.31
Total Menopausal Symptoms	28.15±4.65	4.00-44.00

Table 3. Frequencies of menopausal symptoms

	None n(%)	Mild n(%)	Moderate n(%)	Severe n(%)	Very severe n(%)
1. Hot flushes, sweatings	4 (1.5)	10 (3.9)	30 (11.6)	100 (38.6)	115 (44.4)
2.Heart Disorders	73 (28.2)	41 (15.8)	62 (23.9)	40 (15.5)	43 (16.6)
3.Sleeping Problems	15 (5.8)	19 (7.3)	56 (21.6)	92 (35.5)	77 (29.7)
4.Malaise	52 (20.1)	34 (13.1)	51 (19.7)	58 (22.4)	64 (24.7)
5.Nervousness	58 (22.4)	28 (10.8)	36 (13.9)	69 (26.6)	68 (26.3)
6.Anxiety/ worry	78 (30.1)	8 (3.1)	33 (12.7)	74 (28.6)	66 (25.5)
7.Physical and mental fatigue	18 (6.9)	17 (6.6)	60 (23.2)	91 (35.1)	73 (28.2)
8.Sexual Problems	102 (39.4)	48 (18.5)	76 (29.3)	25 (9.7)	8 (3.1)
9.Urinary Problems	80 (30.9)	31 (12.0)	51 (19.7)	48 (18.5)	49 (18.9)
10.Vaginal Dryness	87 (33.6)	26 (10.0)	46 (17.8)	55 (21.2)	45 (17.4)
11.Joint and Muscle Problems	4 (1.5)	3 (1.2)	42 (16.2)	114 (44.0)	96 (37.1)

There were statistically significant relationships between using any mind-body technique as a CAM method and physical functioning (r = 0.291), physical role limitations (r = 0.159), and MHS (r = 0.177) ($p < 0.05$). There was also a statistically significant positive relationship between using any method as other CAM methods and physical functioning (r = 0.265), physical role limitations (r = 0.160), and MHS (r = 0.155) ($p < 0.05$) (Table 4). Multicollinearity was not detected between the independent variables.

Table 4. The relationship between used CAM methods and life quality and menopausal symptoms in the postmenopausal women

Variables[c]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.Herbal treatments	1														
2.Nutritions-vitamins-minerals therapy	.928[b]	1													
3. Mind-body techniques	.836[b]	.845[b]	1												
4.Other methods	.957[b]	.928[b]	.856[b]	1											
5.Physical functioning	.261[b]	.235[b]	.291[b]	.265[b]	1										
6.Physical role limitations	.171[b]	.119[a]	.159[a]	.160[a]	.667[b]	1									
7.Pain	-.022	-.030	.000	-.047	.446[b]	.570[b]	1								
8.General health perception	-.026	-.024	.020	-.023	.513[b]	.497[b]	.621[b]	1							
9.Vitality	.052	.048	.111	.068	.440[b]	.486[b]	.582[b]	.530[b]	1						
10. Social functioning	.013	.007	-.030	-.022	.293[b]	.415[b]	.757[b]	.478[b]	.463[b]	1					
11. Mental role limitations	.126[a]	.100	.115	.112	.467[b]	.705[b]	.554[b]	.353[b]	.445[b]	.490[b]	1				
12. Mental health	.020	.030	.045	-.006	.289[b]	.421[b]	.710[b]	.384[b]	.647[b]	.750[b]	.528[b]	1			
13. PHS	.014	.016	.012	-.011	.207[b]	.448[b]	.691[b]	.360[b]	.630[b]	.800[b]	.745[b]	.912[b]	1		
14. MHS	.153[a]	.117	.177[b]	.155[a]	.869[b]	.789[b]	.604[b]	.717[b]	.457[b]	.337[b]	.386[b]	.217[b]	.140[a]	1	
15. Menopausal symptoms	.048	.046	.009	.068	-.306[b]	-.407[b]	-.719[b]	-.392[b]	-.545[b]	-.713[b]	-.497[b]	-.859[b]	-.795[b]	-.275[b]	1

[a]p<.05, [b]p<.01, [c]Pearson's correlation analysis was applied as a parametric test.

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Multiple regression analysis was performed to determine the contribution of CAM methods associated with physical functioning and physical role limitations in postmenopausal women, which are the sub-dimensions of quality of life. Separate models were established for the physical functioning and physical role limitations in postmenopausal women. The individual regression models for physical functioning and the physical role limitations, the sub-dimensions of the quality of life, were statistically significant ($p< 0.05$). The mind-body techniques ($\beta = 0.273$; $p 0<.05$) applied for physical functioning, which is the sub-dimension of quality of life, were found to be statistically significant predictors. Nutritions-vitamins-minerals therapies ($\beta = -.359$; $p <.05$) were found to be statistically significant predictors for physical role limitations (Table 5).

Table 5. Life quality predictors in postmenopausal women

	Physical Functioning[a]			Physical Role Limitations[a]		
	Beta	**T**	**p**	**Beta**	**T**	**p**
Herbal Therapies	.135	.610	.542	.363	1.603	.110
Nutritions-Vitamins-Minerals Therapies	-.217	-1.221	.223	-.359	-1.974	.049
Mind-Body Techniques	.273	2.275	.024	.127	1.034	.302
Other Methods	.103	.451	.652	.036	.155	.877

[a]The established regression model for Physical functioning and Physical role limitations was statistically significant $p<.05$. Herbal therapy, nutritions-vitamins-minerals therapies, mind-body techniques and other methods were taken as dummy variables.

Although there was a significant relationship between receiving CAM methods as herbal treatment, nutritions-vitamins-minerals supplementation, and other methods, and physical functioning, according to Pearson's correlation analysis, the regression model was not significant. Similarly, there was a significant relationship between mental health status (MHS) and receiving herbal treatment as a CAM method, mind-body techniques, and other methods according to Pearson's correlation analysis, the regression model was not found to be significant.

DISCUSSION

The main findings of this study are that nutrition, vitamins, and minerals treatment are significant predictors of physical role limitations, which is a sub-dimension of quality of life in postmenopausal women, and mind-body techniques applied for physical functioning are also significant predictors.

According to our knowledge, this article is the first one on this subject. It provides valuable data on the use of CAM methods by women in postmenopausal periods in a province in the southeastern part of Türkiye and the effects of menopausal symptoms and life quality.

Due to the side effects and adverse effects of HT, the investigation of new non-hormone therapies for alleviating menopausal symptoms has been brought to the agenda.[11-14,26] One of these is CAM methods. It is stated that women in the menopausal period use CAM methods because they believe that CAM methods and products are natural and safe, can relieve symptoms and maintain overall health and have not adverse or side effect.[27] In this study, more than half of the women in the postmenopausal period stated that they were relieved psychologically, and their complaints decreased and disappeared after using CAM methods.

CAM usage rates vary in the studies conducted in different countries.[5,13,18] In a 6-year follow-up study conducted with different ethnic groups in the USA, approximately 80% of the participants used a CAM method in any period during entering menopause. In the same study, 38.77% of the African-Americans, 57.61% of the whites, 46% of the Chinese individuals, 20.14% of the Hispanics, and 64.29% of the Japanese individuals used at least one CAM method.[28] In our study, three-quarters of the women were using CAM methods. Different cultural characteristics may affect the use of CAM methods as well as medical treatments.

