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Association between leisure-time physical activity and mental and physical health among Iranian women: a cross-sectional study

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Abstract

Background: Women's physical and mental health in Middle Eastern populations remains under researched. This study aimed to examine the association between physical activity and depression among women, considering sociodemographic and health-related factors.

Material and methods: A cross-sectional study was conducted in Kerman, Iran, between June and December 2023 using an online questionnaire. A total of 105 women participated (mean age 36.01±13.25 years). Data included sociodemographic, health behaviors, depression, and physical activity. Statistical analysis included Spearman's correlation and non-parametric tests.

Results: A significant negative association was found between leisure-time physical activity and depression (r=-0.57, p<0.001). Physical activity levels differed according to education (p=0.003) and profession (p=0.020). Higher depression scores were observed among women with anemia (p=0.023). Multiple linear regression analysis showed that physical activity remained significantly associated with depression (β=-0.559, p<0.001). Fast-food and caffeine intake were associated with diet (p=0.019, p=0.033).

Conclusions: Higher levels of physical activity were associated with lower levels of depression among women. These findings underscore the importance of physical activity in strategies to improve mental health.

Keywords: physical health, physical activity, anemia, diet, mental health

Introduction

Leisure-time physical activity is a well-established determinant of both physical and mental health, contributing to a reduced risk of depression, anxiety, and chronic diseases [1-3]. Regular engagement in physical activity supports cardiovascular and metabolic health and contributes to psychological well-being and quality of life [4,5]. It may also be associated with mental health through biological and psychological mechanisms such as neurotransmitter regulation and stress reduction [6,7]. Despite these benefits, research on women's health in Middle Eastern populations, particularly in Iran, remains limited [8,9].

Sociodemographic factors, including education and occupation, may influence engagement in physical activity and related health outcomes [10,11]. Lifestyle behaviors, including diet and

caffeine intake, can influence physical and mental health and may interact with physical activity to affect well-being [12-14]. In addition, certain health conditions, such as anemia, have been associated with higher levels of depressive symptoms [15]. These factors highlight the importance of considering multiple dimensions when examining mental health outcomes.

Although previous studies have explored these relationships in general populations [1,12], few have focused specifically on Iranian women of working age, who may face unique social and cultural challenges affecting their health behaviors.

Aim of the work

The aim of the study was to examine the association between leisure-time physical activity and physical and mental health (depression) among Iranian women in relation to sociodemographic characteristics and health behaviors.

Material and methods

Research design and setting

The study was designed as a cross-sectional study and was conducted in Kerman County, located in the Kerman Province, Iran.

Participants

The target population consisted of Iranian adult women aged 18-65 years. The participants were included if they reported no severe physical or mental impairments and were able to understand the questionnaire in Persian. This information was based solely on self-reports and was not clinically verified. Data were collected between June 2023 and December 2023.

Sampling technique

A non-random convenience sampling method was used. The participants were recruited through online platforms, including social media (e.g. WhatsApp and Telegram), where the survey link was distributed within groups and channels commonly used by women in Kerman, such as local community groups, university student groups, and women's social networks. The participants were also encouraged to share the survey link with other eligible individuals (snowball sampling). Individuals who met the inclusion criteria were invited to participate voluntarily.

A total of 105 responses were included in the analysis. Due to the online recruitment method, it was not possible to determine the number of individuals who received the invitation; therefore, a response rate could not be calculated.

Before accessing the questionnaire, the participants were presented with an electronic informed consent form and information about the study, including its purpose and inclusion criteria. Only those who agreed to participate were allowed to proceed. The participation was voluntary and anonymous, and the participants could withdraw at any time.

Data collection tools

The questionnaire utilized in this study comprised several sections aimed at eliciting comprehensive sociodemographic information, health behavior patterns, mental health status, and physical activity levels of the participants.

