Do Physical Activity and COVID-19-Related Anxiety Affect Eating Disorders? Eating disorders and physical activity

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Abstract

Background

Eating disorder is one of the most common disorders among adolescents and young females. The present study aimed to investigate the relationship between eating disorders (nutrition attitude) with nutrition knowledge, physical activity level, and COVID-19-related anxiety in female students.

Methods

The present research was a correlational and causal-comparative study. The statistical population consisted of all female students of Farhangian University of Mashhad (1500 students) in 2021, of whom 247 students were randomly selected. Out of whom, 107 students were active and 140 inactive. Nutrition knowledge, eating disorder, COVID-19-related anxiety, physical activity level, and health-related anthropometric parameters were assessed via the online survey. Statistical analysis was performed using the Kolmogorov-Smirnov test, independent t-test, Pearson correlation, and linear regression in SPSS software.

Results

The results showed that there was a significant difference between active and inactive students in nutrition knowledge ($P=0.01$), eating disorders ($P=0.003$), COVID-19-related anxiety, and physical activity level ($P=0.001$). Additionally, eating disorders correlated significantly with COVID-19-related anxiety and physical activity level ($P=0.001$). The linear regression results showed that COVID-19-related anxiety could predict eating disorders in female students ($P=0.001$). Despite a significant negative correlation between eating disorders and physical activity level, the regression model showed that the latter could not predict the former in female students ($P>0.05$).

Conclusion

According to the results, it can be said that in certain conditions, such as the COVID-19 pandemic, increased anxiety levels can increase the prevalence of eating disorders. It seems that regular physical activity can indirectly reduce eating disorders by alleviating anxiety levels.

Key Points

- Inactive students showed a higher level of Covid-19-related anxiety than active students.
- Only the total score of COVID-19-related anxiety in female students could predict changes in nutrition attitudes or eating disorders

- 72% of the students had either eating disorders or poor nutrition attitudes
- The incidence of eating disorders had a significant negative correlation with different dimensions of physical activity.

Introduction

Eating disorders, such as obesity and anorexia, are serious problems that can impair humans' emotional stability, judgment, and cognitive function and disrupt normal daily functioning [1]. Such disorders have serious effects on the quality of life and psychological, social, and physical states [2]. In recent years, the identification of some factors that can contribute to the development and persistence of eating disorders has directed the attention of researchers toward this field [3]. Studies have indicated an increase in the prevalence of eating disorders even more than previously reported rates, especially among young individuals, particularly young women [4].

Eating disorders might appear at any age; however, they often begin in adolescence and early youth within the age range of 12-25 years. Nearly 86% of individuals report the onset of eating disorders in their 20s when most young individuals enter university, facing numerous challenges and problems in academic, social, and personal life during the transfer from high school to university. Some of the aforementioned problems include adaptation to the university environment, selection of a suitable occupation, communication with peers, and social and psychological adjustments [5]. In this regard, in a study conducted on students, Bernadette reported that about 19% of girls and 2.3% of boys had high scores on eating disorders [6].

Moreover, studies show that female students, while reporting physical dissatisfaction and mental obsession with their weight, aspire to lose weight to succeed in social and educational aspects and gain better social acceptance, a phenomenon making them vulnerable to eating disorders [7]. Some female students use unconventional methods to control their weight. Although it is important to control weight for good health and physical attractiveness, excessive focus on this issue leads to symptomatic weight loss and can facilitate the development of eating disorders [8]. Furthermore, several psychological factors, such as anxiety, are important in the pathogenesis of eating disorders. For example, the evidence from clinical studies shows that mood disorders and anxiety can be concomitantly observed in individuals with eating disorders [9]. The evidence also demonstrates that anxiety is strongly associated with eating disorders and abnormal eating behaviors, including dietary restrictions and overeating [10].

Turkani et al. stated in their study (2014) that individuals are responsible for their dietary habits, attitudes, and behaviors during adolescence. In addition, attitudes play an important role in the coherence and persistence of various eating habits and behaviors [11]. However, Kim et al. (2010) investigated the relationship between dietary regimen and physical activity level in students in Seoul, South Korea. In the aforementioned study, the amount of consumed energy was significantly higher in the group of adolescents with moderate physical activity than in the inactive group [12]. On the other hand, Dorindet et al. (2009), in a cross-sectional study, observed no significant association between nutrition knowledge,

physical activity level, and body mass index (BMI) [13]. However, Basami et al. (2016), in their study on the male athlete students participating in the Student Sports Olympiad, reported a positive and significant relationship between nutrition knowledge and nutrition attitude with nutritional performance [14]. Therefore, a better understanding of the relationship between physical activity and dietary regimen can improve the health-related consequences of unhealthy diets and inactivity, as two important risk factors for human health [15].