Women, who generally prefer treatment methods aligned with their cultural practices, often engage in acupuncture, yoga, relaxation exercises, meditation, exercise, and homeopathy. They may also use traditional Chinese medicines, natural estrogen sources, diet, vitamin, and mineral supplements.[29]

In this study, nutritions-vitamins-minerals therapies were found to be a significant predictor for physical role limitations, which is the sub-dimension of the quality of life in postmenopausal women. As the use

of nutritions-vitamins-minerals therapies as a CAM method increased in the postmenopausal period, the physical role limitations subdimension of the life quality decreased. In a study conducted in China, it was determined that the use of Chinese herbal medicine granules increased the quality of life in menopausal women, especially by alleviating vasomotor symptoms.[19] In a randomized controlled study, 12-week traditional treatment with Chinese medicine and acupuncture led to a significant decrease in the severity of hot flashes in postmenopausal women.[20] In a study conducted in London (UK), it was determined that there was an increase in the quality of life of menopausal women when Chinese herbal medicines were applied.[30] In a study conducted with women with breast cancer, vitamin E was found to have only a marginal effect on their vasomotor symptoms.[31] It was shown that daily use of 50 mg of soy isoflavone not only reduced the number and severity of hot flashes in perimenopausal women but was also safe for endometrial and breast tissue.[32] In another study, it was determined that soy isoflavone supplementation did not provide any benefit for the quality of life in postmenopausal women.[33] In a randomized controlled study, Femal, a pollen extract, was very effective in reducing hot flashes and some other menopausal symptoms.[26] In a study conducted with perimenopausal and postmenopausal women, it was found that a 12-week omega-3 treatment did not improve VMS frequency and discomfort, sleeping quality, or mood compared to a placebo.[34] In contrast, another study on omega-3 supplementation study had supporting findings for the positive effects of this treatment on VMS.[35] A study conducted to determine the effectiveness of 3 non-hormonal treatments in improving life quality in menopausal women with VMS revealed that yoga slightly improved the quality of life in them while exercise and omega-3 supplements did not improve.[36] Some studies show that nutrition-vitamins-minerals supplements positively affect menopausal symptoms and quality of life, but some studies also showed no effect on them. In our study, nutrition, vitamins, and mineral supplementation negatively affected the quality of life. This negativity may be due to factors such as the low level of education and socioeconomic status of the women living in the region, the absence of perception related to this method, the differences in how and how often they use the method, the effect of the memory factor as the data were collected retrospectively, the intense menopausal symptoms of the women, the different reasons affecting the quality of life.

This study found that mind-body techniques were a significant predictor for physical functioning, which is the sub-dimension of quality of life in postmenopausal women. As the rate of use of mind-body techniques as a CAM method increased, physical functioning in the quality of life increased. A systematic review, which was conducted to evaluate the available evidence to date for the effectiveness of different mind-body therapies to relieve hot flashes and night sweats in healthy menopausal women and breast cancer survivors, concluded that the interventions involving cognitive behavioral therapy as well as breathing and relaxation techniques may be beneficial to alleviate vasomotor symptoms.[37] In a study conducted in India, it was stated that menopausal women's quality of life has been greatly improved with 18 weeks of yoga practice, including breathing exercises and meditation.[9] In another study, health life quality for vasomotor symptoms, the quality of sleep and memory inceased in the postmenopausal women who underwent relaxation techniques for 12 weeks, compared to the control group.[38] A study reported that eight weeks of meditation training improved postmenopausal women's sleep quality, quality of life, attention levels, and vasomotor symptoms.[39]

In a study conducted in Türkiye, it was stated that physical activity may play an essential role for alleviating the symptoms of menopause.[1] In a study conducted in the USA, it was observed that the women who stated that they exercised more frequently experienced menopausal symptoms.[40] In a study conducted to determine the effects of lavender aromatherapy on sleep quality and heart rate variability in middle-aged women experiencing insomnia, it was emphasized that there was a significant improvement in the sleep quality of the women receiving lavender aromatherapy, but it was not found to be beneficial for heart rate variability.[41] In a study investigating the use of CAM in menopausal women in Canada, it was stated that prayer/spiritual recovery was among the most useful CAM methods.[17] A study conducted in Brazil showed that therapeutic massage improved anxiety, depression, quality of life, and insomnia in postmenopausal women.[42] Upon reviewing the available evidence, we can conclude that health promotion programs focused on mind-body

techniques may improve menopausal symptoms and enhance quality of life.

This study has some limitations. First Limitation: Since this study was conducted in only one FHC region, the results of the survey can only be generalized to the postmenopausal women associated with this FHC. Second Limitation: The data was collected retrospectively, and therefore, it may not provide precise information about cause and correlation due to memory factors. Third Limitation: The last menstruation date was determined according to their statements, and therefore, it is difficult to determine whether women were in the menopausal transition period or early postmenopausal period at the time of the study. Fourth Limitation: In the study, the relationships between CAM methods and variables such as education status, income status, and employment status were not shown. Despite these limitations, we suggest that our study provided valuable data on the effects of CAM use on menopausal symptoms and quality of life. In addition, the fact that it is the first study on the subject in Türkiye constitutes the study's strength.

CONCLUSION

In this study, three out of four women preferred to use CAM to relieve menopausal symptoms. Nutritions-vitamins-minerals treatments were found to be a significant predictor for physical role limitations, which is the sub-dimension of quality of life in postmenopausal women. In addition, it was determined that mind-body techniques are a significant predictor of physical functioning. Nowadays, evidence for CAM methods is still a mixed issue, and their reliability is controversial. Therefore, it is important to identify safe and effective CAM methods to alleviate menopausal symptoms. In order to suggest that the use of CAM is beneficial in alleviating menopausal symptoms, more evidence-based studies should be conducted with larger samples. Treatments with proven reliability in the literature should be given priority. Health professionals also have important roles in informing the public about safe CAM methods.

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ORIGINAL RESEARCH

Assessment of the Short-Term Efficacy of a Wet-Cupping Therapy Session in Alleviating Symptoms of Fibromyalgia Syndrome: A Single-Arm Clinical Trial

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Abstract

Objective: This study aims to evaluate the short-term effectiveness of wet cupping therapy in alleviating symptoms of fibromyalgia syndrome (FMS).

Materials and Methods: A prospective, single-arm intervention design was employed. Participants were assessed before and after treatment using various tools, including the Socio-Demographic Questionnaire, Visual Analog Scale (VAS) for Pain, Fatigue Severity Scale (FSS), Beck Depression Inventory (BDI), and Fibromyalgia Impact Questionnaire (FIQ).

Results: A total of 20 eligible participants were enrolled. Significant reductions in pain were observed both before treatment and by the end of the first week. Additionally, notable improvements were seen in FSS and BDI scores during the first week of therapy. FIQ scores also showed marked improvement after treatment compared to baseline. Overall, wet cupping therapy had a substantial positive impact on all assessed clinical indicators of FMS.

Conclusion: Wet cupping therapy effectively reduces pain, alleviates fatigue, improves mood, and enhances the overall well-being of individuals with FMS. It presents a promising therapeutic option for managing this condition.

Keywords: Wet-cupping Therapy, Fibromyalgia, Fibromyalgia Impact Questionnaire Pain

INTRODUCTION

Fibromyalgia Syndrome (FMS). is a common chronic pain disorder that presents diagnostic challenges for clinicians. It is characterized by widespread pain and tenderness, fatigue, sleep disturbances, and cognitive difficulties.[1-3] The prevalence of FMS varies depending on the population studied, but it is estimated to affect approximately 2-8% of the general population.[4] Due to its high prevalence and the complexities involved in its diagnosis and management, is of significant concern in both primary care and physical therapy settings.