The first section, focusing on sociodemographic characteristics and short anamnesis, provided detailed insights into the participants' backgrounds. Key demographic variables such as age, gender, marital status, education level, and current occupation were collected. Additionally, the participants were queried about their height and weight to facilitate the calculation of Body Mass Index (BMI), which is a commonly used indicator of weight status and health.

The second section of the questionnaire explored health behavior and status, including the presence of anemia, frequency of fast-food consumption, specific digestive diseases, daily caffeine intake, diet (fasting), and daily cigarette consumption. These questions aimed to capture a holistic view of the participants' health behaviors and potential health concerns.

The third section employed the Beck Depression Inventory questionnaire to assess the participants' mental health status. This instrument consists of 21 questions, each offering four response options graded in terms of severity. The participants' responses were scored accordingly, with higher cumulative scores indicating a higher level of depressive symptoms. The participants were categorized into different levels of depression severity based on their total scores, ranging from normal to extreme depression. The participants with scores of 1-10 were normal, with 11-16 were mild mood disturbance, with 17-20 borderline clinical depression, with 21-30 were moderate depression, with 31-40 were severe depression, and with over 40 were extreme depression [16,17].

The fourth section assessed physical activity using Godin Leisure-Time Exercise Questionnaire (GLTQ), a validated instrument that measures the weekly frequency of mild, moderate, and strenuous physical activity lasting at more than 15 minutes. A total leisure-time physical activity score was calculated using the following formula: (9 × strenuous) + (5 × moderate) + (3 × light). Based on the total score, the participants were categorized into three groups: insufficiently active (<14), moderately active (14-23), and active (≥24) [18,19].

Data analysis

Statistical analyses were performed using IBM SPSS Statistics 25.0 for WIN (IBM Corp., Armonk, NY, USA). Microsoft Excel was used for data organization. Normality of distribution was assessed using the Kolmogorov-Smirnov test ($p<0.001$). Due to the non-normal distribution of the data, non-parametric tests were applied. The Mann-Whitney U test was used to compare differences between two independent groups, while the Kruskal-Wallis test was used for comparisons across more than two groups. In addition, Spearman's correlation analysis was performed to examine the association between leisure-time physical activity and depression.

A multiple linear regression analysis was conducted to assess the association between physical activity and depression after adjusting for age, BMI, educational attainment, and anemia status. Statistical significance was set at $p<0.05$. Educational attainment was entered into the regression model as a categorical variable using dummy coding, with academic education serving as the reference category.

Prior to performing the regression analysis, the assumptions of linear regression were assessed. The normality of residuals was evaluated using histograms and normal probability plots, while homoscedasticity was assessed using scatterplots.

Because several educational categories had sparse observations, educational attainment collapsed into three categories prior to multivariable regression analysis to improve the stability and interpretability of parameter estimates. The resulting categories were lower education (primary education/diploma; n=21), academic education (associate degree/bachelor's degree/master's degree; n=77), and doctoral education (PhD; n=7).

Results

Main characteristics

A total of 105 women participated in the study. The participants were aged between 18 and 65 years, with a mean age of 36.01±13.25 years, with varying levels of education and occupational status. The sociodemographic characteristics of the participants are presented in Table 1.

Table 1. Sociodemographic characteristics of the participants (n=105)

Characteristics	Categories	Frequency (n)	Percent (%)
Age categories (years)	**18-24**	26	24.8
	25-44	54	51.4
	45-65	25	23.8
Marital status	**Married**	37	35.2
	Single	50	47.6
	Divorced	7	6.7
Education	**Primary**	1	1.0
	Diploma	20	19.0
	Associate's degree	12	11.4
	Bachelor's degree	38	36.2
	Master's degree	27	25.7
	PhD	7	6.7
Profession	**Housewife**	8	7.6
	Teacher	15	14.3
	Employee	32	30.5
	Student	32	30.5
	Health professional	7	6.7
	Business	5	4.8
	Entrepreneur	5	4.8
	Researcher	1	1.0

Notes: BMI – Body Mass Index.

