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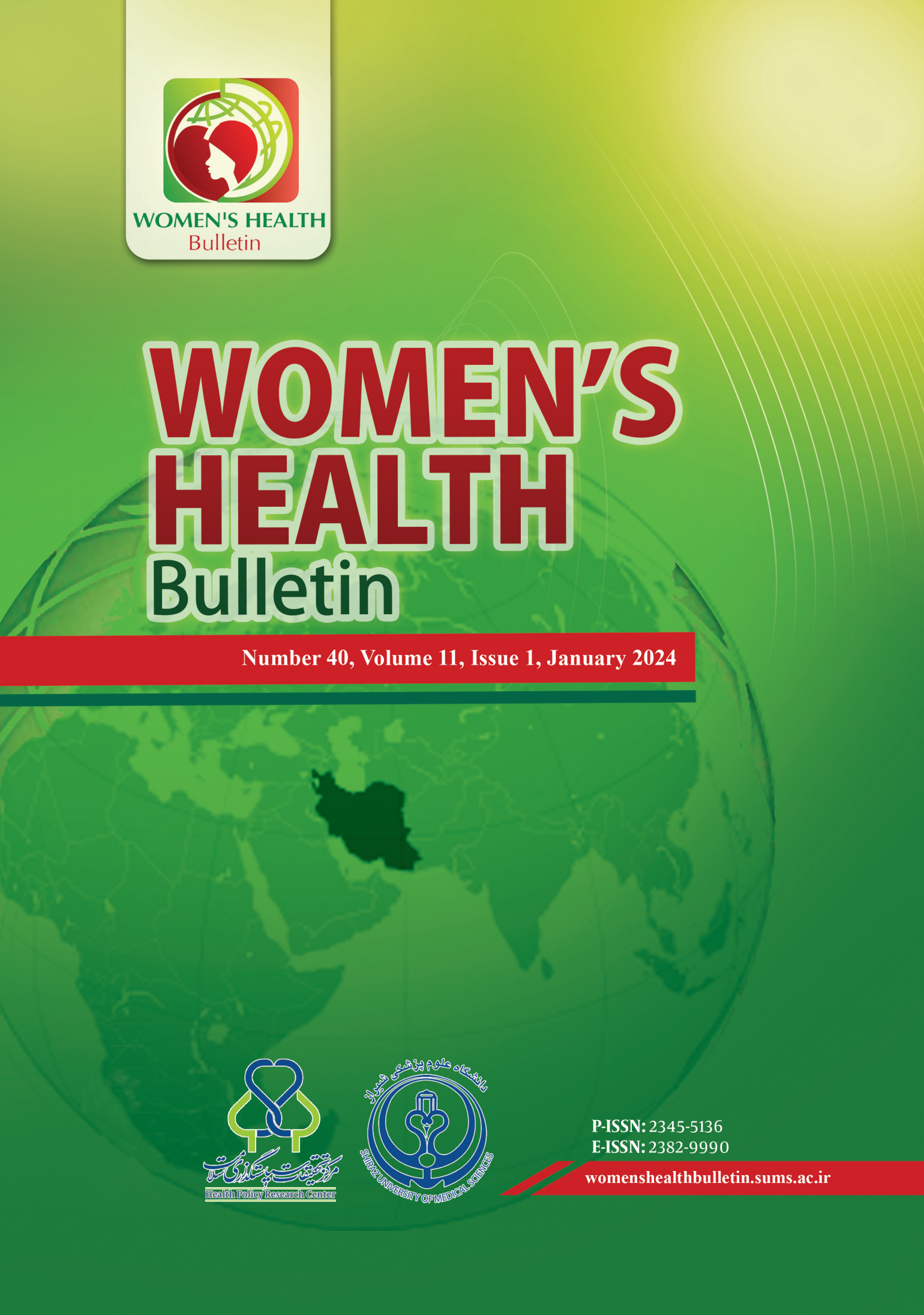

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AIM AND SCOPE

Women's Health Bulletin (WHB) is a quarterly peer-reviewed journal, the aim of which is to provide a scientific medium of communication for researchers throughout the globe. It is journal policy to publish work deemed by peer reviewers to be a coherent and sound addition to scientific knowledge and to put less emphasis on interest levels, provided that the research constitutes a useful contribution to the field. Manuscripts are publishable in the form of original article, review article, case report, letter to the editor, etc.

CONTENT COVERAGE

The journal considers articles on all aspects of the health and healthcare of adolescent girls and women, with a particular focus on the prevention, diagnosis, and management of disorders and diseases related to them, as well as related genetics, pathophysiology, epidemiology, clinical reports, and controlled trials.

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Research Articles

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Original Article

Knowledge and Awareness of Genital Warts among Female College Students in Iran and Its Role in Vaccination

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Abstract

Background: Human papillomavirus (HPV) is capable of infecting individuals engaging in sexual activity at some points in their lives. As general vaccination of children and adolescents is not a standard practice in Iran, this study aimed to assess the awareness of Iranian female college students regarding HPV and its associated vaccinations.
Methods: This cross-sectional research was conducted in 2020 on a cohort of 350 female college students from Shahed University, Iran. Participants were selected through a convenience sampling technique, with the determined sample size based on the enrollment in each faculty. An electronic questionnaire was prepared and administered virtually to the participating students.
Results: The mean age of the participants in this study was 21.63±1.93 years. Remarkably, 90% of the students were familiar with genital warts, while only 41% were knowledgeable about the available vaccine. Additionally, a third of the participants were unaware of the sexual transmission of HPV, and half were uninformed about the association between various cancers and genital warts. The average score for overall knowledge was 6.19±3.54. Notably, a significant correlation was observed among age, academic years of study, faculty affiliation, and knowledge about HPV and its vaccine (P<0.001). Interestingly, academic education emerged as the primary source of information after public media and the Internet.
Conclusion: The level of knowledge concerning HPV and its associated vaccine among the study participants was predominantly moderate. Considering the pivotal link between cervical cancer and HPV, the significance of providing adequate information and education on preventive measures cannot be overstated.

Keywords: Human Papilloma virus, Cancer, Knowledge

How to Cite: Abak F, Rabiee M, Jouhari Z. Knowledge and Awareness of Genital Warts among Female College Students in Iran and Its Role in Vaccination. Women. Health. Bull. 2024;11(1):1-10. doi: 10.30476/WHB.2024.100187.1249.

1. Introduction

One of the most prevalent sexually transmitted infections is Human Papillomavirus (HPV), which nearly all sexually active individuals will encounter at some points in their lives. HPV spreads through skin-to-skin contact or sexual activity and can be transmitted by asymptomatic carriers. Unlike many genitourinary tract infections, HPV infection often lacks acute symptoms such as burning, itching, or vaginal discharge. Nevertheless, the host's immune system typically combats the infection, leading to the absence of clinical signs in most HPV-infected individuals. Only 24.8% of women previously infected with HPV types 6 or 11 had genital warts in a prior studies (1, 2). To date, 228 varieties of HPVs have been identified, with 40 of these types exhibiting a preference for infecting the genital mucosa; HPVs belong to the group of double-stranded DNA viruses. Phylogenetic analyses have categorized HPV genotypes into low-risk, possibly high-risk, and high-risk categories (3). Low-risk variants like HPV 6 and 11 are responsible for 90% of ano-genital warts and respiratory papillomatosis, both of which can be potentially fatal diseases. In contrast, HPV types 16, 18, 31, 35, 39, 45, 51, 52, and 33, along with other high-risk variants, are major contributors to most cases of cervical cancer, as well as malignancies of the vulva, vagina, anus, penis, mouth, and oro-pharynx. HPV strains 16 and 18, specifically, account for 70% of global cervical cancer cases (3, 4). HPV infection is recognized as a significant risk factor for these malignancies, even though the incidence rate of HPV-related tumors is lower than that of cervical cancer (5). Cervical cancer was the fourth most common malignancy in women worldwide, accounting for 7.5% of all cancer-related deaths in women in 2018 (4-6). Although the majority of HPV infections are asymptomatic, transient, and curable with no specific treatment, preventing HPV infection, particularly the high-risk variants, could

reduce the incidence of HPV-related malignancies (7). It is crucial for parents and teenagers, who are the most vulnerable population, to understand how HPV spreads, how ano-genital warts develop, and how these malignancies are associated (8). In response to the high mortality associated with cervical cancer in both developed and developing countries and its strong link to HPV infection, the World Health Organization (WHO) has developed a global strategy for the elimination of cervical cancer known as the Cervical Cancer Elimination Modeling Consortium. This program includes three key interventions: 70% biannual cervical screening, 90% HPV vaccination, and 90% treatment of pre-invasive lesions and invasive malignancies by 2030 (5). The development of a vaccine represents a significant step towards reducing the incidence of cervical cancer and related malignancies (9). According to the World Health Organization, girls between the ages of 9 and 13, who have not yet engaged in any sexual activity, constitute the primary target demographic for HPV vaccination campaigns. Parental knowledge and attitudes significantly influence the effectiveness of vaccination programs (10). Epidemiological data indicated that vaccination rates remain low despite the availability of a vaccine against the agent responsible for cervical cancer (11). Adequate information, appropriate risk perceptions, healthy sexual attitudes, and protective sexual practices have all been shown to be related factors. Conversely, family members, peers, and education play pivotal roles in providing health information to teenagers (12). Furthermore, some parents refrain from discussing the virus, how to prevent it, and vaccination with their children due to embarrassment about the sexually transmitted nature of the illness and their lack of knowledge (13). A study conducted in Iran found that women had a 2.4% prevalence rate of HPV infection (14). In Iran, a developing country, it is estimated that 947 women receive cervical cancer diagnoses annually, with 370 of them succumbing to the disease. In two investigations involving Iranian women diagnosed with cervical cancer, HPV was detected in 87% and 85% of the patients, respectively (15). Moreover, it has been demonstrated that over 70% of Iranian women who develop cervical cancer may be infected with HPV-16 that followed by genotypes 11 and 66 (14). Considering that the prevalence of HPV infection in women peaks at age of 20, with the highest prevalence occurring between the ages of 18 and 28 (16), this study was conducted to assess the knowledge of university students regarding HPV, its transmission, its association with cancer, and their willingness to receive vaccination. The findings of this research hold significant importance since students are at risk of contracting the virus, and their understanding of transmission mechanisms and infection prevention can contribute to a reduction in the prevalence of genital warts, cervical cancer, and other associated cancers. Notably, the involvement of one spouse in the virus can lead to family disruption in Iran due to religious and moral structures that uphold family privacy. This underscores the importance of comprehending the virus, its prevention, and vaccination. In light of these considerations, it becomes essential to examine the level of awareness about this virus and the acceptance of the vaccine among young people, as this information can inform health planning and policies. This study was designed and implemented to investigate the knowledge of genital warts among female students and their willingness to accept vaccination against it.

2. Methods

This study was a descriptive investigation conducted to assess the knowledge level of female students at Shahed University of Tehran, Iran, regarding HPV infection and its vaccine in 2020 (from April 1 to March 31, 2020). With a confidence level of 95%, an alpha value of 0.05, and an estimated awareness rate of 30% (16-21), this study's sample size was 322 individuals. Accounting for a 5% potential loss of participants, the total sample size was determined to be 350 individuals, employing the following formula:

$$n = \frac{\left(z_{1-\alpha/2}\right)^2 Pq}{\left(d\right)^2}$$

where N represents the sample size, P denotes the initial estimation for the desired attribute ratio, d represents the maximum acceptable error in estimating the ratio, α is the probability of error of the first type, and Z1-α/2 equals 1.96 for α=0.05.

The selection of participants was based on the number of students within each faculty, ensuring that the faculty with the highest student enrollment had a more significant representation through

convenience sampling techniques. The necessary data were collected using a researcher-designed questionnaire. This questionnaire was developed by reviewing similar instruments used in previous studies (8, 9, 13) and subsequently subjected to review and validation by 5 obstetricians and 2 social medicine specialists. The content validity ratio (CVR) was determined to be 0.99, and the content validity index (CVI) exceeded 0.9. To calculate CVI, experts were asked to categorize each question into one of the following categories: unrelated, relevant but in need of fundamental revision, relevant but in need of revision, and relevant. The number of specialists who selected options 3 and 4 was divided by the total number of specialists.

The questionnaire was administered to 15 female students from Shahed University to establish its reliability. After one week, the same group completed the questionnaire again, and the reliability coefficient was determined using the Pearson correlation test, yielding a coefficient of 0.78.

Due to the COVID-19 pandemic and the closure of universities, an electronic questionnaire was prepared and distributed virtually to the enrolled students. Notably, the questionnaire was anonymous, and students unwilling to participate were excluded from the study at this stage. The questionnaire consisted of 22 questions, categorized into three parts:

1. Eight demographic and personal information (questions 1 to 6, 21, and 22)

2. Eight questions related to knowledge about HPV and genital warts (questions 7 and 9 to 15)

3. Five questions related to knowledge about the HPV vaccine (questions 16 to 20)

Questions 1 to 6 and 8, 21, and 22 had no point values. Questions 7, 9, and 20 were assigned a positive score for correct answers, while no points were awarded for incorrect answers or responses of "I do not know." Consequently, the minimum and maximum total scores for the questionnaire were zero and 13. In contrast, the score for knowledge regarding genital warts ranged from zero to 8, and the score for knowledge about the HPV vaccine ranged from zero to 5.

2.1. Statistical Analysis

The necessary data was collected and subsequently entered into SPSS version 16. Following this, frequency and percentage were employed to represent qualitative data, along with mean and standard deviation, to convey quantitative descriptive data. Given the non-normal nature of the quantitative data in this research, Mann-Whitney, Kruskal-Wallis, and Fisher tests were employed to analyze the aberrant data.

3. Results

3.1. Demographic Characteristics

The mean age of the study participants was 21.63±1.93 years, with a maximum age of 33 years and a minimum age of 19 years. The average duration of students' education was 3 years for middle education and 4 years for high school education, with a maximum of 8 years and a minimum of 1 year. Moreover, 68% (238 individuals) were undergraduate students, while 32% (112) were pursuing a professional PhD. Additionally, 252 participants (72.2%) were unmarried, and 97 (27.8%) were married. The prevalence rate of genital warts among the study participants was estimated at 4.3%, involving 15 cases. Furthermore, 8 (2.3%) students had received prior vaccination. Additional demographic information about the study participants is presented in Table 1.

3.2. Awareness and Knowledge of HPV and the Vaccine

It was discovered that 315 (90%) of the students possessed information about genital warts. Additionally, 234 (67%) students were aware of the sexual transmission of genital warts, and 178 (50.9%) understood the link between genital warts and the development of various cancers. Responses to other questions can be found in Table 2. The mean score from the questionnaire sections related to knowledge about HPV and genital warts was 3.75±2.29.

Significantly, 144 (41%) subjects had awareness of the vaccine. In response to whether the vaccine is administered exclusively to girls and women, 194 (63%) students lacked information on this matter, and 59 (16.8%) individuals believed that

Table 1: Demographic characteristics and their correlation with students' awareness of HPV and its vaccine

	Prevalence (%)	Virus awareness score	P value	Vaccine awareness score	P value	Total awareness score	P value
School of study							
Science	58 (16.6)	/1±78/2 94	<0.001	27/1±46/1	<0.001	/2±29/580	<0.001
Humanities	76 (21.7)	2.00±1.89		1.13±.75		3.42±3.11	
Engineering	47 (13.4)	2.74±1.8 5		1.24±1.06		4.61±3.03	
Medical	67 (19.1)	5.94±1.32		2.85±1.82		9.77±2.80	
Nursing	57 (16.3)	4.05±2.71		1.40±.97		6.40±2.49	
Dentistry	45 (12.9)	5.44±1.28		1.66±1.1 2		8.08±1.89	
Grade							
Masters	238 (68)	2.81±2.04	<0.001	1.18±1.14	<0.001	4.83±1.08	<0.001
PhD	112 (32)	5.74±1.32		2.37±1.68		9.09±2.60	
Location							
Home	254 (72.2)	3.85±2.29	<0.265	1.70±1.51	<0.01	6.48±3.58	<0.038
Dorm	95 (27.2)	3.53±2.25		1.27±1.09		5.50±3.33	
Marital status							
Single	252 (72.2)	3.63±2.30	<0.100	1.46±1.44	<0.126	5.99±3.53	<0.59
Married	97 (27.8)	4.09±2.22		1.74±1.56		6.79±3.49	
Vaccination							
Yes	8 (2.3)	4.77±1.88	0.204	2.87±.99	0.006	8.75±2.86	0.066
No	342 (97.7)	3.72±2.29		1.50±1.47		6.13±3.54	
History of genital warts							
Yes	15 (4.3)	4.33±2.19	0.353	1.86±1.45	0.289	7.20±3.42	0.264
No	335 (95.7)	3.72±2.29		1.52±1.48		6.15±3.55	

HPV: Human Papillomavirus

Table 2: Students' answers to questions about HPV and its vaccine

	Yes (%)	No (%)	Don't know
Have you heard of genital warts (Human Papilloma virus)?	317 (90.6)	33 (9.4)	-
Is the prevalence of genital warts increasing?	231 (67.2)	7 (2)	106 (30.8)
How does a person get genital warts?			
Skin-to-skin contact	52 (14.9)		
Types of sexual contact	235 (67.1)		
Body fluids (urine, saliva, feces .....)	8 (2.3)		
Transfer from mother to fetus	1 (.3)		
Don't know	54 (15.4)		
Is it possible for a person to be infected with human Papilloma virus and have no symptoms?	192 (54.9)	34 (9.7)	124 (35.4)
Can asymptomatic people transmit the virus?	166 (47.4)	34 (9.7)	150 (42.9)
Are there different types of genital warts?	131 (37.4)	30 (8.6)	189 (54)
Can different types of genital wart virus be Detected by testing?	130 (37.1)	45 (12.9)	175 (50)
Is genital wart associated with cancers (cervix, mouth and throat, etc.)?	178 (50.9)	34 (9.7)	138 (39.4)
Is there a vaccine to prevent genital warts?	144 (41.1)	27 (7.7)	179 (51)
Does the vaccine completely and definitively protect a person from getting genital warts?	44 (12.3)	79 (22.6)	227 (64.1)
Does the vaccine prevent cancer (cervix, mouth and throat, etc.)?	193 (55.3)	112 (32.1)	44 (12.3)
Is the vaccine recommended only for girls and women?	59 (16.9)	96 (27.5)	194 (55.6)
Is there an age limit for vaccination?	107 (30.6)	32 (9.1)	211 (60.3)

HPV: Human Papillomavirus

only girls should be vaccinated. The mean level of knowledge about the HPV vaccine was 1.53±1.48. The percentage and frequency of answers to each questionnaire question are separately presented in Table 2. The average score for total knowledge obtained from the questionnaire (representing overall awareness of papillomavirus and its vaccine) was 6.19±3.54, ranging from zero to 13.

3.3. Correlation between Participants' Knowledge and Demographics

A positive and statistically significant

correlation was identified between participants' ages and the mean scores of general knowledge obtained from the questionnaire (r=0.426), as well as scores related to knowledge about HPV (r=0.408) and scores about knowledge regarding the HPV vaccine (r=0.342) (P<0.001). Additionally, a positive and statistically significant correlation was observed between students' academic years, the mean of general knowledge scores obtained from the questionnaire (r=0.452), scores related to knowledge about HPV (r=0.449), and scores about knowledge regarding the HPV vaccine (r=0.341) (P<0.001). When comparing the mean scores of general knowledge obtained from the questionnaire, scores related to knowledge about HPV, and scores about knowledge regarding the HPV vaccine based on the students' faculties, a statistically significant difference was evident (P<0.001). Most scores were associated with medical and dental students (Table 1). Notably, the highest vaccination rate (4.48%) was observed in the medical school, which also exhibited the highest level of knowledge about HPV and its vaccine. However, no statistically significant difference was found between other demographic characteristics and knowledge about HPV and vaccination (Table 1).

3.4. The Correlation between Participants' Knowledge and Information Sources

The primary source of information was university courses, comprising 151 respondents (47.3%), while public media and the Internet accounted for 162 respondents (50.8%). Therefore, it has been determined that university courses are the predominant source of information for medical, dental, and nursing students. In contrast, public media and the Internet are the primary sources for engineering, humanities, and basic science students (Figure 1).

A statistically significant difference was observed when comparing the mean general knowledge scores obtained from the questionnaire based on the students' information sources. Specifically, the highest knowledge scores were associated with students who acquired their information from university courses (P<0.0001) (Table 3).

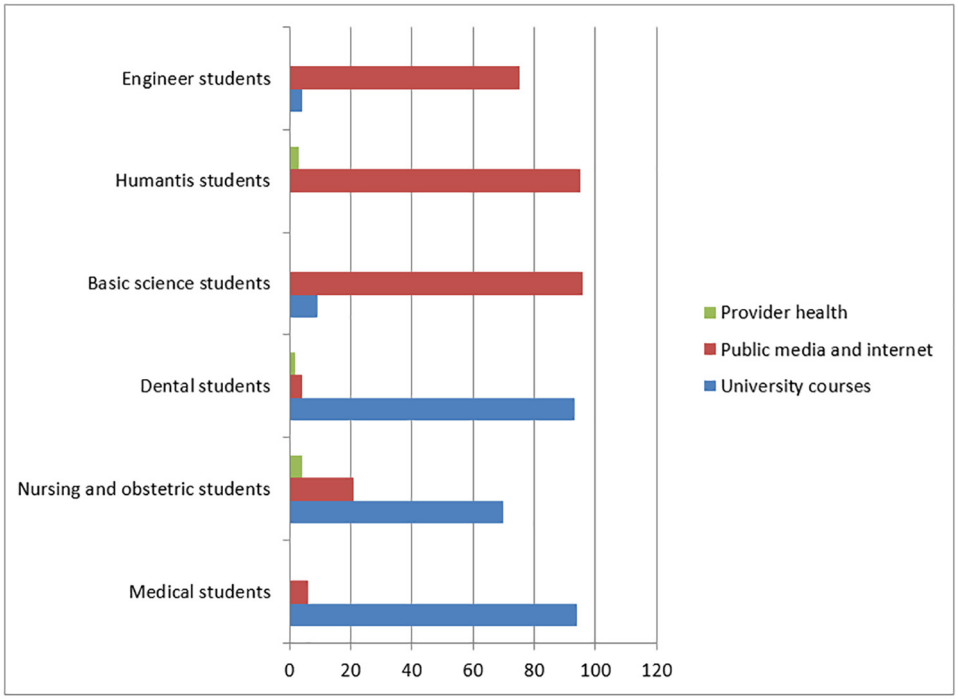

Figure 1: The figure shows the correlation between college students and source of information.

Table 3: The correlation between participants' knowledge and source of information

Source of information	Total knowledge score	P value
University courses	8.67±2.45	<0.0001
Public media and internet	5.06±2.6	
Provider health	6.25±0.5	
Friends and family	7±2.28	

4. Discussion

This study revealed that 90% of the students possessed information regarding genital warts. Additionally, 67% of the students demonstrated awareness of sexual transmission, while 50.9% were cognizant of the link between genital warts and the development of various cancers. The average knowledge score, derived from the questionnaire encompassing papillomavirus and its vaccine awareness, stood at 6.19±3.54.

Earlier studies conducted in Iran documented high incidence rates of HPV-6 (75%) and HPV-11 (16.7%), along with co-infections involving both HPV-6 and 11. Furthermore, in addition to its association with cervical cancer, HPV has been linked to head and neck cancers. The prevalence of HPV among women with normal cervical cytology ranged between 6.6% and 32.5%, while specific HPV genotypes, such as 16 and 18, were implicated (5-7, 16). Comprehensive insights into HPV infection and attitudes within general and educated populations are essential for enhanced illness management and treatment. Numerous studies consistently demonstrated that despite the high incidence of HPV, a dearth of information or misconceptions regarding the virus persists, even among informed individuals (17-21). Fortunately, 90% of the participants reported prior knowledge of HPV, an unexpectedly favorable outcome.