There are several risk factors associated with fibromyalgia. These include female gender, genetic predisposition, physical or emotional trauma, and certain comorbid conditions such as rheumatoid arthritis and systemic lupus erythematosus.[3] The pathophysiology of FMS is not fully understood, but it is believed to involve a complex interplay of genetic, neurobiological, and environmental factors. Abnormalities in the central nervous system, including altered pain processing and increased sensitivity to stimuli, have been observed in individuals with FMS.[4]

The diagnosis of FMS has evolved over time. The American College of Rheumatology initially required tender points for diagnosing FMS. However, recent research shows this is unnecessary, leading to a new case definition that no longer includes tender point examination. This definition includes the widespread pain index (WPI) and a symptom severity (SS) scale, which assesses the severity of characteristic symptoms.[1,4]

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Excellence offers general principles recommended for the clinical management of FMS.[5] Treatment options for FMS aim to alleviate symptoms and improve quality of life. Non-pharmacological interventions such as exercise, cognitive-behavioural therapy, and patient education have been shown to be effective in managing FMS symptoms.[3-6] Pharmacological treatments include medications such as antidepressants, anticonvulsants, and analgesics.[3-5] A framework comprising four key foundations is suggested for the recovery of individuals with fibromyalgia: 1) patient education; 2) psychological therapy; 3) medication-based treatment; and 4) physical activity. Additionally, it has been proposed to integrate Traditional and Complementary Medicine (T&CM) into the management of FMS.[7] These treatments aim to support the alleviation of FMS symptoms and improve the overall well-being of individuals with the condition.[8,9] Some of the T&CM treatment options for FMS include Acupuncture[8,10], Herbal medicine, Manual therapies, Low-level laser therapy[11], Mind-body interventions[12], and Cupping therapy.[13]

Cupping therapy is one of the Traditional & Complementary Medicine (T&CM) methods that has been practiced for thousands of years across different cultures.[13-16] In contemporary Western clinical practice, cupping has gained popularity as an intervention utilized by manual and physical therapists.[17] It involves creating a vacuum inside cups placed on the skin, which draws the skin and underlying tissue into the cup.[16] Cupping therapy is believed to promote blood flow, relieve pain, and improve overall well-being.[16] Diverse types of cupping therapy exist, predominantly, dry cupping, which involves suctioning the skin into the cup without breaking the skin's surface, and wet cupping, which involves making superficial incisions on the skin to allow blood to be drawn into the cup.[14,15]

This study aims to assess the short-term efficacy of a wet-cupping therapy session in alleviating symptoms of FMS.

MATERIALS AND METHODS

Study design

This study employed a prospective, single-arm intervention design to explore the effects of cupping therapy on individuals diagnosed with FMS. The research aimed to assess changes in pain perception, fatigue levels, mood, and disease impact following cupping therapy intervention.

Sample selection

The study population comprised individuals diagnosed with FMS who sought treatment at the Physical Therapy Clinic of Esenler Hospital, Istanbul Medipol University. All participants received a clear explanation of the study's objectives, and their participation was voluntary.

Participant inclusion and exclusion criteria

Inclusion criteria for this study involved patients aged 18 to 65, clinically diagnosed with FMS. Participants who possessed contraindications to cupping therapy, had concurrent rheumatological or neurological disorders, or were pregnant were regrettably excluded.

Participant recruitment

Following careful assessment, a total of 20 eligible individuals who met the defined criteria and demonstrated a willingness to participate were enrolled in the study.

Intervention protocol

During a cupping therapy session, the licensed therapist applied five cups to the patient's upper back. The 15-minute session started with dry cupping to relax the muscles, followed by wet cupping, where the therapist made small, superficial incisions at the treatment sites. The cups were then reapplied to draw a small amount of blood.[14,15]

Assessment measures

Baseline assessments were conducted before the initiation of cupping therapy. Post-treatment assessments were conducted within the first week following the completion of the cupping therapy sessions. Baseline and post-treatment evaluations encompassed a comprehensive battery of assessment tools:

Socio-Demographic Data Form: This form captured essential demographic information, including age, gender, educational background and anthropometric data.

Visual Analog Scale (VAS) for Pain: It was employed to measure pain perception. Participants indicated their pain intensity on a graduated scale, allowing for accurate pain assessment (1 to 10).

Fatigue Severity Scale (FSS): Utilized to gauge the extent of fatigue, the FSS required participants to rate a series of items on a seven-point scale. The cumulative score was indicative of the overall fatigue level, with higher scores signifying more pronounced fatigue.[18]

Beck Depression Scale (BDS): With 21 questions, it quantified the presence and severity of depression.

Participants assigned scores ranging from 0 to 3 to each question, contributing to a composite score indicative of their depression level.[19]

Fibromyalgia Impact Questionnaire (FIQ): A comprehensive tool that meticulously examined the impact of FMS on various aspects of life. From physical function to psychological well-being, participants provided responses that collectively represented their disease status.[20]

Statistical Analysis

Quantitative variables were summarized using measures of central tendency and variance, expressed as Mean ± Standard Deviation. A Paired Sample T-Test was administered to explore statistically significant differences between pre- and post-treatment measurements. The level of statistical significance was set at $p<0.001$ level. Data analysis was carried out utilizing IBM SPSS Statistics Version 21.0.

Ethical Considerations

The study adhered to the ethical principles outlined in the Declaration of Helsinki. Ethical clearance was obtained from the Traditional and Complementary Medicine Ethics Board of Istanbul Medipol University (Approval number:20, Date: 3 December 2020). Prior to the commencement of this study, a comprehensive informed consent process was diligently undertaken with all participants. The participants were provided with detailed explanations regarding the study's objectives, procedures, potential risks, and benefits. This ensured that participants had a clear understanding of what their involvement would entail.

RESULTS

A total of 20 participants were enrolled in the study, including 18 females and 2 males. The educational distribution of participants was as follows: 25% (n=5) had received primary education, 20% (n=4) had completed high school, and 55% (n=11) held a university degree. The mean age of participants was 37.9 ± 8.43 years. The average pain duration was 42.85 ± 44.47 months (Table 1).

Table 1. Sociodemographic and anthropometric data.

Parametre	**Groups**	**n (%)**
Education	Primary school	5 (25.0%)
	High school	4 (20.0%)
	University	11 (55.0%)
Gender	Female	18 (90.0%)
	Male	2 (10.0%)
	Mean ± SD	Median (Min-Max)
Height	164.4 ± 6.94	163 (153 - 182)
Weight	68.75 ± 11.73	67.5 (48 - 98)
Duration	42.85 ± 44.47	30 (3 - 120)
Age	37.9 ± 8.43	39 (20 - 49)

Significant alterations in pain perception, as measured by the VAS, were evident both prior to treatment and at the end of the first week of treatment ($p<0.001$). Additionally, statistically significant favorable effects of the treatment were observed on fatigue levels and mood during the initial week of therapy ($p<0.001$). Moreover, a marked improvement was identified in FIQ scores after treatment compared to baseline ($p<0.001$).

Across all evaluated clinical indicators, cupping therapy exhibited a statistically significant positive influence on FMS (Table 2). Figure 1 visually represents the changes in clinical indicators (VAS, FSS, Beck, FIQ) before and after treatment, illustrating the average values. No immediate adverse reactions were observed.

Table 2. Comparison of clinical indicators before and after treatment.

Assessment	**Avg. Before**	**Avg. After**	**Avg. Difference**	**p values**
VAS	7.0 ± 2.0	3.7 ± 1.63	-3.3 ± 1.69	**<0.001**
	7 (5 - 10)	3.5 (2 - 7)	-3 (-6 - 0)	
FSS	5.81 ± 0.99	4.62 ± 0.98	-1.19 ± 1.11	**<0.001**
	6.1 (3.5 - 7)	4.65 (3.2 - 6.7)	-1.2 (-3.5 - 0.9)	
Beck	14.5 ± 8.35	10.3 ± 7.11	-4.2 ± 5.75	**<0.001**
	12.5 (3 - 34)	8 (2 - 30)	-4 (-17 - 5)	
FIQ	63.21 ± 16.78	38.32 ± 19.8	-24.89 ± 16.11	**<0.001**
	62.45 (33 - 95.1)	35.45 (8.1-73.8)	-24.9 (-55.4 - 7)	