Upon the widespread coronavirus disease 2019 (COVID-19) worldwide outbreak, routine physical activities, and exercises have faced difficulties in society. The World Health Organization instructed public health measures, including restricting unnecessary traffic and using sports and recreational facilities, to curb the spread of the virus [16]. Therefore, it seems that these restrictions would create some changes in individuals' behavior, lifestyle, physical activity level, and various daily life aspects. Consequently, the unwanted effects of decreased physical activity and sedentary behaviors become prevalent, exposing individuals to chronic health-related diseases more than before [17]. In this regard, Posinlli et al. (2021) investigated the effects of social distancing during the COVID-19 pandemic on the level of physical activity and its relationship with anxiety and depression, and their results showed that during this period, there was a decrease in the level of physical activity, which was associated with an increase in the prevalence of mood disorders, especially anxiety and depression [18].

At the same time, research has shown that active individuals usually experience less stress, depression, and anxiety than other peers [19]. For this reason, studies have focused on regular physical activity as a potential treatment for depression and anxiety, either as an alternative therapy or in combination with pharmaceutical agents [20].

A certain ratio (around 11.6%) of individuals in the community annually develop some forms of anxiety-related disorders [21]. These individuals are prone to express extreme fear or anxiety in response to perceived threats; accordingly, they develop profound functional dysfunction in the face of specific environmental conditions [22]. Studies have not adequately addressed the anxiety related to the COVID-19 pandemic yet; nevertheless, some studies have noted an increase in the prevalence of psychological problems during the pandemic. For example, Ripon et al. showed a surge in post-traumatic stress disorder and depression symptoms during the quarantine, compared to that of the pre-quarantine period, with more severe stress and depression among low-income individuals than others [23].

Various dimensions of the psychological and physiological outcomes of COVID-19, as well as their exacerbating and modulating factors, are still unknown. Therefore, it is essential to evaluate the mental health status of individuals in interaction with their lifestyles during the COVID-19 pandemic. Regarding the increasing prevalence of eating disorders in recent years, especially among female students, it seems necessary to identify the psychological factors directly linked with eating disorders or predispose students to these problems. Therefore, this study aimed to investigate the association of eating disorders (nutrition attitudes) with the levels of nutrition knowledge, physical activity, and COVID-19-related anxiety among female students.

Methods

This research was a correlational and causal-comparative study. The statistical population of this study included all 19-25-year-old female students (1500 students) studying at Farhangian University of Mashhad, during the academic year of 2020-2021. The sample size was determined using G-Power software the power of the study is 80% and with a significance level of 5%, the 95% confidence interval, based on a previous study [24]. Accordingly, 240 students were selected using the random sampling method, of whom 107 students were active with regular exercise (3 days a week, more than 1 hour each session), and 140 students were inactive.

After obtaining the necessary permissions from the university officials, the online questionnaire link (in the context of Porsline) was provided to students through WhatsApp and Telegram as tools used by the university for the students' online learning. The students were asked to answer all the questions carefully. The online questionnaire consisted of the section of demographic information, The level of physical activity, nutrition knowledge, eating disorders, health-related anthropometric parameters, and COVID-19-related anxiety using the Baecke Physical Activity Questionnaire, Eating Attitudes Test, General Nutrition Knowledge Questionnaire, and Corona Disease Anxiety Scale, respectively. At the beginning of the questionnaire, a complete explanation of the research purpose was provided and the students answered the questions after documenting their informed consent to participate in the research. A telephone number and email address were provided to students for any possible questions. In this study, BMI and waist-to-hip ratio (WHR) were used to evaluate health-related anthropometric measures. The BMI is commonly used in epidemiological studies and clinical settings as an index for the assessment of health and body weight [25].

Baecke Physical Activity Questionnaire (BPAQ): This scale includes 16 items and measures the level of physical activity in three sections, namely occupation-related physical activity, sport, and leisure-time physical activity. The scoring is based on a Likert scale from 1 to 5. The reliability of this tool has been reported within the range of 0.65-0.89 [26].

General Nutrition Knowledge Questionnaire (GNKQ): This questionnaire was designed by Parmenter and Wardell in 1999, and its validity and reliability ranged from 0.70 to 0.97 [27]. The tool was also validated by Azizi et al. in (2011) [28]. This questionnaire consists of three sections, namely knowledge, attitude, and procedures, with the first section containing 11 items on nutrition knowledge and a total score of 46.