In contrast, a mere 10.3% of Chinese students had prior knowledge of HPV, and a mere 5.4% were aware of vaccination, as reported by Zou and colleagues (22). In a meta-analysis, awareness of HPV and its vaccination ranged widely from 5.2% to 94% of individuals surveyed (23). However, it is essential to note that hearing the term "HPV" does not necessarily equate to a comprehensive understanding of the virus and its potential implications (24). This research underscored a deficiency in comprehension regarding HPV and its vaccine.

This analysis identified key sociodemographic factors associated with HPV knowledge. These included the type of faculty, level of education, age, and study duration. Despite the generally low level of knowledge regarding HPV and its vaccine among all students, considerable disparities were observed among students from various colleges. Medical and dental students exhibited the highest level of HPV knowledge. Consistent with our findings, several studies reported statistically significant differences in knowledge between different colleges, with health sciences students displaying higher awareness levels (25-27), a logical outcome. Interestingly, this study revealed low awareness levels among nursing and midwifery students, a trend also observed in studies conducted in Indonesia (28, 29).

However, in this study, knowledge of the HPV vaccine among medical and dental students was notably deficient. In study by Pelullo and colleagues, out of 556 nursing students surveyed, nearly all reported awareness of HPV infection. However, only 36.5% were knowledgeable about HPV infection risk factors and the preventative role of the HPV vaccine (28). Our statistical analyses demonstrated a positive correlation between increasing age, years of education, and knowledge about HPV and its vaccine. This association likely stems from increased exposure to information about HPV and its vaccine as the students progress through their academic years.

Interestingly, our study found that students residing in private homes generally exhibited more information about the virus and its vaccine, contrary to the initial expectation that students living in dormitories, with more exposure to medical and paramedical peers, might be better informed.

In contrast to study of Salehifar and co-workers (30), no significant difference in knowledge was observed between married and unmarried individuals in our study. Research of Salehifar and co-workers (30) also suggested that married students were five times more knowledgeable than their unmarried counterparts, possibly due to counseling information provided at healthcare centers and personal experiences.

Among the factors considered to influence students' awareness were a history of genital warts and vaccine injections. Our research indicated a significant relationship between vaccine injection and vaccine knowledge. Nonetheless, compared to international statistics (31-33), our study group exhibited a meager percentage of HPV vaccine coverage. This may be attributed to cultural variations and a lack of community awareness. Knowledge and awareness of the HPV vaccine are reliable indicators of vaccine receipt or intention to vaccinate. Furthermore, comprehension of cervical

cancer and the role of HPV plays a predictive role in vaccination behavior (34).

In our study 50% of the studied people had obtained their information from the Internet and social networks and 47% from university courses. Surprisingly, medical staff and healthcare providers constituted only 1.3% of students' information sources. In alignment with our findings, a study by Ghotbi and Anai on Japanese students reported that source of information for students about HPV and its vaccination, respectively: 90% university courses, 7% on media, and only 0.1% on healthcare providers (35). The lack of knowledge regarding HPV among medical professionals, including physicians, may be why students and others seek information from them. Inadequate awareness of the health system about the HPV virus and the importance of vaccination has caused them to give little advice to clients for vaccination)36, 37). Remarkably, just 27% of paramedics were familiar with the names of commercially available HPV vaccines, compared to 86% of gynecologists. Paramedical staff expressed a substantial lack of understanding about the primary cause, risk factors, and symptoms of cervical cancer, as well as HPV vaccination (37). Research in the UK also indicated the need for further training to medical practitioners in order to address HPV screening and vaccination (38).

Regarding sexual health, our study revealed a significant knowledge deficit concerning HPV. Findings indicated a widespread misconception that males cannot contract HPV, a misconception consistent with previous research. Historically, the emphasis on HPV primarily affecting women's health may have contributed to this misperception. Additionally, respondents generally lacked awareness that the majority of sexually active individuals will contract the virus at some points in their lives, that early sexual debut increases the risk of HPV contraction, or that HPV is the primary cause of genital warts (24). Sexual conduct is widely recognized as the primary risk factor for HPV. Furthermore, it is well-established that increased awareness of HPV and HPV vaccinations can lead to higher vaccine uptake, while a lack of understanding may contribute to poor sexual hygiene and resistance to vaccine adoption (39).

4.1. Limitations

One limitation of this study is its exclusive focus on female students. Questions about the characteristics of sexual relations, such as the age of starting sexual relations, the type of sexual relations, non-conventional sexual relations, and other relevant materials were not asked.

5. Conclusions

The students' comprehension of both HPV and HPV vaccinations was notably deficient. Regrettably, only approximately half of the students exhibited awareness regarding the vaccination and the correlation between HPV and malignancies. According to the Health Belief Model, possessing adequate information ranks as one of the paramount variables for altering health beliefs and potentially influencing shifts in individuals' health behaviors. These unsatisfactory levels of knowledge pose a significant challenge within this research context. Consequently, it may prove highly advantageous to fortify government policies on preventing this infection while simultaneously recognizing the media's pivotal role in disseminating information and education on prevention. Nonetheless, due to the evolution of 1) young people's attitudes towards sexuality, 2) the need for the Ministry of Health program to endorse HPV vaccination and reassess the merits of HPV vaccination, and 3) the necessity for high-risk age groups to incorporate comprehensive instruction on sexually transmitted diseases, notably HPV, into their curricula, it becomes evident that HPV could potentially emerge as a dynamic threat to individuals.

Ethical Approval

The researchers conducted this study following the ethical principles outlined in the Helsinki Accords. It was ensured that information of the Student Questionnaire would remain confidential. This study received approval from the ethics committee of Shahed University, Tehran, Iran, with the code IR.SHAHED.REC.1399.035. Also, written informed consent was obtained from the participants.

Conflict of Interest: None declared.

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Original Article

Correlation between Physical Activity and Depression, Perceived Health, Physical Function, and Quality of Life in Older Women with Mild Cognitive Impairment

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Abstract

Background: While the beneficial effects of PA on the mental and physical well-being of elderly individuals are recognized, there has been little focus on its effects on older adults with mild cognitive impairment (MCI). Therefore, the objective of this investigation was to examine the correlations between physical activity (PA) and depression, perceived health, physical function, and quality of life (QoL) among older women with Mild Cognitive Impairment (MCI).
Methods: This study employed a descriptive-correlation design. The statistical population comprised women with MCI (scoring 21 to 24 on the Mini–Mental State Examination) over 65 years residing in nursing homes in Tehran, Iran in 2023. The sample of this study consisted of 334 women (mean age=69.12±3.68) with MCI who were selected using a purposive sampling method. Standard tools were utilized for measuring PA, depression, balance, muscle strength, and QoL, respectively. Perceived health status was assessed using one item. Pearson correlation test and independent t-test were employed for data analysis.
Results: The results showed that 66% of the entire sample suffered from depression. The participants engaged, on average, in 14.69 minutes of moderate physical activity (MPA) per day. Only 22% of the participants met the WHO's guidelines of 30 minutes of MPA daily. It was found that higher MPA was significantly correlated with lower depression ($P<0.001$) and higher perceived health, physical function (both balance and muscle strength), and QoL (all $P<0.001$). On the other hand, higher sedentary time was significantly correlated with higher depression ($P<0.001$) and lower perceived health, physical function (both balance and muscle strength), and QoL (all $P<0.001$).
Conclusions: The results suggested that strategies to improve health-oriented PA status in the elderly with MCI are necessary. In this regard, it is especially recommended that nurses plan recreational physical and sports activities for the elderly in groups or individually so that they can enjoy the benefits of PA.

Keywords: Aging, Cognitive dysfunction, Exercise, Mental health, Quality of life

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1. Introduction

Aging is an inevitable phenomenon encompassing natural changes in various biological, psychological, physiological, environmental, behavioral, and social aspects, ultimately leading to limitations and decreased efficiency in elderly individuals' lives (1). Old age is often characterized by a decline in performance and age-related physical changes, with individuals aged 65 and above classified as elderly by the World Health Organization (WHO) (2, 3). In 2019, the proportion of people aged 65 and over was 9%, projected to reach 12% by 2030, 16% by 2050, and 23% by 2100 worldwide (3).

With advancing age, cognitive changes become more prevalent, ranging from normal cognitive aging to mild cognitive impairment (MCI) and Alzheimer's disease (4). MCI serves as an intermediary phase between typical cognitive aging and the onset of Alzheimer's disease, aimed at impeding its progression (5, 6). It is characterized by measurable cognitive deterioration in one or multiple cognitive domains, notably episodic memory loss and delayed recall (7, 8). Additionally, older adults with MCI often experience declines in executive functions, working memory, attention, visual processing speed, and language function (9). The prevalence of MCI among individuals aged 65 and above in population studies ranges from 10 to 20 percent (10). Identifying MCI is crucial, as it adversely affects quality of life (QoL) and functional ability and tends to progress into

dementia, making early detection and intervention pivotal in delaying or preventing cognitive decline associated with aging (8-11).

While MCI was previously associated solely with poor cognitive performance, recent research has uncovered additional issues affecting elderly individuals with MCI (12-14). Studies have revealed a high prevalence of depression among this population (12-18). Furthermore, older adults with both MCI and depression tend to exhibit more pronounced cognitive deficits (13, 16), performing weaker in immediate and delayed memory tasks compared to those with MCI alone (19, 20). Significant differences in visual-spatial performance, memory, and executive function have been observed between non-depressed and depressed elderly individuals with MCI (21). The correlation between depressive symptoms and cognitive function in older adults with MCI is significantly higher than those with Alzheimer's disease (22). Older adults with MCI and simultaneous depression progress to dementia more often than those with MCI without depression (23). The annual conversion rate of MCI to dementia has been reported between 25% and 28% in patients with MCI and concurrent depression (5-8).

Depressive symptoms significantly influence the progression to dementia and are associated with QoL in elderly individuals with MCI (13, 15, 18, 20). Depression also correlates with increased medication use, higher non-prescription drug costs, elevated alcohol consumption risk, extended hospital stays, and increased care costs (24, 25). Therefore, addressing depressive symptoms in individuals with MCI is crucial for improving QoL and potentially slowing further cognitive decline. While antidepressants are commonly prescribed, their effectiveness in older adults with MCI and dementia remains inconclusive (26), emphasizing the importance of exploring non-pharmacological interventions such as physical activity (PA). PA has been suggested as a potential therapy for depression (27, 28) and is considered a complementary approach in treatment guidelines for mild to moderate and severe depression (29).

According to WHO recommendations, older adults should engage in a minimum of 30 minutes of moderate physical activity (MPA) daily to enhance overall health (30). An active lifestyle may mitigate aging, with physically active elderly individuals exhibiting better health and vitality (31). Regular PA helps prevent cardiovascular diseases, diabetes, and other systemic illnesses, contributing to physical and mental well-being. Evidence supported the positive impact of PA on health (32), as it maintains physical and mental well-being, boosts self-confidence and life expectancy, and stimulates the release of serotonin, reducing depression and enhancing QoL (33, 34). Moreover, PA and sports play a valuable role in rehabilitating and managing mental health conditions (31, 35), with regular aerobic exercise shown to alleviate symptoms of anxiety and depression, boost self-esteem, and improve mood (32, 34). Additionally, PA participation improves physical functions in the elderly (33, 34).

While the beneficial effects of PA on the mental and physical well-being of elderly individuals are recognized, there has been limited research on its specific effects on older women with MCI. Hence, this study aimed to explore the associations between PA and depression, perceived health, physical function, and QoL in this particular demographic of older women with MCI.

2. Methods

2.1. Design and Participants

The research employed a descriptive-correlational design; the statistical population of this study comprised women with MCI Mini–Mental State Examination scores ranging from 21 to 24 aged over 65 years residing in nursing homes in Tehran, Iran between January and May 2023.

2.2. Inclusion and Exclusion Criteria

Study participation requirements include 1) providing informed consent, 2) being aged 65 years and older, 3) receiving a diagnosis of MCI (Mini–Mental State Examination scores ranging from 21 to 24), 4) possessing at least elementary literacy, and 5) the absence of other neurological illnesses according to the diagnosis of the nursing home physician. Exclusion criteria for the study encompassed 1) incomplete questionnaire responses and 2) failure to implement the accelerometer protocol fully.

2.3. Procedure

Researchers visited nursing homes in

Tehran, Iran to select participants. Purposive sampling was employed to ensure the sample's representativeness concerning the number of research variables. As a result, 338 women over 65 years (mean age=69.12±3.68) were selected as the research sample. Accounting for potential experimental mortality, distorted questionnaires, and outliers, 344 questionnaires were utilized for data analysis. Upholding ethical principles throughout this study, researchers personally completed all research questionnaires. The research objectives and procedures were communicated to relevant officials and participants before the questionnaire's completion. All participants provided written informed consent, as approved by the university ethics committee (code: IR.IAU.TNB.REC.1401.059).

2.4. Measures

2.4.1. Physical Activity

A modern accelerometer with high validity and reliability measured MPA (36). A conventional protocol was used, involving attaching the device to the right thigh for one week, with removal during sleep, bathing, or any other activities that could potentially harm the device. A counts per minute (CPM) range of ≥1952–5724 was utilized to calculate MPA (36).

2.4.2. Depression

The Geriatric Depression Scale (GDS-15) (37) was applied to evaluate depression. Consisting of 15 questions, responses were recorded in a "Yes/No" format. Depression severity was categorized as usual, mild, moderate, or severe based on scores ranging from 0-4, 5-8, 9-11, and 12-15, respectively. The Persian adaptation of this measurement tool was validated by a panel of 8 specialists (CVI=0.90, CVR=0.92). The scale's reliability was assessed with a Cronbach's alpha coefficient of 0.92.

2.4.3. Perceived Health

Perceived health status was assessed using a single item: "Overall, how would you evaluate your current health condition? Would you consider it to be excellent, good, fair, poor, or inferior?" (Rated on a five-point scale from 1=very poor to 5=excellent). The Persian version of this scale was validated by 8 experts (CVI=1.00, CVR=1.00).

2.4.4. Physical Function

Balance: Participants' balance ability was assessed using Stork's test. This test involved standing on the sole of the superior foot while placing the sole of the other foot on the inner side of the knee of the supporting leg. The test was conducted three times, with the best time recorded. The interval between performances was 3 minutes.

Muscle Strength: Participants sat on a 43 cm-high chair, standing up and sitting down for 30 seconds while placing their hands in front of their bodies on the chest. The number of sit-to-stand repetitions in 30 seconds was considered the score.

2.4.5. Quality of Life

The SF-36 was employed to assess QoL among older individuals (38). Each question was scored from 0 to 100, with higher scores indicating better quality of life. The Persian adaptation of this measurement tool was validated by a panel of 8 specialists (CVI=0.88, CVR=0.90). The scale's reliability was assessed with a Cronbach's alpha coefficient of 0.90.

2.5. Statistical Analysis

Data analysis was conducted using SPSS version 26. Descriptive statistics such as mean, standard deviation (SD), numbers (n), and percentages (%) were used to depict the data. The Kolmogorov-Smirnov test indicated that the data exhibited a normal distribution (all $P>0.05$). Pearson correlation analysis was conducted to assess the relationships among the variables. Additionally, to determine whether meeting WHO guidelines for PA led to improvements in depression, perceived health, physical function, and QoL, participants were divided into two groups: 1) individuals meeting the daily 30-minute MPA recommendation ("Met" group) and 2) those not meeting the recommendation ("not-met" group). The difference between these two groups was assessed using an independent t-test; the significance level was set at $P<0.05$.

3. Results

3.1. Demographic Characteristics

The study comprised 334 women and older adults aged over 65 years (Mean age: 69.12±3.68). On

average, participants had resided in nursing homes for 2.75 years. Of these, 113 (34%) had lived for less than three years, 170 (51%) between 3-5 years, and 51 (15%) for more than five years. The sample's average body mass index (BMI) was 25.67±2.29, indicating they were overweight. Among them, 35 (10%) had a BMI less than 25 (healthy status), 220 (64%) had a BMI between 25 and 27 (overweight status), and 79 (24%) had a BMI greater than 27 (obesity status). Additionally, 285 (85%) were married, 30 (9%) were divorced, and 19 (6%) were widowed. Furthermore, 27 (8%) had a college education, 60 (18%) had high school diplomas, and 247 (74%) had middle school education or less.

3.2. Physical Activity

PA patterns were assessed using accelerometers over one week. The results are shown in Table 1. Results indicated that the range of daily MPA for the entire sample varied from 2 to 45 minutes, with an average of 14.69 minutes per day. It was noted that the WHO's guidelines recommending at least 30 minutes of daily MPA were not adhered to the participants (30). Moreover, MPA showed a significant positive correlation with BMI (r=0.359, P<0.001), while sedentary behavior exhibited a significant negative correlation with BMI (r=–0.421, P<0.001).

3.3. Depression

Mean and standard deviation of depression scores are presented in Table 1. The mean depression score for the entire sample was 9.58, indicating a moderate level of depression. Of the participants, 34% had a normal condition, 22% had mild depression, 28% had moderate depression, and 16% had severe depression. Furthermore, 66% of participants experienced depression (mild, moderate, or severe levels).

3.4. Perceived Health

Mean and standard deviation of perceived health status are demonstrated in Table 1. Participants reported an average perceived health status close to regular (mean=2.88). Specifically, 7% perceived their health as good, 21% as good, 35% as regular, 28% as bad, and 9% as bad.

3.5. Physical Function

Mean and standard deviation of physical function's items are presented in Table 1.

3.5.1. Balance

The average balance performance among participants was 4.92 seconds, ranging from 1 to 10 seconds.

3.5.2. Muscle Strength

The average muscle strength performance was 4.38 repetitions in 30 seconds, ranging from 1 to 7 repetitions.

3.6. Quality of Life

Mean and standard deviation of QoL is presented in Table 1. Participants had an average QoL score of 60.58, ranging from 32.61 to 84.09.

3.7. Correlations between Physical Activity with Depression, Perceived Health, Physical Function, and Quality of Life

Results of Pearson correlation tests are shown

Table 1: Mean and standard deviation (SD) of the research variables across gender

Variable	MPA (minutes/day)	Sedentary time (minutes/week)	Depression	Perceived health	Balance (second)	Muscle strength (number)	QoL
Mean±SD	14.69±5.48	583.93±108.16	9.58±2.14	2.88±0.74	4.92±2.21	4.38±1.30	60.58±9.25

QoL: Quality of Life

Table 2: The correlations between Physical activity with depression, perceived health, physical function and quality of line

	Depression	Perceived health	Balance	Muscle strength	QoL
MPA	r=-0.527 P<0.001	r=0.340 P<0.001	r=0.724 P<0.001	r=0.638 P<0.001	r=0.607 P<0.001
Sedentary time	r=0.416 P<0.001	r=-0.503 P<0.001	r=-0.419 P<0.001	r=-0.471 P<0.001	r=-0.397 P<0.001

QoL: Quality of Life

Table 3: Mean and standard deviation (SD) of the variables across "Met" and "Not-Met" groups

Variable	Met group	Not-met group	Group differences
Depression	8.47±2.10	10.68±3.42	t=−4.516 P<0.001
Perceived health	3.36±0.87	2.42±0.93	t=3.295 P<0.001
Balance	5.39±1.04	3.21±1.46	t=5.228 P<0.001
Muscle strength	5.20±1.80	2.95±1.25	t=−6.157 P<0.001
QoL	65.23±8.19	52.41±10.08	t=−7.058 P<0.001

Met group: The group who were met, Not-Met group: The group who were not met. QoL: Quality of Life

in Table 2. The results indicated that higher MPA was significantly correlated with lower depression (P<0.001), higher perceived health, physical function (both balance and muscle strength), and QoL (all P<0.001). Conversely, higher sedentary time was significantly correlated with higher depression (P<0.001) and lower perceived health, physical function (both balance and muscle strength), and QoL (all P<0.001).

3.8. Depression, Perceived Health, Physical Function, and QoL across "Met" and "not-Met" groups

A total of 22% of participants engaged in more than 30 minutes of MPA daily, while 78% had less than 30 minutes of MPA per day. The results are shown in Table 3. Participants in the "Met" group had significantly lower depression scores than those in the "Not-Met" group (P<0.001). Additionally, the "Met" group reported significantly higher perceived health, physical function (both balance and muscle strength), and QoL compared to the "Not-Met" group (all P<0.001).

4. Discussion

The aging population presents significant economic, social, and health challenges in the 21st century. Within this context, MCI stands out as a common consequence of aging, often associated with declines in cognitive abilities (4). This study aimed to explore the relationship between PA and depression among older women with MCI, as well as its associations with perceived health, physical function, and QoL. Notably, 66% of the total sample in this study exhibited signs of depression, consistent with prior research (39), underscoring depression as a severe consequence of MCI in older women. These findings emphasized the need for strategies tailored to address the effects of aging and MCI, mainly focusing on older women.

The study revealed that engaging in PA could potentially mitigate depression among older women with MCI. Despite participants not meeting the WHO's recommended guideline of 30 minutes of daily MPA, higher levels of MPA were significantly associated with lower depression levels (30). Furthermore, participants adhering to the WHO's guidelines reported notably reduced depression levels compared to those who did not meet the guidelines (27, 28, 35). Clinical studies have proposed mechanisms explaining the positive impact of PA on depression, including increased levels of serotonin, dopamine, and norepinephrine—commonly referred to as "feel-good" hormones—thus reducing stress and enhancing overall well-being (40).

Moreover, the findings highlighted the positive impact of PA on perceived health and QoL among elderly women with MCI. Increased MPA correlated significantly with higher perceived health and QoL ratings. Similarly, women meeting the WHO's guidelines for daily MPA reported significantly better-perceived health and QoL than those who did not meet the guidelines, consistent with prior studies (26, 28). This positive effect of PA on QoL may be attributed to increased self-confidence, self-esteem, and physical fitness (33). PA is known to maintain physical fitness, promoting healthy weight, bone density, muscle strength, joint mobility, and overall physiological well-being, thus reducing the risk of falls, a critical concern among the elderly, and strengthening the immune system (34, 35).

Furthermore, the research indicated that higher levels of MPA were associated with better physical function, including balance and muscle strength, in

older women with MCI. These physical abilities are (34) crucial for daily activities and fall prevention in the elderly, suggesting that PA significantly contributes to their well-being and QoL.

Additionally, the study examined sedentary behavior, revealing direct correlations with depression and inverse correlations with perceived health, QoL, and physical function among older women with MCI. Sedentary lifestyles were associated with elevated depression levels and decreased perceived health, QoL, and physical function (35). This underscores the importance of reducing sedentary behavior and increasing PA to enhance the physical and mental well-being of older women with MCI.

4.1. Limitation

While this study benefited from objective measurements of physical activity using modern accelerometers, its cross-sectional design limits causal inferences. Future research should consider intervention studies to explore the effects of various physical activities and sports on elderly individuals with MCI. Moreover, the study's exclusive focus on elderly women in nursing homes in Tehran, Iran, calls for caution when generalizing findings to broader populations. Finally, light and vigorous levels of PA were not used in this study, because according to WHO's guidelines, MPA as well as sedentary behavior are considered as indicators of health-oriented PA for older adults.

5. Conclusion

Findings revealed a high prevalence of depression among participants, with a notable portion failing to meet PA guidelines. However, higher levels of MPA were associated with reduced depression and improved perceived health, physical function, and QoL. These results underscored the significance of PA for older women with MCI, emphasizing the need for strategies to promote health-oriented PA among this demographic characteristic. Particularly in nursing home settings, nurses can play a vital role in planning recreational physical activities, ensuring elderly individuals reap the benefits of PA.