Stats: Mean ± SD/Median (Min–Max), Paired Sample T-Test

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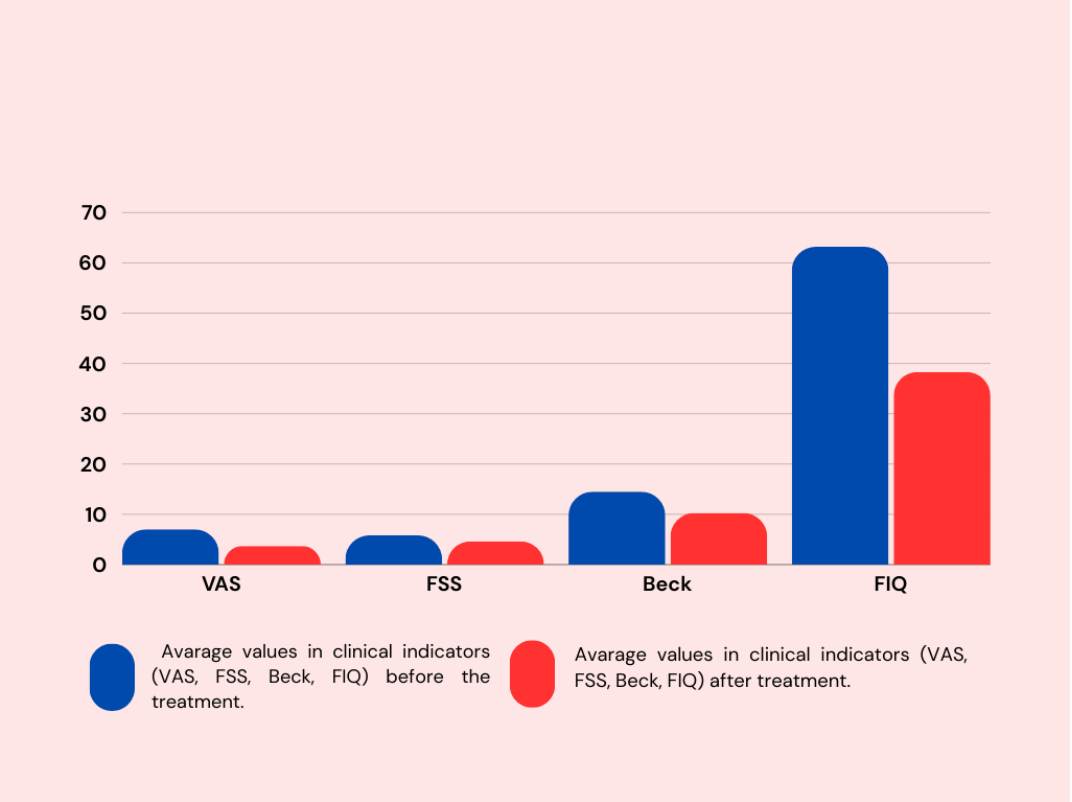

Figure 1. Changes in clinical indicators before and after treatment

DISCUSSION

The provided data showed that wet cupping therapy exerts significant positive effects on individuals suffering from FMS. This assertion is supported by the analysis of various clinical parameters, including pain perception measured via the VAS, levels of fatigue, mood states, and scores derived from the FIQ. The study demonstrates that both before the initiation of treatment and at the end of the first week of therapy, notable alterations in pain perception were apparent. Furthermore, during the initial week of treatment, significant beneficial impacts of cupping therapy on fatigue levels and mood states were observed. Additionally, a considerable amelioration in FIQ scores after cupping therapy was identified when compared to the baseline measurement, and this improvement exhibited statistical significance. In totality, across all evaluated clinical parameters, cupping therapy exhibited significant and positive effects on the manifestation of FMS.

A study conducted by Salazar-Méndez et al. (2023) examined the effectiveness of cupping therapy in managing pain, enhancing quality of life, addressing sleep disturbances, and mitigating the impact of FMS in individuals with this condition. This analysis encompassed two research investigations, involving a total of 155 participants. Significant improvements were observed in terms of pain severity, with substantial effects, while moderate effects were identified concerning the enhancement of overall quality of life. In contrast, the amelioration of FMS symptoms and sleep disturbances showed more modest improvements. However, it is important to note that the degree of confidence in the results is relatively limited for most aspects, except for the outcomes related to sleep disorders.[21] The effectiveness of cupping therapy on muscle pain has been investigated in several studies. A systematic review by Kim et al. (2011) aimed to assess the evidence for the effectiveness of cupping therapy for pain.[22] The review encompassed randomized clinical trials (RCTs) that investigated the effectiveness of cupping therapy in patients experiencing pain of diverse origins. This study incorporated seven RCTs that met the predefined inclusion criteria. Among these trials, two RCTs yielded evidence indicating a significant reduction in pain associated with cupping therapy, particularly in cases of low back pain when compared to standard care and analgesic treatments.

Additionally, two other RCTs reported positive outcomes for cupping therapy in the management of cancer-related pain and trigeminal neuralgia, demonstrating its efficacy compared to anticancer medications and analgesics, respectively. However, it is noteworthy that one RCT did not establish the superior efficacy of cupping therapy over antiviral medication in alleviating pain related to herpes zoster.[22]

Moreover, a systematic review conducted by Cao et al. in 2012 identified a total of 135 RCTs investigating the utilization of cupping therapy. These studies were generally characterized by a low level of methodological quality. Cupping therapy was frequently employed in the treatment of conditions such as herpes zoster, facial paralysis, cough and dyspnea, acne, lumbar disc herniation, and cervical spondylosis. The findings of this review suggested that cupping therapy may hold promise as an effective intervention for addressing herpes zoster and specific other medical conditions. Nevertheless, it underscored the imperative need for further meticulously designed trials to comprehensively evaluate the therapeutic potential of cupping therapy for various other medical conditions.[16] Qureshi et al. (2019) mentions that patients with myofascial pain syndrome (MPS), which shares some similarities with fibromyalgia, respond well to a variety of interventions including cupping therapy. It states that cupping therapy, along with other manual therapies, injection techniques, acupuncture, and other holistic treatments, may be beneficial in managing MPS.[23]

Li et al. (2016) employed near-infrared spectroscopy to appraise the therapeutic impact of dry cupping therapy on muscle discomfort.[10] The findings demonstrated a notable and enduring rise in blood oxygen levels resulting from the application of cupping therapy. The research centred on the use of dry cupping treatment and assessed its influence on the infraspinatus muscle, which is frequently utilized for addressing shoulder discomfort.[10]

In a research endeavour designed to evaluate the effectiveness of cupping therapy in ameliorating symptoms and enhancing the quality of life for individuals diagnosed with FMS, study participants were randomly allocated to receive one of three interventions: actual cupping therapy, a sham procedure, or conventional care.[24] The cupping therapy was administered on five occasions, with a frequency of twice per week, targeting the upper and lower back regions. Patients expressed moderate satisfaction with both cupping and sham cupping treatments, and minimal adverse effects were noted. Although cupping therapy exhibited better effectiveness in enhancing pain intensity and quality of life compared to standard care, the observed effects were modest and similar to those of a sham treatment. Consequently, given the present circumstances, it is not advisable to recommend cupping as a viable option for managing fibromyalgia. In the context of patients diagnosed with FMS, five sessions of cupping therapy demonstrated greater effectiveness compared to standard care in terms of enhancing pain intensity and quality of life. However, considering the relatively modest impact observed and the absence of clear superiority over sham cupping treatments, it is not possible to recommend cupping as a definitive treatment for FMS at present.[24]

It is important in primary healthcare and physical treatment because advances in the understanding of FMS pathophysiology and clinical presentation have improved its recognition and diagnosis in clinical practice [3]. The hallmark symptoms used to identify FMS include chronic widespread pain, fatigue, and sleep disturbances.[3] Therefore, family medicine practitioners need to be aware of these symptoms and common mimics of FMS to increase confidence in establishing a diagnosis.[3]

In the realm of FMS treatment, the primary objectives involve the mitigation of pain, enhancement of sleep quality, and improvement of physical functionality.[25] It is imperative to not only recognize but also address any potential pain origins that might coexist with fibromyalgia, including peripheral inflammatory or neuropathic pain sources, as well as visceral pain.[25] This holistic treatment strategy serves as a pivotal element in the effective clinical handling of FMS.[25] In addition to pharmacological treatments, nonpharmacological interventions are also recommended for the management of fibromyalgia. Exercise has been shown to improve functional status, key symptoms, and self-efficacy in women with FMS.[26] Psychoeducation, recommendations for a healthy lifestyle, and nonpharmacological interventions have been recommended for FMS patients.[27]

Increasing knowledge and awareness of patients and their families about FMS can contribute to improved functionality and better treatment outcomes.[27] Improved recognition and diagnosis of fibromyalgia, along with a comprehensive approach to treatment that includes pharmacological and nonpharmacological interventions, can lead to better management of the condition and improved patient

outcomes. Patient education and awareness are also crucial in the management of fibromyalgia.