The study included 105 participants with a mean age of 36.01±13.25 years. Heights ranged from 150 to 183 cm and weights from 42 to 95 kg. The average BMI was 23.59±3.67 kg/m² (Table 2).

Table 2. Anthropometric characteristics of the study sample (n=105)

Anthropometrics	Minimum	Maximum	Mean	SD
Height (cm)	150	183	164.40	6.37
Weight (kg)	42	95	63.72	10.31
BMI (kg/m^2)	15.94	34.63	23.59	3.67

Notes: BMI – Body Mass Index, SD – standard deviation.

Health and lifestyle

Health-related behaviors, including anemia status, dietary patterns, caffeine consumption, and smoking habit, are summarized in Table 3. The data shows varied health behaviors among Iranian women. About 30.5% reported anemia, while most did not. Smoking was uncommon, with 83.8% identifying as non-smokers. Fast-food and caffeine consumption were relatively common, with many participants reporting an intake several times per week. Most women (63.8%) did not experience gastrointestinal issues, though some reported constipation and stomach discomfort. Dietary patterns varied among the participants, reflecting different eating habits and routines.

Table 3. Health characteristics of the study sample (n=105)

Conditions/Habits	Categories	Frequency (n)	Percent (%)
Anemia	**No**	73	69.5
	Yes	32	30.5
Fast food consumption (weekly)	**Nothing**	39	37.1
	Once a week	26	24.8
	Twice a week	27	25.7
	Three times a week	11	10.5
	More	2	1.9
Caffeine intake (weekly)	**Nothing**	17	16.2
	Once a week	18	17.1
	Twice a week	17	16.2
	Three times a week	40	38.1
	More than	13	12.4
Gastrointestinal diseases	**Non**	67	63.8
	Reflux	2	1.9
	Diarrhea	4	3.8

	Constipation	19	18.1
	Stomach-ache	10	9.5
	Diarrhea and constipation	3	2.9
Diet days (yearly)	**0**	48	0.45
	1-9	13	0.12
	10-19	14	0.13
	20-29	8	0.076
	30	22	0.20
Smoking (daily)	**0**	88	83.8
	1-9	14	2.9
	10 or more	3	2.9

Notes: BMI – Body Mass Index.

The data indicate that women consumed fast food on average 1.15±1.10 times per week and caffeine 2.13±1.10 times weekly. Smoking levels were low, with an average of 1.01±2.65 cigarettes per day. Dietary patterns varied among the participants, reflecting differences in eating habits (Table 4).

Table 4. Health and behavior of the study sample (n=105)

Habits	Mean	SD
Fast food consumption (weekly)	1.15	1.10
Caffeine intake (weekly)	2.13	1.30
Diet days (yearly)	9.92	12.27
Smoking (daily)	1.01	2.65

Notes: SD – standard deviation.

Depression

The distribution of depressive symptom severity, based on BDI scores, is presented in Table 5.

Table 5. Depression categories according to the Beck Depression Inventory (n=105)

BDI	Categories	Frequency (n)	Percent (%)
Scale score	**Normal**	74	70.5
	Mild mood disturbances	12	11.4
	Borderline clinical depression	3	2.9
	Moderate depression	11	10.5
	Severe depression	4	3.8
	Extreme depression	1	1.0

Notes: BDI – Beck Depression Inventory.

Results showed a mean score of 9.23±9.70, indicating generally mild depressive symptoms among the participants, though scores varied widely (0-43). Most women (70.5%) reported minimal or normal mental health status. Smaller proportions experienced mild mood disturbances (11.4%) or moderate depression (10.5%), while fewer participants showed severe or extreme levels of depression.

Physical activity

The distribution of leisure-time physical activity level, based on GLTQ scores, is presented in Table 6. Women's GLT Activity Scores ranged from 0 to 81, with a mean of 29.33±21.31, indicating overall moderate physical activity. About 54.3% of the participants reported an active lifestyle, 13.3% were moderately active, and 32.4% led a sedentary lifestyle, highlighting considerable variability in activity levels among women.