Acknowledgment

We appreciated the participants who took part in current research.

Ethical Approval

The Ethics Review Board of North Tehran Branch, Islamic Azad University, approved the present study with the code of IR.IAU.TNB.REC.1401.059. Also, written informed consent was obtained from the participants.

Authors' Contribution

Shaghayegh Hashemi Motlagh: Substantial contributions to the conception and design of the work, acquisition, analysis, and interpretation of data for the work, drafting the work. Amir Dana: Contributions to the conception of the work, drafting the work and reviewing it critically for important intellectual content. Zahra Alam: Contributions to the conception of the work, drafting the work and reviewing it critically for important intellectual content. Sima Mokkari Saei: Acquisition, analysis, and interpretation of data for the work, drafting the work. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work, such that the questions related to the accuracy or integrity of any part of the work.

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Original Article

The Relationship Between Physical Activity and Primary Infertility in Iranian Women

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Abstract

Background: Inadequate lifestyle choices, such as insufficient physical activity, may be linked to adverse fertility outcomes. Given the profound influence of lifestyle on women's reproductive health, this study was undertaken to compare the levels of physical activity and body composition among fertile and infertile Iranian women in 2022.
Methods: This cross-sectional study encompassed 653 fertile women (mean age: 32.58±5.99 years, mean body mass index (BMI): 25.7±3.64 kg/m²) and infertile women (mean age: 32.59±5.38 years, mean BMI: 26.4±5.6 kg/m²) who sought assistance at infertility centers in six provinces (Guilan, Markazi, Hamedan, Sistan, and Baluchestan, Isfahan, and Khuzestan) during the research period spanning 2021 to 2022. Participants completed questionnaires regarding their lifestyle habits and physical activity levels, body composition was also assessed. Chi-square and multiple logistic regression tests were employed for data analysis.
Results: Fertile women exhibited superior physical activity (P=0.04) and a lower BMI (P=0.001) than their infertile counterparts. Women with a high level of physical activity (OR=4.42, P=0.004) were more likely to experience infertility. Inactive women who spent more than 300 minutes per day sitting were 2.07 times more susceptible to fertility complications than their physically active peers (moderate activity) (OR=2.07, P=0.001).
Conclusion: Given the simultaneous increase in obesity, inactivity, and infertility among Iranian women, it is imperative to place greater emphasis on lifestyle habits, including appropriate physical activity, to prevent and potentially treat infertility.

Keywords: Iran, Body mass index, Infertility, Sedentary behavior, Women

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1. Introduction

Sedentary behaviors and physical inactivity pose a severe threat to global health. These behaviors have been demonstrated to impact various health factors and mortality rates independently (1). Specifically, physical activity (PA) has conflicting effects on fertility. In men, engaging in light PA is associated with improved semen quality (2). However, some reports fail to establish a clear relationship between PA and sperm fertility (3). Light physical activity, irrespective of body composition, enhances fertility parameters and the live birth rate among women during fertility treatments (4).

Conversely, intense physical activity has been correlated with a decline in semen quality in men (5) and fertility issues in women (6). Notably, sedentary behaviors have not been definitively linked to reduced sperm fertility, although an increase in TV viewing has been associated with decreased sperm count (7). Research on the relationship between sedentary behaviors and female reproductive health has received less attention (8).

On the other hand, excess weight is closely associated with reduced mobility, and obesity is strongly linked to infertility in couples. Studies showed that a BMI exceeding 24.9 kg/m² is associated with infertility (9). Overweight individuals exhibit reduced sperm fertility, lower sperm count, single-stranded sperm DNA, defective eggs, and incomplete ovulation and implantation (10). While the manifold beneficial effects of exercise on human health, such as preventing premature death, have been well established (1), the role of physical activity in male and female fertility remains poorly understood. One study found that engaging in more vigorous exercise was associated with a decreased risk of female infertility (11).

Conversely, Morris and colleagues discovered that women participating in fertility treatment programs who exercised for four hours or more per

week experienced a 40% decrease in the likelihood of live birth and an increased risk of implantation failure (12). Another study by Foucaut and colleagues suggested that sedentary behaviors may contribute to infertility in women, emphasizing the importance of considering the frequency and type of exercise in an exercise program (13). Therefore, although the exact causes remain unclear, lifestyle factors and habits may explain some idiopathic infertility (14).

Hence, it is crucial to consider these risk factors in these individuals, as understanding the underlying causes of this problem can lead to improved management of idiopathic infertility. Nevertheless, while the relationship between physical activity and the fertility of both men and women has been explored to a limited extent globally, this interaction has not been investigated explicitly in Iran. Consequently, due to variations in attitudes and levels of physical activity across different societies, the contribution of this crucial lifestyle factor to the incidence of various diseases also varies. Given the above considerations and the scarcity of research on this critical public health issue, this study investigated the potential relationship between types of physical activity and infertility in Iranian women.

2. Methods

This research was a retrospective study conducted in six provinces of Iran including Gilan, Khuzestan, Markazi, Hamedan, Sistan and Baluchestan, and Isfahan, from 2021 to 2022. In this research, the aim was to encompass all regions of the country in the sampling. The research plan allowed for identifying various independent variables associated with primary infertility. In this study, a total of 653 women were selected and examined as follows:

Out of the 653 cases, 328 involved married women within the reproductive age range of 18-40 years who had been unable to conceive for a minimum of one year despite regular exposure to pregnancy. To determine the required sample size, a prior study (15) was referred to, which reported a type 1 error of 0.05, type 2 error of 0.2, and mean±SD of sitting time in minutes per day as 264.6±126.8 for infertile women and 236.4±109 for fertile women. Utilizing an appropriate formula (16), it was determined that a sample size of 325 individuals for each case and control group was necessary to estimate the effects of the desired risk factors. An additional 10 individuals were added to the initial sample size to account for potential sample reductions, resulting in 335 individuals for each group. Therefore, the total number of participants in each province was increased to 670 women for the survey (Figure 1).

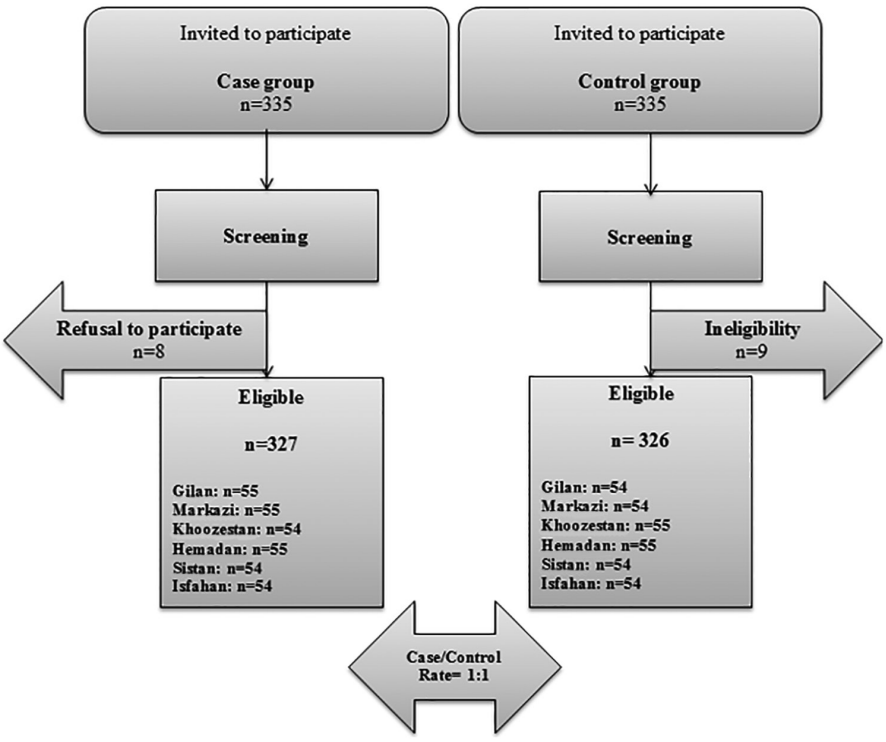

Figure 1: The figures shows the flowchart for selection of study population.

During the screening process, eight individuals from the case group and ten from the control group were excluded from the survey. Consequently, the final number of subjects included in the study was 653 people.

Three infertility treatment centers were selected in each province as part of a simple sampling method encompassing all social strata within the respective cities to establish the sample frame. This selection aimed to ensure an almost equal distribution of samples. The population framework consisted of a list of women who had visited these fertility centers between March 2021 and June 2022, seeking medical advice for infertility. Based on hormonal and ultrasound evaluations, it was confirmed that the cause of infertility was related to the woman in the family. The samples were randomly selected from this list, and questionnaires were completed either at the participants' homes or during visits to the infertility treatment center through telephone interviews, per the participants' preferences.

A multi-stage sampling technique was employed to designate the control group. Firstly, each city was categorized into three classes based on socioeconomic conditions. Subsequently, a health-treatment center (for example, in the city of Arak, centers like Alam Al-Hadi, Hepko, and Vali Asr) was randomly selected from each class, and control group was chosen in proportion to the population served by each center.

The inclusion criteria for women in the case group included being of reproductive age, suffering from infertility, having a general health condition suitable for answering questions, being of Iranian origin, and possessing the ability to engage in a 30-minute conversation with the interviewer. Additionally, participants were required to have a residence history of at least three years in the cities under study. Individuals in the infertile group had engaged in unprotected sexual intercourse for at least 12 months without a diagnosed cause of infertility and had no history of abortion.

Exclusion criteria for the case group encompassed individuals who had previously experienced infertility, those unwilling to answer questions, those with dialects not understood by the interviewer and pregnant women.

2.1. Study Tools

Contributors completed questionnaires detailing their demographic information and lifestyle habits, including gender, age, education level, and smoking status. To assess the participants' physical activity levels, the short form of the International Physical Activity Questionnaire (IPAQ) was utilized, categorizing activities into three levels: walking, light physical work, and intense physical work. Additionally, the questionnaire captured individuals' time without movement (17). A panel of fifteen experts established the Persian version of the questionnaire's validity with a Content Validity Ratio of 0.84 and a Content Validity Index of 0.83 (17). The reliability of the Persian version of the scale, measured by Cronbach's alpha coefficient, was found to be 0.79 (17).

Activities such as cycling, running, jogging, gardening, and walking with added resistance that elevates breathing slightly above the average rate are considered moderate activities. In contrast, vigorous physical activities like jogging and farming require significantly higher exertion, causing breathing to be substantially more strenuous than the standard baseline. Data for each type of activity included the frequency of engagement in such activities over the past week and the total duration in minutes during any given day. Responses were recorded separately, and the data was analyzed by the guidelines set forth by the World Health Organization (17).

During the IPAQ assessment, two distinct categories of information were generated. The first category classified activities as light, moderate, or vigorous; the second category quantified activity regarding metabolic equivalent of task (MET) minutes per week. MET is the unit of measurement for the body's energy expenditure rate and is based on the energy consumption at rest. Intermediate physical activity is anticipated to burn four times as many calories as sedentary activity, while intense activity is expected to burn eight times as many. The mean MET value for each type of physical activity was established using the methodology outlined by Ainsworth and colleagues (18).

2.2. Collecting Data

The weight of individuals, excluding shoes and additional clothing items such as overcoats and tents, was meticulously measured and recorded

using a scale with a precision of 100 grams. The height of females without footwear was determined with a precision of 0.1 cm, ensuring that the back of the head, shoulders, hips, and back of the foot remained in contact with the measuring rod. Subsequently, the BMI was assessed.

2.3. Statistical Methods

Descriptive analysis was performed for quantitative and qualitative variables, reporting the latter's means, standard deviations, frequencies, and percentages. The distribution of quantitative variables was assessed using Kolmogorov-Smirnov's one-sample test, revealing that the related variables exhibited a non-parametric distribution. The Chi-square test was employed to compare fertile and infertile individuals about each qualitative variable. The Mann-Whitney U test was utilized to ascertain differences in scores for each variable between fertile and infertile individuals. In the case of quantitative variables with a normal distribution, the Independent T-test was applied. Multiple logistic regression analysis assessed the relationship between the variables under study and infertility. In this equation, Y represents fertile/infertile with (0, 1), and "P" is the probability of Y being 1. In addition, X1..., Xk is a set of predictor variables. Then, the logistic regression of Y on X_1… ,X_k calculates parameter values for β_0, β_1, …, β_k by maximum likelihood procedure of the subsequent equation:

$$\text{Logit}(P)=\text{Log}(P/1-P)=\beta_0+\beta_1X_1+\ldots+\beta_k X_k$$

Any variable with P>0.2 was subsequently removed from the model. Data analysis was conducted using Stata 12.0.

3. Results

Table 1 displays the demographic characteristics, body composition, and socioeconomic status of fertile and infertile women under study. The mean age of fertile women was 32.58±5.99 years, while that of infertile women was 32.59±5.38 years, indicating no significant difference between the two groups (P=0.98). The onset of menstruation was 13.51±1.55 years for fertile women and 13.38±1.52 years for infertile women, with no statistically significant variation observed (P=0.30). The average age at marriage for fertile women was 22.13±4.27 years, compared to 22.30±5.74 years for infertile women, displaying no significant divergence between the two groups (P=0.66). Concerning BMI, infertile women exhibited a significantly higher BMI than fertile women (26.75±4.60 vs. 25.71±3.64 kg/m^2) (P=0.001).

Furthermore, the study revealed that 18.8% of fertile women had a low level of education, whereas 38.4% of infertile women fell into the same category.

Table 1: Characteristics of the studied fertile and infertile women

	Fertile women	Infertile women	P value
Age(yr.): mean±(SD)	32.58±5.99	32.59±5.38	0.98
Weight(kg): mean±(SD)	68.71±10.93	70.34±11.07	0.05
BMI(kg/m2): mean±(SD)	25.71±3.64	26.75±4.60	0.001
Age of menarche(yr.):mean±(SD)	13.51±1.55	13.38±1.52	0.30
Marital age(yr.): mean±(SD)	22.13±4.27	22.30±5.74	0.66
Education history: number (%)			
Less than 10 years	61(18.8)	126(38.4)	0.001
Between 10 and 12 years	90(27.7)	86(26.2)	
More than 12 years	174(53.5)	116(35.4)	
Employment status: number (%)			
Employed	226(69.5)	256(78.0)	0.01
Unemployed	99(30.5)	72(22.0)	
Use of birth control pills (month)			
Non-use	223(68.62)	211(64.33)	0.001
Less than 12 months	30(9.23)	17(5.19)	
More than 12 months	72(22.16)	100(30.49)	
Smoking: number (%)			
Yes	13(4.0)	31(9.46)	0.04
No	312(96.0)	297(90.54)	

BMI: Body Mass Index

The data also indicated that 69.5% of fertile women and 78.0% of infertile women were housewives, demonstrating no significant disparity in employment status (P=0.01). Additionally, the study found that 68.0% of fertile women and 58.2% of infertile women did not use birth control pills, with 14.28% of fertile women having a history of using birth control pills for more than 12 months, thus highlighting a difference between the two groups (P=0.001). Lastly, it was discovered that 0.4% of fertile women smoked, while the prevalence of smoking in infertile women was 9.46%, signifying a distinction between the two groups in terms of smoking (P=0.04) (Table 1).

The findings about assessing physical activity levels and sedentary behaviors among fertile and infertile Iranian women are presented in Table 2. The analysis revealed that 52.9% of fertile women had a low level of physical activity, whereas 54.3% of infertile women fell into the same category. Conversely, infertile women exhibited significantly more sedentary behavior compared to fertile women (P=0.005). Specifically, 57.0% of infertile women spent more than 5 hours a day in sedentary activities, whereas this proportion was 49.2% for fertile women (Table 2).

The results concerning the relationship between infertility and the variables under examination are outlined in Table 3. In this study, the likelihood of experiencing infertility significantly decreased with advancing age by 8% (OR=0.92, P=0.006). It was observed that individuals with high levels of physical activity had a 4.428 times higher probability of infertility than those with low physical activity (OR=4.428, P=0.004). Additionally, when assessing the adjusted relationship between infertility and sedentary behavior, it was found that individuals with more prolonged periods of daily sitting had a 2.070 times higher likelihood of experiencing infertility (OR=2.070, P=0.001) (Table 3).

4. Discussion

The results of the study indicated that infertility in women may be influenced by lifestyle and body composition. It was observed that inactivity and sedentary behaviors in women were directly associated with infertility. Furthermore, BMI demonstrated a significant relationship with women's infertility conditions. Among the participating

Table 2: Level of physical activity and sedentary behaviors in fertile and infertile women

	Fertile women	Infertile women	P value
Physical activity: number (%)			
Low physical activity	172(52.9)	178(54.3)	
Moderate physical activity	97(29.8)	115(35.1)	0.04
High physical activity	56(17.2)	35(10.7)	
Sitting time(hours/day):mean±(SD)	4.65±1.71	5.05±1.80	0.005
Less than 5	165(50.8)	141(43.0)	0.04
More than 5	160(49.2)	187(57.0)	

Table 3: Multiple logistic regressions adapted to determine the relationship between infertility and the variables

	Classification	Odds Ratio	95% CI	P value
Age		0.928	0.880-0.978	0.006
Body mass index		1.076	0.962-1.203	0.19
Age of menarche		0.992	0.822-1.034	0.14
Marital age		1.178	1.070-1.297	0.001
Birth control pills		1.034	1.000-1.070	0.04
Smoking		0.207	0.058-0.736	0.01
Level of education	Less than 10 years	1		
	Between 10 and 12 years	0.244	0.086-0.692	0.008
	More than 12 years	0.295	0.118-0.741	0.009
Employment status	Employed	1		
	Unemployed	0.412	0.145-1.170	0.09
Physical activity level	Low physical activity	1		
	Moderate physical activity	0.147	0.060-0.362	0.001
	High physical activity	4.428	1.608-12.197	0.004
Sitting time		2.070	1.365-3.141	0.001

women, sedentary behaviors were found to be linked to infertility, although specific studies have not consistently confirmed this relationship (19-24). It is noteworthy that sedentary behavior strongly correlates with leptin release, which can decrease fertility and in vitro fertilization (IVF) gestation rates by disrupting the hypothalamic-pituitary-ovarian (HPO) axis (25). This disruption in the HPO axis can impact gonadotropin synthesis, potentially leading to menstrual irregularities and ovulatory dysfunction (26).

Our study observed that the body mass index of infertile women was higher than that of fertile ones, which was associated with women's fertility (odds ratio 1.076). This could be a confounding factor in the relationship between inactivity and the adjustment of pro-inflammatory cytokines (27). It is important to note that sedentary habits are independently related to central obesity and overall adiposity. This accumulation of harmful fat plays a significant role in the synthesis of adipocytokines, which can affect estrogen biosynthesis (28). Obesity can also pose a threat to the reproductive endocrine system by increasing the release of androgens and estrogens while decreasing the synthesis of sex hormone-binding globulin. The connection between body fat percentage and fertility is more evident in infertile women with ovarian disorders (20, 25). Although previous studies investigated and confirmed the association of infertility with body composition (10, 11, 19), further exploration is needed to understand better the high risk of infertility in women with specific body structures. This relationship has not been well-documented in Iran, especially in a study that includes nearly the entire population.

By other research, the link between physical inactivity and female infertility has been substantiated (24). This underscores that the relationship between physical activity and fertility may vary depending on the individual's body mass index. In line with these findings, Mallinson and colleagues reported that light physical activity enhances fertility indices independently of female body mass index (29). Similarly, Gudmundsdottir and co-workers noted an association between physical activity and infertility in women. Groups engaging in physical activity for fewer than 15 minutes or more than 60 minutes per session exhibited a higher incidence of infertility than those engaging in physical activity between 16 and 60 minutes (6).

Our research also revealed fertile women engaged in higher physical activity levels than infertile ones. Additionally, three sessions of light-intensity aerobic exercise have been shown to increase the likelihood of a live birth in women undergoing IVF compared to sedentary women (24). A novel aspect of our study is the negative association between vigorous physical activity and fertility. Discovering that the odds of infertility are significantly higher in women who engage in intense physical activity, it has been generally accepted that the regularity of the female reproductive hormonal axis is negatively correlated with very strenuous physical activity (25).

It appears that the overall level of physical activity is a variable that indicates a relationship with fertility status, although other parameters of physical activity, including frequency, intensity, duration, and type of exercise, should also be investigated. This analysis, known as the principle of FITT (frequency, intensity, time, and type of training), holds promise for further fertility examination in both men and women.

Physical inactivity has been recognized as a significant risk factor for cardiometabolic diseases. Physical activity has been demonstrated to help regulate blood pressure body weight, and improve glucose tolerance. Numerous studies indicated that physical activity can impact reproductive organs (7, 13, 15, 19). Nevertheless, some studies explored the effect of physical activity on female infertility under normal conditions (20). The exact mechanisms by which vigorous physical activity increases the risk of infertility are not yet fully understood, but high-intensity physical activity may likely impair ovulation (15).

Our results emphasized that sedentary habits and physical inactivity are two independent factors that should be considered in the context of fertility, as recommended for the general population. Factors such as the frequency, duration, intensity, and type of physical activity can influence infertility indices in women (9, 29). To provide more specific recommendations, further research needs to be conducted on the FITT criteria for physical activity. Additionally, sedentary behaviors should be more comprehensively investigated, considering visceral fat accumulation and BMI (6). In-depth studies

exploring the interaction between sedentary behaviors and physical activity on fertility are necessary; furthermore, the relationship between fat and lean mass with fertility warrants further investigation. Recent studies have examined obese mice to investigate the connection between body composition and reproductive processes via the regulation of oxidative stress during exercise (28). The total distribution of fat and lean tissue is believed to influence reproductive indices (27). In addition to standard measures for treating infertility, addressing lifestyle changes should also be considered. A controlled interventional study would be appropriate to test these theories.

4.1. Limitations

While the present study yields valuable insights, it is burdened by certain limitations. Despite the precision of our findings, this study may lack the requisite statistical power to discern associations among certain variables. Additionally, the fertile individuals exhibited slightly greater age than the infertile ones, and they were likely recruited after the birth of their offspring, generally excluding the immediate postpartum period. The examination of pairwise associations was unfeasible and warrants further exploration in subsequent investigations.

5. Conclusions

Our investigation revealed a significant correlation between physical inactivity, sedentary behaviors, and body mass index in women with idiopathic infertility. Notably, this study underscored that physical inactivity, sedentary habits, and a high body mass index each represent independent risk factors for infertility. These findings underscored the imperative of advocating for lifestyle support throughout the lifespan to enhance pregnancy and birth rates.

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Ethical Approval

Ethics Committee of the University of Arak University of Medical Sciences confirmed the protocol with the code of IR.ARAKMU.REC.1400.050. In addition, the consent form for participation in the study was obtained from all volunteers.

Conflict of Interest: None declared.

Authors' Contribution

Abbas Saremi: Substantial contributions to the conception and design of the work, drafting the work and reviewing it critically for important intellectual content. Rahmatollah Moradzadeh: Substantial contributions to the conception of the work, analysis of data for the work, reviewing the manuscript critically for important intellectual content.

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Original Article

Associations between Mindfulness, Social Anxiety, Depression, Self-efficacy, and Physical Activity Participation among Obese Teenage Girls

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Abstract

Background: The relationship between mindfulness and the repercussions of obesity, particularly in girls, has received limited attention. Consequently, the current research aimed to explore the correlation between mindfulness and social anxiety, depression, self-efficacy, and physical activity (PA) participation in obese teenage girls.