Healthcare practitioners may find advantages in adopting a patient-centred strategy for treatment, emphasizing efficient pain control and consistent assessment of functional advancement.[28] Proficiency in integrative healthcare equips healthcare providers to dispense informed counsel and suggestions that are customized to the distinct preferences of each patient. Complementary therapies are accepted and used differently across medical specialties; therefore, both primary healthcare practitioners and professionals specializing in physical therapy and rehabilitation should cultivate a comprehensive understanding of these treatments in managing FMS.[29, 30]

Limitations: While the study offers promising insights into the potential benefits of cupping therapy for FMS, there are several limitations. The small participant group raises questions about generalizability, and the short treatment period of one week might not capture long-term effects. The absence of a control group or placebo makes attributing improvements solely to cupping therapy complex. Reliance on self-reported measures introduces potential biases, and the lack of blinding adds another layer of intricacy. Considering the variation in FMS symptoms and the short-term focus, a comprehensive understanding of cupping therapy's impact requires further research with larger groups and stronger controls.

CONCLUSION

This research offers a hopeful direction by demonstrating that cupping therapy can lead to positive results concerning the perception of pain, reduction in fatigue, improvement in mood, and the overall impact of FMS. Therefore, it presents a potential pathway for therapeutic intervention in individuals affected by this condition. Nevertheless, it's important to recognize that while T&CM may provide some relief for FMS symptoms, these treatments should be used alongside evidence-based therapies and under the guidance of a healthcare professional. The effectiveness of T&CM can vary from person to person, so consulting with a healthcare provider before starting any such therapies is essential.

Furthermore, it's worth highlighting that cupping therapy should only be administered by properly trained professionals to ensure safety and minimize the risk of adverse effects. Individuals with FMS who are contemplating cupping therapy should engage in a discussion with their healthcare provider to thoroughly explore potential benefits and risks.

Awareness of complementary therapies empowers professionals in primary care and physical treatment and rehabilitation to offer well-informed advice and recommendations tailored to individual patient preferences.

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ORIGINAL RESEARCH

Determination of the Use of Complementary and Alternative Treatment Methods in Burn Wounds of Patients Who Apply to The Emergency Department with Burn Complaints

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Abstract
Objective: This study aimed to determine the use of complementary and alternative treatment methods in burn wounds among patients who visited the emergency department with burn complaints.
Material-Method: This descriptive, cross-sectional study was conducted with 100 patients who applied to the emergency department of a training and research hospital with burn complaints. Data were collected using three questionnaires: one on the patients' socio-demographic information, another on the characteristics of the burns, and a third that assessed knowledge and use of complementary treatment methods for burns.
Results: It was determined that 32% of the participants were burned due to scalding, with most cases involving 1st and 2nd-degree burns. The participants reported that they were aware of traditional burn treatment methods, including washing with cold water (43.9%), using St. John's wort oil (17%), and applying yogurt (14.6%). The most commonly used methods in burn treatment were cold water (90.8%) and St. John's wort oil (5.7%).
Conclusion: It was determined that while participants were aware of various complementary and alternative treatment methods for burn injuries, they did not frequently use these methods.
Keywords: Burn, Complementary and Alternative Treatment, Emergency Service, Nursing Care.

INTRODUCTION

Burn is a severe trauma that can affect individuals of all ages from past to present and is the leading cause of injury-related deaths worldwide.[1] According to the estimates of the World Health Organisation, 265,000 people die every year due to burns all over the world.[2] Hundred burn cases are admitted to the emergency service every day in various ways.[3] Correct first aid intervention within the first hour reduces the pain, tissue damage, hospitalization time, and mortality rate of the patient/injured in the burn area[5] and accelerates wound healing by providing rapid proliferation of epithelial cells in the burn area.[4-6] However, it is reported in the literature that correct first aid is not provided in hospital interventions, water application is insufficient to relieve pain and suffering in burn wounds, and traditional treatments such as tomato paste, butter, toothpaste, potatoes, and egg whites are also mentioned.[7] A study examining the methods used by mothers who treated their children after burns found that 53.3% of the participants treated the burn area with water, 6.7% applied yogurt, and 5.5% applied ice.[1] However, for a plant to be used for medicinal purposes, the suitable species must be collected at the right time. Studies conducted on plants sold by herbalists indicate that the situation threatens public health, while unconscious application by unauthorized people threatens health.[7-11] In addition, social media and television programs cause individuals living in urban and rural areas to apply complementary and alternative treatment methods unconsciously.[12] Complementary treatment methods applied unconsciously may increase the depth of the burn, prolong the hospital stay, and even cause death.

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According to the recommendation of the American Association of Surgeons, any pre-existing condition that may complicate the treatment, prolong recovery, or affect mortality-among the criteria for referral to the burn center, the emergency room nurse should detect this situation and share it with the relevant physician. In addition, during the care of a burn patient, the emergency room nurse should provide information about keeping the wound clean, the frequency of dressing, and the medications prescribed under the supervision of a doctor that should be used in the dressing.[13]

In this direction, the study was conducted to determine the use of complementary and alternative treatment methods in burn wounds of patients who applied to the emergency service with burn complaints.

MATERIALS AND METHODS

The ethical dimension of the research

Before starting the study, permission was obtained from Karabük University Non-Interventional Clinical Research Ethics Committee (Date:17.01.2023, decision no: 2023/1235). In addition, institutional permission was obtained from Karabük University Training and Research Hospital (Date:06.02.2023, Number: E-34771223-774.99-208424864). The purpose and importance of the study were explained to the participants, and their consent was obtained in line with the principle of voluntariness. The study was conducted in accordance with the Helsinki Declaration 2008 Principles.

Type of research

The study is descriptive and cross-sectional type.

Population and sample of the study

The study population consisted of patients who applied to the Emergency Service of Karabük Training and Research Hospital with burn complaints between 01.02.2023 and 01.03.2023. The study sample included patients over 18 who applied to the emergency service of Karabük Training and Research Hospital between 01.02.2023 and 01.03.2023 with a complaint of burns and who voluntarily accepted to participate (n=100). During the study, 105 burn patients were admitted to the emergency service. Five patients did not agree to participate in the study. Accordingly, the study was concluded with 100 patients.

Data collection

In the collection of the data, a questionnaire prepared by the researcher based on the literature, including socio-demographic information (age, gender, marital status, marital status, educational status, employment status, and place of residence), a questionnaire including the characteristics of burn[14] and a questionnaire determining the knowledge and use of complementary treatment methods used in burn were used.[1,15]

Statistical analysis of data

Data were analyzed using SPSS (Statistical Package for Social Science) 24 package program to analyze the results. Descriptive statistical methods such as number, mean, standard deviation, and percentage were used to evaluate the data. Each item was assessed within itself.

RESULTS

When the socio-demographic characteristics of the patients presenting to the emergency service with burn complaints were analyzed, it was found that the mean age was 32.49±17.06 years. It was determined that 52% (n=52) of the participants were male, 50% were married (n=50), 24% had a bachelor's degree or above, 52% were not working, and 69% lived in the city center (Table 1).