Table 6. Leisure time physical activity according to the Godin Leisure-Time Exercise Questionnaire

GLTQ	Categories	Frequency (n)	Percent (%)
Scale score	**Insufficiently active/sedentary**	34	32.4
	Moderately active	14	13.3
	Active	57	54.3

Notes: GLTQ – Godin Leisure-Time Exercise Questionnaire.

Physical activity levels differed significantly according to education level (Kruskal-Wallis test, p=0.003) and profession (Kruskal-Wallis test, p=0.020). However, due to small subgroup sizes, these findings should be interpreted with caution. Detailed subgroup analyses are presented in the supplementary material (Table S1).

No statistically significant differences in depressive symptoms were found across sociodemographic variables (Kruskal-Wallis test, p>0.05).

Physical activity levels differed significantly according to education level (Kruskal-Wallis test, p=0.003). However, no statistically significant differences were observed in depression scores across education levels (p=0.528). Due to small subgroup sizes, these findings should be interpreted with caution. Detailed results are presented in the supplementary material (Table S2).

Some associations were observed between dietary behaviors and lifestyle factors; detailed results are presented in the supplementary material (Table S3).

Women with anemia had significantly higher depressive symptom scores compared to those without anemia (p=0.023). The analysis revealed that women with anemia had higher BDI scores (11.16±8.89) than those without anemia (8.40±9.98), indicating more pronounced, though still mild, mental health issues (p=0.023). Physical health status did not significantly affect engagement in leisure-time activities (p>0.05) (Table 7).

Table 7. Between-group differences based on presence or absence of anemia in physical activity and depression (n=105)

Anemia		BDI total	GLTQ			
			Strenuous exercise	Moderate exercise	Light exercise	Activity score
Without (n=73)	**Mean**	8.40	1.16	1.70	3.36	29.04
	SD	9.98	1.42	1.46	2.02	20.73
With (n=32)	**Mean**	11.16	1.03	2.06	3.47	30.00
	SD	8.89	1.33	2.42	1.88	22.89
Total (n=105)	**Mean**	9.24	1.12	1.81	3.39	29.33
	SD	9.70	1.39	1.80	1.97	21.31
Mann-Whitney U	**Z**	-2.279	-0.404	-0.184	-0.021	-0.174
	p	**0.023**	0.686	0.854	0.983	0.862

Notes: BDI – Beck Depression Inventory; GLTQ – Godin Leisure-Time Exercise Questionnaire.

The results of the multiple linear regression analysis are presented in Table 8.

Table 8. Multiple linear regression analysis of factors associated with depression (BDI score)

Variable	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std	Beta		
Anemia	2.037	1.705	0.102	1.195	0.235
Age	-0.122	0.077	-0.174	-1.586	0.116
GLT score	-0.244	0.037	-0.559	-6.538	<0.001
BMI_SUM	-0.152	0.257	-0.060	-0.591	0.556
Lower Education	-0.535	2.245	-0.023	-0.238	0.812
PhD	8.052	3.785	0.186	2.127	0.036

Notes: BDI – Beck Depression Inventory, β – standardized regression coefficient, GLTQ – Godin Leisure-Time Exercise Questionnaire; BMI – Body Mass Index. Reference category: academic education (Associate/Bachelor/Master), lower education (Primary/Diploma).

A multiple linear regression analysis was performed to examine the association between leisure-time physical activity and depression while controlling sociodemographic and health-related variables.

The overall regression model was statistically significant ($F=8.326$, $p<0.001$). The model explained 34.0% of the variance in depression score ($R^2=0.340$), with an adjusted R^2 of 0.299.

Among the independent variables, GLT score was significantly and inversely associated with BDI score ($\beta=-0.559$, $p<0.001$), indicating that higher GLT scores were associated with lower depression levels. In addition, participants with a PhD degree had significantly higher BDI scores compared with the reference educational category (academic education level) ($\beta=0.186$, $p=0.036$).