Methods: The research was a descriptive-correlational study conducted from October 2022 to May 2023 in Tehran, Iran. The statistical population for this study comprised obese teenage girls aged 13 to 15 attending their first secondary school. The study sample consisted of 384 obese teenage girls selected through convenience sampling. Standard instruments were employed to assess mindfulness, social anxiety, depression, self-efficacy, and PA participation. Data analysis was performed using the Pearson correlation test and ANOVA, facilitated by SPSS version 26.

Results: The results indicated that, on average, participants engaged in 13.01±3.02 minutes of moderate-to-vigorous physical activity (MVPA) daily. Furthermore, teenage girls exhibited relatively high levels of social anxiety (mean=39.79±8.85) and depression (mean=9.55±2.67). Moreover, there were significant correlations between mindfulness and reduced levels of social anxiety and depression (both P<0.001). Finally, significant associations were observed between mindfulness, higher self-efficacy, and increased PA (P<0.001).

Conclusions: These findings suggested a link between mindfulness and reducing the adverse consequences of obesity in teenage girls. In this regard, reinforcing mindfulness practices can prove an effective way for reducing anxiety and depression. Such practices may encompass meditation, mindful breathing, mindful observation, attention to the surrounding environment, heightened awareness, and mindful listening.

Keywords: Obesity, Mindfulness, Exercise, Mental Health, Adolescent

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1. Introduction

Obesity is a medical condition characterized by excessive body weight due to various physiological factors that surpass typical levels; it also entails severe overweight or obesity (1, 2). Body mass index (BMI) is a reliable indicator for diagnosing obesity based on height, age, and sex. Obesity results from multiple factors, including genetics, hormonal imbalances, metabolic processes, and behavioral patterns. Inadequate physical activity (PA) and unfavorable nutritional conditions are recognized as the primary contributors to excess weight gain (3). Obesity is a prevalent health concern and a significant contributing factor to numerous chronic illnesses (4). Conditions such as Type 2 diabetes, a high prevalence of cardiovascular diseases, an increase in the incidence of various cancers, and the emergence of several mental health disorders are linked to obesity (5). Notably, there is a global surge in overweight and obesity among children, as evidenced by numerous studies (3-5). The prevalence of obesity and overweight worldwide has tripled over the past decades, reaching 17.5% among teenagers aged 12 to 19 years (6).

Psychologically, obesity in teenagers is associated with depression, social anxiety, low self-efficacy, and diminished self-confidence, leading to frustration (5, 7). Some evidence suggested that obesity can trigger mental health problems such as depression (7-9). Studies demonstrated an increasing prevalence of anxiety in obese children (10, 11). Additionally, apart from anxiety, weight gain and obesity can be risk factors for depression (8, 10, 11). Moreover, obesity may be linked to

reduced mobility and unhealthy dietary habits in teenagers, with long-lasting effects that persist into adulthood (11). In this context, several studies indicated that teenagers exhibit reduced interest in participating in PA and do not meet international guidelines related to health-oriented PA engagement (12, 13).

Furthermore, research indicated that girls engage in lower levels of PA compared to boys. This disparity in activity levels may hinder girls from reaping the numerous health benefits associated with regular PA, including a reduced risk of chronic illnesses, prolonged life expectancy, improved physical and mental well-being, and ultimately, enhanced overall quality of life (14, 15). Consequently, developing effective strategies to increase PA participation among girls is imperative.

Although studies investigated the positive effects of factors such as social support, access to sports facilities, and school climate on mitigating the negative consequences of obesity in teenagers (16), other factors warrant consideration. One of these factors that has received less attention in previous studies is mindfulness. Mindfulness involves a heightened awareness of present experiences in a non-judgmental or evaluative manner (17). It promotes emotional equilibrium by refraining from passing judgment and enhancing awareness of mental and physical sensations, facilitating real-time perception and acceptance of emotions and bodily experiences. Mindfulness activates brain regions associated with attention, memory, and empathy, ultimately leading to improved psychosocial functioning (18).

Studies demonstrated that increased mindfulness levels are associated with higher self-efficacy, positive emotions, a reduced likelihood of fatigue, and increased PA participation (19). Furthermore, mindfulness has been proved to be effective in reducing depression and rumination. Some research also indicated that mindfulness-based training positively reduces obesity across different age groups (18-20). These findings underscored the potential impact of mindfulness on the outcomes of obesity. However, as previously mentioned, the relationship between mindfulness and the consequences of obesity, particularly in girls, has received limited attention. There has been a growing interest in mindfulness in recent years, and mounting evidence suggests its utility in clinical settings, particularly in healthcare. Nevertheless, there has been minimal investigation into the effectiveness of mindfulness in improving health-related aspects among obese teenage girls. Therefore, the objective of this research was to examine the association between mindfulness and social anxiety, depression, self-efficacy, and PA participation among obese teenage girls.

2. Methods

2.1. Design and Participants

The current research was a descriptive-correlational study conducted from October 2022 to May 2023 in Tehran, Iran, specifically in districts 1, 2, 5, and 22. The statistical population for this study consisted of obese teenage girls between the ages of 13 and 15 attending their first secondary school.

To determine the required sample size for this correlational study (n=20), 319 participants were selected. Subsequently, for the current investigation, 384 obese teenage girls with a mean age of 13.86±0.58 years were chosen using purposive sampling. Twenty-four schools were randomly selected after obtaining coordination with educational institutions. Afterward, contact information provided by the schools was used to reach out to the parents of the eligible participants. Following a detailed explanation of the research's objectives and upon obtaining parental consent for their children's participation, parents were requested to have their children complete the questionnaires independently or with the assistance of an examiner, based on their preference.

Following the guidelines set forth by WHO (21), individuals with a BMI exceeding 29.0 kg/m^2 were classified as obese. In this study, BMI was also employed as a measure of obesity. To this end, the researchers accurately measured the height and weight of the volunteers. Subsequently, they calculated the BMI using the standard formula: weight (kg) divided by height (m^2). Individuals with a BMI exceeding 29.0 kg/m^2 were selected as subjects and included in the study phase. The criteria for inclusion in the study were as follows: 1) being a female student in the first secondary school, 2) having a BMI greater than 29.0, 3) voluntary participation in the study, and 4) not having any physical disabilities. Exclusion criteria comprised:

1) failure to complete the PA protocol, 2) incomplete questionnaire responses, and 3) a lack of willingness to continue participating in the study. It should be noted that 423 teenagers participated in the study; however, 39 were excluded due to the mentioned criteria. All parents and students provided written consent, and the study protocol was approved with the code of IR.IAU.TNB.REC.1401.059.

2.2. Measuring Tools

The Mindful Attention Awareness Scale (MAAS) was employed to gauge mindfulness (22). The MAAS is a 15-item scale designed to assess consciousness and concentration on occurrences and encounters in everyday life. The questions are rated on a scale of 1 (almost always) to 6 (rarely). The overall score ranges from 15 to 90, with a higher score indicating a greater level of mindfulness. In the current study, the validity of this scale was confirmed by ten experts (CVI=0.90, CVR=0.96). Additionally, the Cronbach's alpha coefficient was 0.90.

The Short Form of the Social Anxiety Scale for Adolescents (SA-A-SF) was utilized to measure social anxiety (23). The SA-A-SF is a self-administered scale suitable for teenagers aged 13 to 18. It comprises 12 items rated on a scale from 1 (Strongly disagree) to 5 (Strongly agree). The total score ranges from 12 to 60, with a higher score indicating more significant social anxiety. In the current study, the validity of this scale was verified by ten experts (CVI=0.89, CVR=0.82). Moreover, the Cronbach's alpha coefficient was 0.94.

The Depression, Anxiety, Stress Scale-21 (DASS-21) (24) was employed to assess depression, this subscale consists of seven items, scored from "did not apply to me at all" to "applied to me very much, or most of the time." The total score ranges from zero to 21, with a higher score indicating a greater level of depression. Within this subscale, scores in the range of 0-4 indicate a normal condition, 5-6 indicate mild depression, 7-10 indicate moderate depression, 11-13 indicate severe depression, and 14+ indicate incredibly severe depression. In the current study, the validity of this scale was affirmed by ten experts (CVI=0.90, CVR=0.90). Furthermore, the Cronbach's alpha coefficient was 0.92.

The General Self-efficacy Questionnaire (GSE-17) was employed to measure self-efficacy (25), this questionnaire comprises 17 questions rated from completely agree (5) to disagree (1). The total score ranges from 17 to 85, with a higher score indicating greater self-efficacy. In the current study, the validity of this scale was validated by ten experts (CVI=0.88, CVR=0.90). Additionally, the Cronbach's alpha coefficient was 0.92.

A modern accelerometer with high validity and reliability (26) assessed PA. The device was attached to the right thigh for seven days, except during sleep, bathing, or other activities that might potentially damage the device. The accelerometer measures various intensities of PA, including light, moderate, and vigorous PA.

2.3. Data Analysis

Using SPSS version 26, descriptive statistics, including the mean and SD, were calculated to summarize the data. The data were also presented in the forms of numbers (n) and percentage (%). Based on the Kolmogorov-Smirnov tests, the data were found to be normally distributed (all $P>0.05$). Furthermore, the Pearson correlation test was employed to investigate the relationships among research variables. Finally, to determine whether different classes of obesity, including obesity class 1 (i.e., 29<BMI>35), obesity class 2 (i.e., 35<BMI>40), and obesity class 3 (i.e., BMI>40), affect social anxiety, depression, self-efficacy, and PA, a one-way analysis of variance (ANOVA) with a Tukey test as a post hoc analysis was conducted. The significance level was set at $P<0.05$.

3. Results

3.1. Demographic Characteristics

The study included 384 obese teenage girls with an age range of 13 to 15 years. The average age of the sample was 13.86±0.58 years. The data revealed that the average BMI of the entire sample was 32.69±2.25. In total, 239 girls (62%) had a BMI between 29 and 35 kg/m^2 (i.e., obesity Class 1), 112 girls (29%) had a BMI between 35 and 40 kg/m^2 (i.e., Class 2), and 33 girls (9%) had a BMI higher than 40 kg/m^2 (i.e., Class 3).

3.2. Mindfulness

Table 1 presents the mean and standard deviation (SD) of mindfulness scores for the participants. The

Table 1: Mean and standard deviation of mindfulness, social anxiety, depression and self-efficacy across different classes of obesity

	Whole Sample	Obesity Class 1	Obesity Class 2	Obesity Class 3	ANOVA	Comparison
Mindfulness	49.46±9.69	56.28±8.67	45.10±6.93	40.28±4.47	F=25.29 P<0.001	Class 1 vs. 2=> P<0.001 Class 1 vs. 3=> P<0.001 Class 2 vs. 3=> P<0.001
Social anxiety	39.79±8.85	34.20±5.17	42.36±7.66	46.92±4.91	F=15.67 P<0.001	Class 1 vs. 2=> P<0.001 Class 1 vs. 3=> P<0.001 Class 2 vs. 3=> P<0.001
Depression	9.55±2.67	7.29±1.08	10.29±1.22	10.21±1.54	F=36.58 P<0.001	Class 1 vs. 2=> P<0.001 Class 1 vs. 3=> P<0.001 Class 2 vs. 3=> P=0.239
Self-efficacy	40.64±9.93	49.28±6.84	39.41±6.07	34.22±7.50	F=22.14 P<0.001	Class 1 vs. 2=> P<0.001 Class 1 vs. 3=> P<0.001 Class 2 vs. 3=> P<0.001

data showed that the mean score for the entire sample was 49.46±9.69, indicating that the participants had moderate levels of mindfulness on average. Concerning different BMI levels, the data revealed that the average mindfulness score for Class 1 was 56.28±8.67. For Class 2, it was 45.10±6.93, and for Class 3, it was 40.28±4.47. The results indicated significant differences between different BMI levels ($F_{(2,383)}$=25.29, P<0.001). Specifically, participants with lower levels of BMI reported significantly higher mindfulness than those with higher levels of BMI (*P<0.001*). Additionally, participants in Class 2 reported significantly higher mindfulness compared to those in Class 3 (P<0.001).

3.3. Social Anxiety

Table 1 displays the participants' mean and standard deviation (SD) of social anxiety scores. The data showed that the mean score for the entire sample was 39.79±8.85, indicating that the participants experienced relatively high levels of social anxiety on average. Regarding different BMI levels, the data revealed that the average social anxiety score for Class 1 was 34.20±5.17; for Class 2: 42.36±7.66; and for Class 3: 46.92±4.91. The results demonstrated significant differences between different BMI levels ($F_{(2,383)=}$15.67, P<0.001). Specifically, participants in Class 1 reported significantly lower social anxiety compared to those in Class 2 and 3 (both P<0.001). Furthermore, participants in Class 2 reported significantly lower social anxiety compared to those in Class 3 (P<0.001).

3.4. Depression

Table 1 presents the mean and standard deviation (SD) of depression scores among the participants. The data revealed that the mean score for the entire sample was 9.55±2.67, indicating a prevalence of high depression levels. Specifically, the data showed that 60 participants (15%) exhibited a normal condition, 35 participants (9%) experienced mild depression, 245 participants (64%) displayed moderate depression, 46 participants (12%) manifested severe depression, and only two participants exhibited extremely severe depression (<1%). Consequently, it can be inferred that 324 participants (84%) were afflicted by some form of depression, whether mild, moderate, severe, or extremely severe.

When considering various BMI categories, the data indicated that the average depression score for the Class 1 was 7.29±1.08, while it was 10.29±1.22 for the Class 2. Finally, the Class 3 exhibited an average depression score of 10.21±1.54. These findings revealed significant disparities in depression levels among different BMI categories ($F_{(2,383)=}$36.58, P<0.001). Specifically, participants in the Class 1 reported significantly lower depression levels compared to those in the Class 2 and 3 (both P<0.001). However, there was no significant difference between the participants in Class 2 and 3 (P=0.239).

3.5. Self-efficacy

Table 1 displays the participants' mean and standard deviation (SD) of self-efficacy scores. The data demonstrated that the mean score for the entire sample was 40.64±9.93, indicating moderate levels of self-efficacy. Regarding various BMI categories, the data indicated that the average self-efficacy score for the Class 1 was 49.28±6.84, whereas it was 39.41±6.07 for the Class 2. Finally, the Class 3 exhibited an average self-efficacy score

Table 2: Mean and Standard Deviation (SD) of physical activity pattern across different classes of obesity

	Whole Sample	Obesity Class 1	Obesity Class 2	Obesity Class 3	ANOVA	Comparison
Sedentary time (minute/day)	569.20±205.61	550.33±158.65	672.93±182.09	593.54±158.65	F=12.38 P<0.001	Class 1 vs. 2=> P<0.001 Class 1 vs. 3=> P<0.001 Class 2 vs. 3=> P<0.001
Light PA (minute/day)	112.65±19.58	116.38±25.09	110.57±14.44	102.87±12.29	F=15.67 P<0.001	Class 1 vs. 2=> P<0.001 Class 1 vs. 3=> P<0.001 Class 2 vs. 3=> P<0.001
MPA (minutes/day)	10.34±3.66	13.23±4.17	9.55±2.30	5.94±2.72	F=15.40 P<0.001	Class 1 vs. 2=> P<0.001 Class 1 vs. 3=> P<0.001 Class 2 vs. 3=> P<0.001
VPA (minutes/day)	2.67±2.45	3.84±1.48	1.56±1.27	0.98±0.85	F=9.60 P<0.001	Class 1 vs. 2=> P<0.001 Class 1 vs. 3=> P<0.001 Class 2 vs. 3=> P<0.001
MVPA (minutes/day)	13.01±3.02	16.89±3.41	10.83±2.28	6.13±1.87	F=8.07 P<0.001	Class 1 vs. 2=> P<0.001 Class 1 vs. 3=> P<0.001 Class 2 vs. 3=> P<0.001

PA: Physical Activity; MPA: Moderate physical activity; VPA: Vigorous physical activity; MVPA: Moderate-to-Vigorous Physical Activity

Table 3: The correlations between mindfulness, social anxiety, depression, self-efficacy and physical activity

	1	2	3	4	5	6	7
1. Mindfulness	-						
2. Social anxiety	r=–0.562 P<0.001	-					
3. Depression	r=–0.635 P<0.001	r=0.476 P<0.001	-				
4. Self-efficacy	r=0.471 P<0.001	r=–0.297 P<0.001	r=–0.390 P<0.001	-			
5. Sedentary	r=–0.394 P<0.001	r=0.555 P<0.001	r=0.234 P<0.001	r=–0.409 P<0.001	-		
6. Light PA	r=0.409 P<0.001	r=–0.691 P<0.001	r=–0.382 P<0.001	r=0.304 P<0.001	r=0.037 P=0.452	-	
7. MVPA	r=0.516 P<0.001	r=–0.470 P<0.001	r=–0.273 P<0.001	r=0.412 P<0.001	r=0.008 P=0.867	r=0.019 P=0.687	-

PA: Physical Activity; MVPA: Moderate-to-Vigorous Physical Activity

of 34.22±7.50. These results highlighted significant discrepancies in self-efficacy levels across different BMI categories ($F_{(2,383)=}$22.14, P<0.001). Specifically, the Class 1 participants reported significantly higher self-efficacy levels than those in the Class 2 and 3 (P<0.001). Additionally, participants in the Class 2 reported significantly higher self-efficacy levels than those in the Class 3 (P<0.001).

3.6. Physical Activity

Table 2 presents the mean and standard deviation (SD) of the PA pattern. As shown, the sample averaged 569.20 minutes of sedentary activity per day. Participants engaged in an average of 112.65 minutes of light PA per day, 10.34 minutes of MPA per day, and 2.67 minutes of VPA per day. Consequently, the total amount of MVPA was 13.01 minutes per day. These results indicated that the sample falls well below the guidelines set by the WHO (15).

Furthermore, significant differences were observed in sedentary time, light PA, moderate physical activity (MPA), vigorous physical activity (VPA), and moderate-to-vigorous physical activity (MVPA) across different BMI categories (Table 2). Specifically, participants with lower BMI demonstrated significantly less sedentary time and engaged in lighter PA, MPA, VPA, and MVPA than those with higher levels of BMI (all P<0.001).

3.7. Correlation Results

Table 3 illustrates the relationships between mindfulness and social anxiety, depression, self-efficacy, as well as PA patterns (i.e., sedentary time, light PA, and MVPA). As indicated,

significant positive associations were observed between mindfulness and self-efficacy, light PA, and MVPA (all P<0.001). Conversely, mindfulness exhibited an inverse and significant relationship with social anxiety and depression (all P<0.001). Notably, positive associations were found between light PA and MVPA with self-efficacy, while they displayed an inverse and significant correlation with social anxiety and depression (all P<0.001). Lastly, sedentary time exhibited positive associations with social anxiety and depression, while it showed an inverse and significant relationship with self-efficacy (all P<0.001).

4. Discussion

The relationship between mindfulness and the consequences of obesity, especially in girls, has rarely been addressed. Therefore, the current research aimed to investigate the correlation between mindfulness and social anxiety, depression, self-efficacy, and PA among obese teenage girls. Concerning mindfulness, the sample exhibited moderately elevated levels of mindfulness. Additionally, researchers observed that participants with higher levels of mindfulness had significantly lower BMI, in alignment with previous studies by Ersöz and colleagues (18), Cotter and co-workers (27), and Loucks and colleagues (28), which also found significant associations between mindfulness and obesity. These findings suggested that teenagers with higher levels of mindfulness tend to exhibit lower obesity rates, likely due to their adoption of healthier eating behaviors and lifestyles.

Regarding social anxiety, the sample displayed relatively high levels of social anxiety. Furthermore, individuals with lower BMIs reported significantly lower levels of social anxiety, while those with higher levels of mindfulness exhibited significantly lower social anxiety. These findings indicated that social anxiety can be considered a negative consequence of obesity in teenage girls, and they were consistent with the work of Alonso-Caraballo and colleagues (7) and also Amiri and Behnezhad (29), who demonstrated a significant association between mindfulness and anxiety symptoms. These studies underscored the importance of approaching experiences without judgment and promoting complete acceptance, as failure may lead to unfavorable consequences.

In terms of depression, the sample exhibited relatively high levels of depression. It can be stated that 324 participants (84%) in the study suffered from depression. This finding suggested that depression can be considered a negative consequence of obesity in teenage girls. Moreover, it was found that mindfulness was significantly and inversely associated with depression among obese teenage girls, consistent with the findings of Sedighi and co-workers (17), who also reported significant relationships between mindfulness and depression. Taken together, these findings indicated that mindfulness can be considered a factor in reducing depression in obese girls. To interpret these results, it can be suggested that mindful individuals may frequently avoid negative interpretations of stressful factors when faced with stressors (15, 18). Furthermore, these individuals may reflexively approach stressful events by viewing each stressor as something novel, thus avoiding the psychological inflexibility associated with higher depression (18).

Regarding self-efficacy, the sample exhibited moderately elevated levels of self-efficacy, implying that reduced self-efficacy can result from obesity in teenage girls. However, individuals with higher levels of mindfulness reported significantly higher self-efficacy. These findings aligned with Rostami and co-workers (30), who observed that mindfulness significantly impacts self-efficacy. Collectively, these findings indicated that mindfulness can be considered a factor in increasing self-efficacy in obese girls. To analyze these findings further, it can be concluded that mindfulness is associated with a sense of empowerment and assurance. Individuals with heightened mindfulness will likely enhance their ability to regulate their thoughts and emotions, bolstering their self-efficacy (22, 31).

Finally, regarding PA, the sample spent an average of 13.01 minutes daily engaged in MVPA. The results indicated that the sample fell below the WHO guidelines regarding the WHO recommendations (15).

Given these results and the importance of regular participation in health-oriented PA for teenagers, it can be stated that increasing PA in obese teenage girls is necessary to improve their health. Additionally, mindfulness was significantly and directly associated with PA among obese teenage girls. These findings were consistent with the studies

conducted by Abdi and colleagues (12), Sheikh and co-workers (13), and Baniasadi and colleagues (15), which demonstrated significant effects of PA on health-related components in children and teenagers. In combination, these findings indicated that mindfulness can be considered a factor in increasing PA in obese girls. To further analyze these findings, it can be concluded that individuals with higher dispositional mindfulness, or those who develop it, may possess a more remarkable ability to translate their intentions for PA into actual behavior. They may also exhibit an intrinsic motivation to participate in PA, be more accepting of negative sensations that may arise during exercise (such as fatigue), and derive enjoyment from the exercise experience (26). This is especially significant for individuals who are overweight or obese, as they often harbor negative attitudes towards PA and find exercise uncomfortable.

4.1. Limitations

This study presented several strengths and limitations. One strength lied in the objective measurement of PA, which provides accurate data on the amount and intensity of PA. Furthermore, focusing on overweight adolescent girls contributes to a better understanding of obesity within this demographic characteristic. However, caution is necessary when extrapolating these findings to other populations, as the study exclusively involved teenage girls. Additionally, using non-random sampling techniques introduces the potential for inherent weaknesses in the outcomes. Moreover, self-report measures may introduce recall bias and imprecise responses, potentially impacting the conclusions.

5. Conclusion

Due to the significant implications of obesity among teenagers, the objective of the investigation was to explore the correlation between mindfulness and various factors, including social anxiety, depression, self-efficacy, and PA participation in obese teenage girls. The research findings underscored the prominence of anxiety and depression as consequential psychological outcomes of obesity in teenage girls. Furthermore, from a physiological standpoint, obesity contributes to a reduction in PA levels among obese girls, which in turn can precipitate adverse ramifications for their future health.

These findings emphasized the imperative need for implementing strategies aimed at mitigating obesity within the teenage girl population. Consequently, one promising approach to ameliorate the detrimental effects of obesity in teenage girls involves the cultivation of mindfulness. In this context, bolstering mindfulness practices can prove efficacious. Such practices may encompass meditation, mindful breathing, observant mindfulness, heightened awareness of surroundings, or mindful listening.