Table 1. Socio-demographic Characteristics of Participants

Socio-demographic Characteristics		**Data**
Age, mean±SD		32.49±17.06
Gender, n(%)	Woman	48 (48)
	Male	52 (52)
Marital status, n(%)	Married	50 (50)
	Single	50 (50)
Education status, n(%)	Illiterate	13 (13)
	Primary School	10 (10)
	Secondary Education	15 (15)
	High School	38 (38)
	Undergraduate and above	24 (24)
Employment status, n(%)	Employee	48 (48)
	Not working	52 (52)
Place of settlement, n(%)	Village	7 (7)
	District	24 (24)
	Province	69 (69)
Total, n(%)		100 (100)

When the causes of burn of the participants were analyzed, it was determined that 32%(n=32) were scalded, 18% (n=18) were burned by fire, and 12%

(n=12) were due to sunburn. The areas burned were hands 35% (n=35) hand, 21% (n=21) arm, 10% (n=10) face were the most commonly burned areas, 50% (n=50) were 1st-degree burn, and 43% (n=43) were 2nd-degree burn respectively (Table 2).

Table 2. Findings of the participants regarding the characteristics of burns

Cause of burn, n(%)	Fire	18 (18)
	Scalding	32 (32)
	Allergenic substance	3 (3)
	Electricity	7 (7)
	Hot oil	11 (11)
	Hot iron	11 (11)
	Steam	6 (6)
	Sun	12 (12)
Burning area, n(%)	Face	10 (10)
	Head and neck	6 (6)
	Hand	35 (35)
	Arm	21 (21)
	Chest-abdomina	4 (4)
	Back	3 (3)
	Foot	7 (7)
	Leg	9 (9)
	Whole body	5 (5)
Burn depth, n(%)	1st Degree	50 (50)
	2nd Degree	46 (46)
	3rd Degree	4 (4)
Total, n(%)		100 (100)

When the status of knowledge, utilizing, and learning complementary and alternative treatment practices used in burn was examined, it was found that 82% of the participants knew/heard of any of the complementary and alternative treatment methods in burn treatment. The most common methods were cold water rinsing 43.9% (n=36), St. John's wort oil 17.0% (n=14), and yogurt 14.6% (n=12) (Table 3). When the complementary and alternative treatment methods used in burn treatment were analyzed, 90.8% (n=79) used cold water, 5.7% (n=5) used St. John's wort oil, 97.7% (n=85) stated that they used this method in their current burn experience, and 96.4% (n=82) indicated that they thought this method was effective. The participants said that they heard about these methods from neighbors/friends 31.7% (n=26), from family/relatives 26.8% (n=22), and from the internet 21.9% (n=18) (Table 3).

Table 3. Participants' knowledge and use of complementary and alternative methods in burn treatment

Complementary and alternative treatment method that you knew/heard is used in burn treatment, n(%)	Yes	82 (82)
	No	18 (18)
Known complementary and alternative treatment methods (n=82), n(%)	Egg white-egg oil	4 (4.8)
	Washing with cold water	36 (43.9)
	St. John's Wort oil	14 (17.0)
	Olive oil	4 (4.8)
	Yogurt	12 (14.6)
	Potato	2 (2.4)
	Ozonated oil	3 (3.6)
	Putty	3 (3.6)
	Tea tree cream	4 (4.8)
Complementary and alternative treatment methods previously used in burn treatment (n=87), n(%)	Cold water	79 (90.8)
	St. John's Wort oil	5 (5.7)
	Olive oil	1 (1.1)
	Putty	1 (1.1)
	Yogurt	1 (1.1)
The situation using this method at the moment, n(%)	I used it	85 (97.7)
	Not used	2 (2.3)
Thinking that the complementary and alternative treatment method used is effective (n=85), n (%)	Yes	82 (96.5)
	Undecided	3 (3.5)
Where they learned complementary and alternative treatment methods (n=82), n (%)	Internet	18 (21.9)
	Newspaper-social media	9 (10.9)
	Doctor	2 (2.4)
	Nurse	5 (6.0)
	Family/relatives	22 (26.8)
	Neighbour/friend	26 (31.7)

Although not shown in the table, no significant relationship existed between the socio-demographic characteristics of the patients who applied to the emergency department and the complementary and alternative treatment methods they knew/heard were used in burn treatment ($p>0.05$).

DISCUSSION

Burn complaints are a form of emergency trauma that can happen to people of all ages and genders.12,16 The literature states that thermal burns are the most common burns in individuals presenting to the emergency service with burn complaints, and most of these burns are scalds.13,17 In our study, 32% of the

patients presented to the emergency service with scalding burns, in accordance with the literature.

It is important to support these patients in functional areas such as hand, face, and extremities as they have difficulty fulfilling their self-care needs and experience psychosocial problems[18]. In the study, the most affected body parts of the patients admitted to the emergency service with burn complaints were the hand (35%), arm (21%), and face (10%). In this direction, since patients will be uneasy due to the deterioration of their appearance, emergency nurses should inform the patients that they should not use substances other than the recommended drugs when they first meet the patient and during the treatment.

The first intervention in a burn case is to keep the burned area under running water for 20 minutes. Then, the burning area should be covered with a clean dressing and go to the nearest health institution.[5] In Hafizurrachman et al. study investigating the traditional treatment methods used in burn injuries in the 21st century, it was found that 29% of the first intervention after the burn was washing with water, 46% was complementary and alternative treatment method, and 30% was applied to the emergency service without any intervention.[19] In the study conducted by Gürler H. et al., the rate of water use was 53.3%. In our study, the rate of knowing how to wash with water after burn was 43.9%, and the rate of those who washed with water before applying to the emergency service was 90.8%.[1]

Burn wounds are very susceptible to infection, especially in the first hour. Inappropriate drugs used during this period increase the depth of the wound and reduce the healing rate.[17] For example, eggs are an excellent culture medium for microorganisms and a potential cause of allergy or anaphylaxis. In a study, a 13-month-old boy with a burn percentage of 5% was found to have an egg applied to the burn by his parents and needed treatment up to intubation.[20,21] In the study conducted by Broadis et al., it was found that only 69% of the patients received first aid at home, and the most commonly used methods were water (31%) and eggs (21%). The interviews with the families who used eggs as the first treatment at home stated that this method was preferred because it was readily available and reduced bullae formation.[22] In our study, 4.8% of the participants stated that they knew egg white as the first intervention in burn treatment as a complementary and alternative treatment used in burn wounds. However, among the traditional and complementary methods used in treating burns in our study, 17% stated that they knew that St. John's wort oil was used, and 6% indicated that they used St. John's wort oil. St. John's wort oil, frequently used in treating burns, has been used for centuries in treating burns, wounds, and ulcers, with diuretic, antibiotic, and antiviral effects. However, it has been reported that yellow cantarone is contraindicated after organ transplants in HIV patients on protease-1 inhibitors and severely depressed patients at risk of suicide. It was also emphasized that those who use these solutions should not be exposed to sunlight, as they sensitize the skin to sunlight.[23,24,25] The study by Altiokka emphasized how misinformation obtained without any filtering or control mechanism in the virtual environment jeopardizes public health by selecting the three most frequently mentioned medicinal plants in social media often used by the public[11]. In this direction, nurses working in emergency services should question the conditions that may cause complications in patients presenting with burn wounds.

Complementary and supportive treatment methods used in burn wounds are available. Still, there are not enough evidence-based scientific studies on the efficacy, acute and chronic toxic effects, and quality of herbal products, which are safe because they are natural. Solid sources should be used to obtain information.[24] The literature says these practices are primarily heard through television, the internet, close friends, and family.[26,27,28] In this study, patients said they mostly heard about the traditional treatment methods used for burns from their close relatives (31.7%), the internet, and social media (21.9%). Nurses in the emergency service should explain to patients that the information given by unauthorized persons while intervening in burn patients does not have any evidence and, therefore, increases infection, triggers bullae formation, prolongs the treatment process, and may even cause death.

CONCLUSION

In this study conducted with patients admitted to the emergency service with burn injury, it was determined that the participants knew many complementary and alternative treatments for burn injury but did not use these methods. In line with these results, it is recommended that emergency service nurses inform patients and their relatives that complementary and alternative treatment methods whose reliability has not been proven may cause life-threatening burn injuries. This study was conducted in the emergency service of a training and research hospital and cannot be generalized to all patients.