Age ($\beta=-0.174$, $p=0.116$), BMI ($\beta=-0.060$, $p=0.556$), anemia status ($\beta=0.102$, $p=0.235$), and lower education level ($\beta=-0.023$, $p=0.812$) were not significantly associated with depression score.

Discussion

The present study demonstrated a significant negative association between leisure-time physical activity and depression among women. Higher levels of physical activity were associated with lower levels of depressive symptoms [20]. This finding is consistent with previous studies suggesting that physical activity may be associated with better mental health outcomes. Women with higher educational attainment or professional occupations may have greater awareness, resources, and opportunities to engage in leisure-time physical activity, highlighting the need for tailored interventions that consider these sociodemographic dimensions [21]. While sociodemographic factors did not directly predict depression scores, women with anemia exhibited higher depressive symptoms, consistent with studies linking iron deficiency and other micronutrient deficiencies to mood disorders [15].

This finding underscores the interaction between physiological status and mental health, suggesting that addressing nutritional deficiencies may complement psychological and behavioral interventions. Lifestyle behaviors, including fast-food and caffeine consumption, were associated with diet duration, reflecting potential interactions between dietary habits and physical activity patterns. These results align with prior research indicating that diet quality influences mental health

outcomes [12-14,22-24]. Proposed mechanisms include regulation of neurotransmitters such as serotonin and dopamine, reduction of stress hormones, improved sleep quality, and enhanced self-efficacy [5-7]. These biological and psychosocial pathways emphasize the multifaceted benefits of physical activity, extending beyond purely physiological effects [25-27].

Limitations

This study has several limitations that should be considered when interpreting the findings. The cross-sectional design does not allow causal inferences between leisure-time physical activity and mental or physical health outcomes. Additionally, the use of non-random convenience sampling and the relatively small sample size may limit the representativeness and generalizability of the results.

The reliance on self-reported data for physical activity, health behaviors, anthropometric measures, and depressive symptoms may have introduced recall and social desirability biases. Furthermore, the use of online recruitment through social media platforms may have introduced selection bias, as individuals with Internet access and higher digital literacy were more likely to participate.

Finally, the study was conducted in a single urban setting, which may limit the generalizability of the findings to other populations. In addition, health conditions and participant eligibility were based on self-reported data and were not clinically verified, which may have introduced misclassification bias. Therefore, the findings should be interpreted with caution.

Conclusions

The findings of this study indicate that higher levels of leisure-time physical activity are associated with lower levels of depression among the study participants. These findings highlight the relevance of physical activity in the context of mental health. Sociodemographic and health-related factors may also play a role in shaping physical activity patterns and mental health outcomes.

Future research using larger and more representative samples is recommended to further examine these associations.

Disclosures and acknowledgements

The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

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The study was conducted in accordance with the principles of the Declaration of Helsinki. The study was approved by the Institutional Review Board/Regional Research Ethics Committee of the University of Pécs, the Medical Research Council Hungary, and the National Public Health Centre (record number: 9283-PTE 2022; September 9th, 2022). Informed consent was obtained electronically. At the beginning of the online questionnaire, the participants were provided with detailed information about the study, including its purpose, procedures, and eligibility criteria. The participants could proceed to the survey only after confirming their consent by selecting an agreement option. The survey link was distributed via social media platforms (WhatsApp and Telegram), and the participants were informed about the study through a brief introductory message accompanying the link. The participation was voluntary and anonymous. The participants were informed that they could withdraw from the study at any time without any consequences. All the data were collected anonymously and handled confidentially.

Artificial intelligence (AI) was not used in the creation of the manuscript.