Ethical Approval

The Ethics Review Board of the university approved the present study with the code of IR.IAU.TNB.REC.1401.059. Also, written informed consent was obtained from the participants.

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We are grateful to all participants who attended in this study.

Authors' Contribution

Ali Khanzad: Substantial contributions to the conception and design of the work, acquisition, analysis, and interpretation of data for the work, drafting the work. Sheida Ranjbari: Contributions to the design of the work, drafting the work and reviewing it critically for important intellectual content. Amir Dana: Contributions to the design of the work, drafting the work and reviewing it critically for important intellectual content. Shaghayegh Hashemi Motlagh: Acquisition, analysis, and interpretation of data for the work, drafting the work.

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Original Article

Effects of Life Scripts in Transactional Analysis Theory on Marriage Readiness among Female University Students: A Qualitative Study

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Abstract

Background: Numerous young women struggle to envision a fulfilling and intimate marriage due to encountering significant challenges during their childhood and/or experiencing multiple unsuccessful relationships in adulthood. This study investigated the influence of life scripts, as defined by transactional analysis theory, on the marriage readiness of female university students of marriageable age in Isfahan, Iran.
Methods: This qualitative case study utilized a non-probabilistic, purposive sampling method to select its participants from among all female university students of marriageable age in Isfahan, Iran, between July and September 2022. The sample comprised 15 individuals, determined through theoretical saturation. Data collection was conducted via semi-structured interviews, encompassing demographic information and life script identification. Triangulation involving the researcher, supervisor, and peer advisors was employed to ensure rigor. Manifest and latent content analyses were applied to the data derived from the participant's responses and narratives using MAXQDA 2022.
Results: Analysis identified five predominant life scripts among female university students who exhibited readiness for marriage: "don't be a child," "please others," "be perfect," "don't think," and "try hard." Conversely, the leading life scripts of students lacking marriage readiness were "don't grow up," "don't get close," "don't be important," and "be perfect."
Conclusion: The findings suggested that life scripts significantly influence marriage readiness and partner selection among female students of marriageable age. Modifying these scripts may enhance these individuals' preparedness for marriage.

Keywords: Marriage, Life, Transactional analysis, Women

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1. Introduction

The family unit is the cornerstone of society, underscoring the importance of forming effective familial bonds to foster a robust and healthy social structure (1). Marriage, the inception of family life, represents the most elemental human connection, merging two individuals' distinct thinking styles, values, beliefs, perspectives, and worldviews (2, 3). Universally, marriage is the foundational social ritual for fulfilling emotional needs, leading to the establishment of the family, the paramount social institution (4). Choosing a spouse marks the ceremonial beginning of family life, a process deemed crucial by family scholars for laying the groundwork for intricate and nuanced human relationships (5).

Individuals embarking on the journey of marriage select their partners based on personal criteria (6). However, given the socioeconomic shifts observed in modern societies, the path to marriage has become increasingly complex (7). Consequently, despite the myriad benefits of marriage cited in academic literature, a notable segment of women delay entering into matrimony due to various fears and apprehensions related to marital life (8). Concerns over marital discord, economic instability, lack of marital communication skills, pessimism, mistrust of the opposite sex, perceived conflict between marriage and academic pursuits, fear of infidelity, self-doubt, and traumatic past experiences contribute to postponing marriage readiness, leading some to opt for a single life (9, 10). Numerous individuals struggle to envision a prosperous and intimate marriage, often as a result of challenging childhood experiences or multiple failed relationships in adulthood (11). Hence, understanding life scripts and attitudes towards marriage, alongside the development of therapeutic interventions, is a critical component of premarital counseling programs.

Life scripts, formulated during childhood and influenced by parental behavior and life events, significantly impact life choices, including those related to marriage and partner selection (12, 13). Transactional analysis posits that life scripts originate from decisions made in childhood, distinct from the conscious thought processes influencing adulthood decisions (14). These early decisions, emerging from pre-verbal emotional responses and shaped by various reality-testing mechanisms, lay the groundwork for adult decision-making (15). The content of an individual's life script is uniquely personal, differing from others (16), and is believed to encompass a finite set of behavioral patterns crucial to significant life decisions, such as criteria for choosing a spouse and motivations for marriage (17-19). Consequently, these scripts can influence evaluations regarding partner selection (20).

In Iran, characterized by its youthful demographic and rising divorce rates, the psychological well-being of the society hinges on the health of its familial structures. Given the deep-seated cultural significance of marriage and the diversity of subcultures within the country, assessing the factors contributing to marriage readiness is essential. Therefore, this study aimed to explore the determinants of marriage readiness among female university students in Isfahan, Iran, through the lens of transactional analysis theory to identify strategies to enhance marital awareness and facilitate a deeper understanding of personal attributes and partner selection criteria, ultimately contributing to a decrease in divorce rates and marital discord.

2. Methods

This study adopted a qualitative research design, employing observations and interviews to gather primary data on the influence of life scripts, as defined by the theory of transactional analysis, on marriage readiness among female university students in Isfahan, Iran. Conducted from July to September 2022, the research focused on a statistically significant population comprising all unmarried female university students in Isfahan who had no history of marriage and consented to participate.

2.1. Sample Selection and Data Collection

Participants were selected using a non-probabilistic, purposive sampling technique tailored for group interviews. The sample size was determined to be 15, and a figure reached upon achieving theoretical saturation; that is, data collection persisted until no new information or concepts emerged, a milestone attained after conducting fifteen interviews.

Semi-structured interviews served as the primary data collection method. Triangulation was employed to enhance the validity and reliability of the findings (21). Nielsen and colleagues (22) highlighted the alignment of interview questions with the study content as a critical principle of triangulation. A pilot interview was organized in two stages to assess validity: (I) gathering demographic data and (II) exploring reasons for marriage readiness among the target demographic within the transactional analysis framework. The interview structure was inspired by Eric Berne's theory of life scripts to confirm the validity of the interview questions (23).

In line with Sileyew's (24) emphasis on the importance of expert opinions in data collection triangulation, the thesis supervisor and other subject matter experts reviewed the interview format to ensure its validity. To safeguard reliability, the researcher concentrated on collecting data reflective of the participants' life experiences, thereby promoting the objectivity and reliability of the data collected.

Flick and co-workers (25) suggested that qualitative research triangulation should also include returning the collected data to interviewees for verification and potential adjustment, a practice that supports the accuracy of the researcher's interpretations. Accordingly, after transcribing and editing the recorded interviews, the participants were allowed to review the content for concept validation and to suggest any additions or deletions. Additionally, to validate the findings further, another researcher conducted several interviews for comparison purposes. The compiled interview content was then submitted to the thesis supervisor for feedback on enhancing the interview's focus and effectiveness through triangulation.

2.2. Data Analysis

The study employed thematic analysis, a qualitative research method designed to identify,

analyze, and report patterns (themes) within data (26). Thematic analysis is frequently utilized for analyzing textual information, such as interviews, books, notes, and other qualitative data, facilitating a focused examination of specific concepts while accommodating ambiguity and integrating diverse concepts (27). The process involves breaking down the content into semantic units, coding these units, categorizing them into themes or patterns, and interpreting the results. This method allows researchers to sift through textual data, seeking recurring patterns and themes to comprehensively understand the content and underlying concepts (28). Themes and sub-themes (with marriage readiness as the primary theme and behavioral symptoms as sub-themes) were identified and analyzed using MAXQDA 2022.

3. Results

The study's participants comprised 15 female university students on the cusp of marriage, averaging 23.62±5.40 years. The analysis revealed distinct life scripts influencing marriage readiness among these women. Figure 1 presents a circular profile of life scripts among female students of marriageable age. Notably, 58.60% of the codes were linked to the "don't be a child" script, followed by 13.30% for the "please people" script, 9.30% for the "be perfect" script, 8.70% for the "don't think" script, and 5.20% for the "try hard" script. Scripts with frequencies below 5.00% were deemed less significant in determining marriage readiness among the study's female university students at marriageable age.

Conversely, Figure 2 outlines a circular profile for female students lacking marriage readiness. In this group, 28.10% of the codes were associated with the "don't grow up" script, 23.60% with the "don't get close" script, 19.40% with the "don't be important" script, 14.00% with the "don't think" script, and 10.50% with the "be perfect" script. Similar to the previous findings, scripts with frequencies under 5.00% were considered less influential on the absence of marriage readiness among female

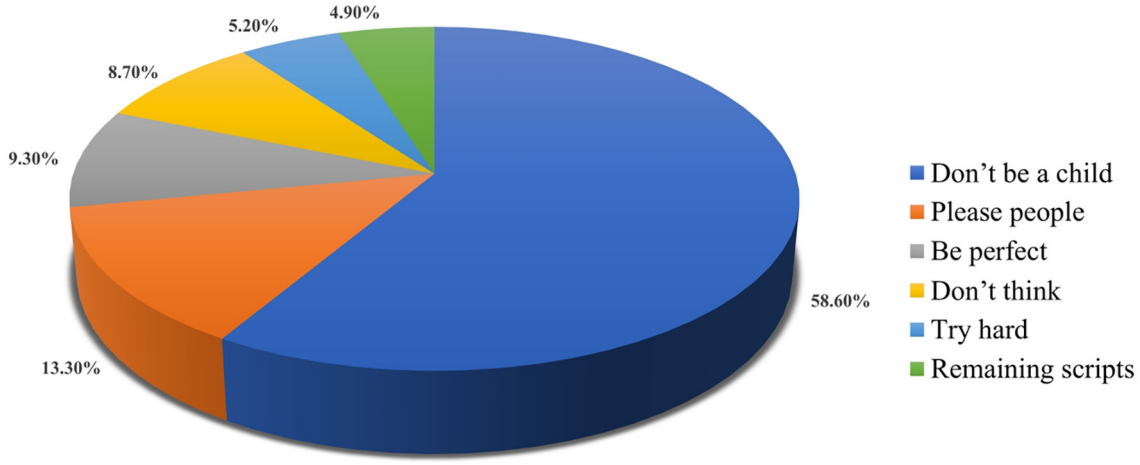

Figure 1: The figure shows the distribution of life scripts for female students at marriageable ages.

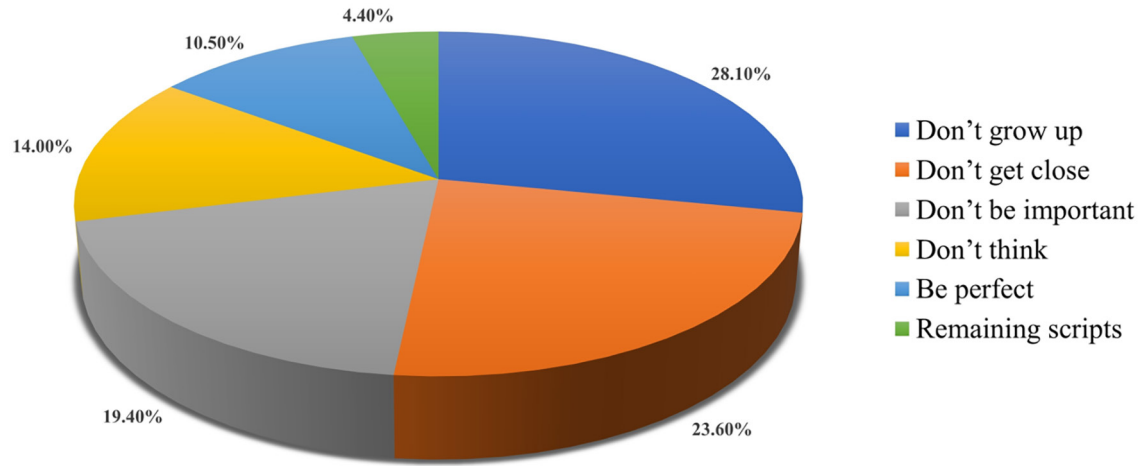

Figure 2: The figure shows the distribution of life scripts for female students who are not marriage-ready.

university students of marriageable age.

Identifying these distinct life scripts provides insight into the psychological factors that may facilitate or hinder marriage readiness among young women, offering valuable implications for counseling and intervention strategies to address these underlying issues.

4. Discussion

The present study aimed to elucidate the factors contributing to the lack of marriage readiness among female university students at marriageable ages in Isfahan, Iran, through the lens of transactional analysis theory. Interview content analysis revealed the significant influence of life scripts on individuals' decision-making processes regarding marriage. The findings underscored the prominence of specific life scripts in shaping marriage readiness and the lack thereof among female students at marriageable ages. Specifically, the scripts of "don't be a child," "please people," "be perfect," "don't think," and "try hard" emerged as primary determinants of marriage readiness, while the scripts of "don't grow up," "don't get close," "don't be important," "don't think," and "be perfect" were identified as key factors contributing to the lack of marriage readiness in this demographic.

The "don't be a child" script emerged as the most prevalent life script influencing marriage readiness. Within this script, individuals assume excessive responsibility and age-inappropriate roles during childhood, often shouldering caretaking duties for others and anticipating negative emotions following moments of enjoyment (29). The underlying parental message associated with this script suggests that individuals must mature prematurely, fostering a perception that marriage represents an opportunity for assuming greater responsibilities and supporting others.

The "please people" script ranked as the second-most frequent life script among female university students at marriageable ages. Individuals governed by this script habitually seek to please others and meet their demands, motivated by a desire for positive affirmation and acceptance (30). These individuals may perceive marriage as fulfilling their parents' wishes and anticipate receiving positive support and affirmation from their partners, akin to the positive reinforcement experienced during childhood. Consequently, partner selection may be driven by a need for validation, approval, and emotional support, reflecting the psychological and emotional needs cultivated during formative years.

Overall, the discussion highlights the pivotal role of life scripts in shaping individuals' attitudes and decisions regarding marriage. The interplay between childhood experiences, parental influences, and psychological needs underscores the complexity of marriage readiness among female students at marriageable ages. Recognizing the influence of life scripts on decision-making processes can inform targeted interventions aimed at promoting healthier relationship dynamics and enhancing marital readiness among young individuals. Additionally, fostering self-awareness and facilitating constructive communication within premarital counseling may offer valuable support in navigating the complexities of marriage and fostering fulfilling, sustainable relationships.

The "be perfect" script ranked as the third most prevalent script among participants (31). This script involves striving for perfection as a means of survival, where female students may perceive marriage as a means to alleviate the stress associated with imperfection and the resulting shame. They hold the belief that marriage transforms them into perfect individuals, aligning with the cultural context of Iranian-Islamic backgrounds, which views marriage as a stage of achieving perfection and realizing one's goals. Perfectionists may seek partners who can fulfill all their needs and expectations, providing support across all aspects of life. However, excessive expectations can lead to disappointment and dissatisfaction within the marital relationship. Husbands may struggle to constantly meet the demands of a perfectionist spouse, resulting in discontentment and unhappiness.

Additionally, efforts toward personal growth and progress may falter under unrealistic expectations. Perfectionists may seek spouses who are also on a journey of personal growth and who inspire them. Nevertheless, marital discord may arise if pursuing growth leads to failure or the spouse falls short of expectations.

The "don't think" script emerged as the fourth most frequent script among marriageable-aged female students (32). This injunction deprives

individuals of the permission to engage in comprehensive and deep thinking, disconnecting them from reality, themselves, others, and their environment. When triggered, individuals forsake rational thinking in favor of emotional responses. Marriage, a significant life event, becomes overwhelming for individuals governed by the "don't think" script, rendering them passive and reliant on others for solutions. Consequently, they view marriage as an inevitable means of coping with stressors.

Lastly, the "try hard" script within the marriage readiness model holds potential significance. Individuals driven by this script expend substantial effort and energy in task performance, often exerting themselves beyond necessary bounds. Consequently, they may engage in marriage as a task to be completed, finding satisfaction in overcoming challenges. The stress and pressure associated with marriage and partner selection can impair rational thinking abilities, influencing individuals to adopt scripts such as "be perfect," "don't think," or "try hard" in navigating marital readiness and decision-making processes.

People often make emotional and hasty decisions during times of stress. When the "don't think" injunction is triggered, leading to emotional decision-making, individuals may select the wrong spouse, thus paving the way for marital issues (32). Moreover, rational considerations such as values, goals, lifestyle, and personality compatibility are crucial in choosing a spouse. However, these considerations may be overlooked when the "don't think" injunction takes precedence. It is worth noting that individuals who readily succumb to the "don't think" injunction during stressful situations may assume a victim mentality, making irrational decisions detrimental to their marital well-being.

The "don't grow up" script emerged as the most prevalent script, indicating a lack of readiness for marriage (30). Individuals governed by this injunction seek a partner to act as a parental figure, making decisions, assuming responsibility, interacting with others, and planning on their behalf. Marriage entails significant responsibilities, which individuals with the "don't grow up" script tend to avoid. Consequently, the reluctance to shoulder responsibilities may explain their lack of readiness for marriage. Similarly, the "don't get close" script ranked as the second most frequent script among female university students lacking readiness for marriage (29). Individuals influenced by this script harbor a fear of intimacy and closeness in their interpersonal interactions, resulting in fewer long-term, deep relationships. Given that marriage hinges on closeness and long-term commitment, individuals governed by the "don't get close" script may not be adequately prepared for marital life.

The "don't be important" script was identified as the third most significant determinant of lack of readiness for marriage (33). This script is strongly associated with low self-esteem, as individuals affected by it feel anxious and inadequate when tasked with leadership roles or when expressing reasonable demands. Fear of rejection and embarrassment prevents individuals with the "don't be important" script from asserting themselves, hindering their readiness for marriage due to insufficient self-esteem and self-expression. Furthermore, inadequate self-expression can lead to ineffective communication with a partner, exacerbating tensions and animosity within the marital relationship. Given that effective communication and problem-solving skills are crucial in addressing marital challenges, individuals lacking self-expression may exhibit a reduced inclination to resolve marital issues.

The "don't think" injunction ranked as the fourth most frequent script among female students lacking marriage readiness (34). This injunction prompts core emotions, causing individuals to respond emotionally rather than engage in observation and critical thinking when faced with challenges. Consequently, they may focus on only a portion of reality while disregarding other aspects due to their fragmented thinking, often resulting in irrational conclusions. As the "don't think" injunction triggers defense mechanisms, obsession, and perfectionism, individuals affected by it may experience doubts regarding their choice of spouse, leading to apprehension about marriage among females of marriageable age. Therefore, the "don't think" injunction is closely associated with a lack of readiness for marriage, potentially causing individuals to question their inclination toward marriage and experience emotional distress. Moreover, it may postpone the decision to marry, resulting in missed opportunities for favorable marital prospects.

Individuals driven by the "be perfect" script relentlessly pursue perfection in all aspects of life (34). They adhere to an all-or-nothing mentality, expecting perfection in everything and viewing imperfection as unacceptable. Such individuals fear and avoid making mistakes, striving for precision and reliability while anticipating and addressing all potential problems. They derive satisfaction from achieving perfection and are most content when they perceive themselves as flawless. Consequently, the prospect of an imperfect marriage diminishes their willingness to marry. The "be perfect" script fosters a stringent approach to details and various aspects of marriage, fueling anxieties about making mistakes or choosing the wrong partner.

Moreover, the decision to marry entails a significant lifelong commitment, evoking heightened anxiety among individuals driven by the "be perfect" script due to the magnitude of this decision. Consequently, they are reluctant to marry and unwilling to tolerate any potential flaws or failures within the marital union. Additionally, they may engage in comparisons with others, feeling inadequate and incapable of making decisions, further exacerbating their apprehension towards marriage.

4.1. Limitations

The present study is not without its limitations, primarily centered on analyzing life scripts to elucidate reasons for marriage readiness, specifically among female students at a marriageable age. Therefore, caution must be exercised in extrapolating these findings to male students contemplating marriage. Furthermore, operational limitations include:

1. Sample Size: The limited sample size may restrict the generalizability of findings beyond the studied population.

2. Participant Bias: Social desirability bias among participants could potentially affect the reliability of the data collected.

3. Self-Selection Bias: The voluntary nature of participation may introduce characteristics among participants that differ from those who chose not to participate, thus impacting the sample's representativeness.

4. Qualitative Nature: The study's qualitative design may constrain the findings' depth and breadth, potentially limiting the exploration of nuanced aspects of the research topic.

5. Time Constraints: Time limitations may have hindered a comprehensive exploration of the research topic, potentially overlooking crucial aspects relevant to marriage readiness.

6. Contextual Factors: Failure to consider contextual factors may constrain the applicability and generalizability of the study findings beyond the specific context of Isfahan, Iran.

5. Conclusions

Life scripts permeate individuals' attributes, social relationships, and decision-making processes, directly influencing their compatibility with various life situations, including decisions regarding marriage. Given the pivotal role of marriage in one's life trajectory, it becomes imperative to recognize that life scripts, rooted in childhood experiences and reinforced by parental behaviors, significantly shape individuals' attitudes and decisions regarding marriage.

In light of these findings, it is recommended that premarital counseling interventions prioritize the identification and reconstruction of life scripts to promote healthier decision-making processes and enhance marital readiness among young individuals. By addressing underlying scripts and fostering self-awareness, individuals can embark on their marital journeys equipped with a clearer understanding of their motivations and expectations, fostering more fulfilling and sustainable marital relationships.

Ethical Approval

The study was approved by the Ethical Committee of Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran with the code of IR.IAU.KHUISF.REC.1402.337. Also, written informed consent was obtained from all participants.

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Authors' Contribution

Fahimeh Rahmati: Substantial contributions to the conception and design of the work; the acquisition, analysis, and interpretation of data for the work, drafting the work. Sayed Esmaeil Mosavi: Substantial contributions to the conception and design of the work; the acquisition, analysis, and interpretation of data for the work, drafting the work and reviewing it critically for important intellectual content. Zahra Yousefi: Substantial contributions to the design of the work, drafting the work and reviewing it critically for important intellectual content. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work, such that the questions related to the accuracy or integrity of any part of the work.

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Original Article

The Impact of Eight Weeks of Corrective Exercises on Postural Parameters, Range of Motion, and Shoulder Joint Pain in Women with Frozen Shoulder and Upper Cross Syndrome

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Abstract

Background: Incorrect posture contributes to a frozen shoulder; this study explored the effects of eight weeks of corrective exercises on postural parameters, range of motion, and shoulder joint pain in women with frozen shoulder and upper cross syndrome.

Methods: A quasi-experimental study with a pre-test-post-test design was conducted. Thirty women aged 40 to 60 years with frozen shoulder and upper cross syndrome were purposefully selected and allocated into control and experimental groups. Pre-test assessments included forward head angle (FHA) and forward shoulder angle (FSA) measured using Kinovea software, thoracic curvature assessed with a flexible ruler, range of motion of the shoulder joint (external rotation, abduction, and flexion) measured with a goniometer, and shoulder joint pain evaluated using the visual analog scale (VAS). The experimental group performed corrective exercises for eight weeks, while the control group continued their daily activities. Post-test assessments were conducted, and covariance tests and paired-sample t-test analysis were employed for between-group and within-group comparisons.

Results: The experimental group demonstrated significant improvements in shoulder joint range of motion (P=0.001), FHA (P=0.001), FSA (P=0.008), thoracic curvature (P=0.001), and shoulder joint pain (P=0.001) following corrective exercises.

Conclusions: It is recommended that trainers and therapists utilize the corrective exercises outlined in this study to enhance shoulder joint range of motion posture and alleviate pain in women with frozen shoulders and upper cross syndrome.