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Author Contributions: Concept–DYG, AA; Supervision–DYG; Materials–AA; Data Collection and/or Processing– DYG, AA; Analysis and/ or Interpretation–DYG, AA; Writing–DYG, AA.
Peer-review: Externally peer-reviewed.

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ORIGINAL RESEARCH

Efficacy of Pericoccygeal Local Injection with Rectal Manipulation in the Treatment of Chronic Coccygodynia

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Abstract

Objective: Coccygodynia, a condition primarily affecting women, is characterized by pain localized around the coccyx, which is aggravated by activities such as sitting, sexual intercourse, defecation, or transitioning from a seated to a standing position. Although a range of conservative treatments, including NSAIDs, ice application, and physical therapy, are commonly employed, a subset of patients fails to achieve symptom relief. This study aims to evaluate the efficacy of rectal manipulation combined with paracoccygeal steroid injections in patients with chronic coccygodynia unresponsive to conservative treatments.

Material-Method: This retrospective study involved 24 patients (20 females and 4 males) with chronic coccygodynia that persisted despite more than three months of conservative treatment. All patients received a combination of steroid-local anesthetic injections and rectal manipulation. VAS scores were recorded before intervention, on the 10th day post-intervention, at one year, and at the last follow-up visit. Patients were assessed for trauma history, BMI, coccyx type, and dynamic radiographic findings.

Results: The mean VAS score significantly decreased from 7.9 pre-treatment to 2.2 on the 10th day post-treatment ($p<0.001$). This improvement persisted with mean VAS scores of 2.9 at one year and 2.7 at the last follow-up, although a slight, non-significant increase was noted over time. Patients with hypermobility of the coccyx showed significantly higher VAS scores at the last follow-up compared to those without hypermobility ($p=0.009$). No significant differences in treatment outcomes were observed between traumatic and atraumatic etiologies or between normal and overweight BMI groups

Conclusion: The combination of paracoccygeal steroid injections and rectal manipulation appears to be an effective treatment for chronic coccygodynia, with a significant reduction in pain scores. Hypermobility of the coccyx may be associated with higher recurrence rates, warranting further investigation into tailored treatments for this subgroup.

Keywords: Coccygodynia, Manipulation, Injection.

INTRODUCTION

Although coccygodynia more commonly affects women, it can be seen at any age and describes symptoms of pain around the coccyx[1,2]. Pain may radiate to the lower extremities or genital area. Sitting may aggravate the pain, while sexual activity, defecation, or the onset of mobilization to a standing position may also increase symptoms. Prolonged standing and inappropriate sitting positions may also cause back pain[2]. Direct falls, trauma, and prolonged sitting on hard surfaces are particularly significant causes of coccygodynia. Additionally, conditions such as pilonidal cysts, infections, tumors, physiological abnormalities, bursitis, and pathologies of visceral organs can also contribute to the

development of this condition. Some cases in which no cause for the symptoms can be found are also considered idiopathic. The exact incidence of coccygodynia is unknown. Although it can be seen at any age, it is usually detected more frequently in the fourth decade[3,4].

Conservative treatment is primarily preferred in coccygodynia. Non-steroidal anti-inflammatory drugs, ice packs, acupuncture, Extracorporeal Shock Wave Therapy (ESWT), hot baths, physiotherapy, coccygeal cushion and rectal manipulation are used in conservative treatment [5,6]. Osteopathic Manipulative Treatment (OMT) is another conservative method that can be beneficial for patients with coccygodynia. OMT utilizes hands-on techniques to diagnose, treat, and prevent various illnesses or injuries. The methods employed in OMT may include stretching, gentle pressure, and the application of resistance. In the context of coccygodynia, OMT can help alleviate pain and improve mobility by addressing musculoskeletal imbalances and enhancing circulation to the affected area[7,8].

Minimal interventional procedures such as direct injections around the coccyx, ganglion impar block/blockade, caudal epidural blocks, neurolysis can be performed in patients who do not respond to conservative treatment[9]. Coccygectomy can be performed in patients who do not benefit from all of these[9].

Coccygeal massage and levator ani stretching exercises can be performed with the intention of treating the tonic spasm thought to be responsible for the pain. Rectal manipulation was first described by Ambroise Pare in 1634[10]. Thiele described levator ani massage in the treatment of chronic coccidinia. In addition, he also recommends coccyx massage[11]. Maigne recommends mobilization of the coccyx extension with stretching of the levator ani muscle[12]. Different conservative methods can be combined in resistant cases[4,5].

The aim of this study was to investigate whether rectal manipulation in addition to paracoccygeal steroid injection improves treatment efficacy in patients with chronic coccidia.

MATERIALS AND METHODS

Patients who were followed up with conservative treatments (nonsteroidal anti-inflammatory therapy and use of coccygeal cushion) for more than 3 months between 2017 and 2019 in a single center and who did not respond to treatment were included in the study. Written informed consent was obtained from all patients. Inclusion criteria were defined as persistent coccygeal pain for more than 3 months and no abnormality in laboratory findings or imaging to explain the pain. Exclusion criteria were pregnancy, uncontrolled diabetes mellitus, local skin infection, previous coccygectomy, sacrococcygeal fusion, and previous interventional treatment. Patients with a follow-up period of less than 2 years and those who did not attend follow-up visits were excluded from the study.

All patients received a combination of steroid-local anesthetic mixture injection and rectal manipulation. A total of 24 patients [20 females (83.3%) and 4 males (17.7%)] were included in the study. Visual Analog Scale (VAS) recorded before the intervention, on the 10th day after the intervention, at one year and at the last follow-up visits were evaluated. Patients were questioned about previous trauma and time of symptom onset. Anteroposterior/lateral plain radiographs were taken in all patients. To evaluate the mobility of the coccyx, standing and sitting dynamic lateral radiographs were taken. In these radiographs, a coccygeal angulation of more than 25 degrees was considered hypermobility. Magnetic Resonance Imaging was also performed to exclude underlying pathologies. Body-mass index (BMI) was calculated in all patients. Coccyx types were determined according to the Postacchini-Massobrio classification[13]. Patients were classified according to the etiology of pain (traumatic or atraumatic), body mass index (normal or overweight), anatomical type of the coccyx.

Technical

Patients were positioned in the prone position for the procedure. After the coccygeal area was sterilized, 3 cc (60 mg) prilocaine hydrochloride was administered, followed by 1 cc (40 mg) methylprednisolone acetate, and 5 cc solution containing 4 cc (20 mg) bupivacaine hydrochloride was injected blindly into the paracoccygeal area. Combined rectal manipulation and massage was started 5 minutes after the injection. Levator ani massage described by Thiele was applied for 3 minutes[14].

The coccyx was then flexed, stretching and mobilized for one minute as described by Maigne[15]. Patients were advised to use a coccygeal cushion for 3 months and NSAII (dexketoprofen trometamol, 25 mg, twice daily) for 10 days after the procedure.

Statistical analysis

SPSS 15 (SPSS Inc., Chicago, IL, USA) program was used for analysis. Friedman test was used for repeated measurements and Wilcoxon Signed Ranks

test was used for post hoc analysis. Mean values of different groups were compared using Kruskal-Wallis test. Mann-Whitney U test was used for post hoc analysis. P value less than 0.05 was considered statistically significant.

RESULTS

The mean age of the patients was 37.2 (range 24-56) years. The mean duration from the onset of complaints until the procedure was performed was 19.1 (range 3-60) months. The mean follow-up period was 32.5 (range 24-50) months at the last follow-up visit (Table 1).