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Supplementary material

Table S1. Between-group differences based on profession in physical activity and depression (n=105)

Profession		GLTQ				BDI sum
		Strenuous exercise	Moderate exercise	Light exercise	Activity score	
Housewife (n=8)	Mean	1.00	1.75	3.50	28.25	6.38
	SD	1.31	1.28	2.56	22.86	5.58
Teacher (n=15)	Mean	0.60	1.47	3.07	21.93	13.20
	SD	0.91	1.92	2.15	16.97	11.01
Employee (n=32)	Mean	0.75	1.69	3.47	25.59	9.03
	SD	1.11	1.62	1.95	19.04	9.82
Student (n=32)	Mean	1.66	2.16	3.59	36.47	7.41
	SD	1.49	2.23	1.92	21.94	6.85
Health professional (n=7)	Mean	2.00	2.14	3.43	39.00	3.14
	SD	2.08	1.07	1.72	24.58	3.39
Business (n=5)	Mean	0.00	0.40	1.40	6.20	22.20
	SD	0.00	0.89	0.55	4.09	17.58
Entrepreneur (n=5)	Mean	1.20	2.00	4.40	34.00	8.20
	SD	1.30	1.41	1.82	22.66	10.83
Researcher (n=1)	Mean	4.00	4.00	3.00	65.00	21.00
	SD	-	-	-	-	-
Total	Mean	1.12	1.81	3.39	29.33	9.24
	SD	-	-	-	-	-
Kruskal-Wallis Test	*p*	0.003	0.421	0.466	0.067	0.528

Notes: BDI – Beck Depression Inventory; GLTQ – Godin Leisure-Time Exercise Questionnaire; SD – standard deviation.

Table S2. Between-group differences based on education level in physical activity and depression (n=105)

Education		GLTQ				BDI sum
		Strenuous exercise	Moderate exercise	Light exercise	Activity score	
2 Primary (n=1)	Mean	3.00	4.00	5.00	62.00	7.00
	SD	-	-	-	-	-
3 Diploma (n=20)	Mean	1.55	1.75	3.70	33.80	8.15
	SD	1.50	1.29	2.08	21.37	8.74
4 Associate's degree (n=12)	Mean	0.08	2.08	2.67	19.17	11.75
	SD	0.29	3.75	2.67	23.33	8.82
5 Bachelor's degree (n=38)	Mean	1.05	1.74	3.58	28.89	7.71
	SD	1.18	1.25	1.73	17.97	9.06
6 Master's degree (n=27)	Mean	0.85	1.70	3.33	26.19	10.26
	SD	1.13	1.68	2.04	21.04	10.77
7 PhD (n=7)	Mean	2.86	2.00	2.71	43.86	12.71
	SD	2.19	1.53	1.11	27.79	13.65

Total (n=105)	**Mean**	1.12	1.81	3.39	29.33	9.24
	SD	1.39	1.80	1.97	21.31	9.70
Kruskal-Wallis Test	***p***	**0.003**	0.421	0.466	0.067	0.528

Notes: BDI – Beck Depression Inventory; GLTQ – Godin Leisure-Time Exercise Questionnaire; SD – standard deviation.

Table S3. Between-group differences based on dietary patterns in lifestyle behaviors (n=105)

Fasting categories (days)		**Fast food**	**Caffeine**	**Smoking**
0 (n=48)	**Mean**	1.31	2.06	1.54
	SD	1.19	1.37	3.27
1-9 (n=13)	**Mean**	1.38	1.31	0.23
	SD	1.04	1.03	0.44
10-19 (n=14)	**Mean**	1.57	2.71	1.50
	SD	1.02	0.99	3.06
20-29 (n=8)	**Mean**	0.75	2.75	0.00
	SD	0.89	1.16	0.00
30- (n=22)	**Mean**	0.55	2.18	0.36
	SD	0.80	1.30	1.71
Total (n=105)	**Mean**	1.15	2.13	1.01
	SD	1.10	1.30	2.65
Kruskal-Wallis Test	***p***	**0.019**	**0.033**	0.284

Notes: SD – standard deviation.