Keywords: Frozen Shoulder, Corrective Exercises, Upper Cross Syndrome, Range of Motion, Pain

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1. Introduction

The shoulder joint represents a pivotal and intricately structured joint in the body, serving as a primary support for bodily functions. Its impairment significantly impedes many activities due to its lack of inherent support (1). Frozen shoulder syndrome, or adhesive capsulitis, is one of the most prevalent causes of shoulder pain and disability, characterized by stiffness and constriction of the shoulder capsule. This condition, defined by the American Association of Shoulder and Elbow Surgeons, manifests initially with pain and restricts shoulder mobility (2). Predominantly affecting individuals aged 40 to 60, its prevalence within the populace ranges from 2 to 5 percent, with a higher occurrence among women and those over 40 (3).

Frozen shoulder is generally categorized into primary and secondary types. The idiopathic form, accounting for 5% of all cases, poses challenges in treatment due to its unknown etiology, prompting ongoing debate among orthopedic surgeons (4). Conversely, secondary frozen shoulder arises from various rheumatological and neurological conditions and is distinguishable from the primary type (5). In particular, people often experience deep shoulder pain that often radiates to the deltoid muscle area and worsens at night. (6). Misalignment, particularly excessive kyphosis, is proposed as a significant contributor to this complication (7). The spine's proper alignment relies on the coordinated function of its muscular, skeletal, and articular structures. Consequently, muscle weakness affecting spinal support structures can disrupt static and dynamic stability, leading to postural deviations (8).

Prolonged improper postures induce widespread

maladaptive changes in joints and soft tissues, resulting in muscle shortening and stiffness on the agonist side and weakening and lengthening on the antagonist side. This imbalance, termed muscle imbalance, disrupts natural bodily alignment, predisposing individuals to postural abnormalities and, occasionally, acute and chronic injuries (9). Page and Frank reported that three prominent patterns, classifying them into upper cross syndrome, lower cross syndrome, and layer syndrome. Upper cross syndrome, characterized by forward head posture, rounded shoulders, scapular protraction, and thoracic hyperkyphosis, elicits significant alterations in the upper body (10). This syndrome may underlie abnormal thoracic kyphosis, alterations in glenohumeral biomechanics, and shoulder and chest pain (11).

Individuals afflicted with frozen shoulder can recuperate through rehabilitation programs lasting 4 to 6 months, although in rare instances, recovery may extend up to 3 years. While prevention remains paramount in frozen shoulder management, treatment primarily focuses on pain alleviation, enhancing range of motion, and restoring joint function (12). Various treatment modalities are recommended, including anti-inflammatory medications, intra-articular steroid injections (13), manipulation under anesthesia (14), surgical interventions (15), arthroscopic procedures (16), physiotherapy regimens (17), and corrective exercises encompassing stretching and strengthening exercises (18). Posture correction programs aim to rectify muscle imbalances and normalize joint range of motion (19), with stretching and strengthening exercises targeting pain reduction through posture correction (20). Studies indicated higher forward head and shoulder angles and increased kyphosis in individuals with frozen shoulders compared to healthy counterparts. Additionally, shoulder abduction, flexion, and external rotation restrictions have been observed (21). Moreover, therapeutic exercise courses were shown to reduce pain and enhance the range of motion in frozen shoulder patients (18, 22).

Study of Jürgel and colleagues in 2005 demonstrated significant improvements in pain reduction, strength, endurance, and range of motion following a 4-week rehabilitation program incorporating aquatic therapy, massage, and electrotherapy in frozen shoulder patients with an average age exceeding 50 years. However, no significant effects were observed in the shoulder's internal and external rotation range of motion (23). Given the inconsistent findings in previous studies and the absence of comprehensive research addressing the collective impact of corrective exercises on postural parameters, pain levels, and shoulder joint range of motion in women with frozen shoulder and upper cross syndrome, this study was undertaken.

2. Methods

This study employed a quasi-experimental design with a pre-test-post-test. The population comprised women aged 40 to 60 years residing in Salmas City, Iran with a diagnosis of frozen shoulder and upper cross syndrome, among whom 30 had sought consultation with orthopedic specialists in Salmas, Iran. These participants were purposively selected and randomly assigned into control and experimental groups, each containing 15 individuals. Randomization was achieved by randomly assigning numbers from 1 to 30 and allocating those with even numbers to one group and those with odd numbers to the other. Additionally, a significant difference in baseline characteristics between the two groups confirmed the efficacy of randomization. Written informed consent was obtained from all participants.

Considering a significance level (alpha) of 0.05 and a power (beta) of 0.2, a minimum sample size of 15 individuals per group was determined to achieve a statistical power of 0.8, utilizing G*Power software (24). In addition, after estimating the sample size based on the kyphosis index as the main dependent variable, the number of 10.89 people was estimated using formula 1 (25). To mitigate potential sample loss and to be in line with G*Power estimates, 15 participants were recruited for the study.

Formula 1:

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 (\delta_1^2 + \delta_2^2)}{(\mu_1 - \mu_2)^2}$$

$$n = \frac{(1.96 - 1.282)^2 \times (2.69^2 + 1.79^2)}{(46.61 - 47.28)^2} = 10.89$$

The inclusion criteria were being female aged 40 to 60 years, concurrently exhibiting three

abnormalities including hyper-kyphosis exceeding 42, forward head angle surpassing 46˚, and forward shoulder angle exceeding 52˚ (26), along with a confirmed diagnosis of primary frozen shoulder disorder and significant reduction in shoulder joint mobility (50% reduction in external rotation), inability to sleep on the affected shoulder, nocturnal and activity-related pain, and absence of surgical history or fractures (27, 28). Conversely, exclusion criteria comprised secondary frozen shoulder, history of systemic diseases or shoulder-related issues including diabetes, arthritis, fractures, dislocations, joint instability, muscle tears, prior surgeries, stroke history, nerve disorders, medication use, pain reliever consumption, and prior therapeutic interventions for frozen shoulder management (29, 30).

Pain assessment during activity was conducted using the visual analog scale (VAS), possessing a validity of 0.70 and reliability of 0.97 (31). This scale comprises a 10-cm horizontal bar, with zero representing no pain and 10 denoting severe pain. Participants indicated their perceived pain level in the shoulder joint by marking the corresponding point on the scale (13). Pain intensity was categorized into four levels: none (0-4 mm), slight (5-44 mm), moderate (45-74 mm), and severe (75-100 mm) pain (32).

Shoulder flexion, abduction, and external rotation were assessed using a universal goniometer, with reliability ranging from 0.94 to 0.98 for flexion and abduction and 0.87 to 0.99 for external rotation measurements (33) (Figure 1). For shoulder flexion measurement, the goniometer's center was positioned 2.5 cm anterior to the acromion, with the fixed arm aligned along the trunk midline and the movable arm aligned parallel to the upper arm's lateral aspect. At the same time, participants executed active shoulder flexion (23). Shoulder abduction range was measured with the subject seated; the examiner held the goniometer's fixed arm vertically adjacent to the trunk on the frontal plane and the center positioned at the acromion process. The movable arm paralleled the arm's axis and the lateral epicondyle of the elbow, tracking shoulder abduction movement. The resulting angle represented the abduction range, with a standard range of 180˚ (23). External rotation range was evaluated with the participant supine on a bed, the shoulder abducted at 90˚, and the forearm perpendicular to the bed. The examiner aligned the goniometer's fixed arm with the forearm and centered it on the olecranon process while the movable arm tracked the styloid process. Participants performed active external rotation, and the resulting angle indicated the range, with a standard range of 90˚ (23).

The body profile view technique was employed to measure the angles of the forward head and forward shoulder (Figure 2). This method exhibits suitable reproducibility, as confirmed by Ruivo and colleagues, who reported intra- and inter-examiner reliability for forward head angle (ICC=0.87, 0.66) and forward shoulder angle (ICC=0.96, 0.78) (34). Anatomical landmarks were identified and marked, including the ear tragus, right acromion, and spinous process of the C7 vertebra. Participants were then positioned next to a wall at a distance of 23 cm, with their left arm closer to the wall. A photographic tripod housing a digital camera was placed 265 cm from the wall at the subject's right shoulder level. Participants were instructed to perform three forward bends and raise their arms above their heads three times before assuming a comfortable, natural stance and focusing on an

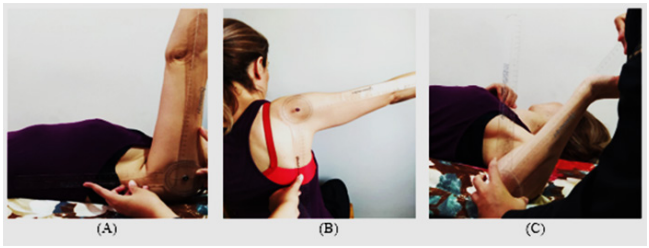

Figure 1: The figure shows the assessment method of the range of motion of flexion (A), abduction (B) and external rotation (C) of the shoulder joint.

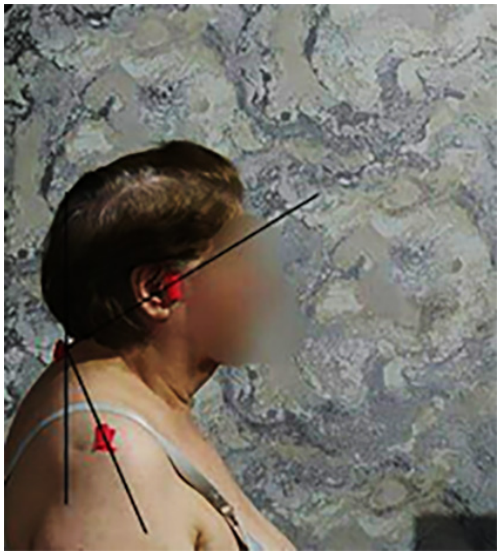

Figure 2: The figure shows the assessment method of forward head (A) and forward shoulder (B) angles.

imaginary point on the opposite wall (eyes aligned with the horizon). After a 5-second pause, a profile photograph was captured. Subsequently, the photograph was transferred to a computer, using AutoCAD software; the angles formed by the line connecting the tragus and C7 with the horizon line (forward head) and the line connecting C7 and the acromion process with the horizon line (forward shoulder) were measured. The average of three angles obtained for each anomaly was recorded as the respective forward head and forward shoulder angle (35, 36).

Kyphosis assessment utilized a flexible ruler with reliability ranging from 0.89 to 0.92 and a validity of 0.91 (Figure 3). Participants stood facing the evaluator naturally without obscuring their upper body. Measurements were conducted in a relaxed standing position with equal weight distribution on both legs and forward gaze. The evaluator marked the spinous processes of the second (T2) and twelfth dorsal (T12) vertebrae. Subsequently, a flexible ruler was positioned along the spinous processes of spine, forming an arc, and the curvature of the spine was delineated. This measurement was repeated three times. Finally, the formula $\Theta=4\arctan 2H/L$ was applied to compute the angle (37).

The training program spanned eight weeks, with sessions held thrice weekly, each lasting approximately one hour under the examiner's supervision (26). Each session comprised five minutes of warm-up exercises, followed by 20-40 minutes of main research exercises, and concluded with five minutes of cool-down exercises. The exercises aimed to restore normal shoulder joint range of motion, alleviate shoulder joint pain, and rectify postural abnormalities. Post-test evaluations were conducted after eight weeks to assess the exercises' effectiveness. The exercise protocol is detailed in Table 1, and the corrective exercises utilized in this study are depicted in Figure 4 (26, 38).

Descriptive and inferential statistical methods were employed in the analysis. The Shapiro-Wilk test assessed the normality of data distribution. Analysis of covariance and paired-sample t-tests were used for between-group and within-group comparisons, respectively. Statistical analysis was conducted using SPSS version 24.

Figure 3: The figure shows the assessment method of dorsal kyphosis.

Independent t-tests confirmed the homogeneity of descriptive variables between the two groups, except for the pain variable, which was determined to deviate from normal distribution by the Shapiro-Wilk test; analysis of covariance and paired-sample t-tests were utilized for between-group and within-group comparisons, respectively. Inter- and intra-group comparisons were performed using the Mann Whitney U Test and Wilcoxon tests for the pain variable.

3. Results

Table 2 presents the mean and standard deviation of individual characteristics of the subjects, including age, height, weight, and body mass index (BMI).

The results of the paired-sample t-test revealed a significant effect of the training program on shoulder abduction range of motion (P=0.001), shoulder flexion range of motion (P=0.001), shoulder external rotation range of motion (P=0.001), forward head angle (P=0.001), kyphosis

Table 1: Exercise Protocol

	Exercise 1	Exercise 2	Exercise 3	Exercise 4	Exercise 5	Exercise 6	Exercise 7	Exercise 8	Exercise 9	Exercise 10
Week 1-2	3*8	3*8	3*8	3*8	3*8	3*8	3*8	3*8		
Week 3-4	3*12	3*12	3*12	3*12	3*12	3*10	3*10	3*10	3*10	3*10
Week 5-6	3*16	3*16	3*16	3*16	3*16	3*12	3*12	3*12	3*12	3*12
Week 7-8	3*20	3*20	3*20	3*20	3*20	3*15	3*15	3*15	3*15	3*15

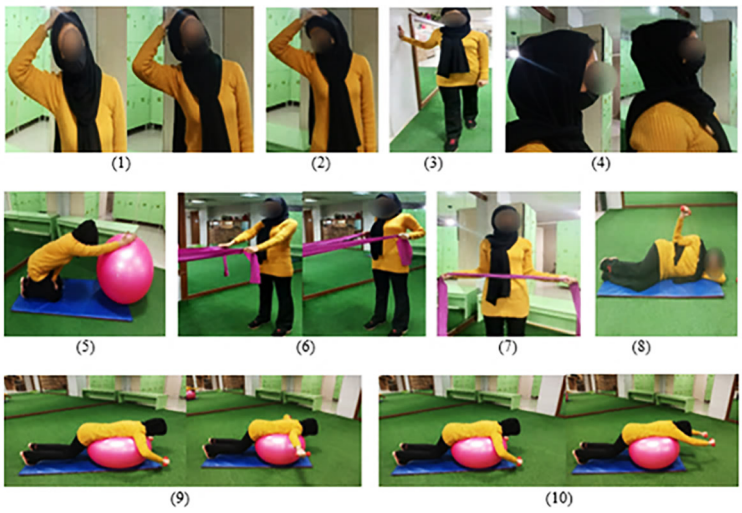

Figure 4: The figure shows the corrective exercise of the current study include: Stretching the Sternocleidomastoid and upper trapezius muscles by the subject (exercise 1); stretching levator scapulae muscle (exercise 2); stretching pectoral muscles (exercise 3); stretching splenius cervicis and flexor muscles of the lower part of the neck (exercise 4); stretching latissimus dorsi muscle (exercise 5); strengthening retraction muscles including middle and lower trapezius and rhomboid (exercises 6 & 7); External rotation of the shoulders with dumbbells (exercise 8); strengthening retraction muscles (exercise 9); strengthening dorsal muscles (exercise 10).

Table 2: Demographic features of the participants

Indicator	Group	No.	mean±SD	P
Age (year)	Control	15	50.66±6.84	0.88
	Training	15	51.66±5.54	
Height (M)	Control	15	1.68±0.02	0.16
	Training	15	1.69±0.03	
Weight (Kg)	Control	15	72.80±2.45	0.89
	Training	15	73.00±5.14	
Body mass index (Kg/M^2)	Control	15	25.79±0.70	0.48
	Training	15	25.44±1.38	

Table 3: Paired-Sample T test results for intra-group comparison of shoulder range of motion, forward head, kyphosis and rounded shoulder

Group	Control group				Training group			
	Pre-test	Post-test	T	P	Pre-test	Post-test	T	P
Shoulder abduction range of motion (degree)	76.66±6.37	76.80±6.03	0.56	0.58	76.86±5.34	81.06±6.08	-8.74	0.001**
Shoulder flexion range of motion (degree)	75.80±8.23	76.13±7.98	-1.09	0.29	78.46±5.52	82.53±4.89	-10.59	0.001**
Shoulder external rotation range of motion (degree)	48.33±7.24	48.53±6.98	-1.00	0.33	50.73±5.52	55.26±5.83	-12.04	0/001**
Forward head (degree)	49.53±1.59	49.80±1.52	-1.29	0.21	50.00±2.03	46.33±1.83	10.55	0.001**
Kyphosis (degree)	45.06±1.90	44.66±1.87	2.10	0.05	44.40±1.50	40.93±1.16	14.66	0.001**
Rounded shoulder (degree)	54.93±1.75	54.53±1.88	1.38	0.18	55.53±1.84	54.86±1.64	3.16	0.007**

**Significant at P<0.01

angle (P=0.001), and rounded shoulder angle (P=0.007) among participants in the training group (Table 3). Additionally, the Wilcoxon test indicated a significant reduction in shoulder pain among subjects following the exercise program (P=0.001). Conversely, no significant difference was observed between pre- and post-tests in the control group (P<0.05).

The outcomes of the analysis of the covariance test for intergroup comparison are presented in Table 4. These results demonstrated a significant disparity between the two groups in shoulder abduction range of motion (P=0.001), shoulder

Table 4: Analysis of covariance test outcomes for inter-group evaluation of shoulder range of motion, forward head, kyphosis and rounded shoulder

Variable	Test stage	Group	Mean ¥	P	Eta squared
Shoulder abduction range of motion (degree)	Post-test	Control	76.90	0.001**	0.67
	Post-test	Training	80.96		
Shoulder flexion range of motion (degree)	Post-test	Control	77.36	0.001**	0.72
	Post-test	Training	81.29		
Shoulder external rotation range of motion (degree)	Post-test	Control	49.69	0.001**	0.79
	Post-test	Training	54.11		
Forward head (degree)	Post-test	Control	49.97	0.001**	0.79
	Post-test	Training	46.16		
Kyphosis (degree)	Post-test	Control	44.40	0.001**	0.82
	Post-test	Training	41.19		
Rounded shoulder (degree)	Post-test	Control	54.73	0.008**	0.64
	Post-test	Training	51.53		

¥ adjusted based on pre-test values; **Significant at P<0.01

Table 5: Results of Mann Whitney U test to investigate the difference inter-groups in shoulder pain variable

Variable	Time	U	Median	W	Z	P
Pain	Pre-test	96.50	5	216.50	-0.71	0.51
	Post-test	36.00	4	156.00	-3.32	0.001**

**Significant at P<0.01; U: Mann–Whitney U; W: W-score; Z: Z-score

flexion range of motion (P=0.001), shoulder external rotation range of motion (P=0.001), forward head angle (P=0.001), kyphosis angle (P=0.001), and rounded shoulder angle (P=0.008).

Furthermore, the results of the Mann Whitney U Test indicated a significant difference in the post-test pain variable between the control and training groups (P=0.001). Specifically, the training group exhibited a marked improvement in these components compared to the control group (Table 5).

4. Discussion

This study aimed to examine the impact of an eight-week regimen of corrective exercises on specific postural metrics, range of motion (ROM), and shoulder joint pain in women afflicted with frozen shoulders accompanied by upper cross syndrome. The findings indicated a significant improvement in shoulder pain and ROM, forward head and shoulder posture, and back curvature among participants in the exercise group compared to those in the control group after the eight-week program.

The results of pain levels and shoulder ROM underscored the effectiveness of corrective exercises in alleviating pain and enhancing shoulder ROM in women with frozen shoulder and upper cross syndrome. Individuals with frozen shoulder experience pain, restricted movement, and diminished ROM in both active and passive motions. Improvement in pain and ROM is crucial for restoring normal shoulder functions and treatments (14, 39). The shoulder's complex functionality is severely hampered by various complications, leading to significant movement restrictions affecting the entire upper limb (18). As Simpson and Budge suggested, managing pain, which intensifies during activity, is a critical initial step in treating a frozen shoulder, emphasizing pain relief and control as fundamental (40). Effective management of pain and ROM is essential, as reduced ROM can lead to joint capsule adhesion, a potential pain source. Thus, prioritizing the restoration of ROM in frozen shoulder management is logical. Previous studies showed the beneficial effects of stretching and flexibility exercises in alleviating shoulder limitations, highlighting the importance of incorporating these exercises into treatment protocols to enhance shoulder ROM (17). The exercise regimen in this study focused on increasing ROM and soft tissue flexibility around the joint, aiming to enhance shoulder flexibility, ROM, and strength, reduce joint stiffness and adhesions, and alleviate pain (18). The positive outcomes suggested that such exercises could benefit women with frozen shoulders, offering a valuable tool for trainers, occupational therapists,

and physiotherapists in improving patient outcomes.

Furthermore, the study's findings on postural indicators revealed the corrective exercises' efficacy in improving forward head, shoulder posture, and back curvature in women with frozen shoulder and upper cross syndrome. Upper cross syndrome is characterized by shortening the neck's upper posterior and anterior muscles (tonic muscles) and the inhibition and weakening of the cervical spine's anterior deep muscles and the shoulder girdle's lower posterior muscles (phasic muscles) (41). These postural changes compromise the stability of the glenohumeral joint, with the scapula's glenoid cavity adopting a more vertical position due to serratus anterior muscle weakness, leading to scapular abduction and elevation. This instability necessitates increased activation of the levator scapula and upper trapezius muscles to maintain joint centrality (42). The primary cause of this condition is poor posture, particularly in individuals with a kyphotic posture.

Additionally, patients with shoulder pain often exhibit an increased forward head posture (protraction of the cervical spine), which, in turn, affects scapular rotation and humeral head compression. This leads to a loss of static stability, necessitating compensation by dynamic stabilizers like the rotator cuff and trapezius muscles, resulting in joint capsule stiffness (7). Adopting kinesiopathological approach of Sahrmann and colleagues (43), this study aimed to restore muscle balance through a focused corrective exercise program, thereby addressing the initial symptoms of a frozen shoulder. The program's design and implementation, emphasizing targeted corrective movements, stretching, and strengthening activities, significantly contributed to correcting deformities in affected individuals. For example, the chin tuck exercise increased the length of shortened neck muscles and strengthened the anterior neck muscles, reducing forward head posture complications. Similarly, exercises promoting arm external rotation and scapular retraction stretched the arm and chest muscles, facilitating spine extension. The training program's effectiveness in reducing forward head and shoulder angles and kyphosis was evident.

4.1. Limitations

The study was limited by the inability to control participants' physical activity levels, nutrition, rest, and sleep. Future research should explore the impact of these exercises on shoulder muscle strength and proprioception.

5. Conclusions

This study suggested that individuals with primary frozen shoulders exhibit poor upper body posture, mainly characterized by forward shoulder posture and scapular protraction, alongside muscle imbalance around the scapula. Addressing pain and restoring normal ROM necessitates focusing on the entire shoulder girdle, especially the scapula, as a pivotal point in the glenohumeral joint's function. The effectiveness of corrective exercises for upper cross syndrome on pain, ROM, and certain postural aspects in women with frozen shoulders was demonstrated, highlighting these exercises as a viable treatment option. The study also acknowledged limitations in controlling the participants' daily activities, nutrition, and mental conditions. Future research should investigate the effects of corrective exercises on secondary frozen shoulders and compare outcomes between men and women.

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Ethical Approval

The study was approved by the Research Ethics Committee of the Urmia University With the code of IR.URMIA.REC.1402.001. Also, written informed consent was obtained from the participants.

Authors' Contribution

Ghazaleh Jamali Kohneh Shahri: Substantial contributions to the conception and design of the work; the acquisition, analysis, and interpretation of data for the work, drafting the work. Ebrahim Mohammad Ali Nasab Firouzjah: Contributions

to the conceptualization, supervision, validation, visualization and contributed to statistical analysis of the study, drafting the work and reviewing it critically for important intellectual content. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work, such that the questions related to the accuracy or integrity of any part of the work.