Table 1. Patient demographic characteristic (n:24)

Characteristic	Total
Age, mean	37.2
Sex (Female)	20 (%83.3)
BMI, mean	26.1
Mean duration from the onset of complaints until the procedure	19 months

The mean VAS score was 7.9 (range 5-10) before treatment and 2.2 (range 0-7) in the early post-treatment period (10th day). This change was statistically significant (P<0.001). The VAS scores at 1 year after the procedure and at the last follow-up were 2.9 (range 0-8) and 2.7 (range 0-8), respectively. Accordingly, there was a slight increase in the VAS score in the early and long-term controls, but this increase was not statistically significant (p=0.167). In six patients (25%), VAS score, which decreased in the early post-procedure period, increased in the last control. The mean VAS scores of these patients before and after the procedure were 7.8 (range 8-10) and 2.9 (range 1-4), respectively. VAS score at the last follow-up was 6.5 (range 4-7) and this increase was statistically significant (p=0.003).

The etiology was trauma in 15 (62.5%) patients, idiopathic in 8 (33.3%) and birth trauma in 1 (4.1%) patient. The mean BMI of the patients was 26.1 (range 17-40) kg/m2. According to the Postacchini-Massobrio classification, there were 7 (29.1%) Type I, 12 (50%) Type II, 4 (16.6%) Type III and 1 (4.1%) Type IV patient. There was no correlation between coccyx type and VAS scores before or after the procedure (p=0.657).

Dynamic radiography revealed a hypermobile coccyx in 12 (50%) of the patients. The mean pre-procedure VAS score of the patients with hypermobility was 8.1 (range 5-10) and 7.8 (range 5-9) in those without hypermobility and there was no significant difference between them (p=0.622). In the early post-procedure period, the mean VAS score was 2.5 (range 2-7) with hypermobility and 2.1 (range 0-8) in those without hypermobility and there was no significant difference between them (p=0.350). At the last follow-up visit, the mean VAS score was 5.8 (range 1-9) in those with hypermobility and 2.1 (range 0-7) in those without hypermobility, and the difference was statistically significant (p=0.009).

Patients were grouped as normal and overweight group according to BMI. The mean VAS score was 8 (range 5-10) in the overweight group and 7.9 (range 5-9) in the normal group before the procedure. After the procedure, these values were 2.4 (range 0-7) in the overweight group and 2 (range 0-8) in the normal group. There was no significant difference between the two groups before and after the procedure (p=0.910, P=0.090, respectively).

Patients were divided into two groups according to etiology as traumatic (15 patients) and atraumatic (9 patients). In the traumatic group, the mean VAS score was 7.8 (range 5-10) before the procedure, 2.2 (range 0-7) and 2.4 (range 0-8) in the early post-procedure period and at the last follow-up, respectively. In the atraumatic group, the mean VAS score was 8 (range 5-10) before the procedure, 2.1 (range 0-6) and 2.4 (range 0-7) in the early post-procedure period and at the last follow-up, respectively. In both groups, the pre- and post-procedure VAS scores were significant (p=0.008), while the change in VAS at follow-up was not significant (p=1 in the traumatic group and p=160 in the atraumatic group). When the traumatic and atraumatic groups were compared with each other, there was no significant difference between the two groups both before and after the procedure (p=0.808 before the procedure, p=0.860 in the early post-procedure period, p=0.790 in the final follow-up) (Table 2).

Table 2. VAS scores according to etiology

VAS score	Traumatic (n:15)	Atraumatic (n:9)	P value
Before the procedure	7.8	8	0.808
Early post-procedure period	2.2	2.1	0.860
Last follow-up	2.4	2.4	0.790

DISCUSSION

Coccygodynia, which affects women five times more than men, is most commonly traumatic or idiopathic. Coccygodynia is primarily caused by trauma to the coccyx from direct impact, prolonged sitting, or fetal

pressure during pregnancy. Additionally, anomalies in the soft tissues of the mid-sacral region, chronic inflammation of the coccygeal bursa, spasm of the pelvic floor muscles, pilonidal sinus, and lower sacral nerve root arachnoiditis are also potential contributors to coccygeal pain[1,2,16].

In our study, complaints were idiopathic in 8 patients (33.3%), 15 patients (62.5%) had a history of trauma. Only 1 patient (4.1%) had postpartum onset of coccygodynia.

Spasticity or other anomalies affecting the musculature of the pelvic floor have been found to be important in patients with coccygodynia[1]. The rationale for massage is to treat tonic spasm by stretching the anatomical structures around the coccyx that are thought to cause pain. Mobilization and stretching maneuvers of the sacrococcygeal and intercoccygeal joints are performed to increase coccygeal mobility. Maigne and Chatellier compared massage, mobilization and stretching methods and reported 29.2%, 16% and 32% success rates respectively after 6 months of follow-up[17].

If non-invasive treatments fail, corticosteroid injections are performed in the sacrococcygeal region[18,19]. In our patients with chronic coccygodynia, our aim with the manipulation technique combined with paracoccygeal local steroid injection was to reduce the local inflammatory response and then to reduce the pain with manipulations. The high success rate in our study (60% complete pain relief at the last control) may be due to the addition of steroid injection to the procedure.

There are different methods in the conservative treatment of coccygodynia and NSAIDs and coccygeal cushions are generally used primarily[1,5]. Fogel et al. reported that NSAIDs, coccygeal cushions and stool softeners used for 8 weeks reduced symptoms[4]. Kwon et al. also reported that the threshold period for the distinction between acute and chronic is 8 weeks[20]. Different treatment modalities may be tried in persistent cases. Steroid injection is claimed to be effective in cases of persistent pain for more than 6 months, while extracorporeal shock wave therapy has been reported to give more satisfactory results than physical modalities in coccygodynia[6,21].

In the management of chronic coccygodynia, various complementary and alternative treatments have been explored to enhance patient outcomes. OMT is a modality that has gained attention for its holistic approach in treating musculoskeletal disorders. OMT involves techniques such as myofascial release, muscle energy techniques, and counterstrain, which aim to improve the functional biomechanics and alleviate pain. Studies have shown that OMT can effectively reduce pain and improve mobility in patients with chronic pain conditions, making it a promising adjunct to conventional therapies for coccygodynia[7,8,22]. Another innovative approach is laser acupuncture, which combines traditional acupuncture principles with low-level laser therapy. This technique uses laser light to stimulate specific acupuncture points without the use of needles, offering a non-invasive alternative. While more extensive clinical trials are needed, preliminary findings suggest that laser acupuncture could be an effective treatment option for chronic coccygodynia, particularly for patients who are reluctant to undergo needle-based acupuncture[23].

Coccygectomy, which is one of the treatment options that can be preferred in refractory pain, has a high complication rate (20-30%), especially postoperative infection[1,4]. Despite this, good or excellent results are obtained in 60-90% of patients[24].

We used perirectal injection followed by manipulation in our study, which included patients who had persistent coccygodynia for more than 3 months and who had used coccygeal cushions and painkillers during this period. In a study comparing steroid injection alone with steroid injection after manipulation, the success rate was reported to be 59% and 85%, respectively. In the same study, the late recurrence rate in the group with combined treatment was 28%[2]. There was a decrease in VAS in 92% of our patients included in the study. Therefore, we think that our success rate increased because we combined injection with manipulation. In addition, the rate of late recurrence in 25% of our patients was similar to the literature.

Obesity seems to be a factor in the occurrence of coccygodynia. In a study by Fogel et al. it was reported that more coccygodynia was observed in obese patients[4]. In our study, 25% of the patients were overweight. No difference was found between normal weight and overweight patients. Maigne et al. stated that the configuration of the coccyx may change in overweight patients[17]. Accordingly, they stated that obese patients had more posterior subluxation, whereas normal weight patients had more normal configuration of the coccyx and may have hypermobility. In thin patients, they stated that there may be more spicules and anterior subluxation may be seen. Hypermobility was present in half of our patients and the VAS score was significantly higher in the hypermobile group compared to the

normal group at the last follow-up. This suggests that there may be more recurrence in patients with hypermobility.

In conclusion, the combination of paracoccygeal steroid injections and rectal manipulation appears to be an effective treatment for chronic coccygodynia, with a significant reduction in pain scores. Hypermobility of the coccyx may be associated with higher recurrence rates, warranting further investigation into tailored treatments for this subgroup.

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