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Original Article

Association between Thyroid Hormones and the Risk Level of Screening Tests in the First Trimester of Pregnancy in Hypothyroid Women

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Abstract

Background: Endocrine disorders, such as hypothyroidism, can impact fetal growth and development. The significance and necessity of fetal screening before birth are critical for the prevention of congenital disabilities. The present study aimed to evaluate the association between thyroid hormones, specifically T3, T4, FT3, FT4, TSH, Anti TPO, Free BhCG, B-MOM, P-MOM, and NT-MOM, and the risk of screening tests conducted during the first trimester of pregnancy in women diagnosed with hypothyroidism.

Methods: This retrospective, case-control study included 82 pregnant women in their first trimester who were referred for fetal screening tests between 2022 and 2023 at Imam Reza and Motazadi hospitals in Kermanshah, Iran. The case group consisted of 41 pregnant women diagnosed with hypothyroidism and treated with levothyroxine, and the control group comprised 41 pregnant women with normal thyroid function. The assessment of serum levels of T3, free T3, T4, free T4, TSH, and Anti TPO was carried out using the ELISA method, while the first-stage fetal screening tests, including Free BhCG, B-MOM, P-MOM, and NT-MOM, were conducted using the Electro-chemiluminescent (ECL) method. Subsequently, data analysis was conducted using SPSS.

Results: In the case group, the average levels of TSH (P=0.001), TPO (P=0.006), trisomy 21 (P=0.001), and trisomy 13/18 (P=0.001) were significantly higher as compared with the control group. Conversely, in the case group, PAPP-A was significantly lower (P=0.001). However, there was no statistically significant difference between the two groups in terms of mean levels of beta-hCG (P=0.297), B-MoM (P=0.202), and NT-MoM (P=0.221). Furthermore, in the case group treated with levothyroxine, mean serum TSH level was significantly higher in the screen positive and medium risk groups of Down syndrome (DS) as compared with the negative screen group (P=0.014).

Conclusion: Our results indicated that it is important to promptly identify pregnant women with hypothyroidism and ensure that timely screening tests for fetal health are carried out as a mandatory practice.

Keywords: Gestation, Thyroxine T4, Triiodothyronine T3, Thyroid-stimulating hormone, TSH, free T4, FT4, First Trimester of Pregnancy

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1. Introduction

Hypothyroidism is a thyroid function disorder that affects 2-3% of pregnant women. Since the fetal thyroid gland does not produce significant amounts of hormones until the second trimester, the mother's thyroid hormones (TH) during pregnancy play a crucial role in the growth and development of the fetus, particularly in neurogenesis (1-3). For example, thyroxine (T4) and the biologically active hormone iodothyronine (T3) influence neurotransmission, differentiation, myelination, and synaptogenesis.

Pregnant women with overt hypothyroidism face an increased risk of adverse pregnancy outcomes, including spontaneous abortion, preeclampsia, preterm birth, placental abruption, postpartum hemorrhage, low birth weight, fetal or neonatal hyperthyroidism, neurocognitive developmental

disorders in the fetus, intrauterine growth restriction, reduced IQ in children, elevated bilirubin levels in newborns, and increased perinatal mortality (4-8). Moreover, maternal hypothyroidism, especially in the first trimester, is linked to delayed neural development in the child (1), and fetuses of hypothyroid women have a 10-20% higher likelihood of congenital abnormalities (4). Furthermore, every pregnant woman, regardless of her medical history, has a potential risk of having a child with chromosomal disorders and congenital abnormalities. Although fetal health screening tests cannot guarantee specific outcomes, they play a vital role in evaluating the likelihood of potential health issues (9). In developed countries, pregnancy screening tests are routinely conducted to detect chromosomal disorders, and in Iran, efforts are underway to expand such testing programs (10-12). The fetal health status can be comprehensively evaluated by performing early pregnancy screening tests, including double, triple, or quadruple tests, and ultrasound scans during the first and second trimesters (13).

Given that several factors can influence fetal abnormality screening and risk determination, it is expected that variations in thyroid hormone levels and their impact on fetal growth requirements in the first trimester of pregnancy may correlate with the risk of screening tests. Given the significance of fetal health and the treatment of mothers with levothyroxine, it is essential to assess thyroid hormone levels and anti-TPO levels and their association with the risk of first-trimester screening tests. Therefore, this study aimed to investigate the association between FT4-TSH and Anti-TPO hormones and the risk level of Down syndrome (DS) screening tests in hypothyroid women in Kermanshah, Iran, in 2022-2023.

2. Methods

This retrospective case-control study enrolled 82 pregnant women during their first trimester, referred to Imam Reza and Motazadi hospitals for fetal screening tests in Kermanshah, Iran. The minimum sample size of 41 samples per group was determined using the sample size formula for comparing two means with a 95% confidence level and 80% power. The required sample size was calculated based on previous study (14), which reported average PAPP-A levels in two groups as 0.9±0.43 and 1.11±0.46, respectively. Consequently, this study included 41 participants in each group, totaling 82 pregnant mothers. The case group consisted of 41 hypothyroid pregnant women treated with levothyroxine, while the control group included 41 pregnant women with normal thyroid function, who were also referred for fetal screening tests. There are no significant differences between case and control group in terms of maternal age and fetal age.

The inclusion criteria comprised pregnant women aged 18-35 years, gravid one, and carrying singleton pregnancies. The exclusion criteria were: pregnant women with diabetes, high blood pressure, endocrine disorders, smoking, drug addiction, and a history of systemic diseases or use of specific drugs. All participants provided a written informed consent, and data were collected through the electronic medical record system. The study adhered to ethical guidelines established by the Ethics Committee of Kermanshah University of Medical Sciences (IR.KUMS.REC.1400.213).

First, 5 ml of blood was drawn from patients in both case and control group. After centrifugation, serum samples were separated and promptly stored in a refrigerator. The serum levels of T3, FT3, T4, FT4, TSH, and TPO were assessed using the ELISA method. The first stage fetal screening tests, including Free BhCG, B-MOM, P-MOM, and NT-MOM, were measured using a quantitative luminescence method with the Cobas E411 device.

Based on the results of Down's syndrome (DS) screening test in the first trimester, patients were categorized as follows: high risk (Positive screen group) if the risk exceeded 1:250, Borderline risk (Medium risk group) if the risk fell between 1:250 and 1:500, and Low risk (Negative screen group) if the risk was less than 1:500.

Statistical analysis was performed using SPSS version 24. Categorical data were assessed using χ^2 or Fisher's exact test, while quantitative data (according to KS test for normality) were analyzed with the independent sample t-test or the non-parametric U-Mann-Whitney test. The results were summarized using two-dimensional tables and numerical indicators, such as mean and standard deviation. P value<0.05 was considered as significant difference between groups.

3. Results

The mean age of the mothers in this study

was 32.02±2.13 years. Both groups, exhibited homogeneity in terms of mean age (P=0.615). Furthermore, none of the mothers in either groups had a history of systemic illness, cigarette smoking, or substance abuse.

The average levels of T4, T3, FT3 (P=0.001) PAPP-A (P=0.001), and P-MOM (P=0.001) in the case group were found to be significantly lower than those in the control group. Also, the average levels of TSH (P=0.001) and TPO (P=0.006) in the case group treated with levothyroxine were significantly higher than in the control group. Moreover, given the mean levels of BHCG (P=0.297), B-MOM (P=0.202), and NT-MOM (P=0.221), no significant statistical difference was observed between the two groups. Finally, the incidence of trisomy 13/18 and 21 was higher in the case group as compared with the control group (P=0.001) (Table 1).

Based on the results of DS screening tests, all individuals in the control group were categorized as low risk for DS. However, 29.3 and 7.3 percent of individuals in the case group were classified as borderline and high-risk, respectively (Table 2).

In the control group, Down's syndrome screening did not yield any positive results for mothers classified as either moderate or high risk. All mothers in the control group fell into the low-risk category for Down's syndrome screening (Table 2).

Within the control group, no instance of Down syndrome was detected among, as all the mothers belonged to the low-risk category for Down's syndrome screening (Table 2).

In the group of mothers receiving levothyroxine, the mean TPO serum level showed no statistically significant difference among the three risk groups of DS screening tests (P=0.3). However, the mean serum levels of TSH and FT4 were notably higher in the positive and moderate screening groups as compared with the negative screening group (P=0.014 and P=0.001, respectively) (Table 3).

4. Discussion

The present study aimed to investigate the association between Thyroid hormones and the risk level of screening tests in the first trimester of pregnancy in hypothyroid women. According to our results, the average levels of TSH (Thyroid-Stimulating Hormone), TPO (Thyroid Peroxidase Antibodies), T21, and T13/18 in the case group

Table 1: Comparison of Mean (Standard Deviation) of Investigated Variables between the two Groups

Variable	Case	Control	P value
T3	1.31 (0.24)	1.50 (0.14)	0.001
T4 (µg/mL)	8.95 (1.66)	9.77 (1.44)	0.021
TSH (*mIU/mL)*	2.76 (1.31)	1.65 (0.75)	0.001
TPO (IU/ml)	62.40 (12.34)	5.09 (2.85)	0.006
FT3 (ng/ml)	2.43 (0.35)	3.03 (0.29)	0.001
FT4 (µg/ml)	1.13 (0.31)	1.32 (0.24)	0.001
PAPPA (mg/L)	2060.04 (1533.5)	4978.12 (4556.5)	0.001
PMOM	0.91 (0.65)	1.62 (0.82)	0.001
BHCG (ng/mL)	128.64 (51.38)	40.53 (40.25)	0.297
B-MOM	1.81 (1.73)	1.46 (1.40)	0.202
NT-MOM	1.33 (0.24)	1.27 (0.24)	0.221
T21	0.004 (0.0028)	0.0002 (0.00018)	0.001
T13/18	0.0008 (0.004)	0.0000	0.001

TSH: Thyroid stimulating hormone; TPO: Thyroid peroxidase; FT3: Free triiodothyronine; FT4: Free thyroxine; PAPP-A: Pregnancy – associated plasma protein A; PMOM: population multiple of the median; BHCG: Beta-Human Chorionic Gonadotropin; B-MOM: B-multiple of the median; NT-MOM: Nuchal translucency – multiple of the median

Table 2: Comparison of frequency and percent of risk results of Down syndrome screening tests in two case and control groups

Patient Risk	Case	Control	Total
Low Risk	21 (63.4 %)	41 (100)	62 (80.5%)
Borderline Risk	12 (29.3 %)	0	12 (15.6%)
High Risk	3 (7.3 %)	0	3 (3.9%)
Total	36 (100.0%)	41 (100.0%)	77 (100.0%)

Table 3: Comparison of the serum level of thyroid hormones (TSH, FT4, TPO) with the results of risk screening tests in the case group

Patient risk	TSH	FT4	TPO
Low risk	2/37 (1/09)	1/27 (0/3)	40/31 (81/81)
Borderline risk	3/19 (1/36)	0/91 (0/1)	122/52 (199/62)
High risk	4/38 (1/58)	0/84 (0/17)	13/45 (1/35)
P value	0.014	0.001	0.3

TSH: Thyroid stimulating hormone; FT4: Free thyroxine; TPO: Thyroid peroxidase

were significantly higher than in the control group. Also, there was no statistically significant difference between the case and control groups in the mean levels of BHCG (Beta-Human Chorionic Gonadotropin), B-MOM (Beta-MOM), and NT-MOM (Nuchal Translucency-MOM). Furthermore, the mean level of PAPP-A (Pregnancy-Associated Plasma Protein-A) was significantly lower in the case group than in mothers with normal thyroid function.

In 2020, Fallatah and colleagues investigated the adverse outcomes and consequences of pregnancy in obese pregnant women with hypothyroidism. They demonstrated that hypothyroidism during pregnancy leads to adverse maternal and fetal outcomes, including miscarriage, intrauterine growth retardation, premature birth, and cognitive impairment in the accompanying children. Therefore, screening for thyroid function tests in the prenatal and antenatal periods is crucial to prevent the occurrence of potential adverse outcomes (15). Moreover, Villanger and co-workers examined TSH level and its association with attention-deficit/hyperactivity disorder in infants. Their results showed that the risk of attention-deficit/hyperactivity disorder among infants with low TSH levels, such as those with hyperthyroidism, was 1.5 times higher than that in the control group (16).

Findings revealed that the average T3 (Triiodothyronine), FT4 (Free Thyroxine), TSH, and TPO levels showed significant elevation in the case group as compared with the control group. Furthermore, TSH serum levels displayed a significant increase in the screen-positive group and the borderline risk group of DS as opposed to the negative screen group. Nevertheless, in a cohort study investigating the association between first-trimester screening tests and thyroid function tests, including TSH, FT4, and thyroid antibodies, Ong and colleagues found no significant difference in FT4 levels between pregnant and non-pregnant women. They also reported that a TSH level exceeding 2.15 did not predict adverse pregnancy outcomes (8).

A low level of PAPP-A heightens the risk of complications during pregnancy. The study results also indicated that the average level of PAPP-A exhibited a significant decrease in the case group as compared with the control group. Similarly, in 2020, Tosun and colleagues reported that mean levels of PAPP-A MoM (Multiple of the Median) and Free-BhcG MoM were notably lower in levothyroxine users (17).

When examining the results of fetal DS screening tests during the first trimester of pregnancy, it was observed that in the control group, all patients were in the negative screen (low risk) group for DS, while 63.4%, 29.3%, and 7.3% of the case group patients were in a low risk, borderline risk, and high-risk groups for DS, respectively.

In other words, the risk of DS was reported to be higher in the group of hypothyroid mothers as compared with mothers with normal thyroid function. Additionally, in the levothyroxine case group, mean level of TSH was significantly higher in the screen-positive group and the medium-risk group for DS than in the negative screen group for DS. Liu and colleagues investigated the association between thyroid disorders and the prevalence of DS in Taiwanese infants. In their study, 51 babies diagnosed with DS were included, and their thyroid function was assessed. According to the results, the prevalence of thyroid disorders in Taiwanese babies with DS was significantly higher than in healthy and normal babies (18). This finding was consistent with the established importance of TH in brain development during intrauterine and early life stages (19-20).

Given that fetal abnormalities and the birth of an unhealthy baby are a big challenge. Fetal screening tests in the first trimester of pregnancy is the best diagnostic strategy in order to determine the risk of the fetus suffering from birth defects.

However, these tests are 80-95% accurate and are not a definite proof of whether the fetus is healthy or sick and new markers should be added to the set of these tests to increase the detection rate of these tests. The goal is to enhance the screening process for fetal abnormalities by concurrently measuring thyroid hormones and thyroid peroxidase levels, in addition to conducting screening tests. This approach aims to improve the overall detection rate of fetal abnormalities during screening. Also, with higher reliability of the results, it prevents psychological pressures on the couple as well as spending money, time and other adverse consequences.

4.1. Limitations

The main limitations of this study were the high cost of laboratory tests and screening. Also, some mothers did not cooperate due to their reluctance to reveal the screening results and confirm any fetal abnormalities.

5. Conclusion

The risk of Down syndrome (DS) was found to be higher among mothers with hypothyroidism compared to those with normal thyroid function. Furthermore, in the case group treated with levothyroxine, the mean serum Thyroid Stimulating Hormone (TSH) level was significantly elevated in both the screen-positive group and the medium-risk group for DS, exceeding the levels observed in the negative screen group for DS. As a result, it is crucial to assess thyroid hormone status, with a specific emphasis on TSH levels, as an integral component of the essential pre-pregnancy assessments and counseling.

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Ethics Approval

The Ethics Committee of Kermanshah University of Medical Sciences in Kermanshah, Iran approved the protocol of this study with the code of IR.KUMS.REC.1400.213. Also, written informed consent was obtained from the participants.

Authors' Contribution

Negin Rezavand: Contribution to the conception and design of the study, drafting the work. Somayeh Darvishi: Contribution to the conception and design of the study, material preparation, data collection, and analysis, drafting the work. Maryam Hematti: Contribution to the conception and design of the study, material preparation, data collection, and analysis, drafting the work. Mansour Rezaei: Contribution to the conception and design of the study, material preparation, data collection, and analysis, critical review of the manuscript for significant intellectual content. Houshang Nemati: Contribution to the conception and design of the study, material preparation, data collection, and analysis, drafting the work. Seyed Mohammad Saleh Seyedzadeh: Contribution to the conception and design of the study, material preparation, data collection, and analysis, drafting the work. Alireza Kamravamanesh: Contribution to the conception and design of the study, material preparation, data collection, and analysis, drafting the work. Saydeh Saba Seyedzadeh: Contribution to the conception and design of the study, material preparation, data collection, and analysis, drafting the work. Mastaneh Kamravamanesh: Contribution to the conception and design of the study, drafting the work, critical review of the manuscript for significant intellectual content. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work, such that the questions related to the accuracy or integrity of any part of the work.

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Original Article

An Assessment of the Correlations between Marital Adjustment and Marital Satisfaction based on Light Triad Traits and Quality of Life in Women

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Abstract

Background: Light triad traits play a significant role in predicting one's mental well-being and can greatly influence interpersonal relationships and overall happiness. This study aimed to assess the correlation between marital adjustment, marital satisfaction and quality of life in alignment with light triad traits.

Methods: Structural equation modeling was used for data analysis. The study population included women living in Bastak, Iran in 2023. A total of 270 participants were selected through convenience sampling method, and completed Light Triad Scale, Dyadic Adjustment Scale (DAS), ENRICH Marital Satisfaction Scale (EMSS), and WHO Quality of Life-BREF questionnaires. Data were analyzed using SPSS version 26 and Amos version 24, with both descriptive and inferential analysis conducted through canonical correlation, regression analysis, and structural model testing.

Results: There was a significant and positive relationship between clear personality traits and compatibility in married couples (β=0.564, P<0.001). Furthermore, the association between adaptation in married couples and quality of life (β=0.307) was also statistically significant at the P<0.001 level. Similarly, the association between marital satisfaction in married couples and clear personality traits (β=0.586) was statistically significant (P<0.001). Also, the association between marital satisfaction in married couples and quality of life was both positive and significant (β=0.215, P<0.001).

Conclusions: Women's marital satisfaction model, which is based on positive personality traits, highlights the significance of taking into account personality traits and their alignment when examining satisfaction in relationships. This suggests that partners with well-adjusted personality traits and compatible differences can contribute to higher levels of satisfaction within a marriage.

Keywords: Marital Adjustment, Marital Satisfaction, Light Triad Traits, Quality of Life, Women

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1. Introduction

Marriage is a highly intricate human relationship, and no other human relationship possesses the same extensive and diverse dimensions as marriage (1). Marital adaptation, a gradual process that occurs throughout the course of marriage, refers to a state in which both husband and wife experience contentment and fulfillment with each other for the majority of the time. This process necessitates the adjustment of preferences, understanding of personality traits, establishment of behavioral guidelines, and development of healthy patterns of communication and interaction (2). According to a previous study, marital adaptation comprises four key elements, namely, couple satisfaction, couple agreement, couple interconnection, and friendly conversations (3). Epidemiological studies indicated that marital maladjustment serves as a significant risk factor for both morbidity and mortality. Furthermore, hostile correlations detrimentally affect the mental and physical well-being of couples (2-4).

Marital adjustment is suggested to be a crucial factor in determining the stability and longevity of a marriage (1). In the study by Roshannejhad and Talepasand, it was determined that couples with higher levels of extraversion, conscientiousness, agreeableness, openness, lower levels of neuroticism, and greater differentiation of self and psychological resilience have greater adjustmentibility in their married life (5). Marital satisfaction and adjustment refer to a situation where spouses generally feel happy and content with each other, and the quality of correlations among women can be assessed based on mutual interest, care for each other, acceptance, and understanding (6). Also, Naziri and colleagues, emphasized the significance of personality factors and traits in marital adjustment, indicating that

personality traits can serve as important predictors of marital adjustment (7).

Life satisfaction refers to a positive and enjoyable attitude that couples have towards various aspects of their correlation (8). Marital satisfaction is when both husband and wife feel happy and content with their decision to marry and be together (9). Marital satisfaction is a temporary assessment that can contribute to the overall functioning and well-being of a family. In essence, it is influenced by factors such as expressing love and affection, mutual respect, sexual relations, shared attitudes and communication style, and problem-solving abilities (10). The examination of theories and models in the field of marriage reveals that several factors influence the stability or instability of a marriage (1). The behavioral theory of marriage highlights the importance of exchanging positive interpersonal behaviors. Positive behaviors contribute to a favorable evaluation of the marriage, while negative behaviors have detrimental effects (6). A study on forgiveness factors and marital satisfaction in Finland revealed a significant correlation between forgiveness and marital satisfaction (11). Shahi and co-workers conducted a study on the correlation between women's mental health and marital satisfaction, involving 300 married individuals in vulnerable areas of Gorgan, Iran. They found that marital satisfaction is predicted by a person's level of mental health (12).

In their research, Kaufman and colleagues found that individuals with light triad traits experience greater satisfaction in both their lives and relationships with others (13). Duradoni and colleagues studied light triad traits of personality and identified three dimensions that are seen as complementary rather than opposing dark triad traits (14). These dimensions, which include empathy, compassion, and altruism, were further validated by Jonason and colleagues (15) in four separate studies, as well as later affirmed by Jonason and colleagues (16). Moreover, light triad traits also influence the "reaction structure" of individuals, shaping their ability to respond appropriately and effectively in various situations (17). Research indicated that individuals with light triad traits, characterized by qualities such as empathy and high altruism, are more likely to sustain stable correlations and collaborate with others, which plays a crucial role in reducing ambivalence and interpersonal sensitivity (14-16). According to many psychologists, the capacity to maintain high-quality correlations and minimize interpersonal issues is an essential indicator of mental health (18).

The concept of quality of life refers to how individuals perceive their position and place within their cultural and environmental contexts, as well as their goals, standards, and interests. Quality of life is influenced by the interaction of several factors, including physical and mental health, religiosity, correlations, and environmental elements (19). Quality of life, particularly concerning health, is defined to be associated with physical, psychological, and social well-being that are shaped by an individual's experiences, beliefs, expectations, and perceptions (20). Job satisfaction, income satisfaction, family status satisfaction, and social well-being are all elements of quality of life that can directly or indirectly impact marital satisfaction (21). By enhancing quality of life and striving for a harmonious alignment within women, marital satisfaction can be improved, ultimately leading to a stronger marital bond. Additionally, the strong correlation between quality of life and marital satisfaction suggests that women with a higher quality of life are more likely to experience greater levels of marital satisfaction. It is challenging to interpret the inconsistent findings reported in previous studies (20-23). Furthermore, it can be concluded that the variables in this research have not been collectively examined and explored within a model (Figure 1). Given the theoretical and empirical foundations, the present study primarily aimed to investigate whether the model of marital adjustment and satisfaction in women, based on light triad traits and quality of life, is appropriately aligned.

2. Methods

Structural equation modeling was used for data analysis. The study population consisted of women living in Bastak, Iran in 2023. A convenience sampling technique was used, with 15 individuals selected for each variable, resulting in a total of 300 participants following the guidelines set by Hu and Bentler (24). These participants completed questionnaires distributed through social media platforms. After excluding 30 incomplete responses, the final sample size was reduced to 270. The inclusion criteria required the participants to be willing to participate, with a minimum of one year of marital experience, specifically seeking counseling for marital conflicts in Bastak, Iran.

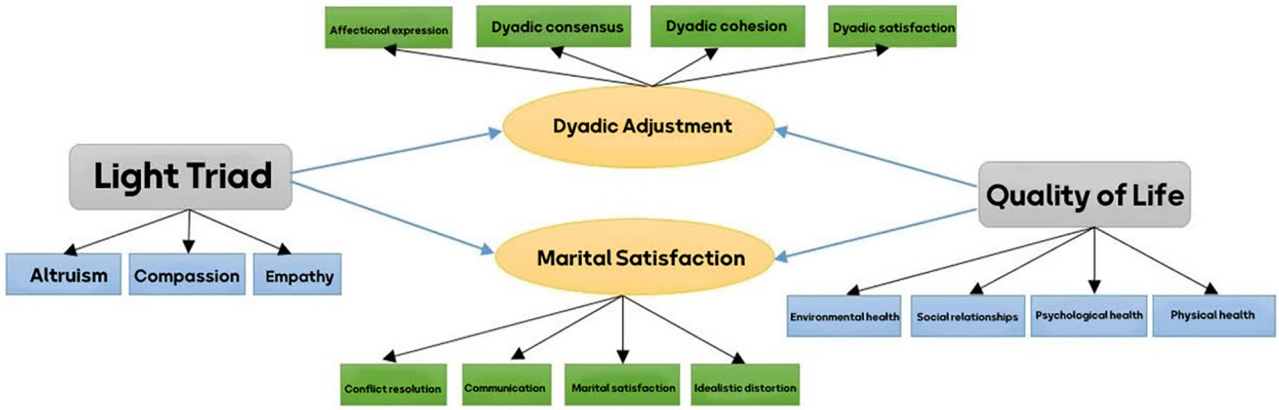

Figure 1: The figure shows the conceptual framework of the research.

Failure to respond to questionnaires or provide consent led to exclusion from the study. The research protocol, questionnaires, and study procedures were approved by the Office of Vice-Chancellor for Research. The researcher personally visited counseling centers in Bastak, Iran to explain the purpose of the study and obtain a written consent form from eligible participants. During this stage, participants were ensured of confidentiality and that their responses would only be used for research purposes. Following data collection, the questionnaires were analyzed using SPSS version 26 and Amos version 24. Ethical considerations included clearly conveying the objectives of the study to participants and ensuring that a written consent form is obtained. The anonymous questionnaires were completed online. The study participants were informed that their involvement was voluntary, they could withdraw at any point, and their information would be kept confidential. Additionally, they were informed that they could receive the findings of the study through email.

2.1. Measures

2.1.1. Dyadic Adjustment Scale

Spanier developed the Dyadic Adjustment Scale in 1976 to gauge the level of adjustment between couples who are married or live together (25). Using factor analysis, Spanier found that this scale measures four dimensions: dyadic satisfaction, dyadic cohesion, dyadic consensus, and affectional expression. Comprising 32 items, this measure is designed to assess the quality of the marital correlation from the perspective of either partner. It serves two primary purposes: to evaluate overall correlation satisfaction based on total scores and to measure the four dimensions of the correlation mentioned above. The husband-and-wife rating scale incorporates three different types of rating scales, with higher scores indicating a more positive and well-adjusted correlation. The items corresponding to each subscale are as follows: dyadic satisfaction (16, 17, 18, 19, 20, 21, 22, 23, 31, 32), dyadic cohesion (24, 25, 26, 27, 28), dyadic consensus (1, 2, 3, 5, 8, 9, 10, 11, 12, 13, 14, 15), and affectional expression (4, 6, 29, 30). Scoring is based on a Likert scale. The method for scoring the measure is straightforward and involves basic calculations that do not require training. The developers suggest that the scores for each subscale can be obtained by adding up the items that belong to that subscale, with some items needing to be scored in reverse. By adding up all individual subscale scores, the DAS Total Score can be determined. The final score can range from 0 to 151, with higher scores reflecting better dyadic adjustment and lower levels of distress. The total score of the scale demonstrates good internal consistency, as evidenced by a Cronbach's alpha of 0.96. Additionally, the subscales exhibit good to excellent internal consistency: dyadic satisfaction (0.94), dyadic cohesion (0.81), dyadic consensus (0.90), and affectional expression (0.73) (26). In this study, the reliability of the scale was determined to be 0.91 through Cronbach's alpha.

2.1.2. ENRICH Marital Satisfaction Scale

Olson (27) developed the ENRICH Marital Satisfaction Scale that contains four different subscales: idealistic distortion, satisfaction within marriage, communication, and resolution of conflicts. This survey consists of 35 questions using a five-point Likert scale, with options ranging from "Strongly Disagree" to "Strongly Agree" scored from 1 to 5. However, certain questions (3-5-6-7-10-13-14-18-19-21-22-23-26-27-28-29-32-33-34)

are reversed in scoring, with "Strongly Agree" receiving a score of 1 and "Strongly Disagree" receiving a score of 5. Essentially, on these questions, the scoring is flipped. The scale follows a Likert-style approach with five choices representing varying degrees of agreement or disagreement, each assigned a number from one to five. A higher score on this scale indicates greater satisfaction in marriage. The alpha coefficients for the subscales of the ENRICH scale were as follows: idealistic distortion (0.9), marital satisfaction (0.81), personality aspects (0.73), communication (0.68), conflict resolution (0.75), financial management (0.74), leisure activities (0.76), sexual correlation (0.48), children and parenting (0.77), family and friends (0.72), for equative roles (0.71) (27). The Marital Satisfaction Scale showed strong correlations with family satisfaction scales (0.41 to 0.60), and with life satisfaction scales (0.32 to 0.41), suggesting the validity of the construct (28). Additionally, all subscales of the ENRICH scale distinguished between satisfied and dissatisfied couples, demonstrating good criterion validity.

2.1.3. Light Triad Scale

The attributes linked with the light triad in this study include: empathy, compassion, and altruism. Empathy involves understanding and perception of human beings in general. Compassion entails treating individuals with tenderness and kindness. Altruism implies showing respect and honor to individuals based on their history and background (14). Participants are asked to rate the items in the questionnaire on a 5-point Likert scale, ranging from 1 (completely disagree) to 5 (completely agree). Items 1-8 evaluate the level of empathy, items 9-16 measure the level of compassion, and items 17-24 assess the level of altruism. Some items, including 22, 21, 20, 18, 15, 12, 8, 7, 4, and 1, are reverse scored. A higher score indicates a higher possession of the corresponding attribute. According to Jonason, the Cronbach's alpha coefficients were as follows: empathy (0.67), compassion (0.80), altruism (0.79), and scale reliability (0.88) (16). To check validity, factor analysis was performed, with factor loadings ranging from 0.24 to 0.50 for empathy, 0.36 to 0.60 for compassion, and 0.30 to 0.70 for altruism. The questionnaire was standardized in Iran (29). In the present study, the reliability of the scale was assessed using Cronbach's alpha coefficient, yielding values of 0.657 for empathy, 0.778 for compassion, and 0.761 for altruism.

2.2. WHO Quality of Life-BREF

This survey includes 26 questions that evaluate an individual's overall quality of life. It was created in 1999 by experts from the World Health Organization by modifying a 100-item version of the same survey (30). The questionnaire consists of 4 subcategories and a total score: physical health, psychological health, social relationships, environmental well-being, and an overall score. Each subcategory provides a raw score that is then transformed into a standard score between 0 and 100 using a specific formula. A higher score suggests a better quality of life. The physical health section is determined by combining the scores of questions 3, 4, 10, 15, 16, 17, and 18. Scores for this section range from 7 to 35, with a 28-point difference. The psychological health section is determined by combining the scores of questions 5, 6, 7, 11, 19, and 26. Scores for this section range from 6 to 30, with a 24-point difference. The social relationships section is determined by combining the scores of questions 20, 21, and 22. Scores for this section range from 3 to 15, with a 12-point difference. The environmental well-being section is determined by combining the scores of questions 8, 9, 12, 13, 14, 23, 24, and 25. Scores for this section range from 8 to 40, with a 32-point difference. The quality of life and overall general health section is determined by combining the scores of questions 1 and 2. Scores for this section range from 2 to 10, with an 8-point difference. After obtaining raw scores for each section, they are converted into standard scores from 0 to 100. The reliability coefficients for test-retest of the sections were: physical health (0.77), psychological health (0.77), social relationships (0.75), and environmental well-being (0.84) (31). In this study, the reliability of the questionnaire was evaluated using Cronbach's alpha coefficient, which resulted in a value of 0.78.

2.3. Statistical Analysis

The researcher analyzed the questionnaires using SPSS version 26 and Amos version 24. The descriptive statistics described the data by calculating frequency, percentage, mean, standard deviation, minimum and maximum values. The inferential statistics used focal correlation methods to examine the correlation between variables, and regression analysis to investigate the predictive role. To ensure adherence to this assumption, outliers and extreme values were initially detected

and eliminated through the use of rectangular diagrams. Subsequently, the normality of the data distribution was assessed via the Kolmogorov-Smirnov test. Furthermore, the substantial sample size and the absence of extreme Skewness and kurtosis in the data substantiate the validation of this assumption. To verify this assumption, the collinearity diagnostics test was employed. The reliability of each indicator for the latent variable in the AMOS model was determined based on the factor loadings of each indicator. The factor loadings of all indicators for the latent variable were equal to or greater than 0.4. One of prerequisite for the analysis is the independence of independent or predictor variables from each other. Tolerance and Variance Inflation Factor (VIF) indexes were checked to check the assumption of collinearity. VIF statistic is used to check the intensity of multiple collinearities. This shows how much of the changes related to the estimated coefficients have increased due to collinearity. If VIF is greater than 5, collinearity is high. If the Tolerance value is more than 0.2, it means that the model has a good fit. This assumption was also confirmed.

3. Results

According to Table 1, 34 (%12.9) of the participants had a high school diploma, 75 (28.4%) had a diploma, 9 (3.4%) of the samples had a degree: Associate degree, 84 (%31.8) an undergraduate degree, 44 (%16.7) a Master's degree, and 18 (%6.8) a PhD degree. Likewise, 15 (%5.7) had lived together for less than 2 years, 8 (%3) had lived together for 2-5 years, 22 (%8.3) had lived together for 5-10 years and 219 people (%83.0) had lived together for more than 10 years. Also, 6 (%2.3) were unemployed, 101 (%38.3) were housewives, 38 (%14.4) were self-employed, and 119 (%45.1) were employees. Table 1 shows the mean and standard deviation of the study variables.

Based on the findings (Table 2), the study variables showed a significant positive correlation with each other (P<0.05). In Table 3, Tolerance and VIF values were checked and confirmed.

Following the model analysis, the researcher examined the path coefficients and significance levels of the variables (Table 4). In terms of the path coefficients, which correspond to standardized beta values in regression analysis, values below 0.3 are considered weak, those between 0.3 and 0.6 are seen as moderate, and anything above 0.6 is deemed strong.

Table 3 and Figure 2 reveal that the model of compatibility in married couples based on clear personality traits has a good fit. The path coefficient between clear personality traits and compatibility in married couples was significant and positive (β=0.564, P<0.001). Also, the compatibility model in married couples based on the quality of life has a good fit. The coefficient of

Table 1: Descriptive statistics of the variables

Variables	N	Mean±SD	Skewness	Kurtosis	Min	Max
Sympathy	264	28.08±3.53	0.113	-0.023	18	38
Compassion	264	32.76±3.84	-0.546	0.743	19	40
Philanthropy	264	34.05±3.65	-0.78	0.926	20	40
Clear personality traits	264	94.89±8.45	-0.493	0.739	64	118
Marital Satisfaction	264	37.12±4.59	1.437	3.362	15	46
Dual solidarity	264	16.48±4.06	-0.346	0.149	4	25
Two-way agreement	264	44.77±9.97	-0.992	1.126	9	60
Expression of love	264	8.59±1.84	-1.172	1.758	2	12
Marital compatibility	264	23.66±7.34	-0.575	-0.324	5	35
Physical health	264	24.83±3.84	0.018	0.067	12	35
Mental health	264	20.94±4.75	0.159	-1.204	12	30
Community Relations	264	11.01±2.16	-0.171	-0.326	5	15
Environmental health	264	27.85±5.84	-0.066	-0.521	12	40
General health	264	7.37±1.40	-0.286	0.548	2	10
Quality of Life	264	92.01±14.14	0.119	-0.43	54	125
Ideal distortion	264	15.92±1.99	0.894	-0.526	14	20
Marital Satisfaction	264	31.59±4.74	-0.789	-0.061	20	38
Connections	264	30.66±4.03	-0.321	0.113	20	38
Conflict resolution	264	32.05±5.44	-0.795	-0.727	20	38

Table 2: Correlation matrix between variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sympathy	-														
Compassion	0.649	-													
Philanthropy	0.673	0.817	-												
Marital Satisfaction	0.604	0.622	0.736	-											
Dual solidarity	0.577	0.537	0.611	0.669	-										
Two-way agreement	0.542	0.459	0.579	0.740	0.697	-									
Expression of love	0.678	0.553	0.665	0.775	0.611	0.797	-								
Physical health	0.686	0.623	0.716	0.756	0.564	0.587	0.722	-							
Mental health	0.673	0.605	0.661	0.573	0.530	0.508	0.628	0.830	-						
Community Relations	0.659	0.635	0.701	0.676	0.517	0.537	0.670	0.854	0.850	-					
Environmental health	0.704	0.670	0.754	0.676	0.565	0.544	0.684	0.847	0.863	0.874	-				
Ideal distortion	0.598	0.514	0.553	0.401	0.365	0.384	0.507	0.596	0.584	0.588	0.667	-			
Marital Satisfaction	0.658	0.561	0.595	0.595	0.495	0.512	0.628	0.671	0.635	0.628	0.646	0.512	-		
Connections	0.528	0.591	0.556	0.457	0.489	0.379	0.461	0.551	0.567	0.504	0.570	0.513	0.818	-	
Conflict resolution	0.603	0.630	0.608	0.507	0.514	0.439	0.528	0.552	0.555	0.517	0.583	0.624	0.809	0.823	-

Table 3: Model path coefficients and model significance

Paths	Estimate	P value	Result
Clear personality traits→ Marital compatibility	0.564	<0.001	Confirmation
Clear personality traits→ Marital Satisfaction	0.586	<0.001	Confirmation
Quality of Life→ Marital compatibility	0.307	<0.001	Confirmation
Quality of Life→ Marital Satisfaction	0.215	<0.001	Confirmation

Table 4: Examining the assumption of non-collinearity between predictor variables

Variable	Collinearity Statistics	
	Tolerance	VIF
Physical health	0.533	1.875
Mental health	0.432	2.315
Community Relations	0.476	2.100
Environmental health	0.490	2.042
Sympathy	0.893	1.120
Compassion	0.619	1.616
Philanthropy	0.614	1.629

VIF: Variance Inflation Factor

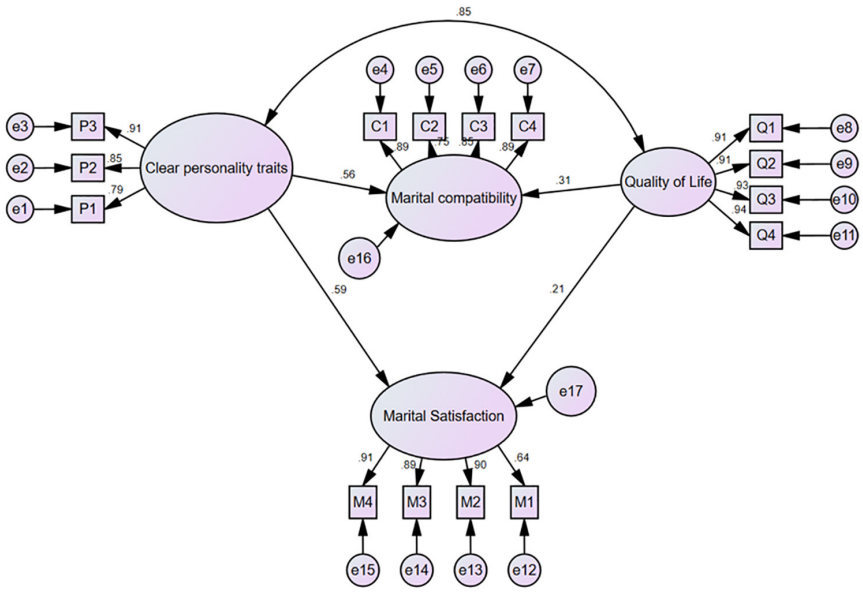

Figure 2: The figure shows the path coefficients between variables.

the path between compatibility in married couples, based on quality of life (β=0.307), was statistically significant (P<0.001). At the same time, the model of marital satisfaction in married people, based on clear personality traits, has a good fit. The path coefficient between marital satisfaction in married couples, based on clear personality traits (β=0.586), was statistically significant (P<0.001). It should be noted that the model of marital satisfaction in married people, based on the quality of life, has a good fit. According to Table 3, the path coefficient between marital satisfaction in married couples based on quality of life (β=0.215, P<0.001) is positive and significant. Table 5 indicates that indices of the research model demonstrate excellent model fit. Consequently, the final model exhibits a satisfactory fit.

4. Discussion

This study aimed to assess how light triad traits and quality of life in Bastaki women can predict marital adjustment and satisfaction. The analysis revealed a significant correlation between the adjustment model in women and light triad traits, suggesting a good fit. Our results indicated a positive and significant association between empathy, one of the light traits, and adjustment. In other words, as women's empathy scores increased, so did their level of adjustment. These findings aligned with the research results of Kaufman and colleagues (13), Jonason and co-workers (16), Zaheri and colleagues (22), and Song and Shi (32).

People who have a high level of life satisfaction also tend to experience more positive emotions and have a positive view of themselves and others. Moreover, they often have deeper emotional experiences, better overall health, and display personality traits that are consistent and commonly exhibited. Research has found that empathy, a trait associated with understanding and sharing the feelings of others, is significantly correlated with higher levels of life satisfaction and better adjustment. Empathy is considered an essential concept and a fundamental human need (10, 11). It is worth mentioning that adjustment and satisfaction play vital roles in an individual's overall well-being, which is closely linked to their physical and psychological health. In case of women, empathy can contribute to improved communication and a pleasant feeling within their married life, thereby reducing stress and pressure, ultimately leading to increased satisfaction and adjustment. Moreover, satisfaction and adjustment enhance an individual's health and effectiveness within their professional environment. Therefore, establishing positive and empathetic correlations with people can contribute to greater satisfaction and adjustment in life (11, 12).

The adjustment model for women, based on quality of life, shows a strong fit. The results of this study were consistent with a research carried out by Ruggeri and colleagues (21). It is evident that strengthening connections has played a role in enhancing marital satisfaction. There are certain skills that can be used to meet the deep-seated desires of families, which are universal across different cultures. These desires, such as love, empathy, belonging, trust, loyalty, security, and pleasure, are highly meaningful. Fulfilling these desires for a spouse and other family members serves a psychological and social purpose, leading to increased love, closeness, self-worth, and personal development for each individual. This creates a nurturing environment that promotes stable support, ultimately improving the quality of marital relationships. Demonstrating compassion is essential for fostering security, stability, positive intimate connections, and personal growth. Furthermore, enhancing connections through enrichment programs has resulted in greater agreement within marital relationships (21).

The model of marital satisfaction in women based on light triad traits and quality of life demonstrates a satisfactory fit. These findings aligned with the

Table 5: Model Fit of the research

Variable	χ^2/df	RMSEA	RMR	GFI	NFI	RFI	IFI	CFI
Marital compatibility	1.365	0.035	0.028	0.840	0.926	0.922	0.979	0.979
Clear personality traits	1.138	0.022	0.044	0.878	0.946	0.942	0.993	0.993
Quality of Life	1.466	0.039	0.064	0.962	0.987	0.982	0.996	0.996
Marital Satisfaction	1.949	0.056	0.188	0.907	0.929	0.919	0.964	0.964

RMSEA: Root Mean Square Error of Approximation; RMR: Root Mean Square Residual; GFI: Goodness-of-Fit Index; NFI: Normed Fit Index; RFI: Relative Fit Index; IFI: Incremental Fit Index; CFI: Comparative Fit Index

results of previous studies conducted by Kaufman and colleagues (13), Jonason and co-workers (16), Entezami Lahijani and colleagues (33), and Sayehmiri and co-workers (34). It can be concluded from these findings that personality traits play a significant role in determining marital satisfaction. Traits such as agreeableness, emotional stability, and extraversion are more likely to contribute to marital satisfaction, whereas traits like neuroticism and low conscientiousness may result in dissatisfaction (34). This discovery is consistent with a previous study that highlights the influence of personality on correlation outcomes (33, 34). Furthermore, this model emphasizes the importance of compatibility among women's personality traits. It suggests that couples with similar or complementary characteristics are more likely to experience higher levels of marital satisfaction. This supports the idea that shared values, interests, and behaviors can foster better adjustment and understanding within correlations. Moreover, the model indicates that individuals can enhance their marital satisfaction by actively cultivating positive personality traits. By consciously striving to increase satisfaction and emotional stability, individuals may improve the dynamics and overall satisfaction of their relationship (35).

This highlights the positive impact of personal growth and self-improvement on marital correlations. However, it is crucial to acknowledge that this model does not account for other factors that can also influence marital satisfaction, such as communication skills, conflict resolution strategies, and external stressors. While personality traits undoubtedly play a significant role, they are not the sole determinants of correlation satisfaction. Future research should incorporate these additional factors to obtain a more comprehensive understanding of marital satisfaction (10, 11). The model of marital satisfaction based on personality traits and appropriate adjustment offers valuable insights into the factors that contribute to marital satisfaction. It underscores the significance of personality traits and their adjustment in predicting and comprehending marital happiness. Nevertheless, it is essential to recognize that this model should be examined in conjunction with other factors that impact marital satisfaction in order to develop a more comprehensive understanding of marital dynamics (36).

The present findings supported the notion that the model of marital satisfaction in women based on quality of life and model fit, is a valuable and effective model for comprehending the factors that influence marital satisfaction (30). Quality of life encompasses elements such as job satisfaction, income satisfaction, satisfaction with family status, and social well-being. These factors can directly and indirectly impact marital satisfaction (31). For instance, job satisfaction and income satisfaction can enhance women's psychological equilibrium and financial stability, thus strengthening marital satisfaction. Additionally, good fit plays a significant role in marital satisfaction (34). Good fit refers to the compatibility and agreement between women's characteristics, values, and needs. Women who have better communication, and harmony, and fulfill each other's needs are more likely to experience higher levels of marital satisfaction. Conversely, an inappropriate fit and lack of alignment between women may lead to dissatisfaction and marital tensions. Therefore, drawing from the model of marital satisfaction in women based on quality of life and good fit, it can be concluded that quality of life and good fit in women have an impact on marital satisfaction.

4.1. Limitations

The limitations of the study included the inability to control variables, such as the social and economic status of the participants; thus, caution should be exercised when generalizing the findings. Due to time constraints, the study did not explore the role of environmental factors even though they play a significant part in determining marital adjustment and quality of life. Implementing the proposed model, women can participate in training programs aimed at enhancing their personality traits, which may incorporate communication skills, stress management, problem-solving techniques, and empathy development. To validate the suggested model, it would be beneficial to conduct cross-sectional studies examining the associations between light and dark personality traits and marital satisfaction at a broader societal level with larger sample sizes.

5. Conclusions

The model of women's marital satisfaction, based on light triad traits with good fit, underscores the importance of personality traits and their adjustment when understanding satisfaction.

This implies that when couples possess adjusted personality traits with a good fit, they can contribute to heightened levels of marital satisfaction.

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Ethical Approval

This study was approved by the ethics committee of Hormozgan University of Medical Sciences with the code of IR.HUMS.REC.1402.359. Also, written informed consent was obtained from the participants.

Authors' Contribution

Abdullah Azhdari: Substantial contributions to the conception and design of the work, the acquisition, analysis, and interpretation of data for the work, drafting the work. Eghbal Zarei: Substantial contributions to the conception and design of the work, the acquisition, analysis, and interpretation of data for the work, drafting the work and reviewing it critically for important intellectual content. Kourosh Mohammadi: Substantial contributions to the design of the work, drafting the work and reviewing it critically for important intellectual content. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work, such that the questions related to the accuracy or integrity of any part of the work.

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