Eating Attitudes Test (EAT-26)

This questionnaire was designed by Garner et al. to assess the symptoms of eating disorders and abnormal attitudes and behaviors and identify anorexia nervosa and bulimia nervosa. This scale contains 26 items and three subscales, namely Dieting, Bulimia and Food Preoccupation, and oral control. This tool has relatively good validity and reliability for athletes and non-athletes [29]. The scores are within the range of 0-78, with a score below 20 indicating a usual nutrition attitude and a score of 20 or higher reflecting a disordered (abnormal) nutrition attitude toward eating (i.e., an eating disorder). By

the application of the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, criteria, Mintz and Ohaloran reported the validity of this scale as 0.90 for eating disorders [30].

Corona Disease Anxiety Scale: This tool has been developed and validated to assess anxiety due to the spread of the coronavirus in Iran. The final version of this tool consists of 18 items assessing psychological and physical indicators. The tool is scored based on a 4-point Likert scale (never: 0, sometimes: 1, often: 2, and always: 3), delivering the minimum and maximum scores of 0 and 54, respectively. A higher score in this questionnaire indicates a higher level of anxiety; accordingly, no/mild, moderate, and severe anxiety groups are assigned with the score ranges of 0-16, 17-29, and 30-54, respectively. The reliability of this tool has been reported as 0.919 according to Cronbach's alpha method. The scale consists of items on the rate of studying and searching for news about the coronavirus, close relatives infected with or died due to COVID-19, perceived anxiety about COVID-19, and family communication conflicts during the quarantine [31].

Statistical Analysis

In the present study, the normal distribution of the data was assessed using the Kolmogorov-Smirnov test. The data were analyzed by the independent t-test. Furthermore, Pearson correlation and linear regression were used to determine correlations between the variables. The SPSS software (version 21) was utilized for statistical analyses, and the significance level was considered 0.01.

Results

The results of the Kolmogorov-Smirnov test confirmed the normal distribution of the data. Table 1 shows the participants' demographic characteristics. Out of 247 female students, 107 and 140 subjects were categorized into active and inactive groups, respectively. The age of the participants ranged from 18 to 22 years. There was no significant difference between the two groups (i.e., active and inactive students) in demographic characteristics.

Table 1
Descriptive Features of Female Students in Active and Inactive Groups

Variables	Active	Inactive
N	107	140
Age	20.31±1.22	20.52±1.46
Hight	162.42±4.83	162.82±5.72
Weigth	55.75±8.43	55.83±9.41
BMI	21.01±2.64	21.01±3.13
WHR	0.77±0.13	0.79±0.14
GNK	31.38±8.37	28.39±9.29
EAT	25.67±10.70	29.45±8.87
BPAT	55.27±9.30	28.22±16.12
CDAS	9.91±5.35	22.20±14.09
GNK: General nutrition knowledge, EAT: Eating Attitudes Test, BPAT: Baecke Physical Activity Total, CDAS: Corona Disease Anxiety Scale		

Regarding eating disorders, the results of this study showed that 178 students (72.1%) had either eating disorders or poor nutrition attitudes; however, 69 students (27.9%) had good nutrition attitudes.

Table 2 shows the results of the independent t-test for the comparison of nutrition knowledge, eating disorders, physical activity level, health-related anthropometric measures, and COVID-19-related anxiety between active and inactive students.

Table 2

Results of the Independent T-test to Determine Differences Between Active and Inactive Students

Variables	Groups	M±SD	std.error Mean	df	t	p
BMI	active	21.01±2.64	0.006	245	0.016	0.987
	inactive	21.01±3.13				
WHR	active	0.77±0.13	-0.015	245	-0.888	0.429
	inactive	0.79±0.14				
GNK	active	31.38±8.37	2.990	245	2.614	0.01*
	inactive	28.39±9.29				
EAT	active	25.67±10.70	-3.77	245	-3.02	0.003*
	inactive	29.45±8.87				
WA	active	29.05±5.05	14.284	245	17.170	0.001*
	inactive	14.77±7.38				
SA	active	14.69±4.89	6.863	245	13.850	0.001*
	inactive	7.82±4.58				
LA	active	11.78±2.43	5.699	245	10.446	0.001*
	inactive	6.08±5.22				
BPAT	active	55.27±9.30	27.049	245	15.492	0.001
	inactive	28.22±16.12				
CDAS	active	9.91±5.35	-12.284	245	-8.553	0.001*
	inactive	22.20±14.09				
* P<0.01						
BMI: Body Mass Index, WHR: Waist-to-hip Ratio, GNK: General Nutrition Knowledge, EAT: Eating Attitudes Test, SA: Sports Activity, WA: Work Activity, LA: Leisure Activity, BPAT: Baecke Physical Activity Total, CDAS: Corona Disease Anxiety Scale.						

Table 3 tabulates the results of correlation analysis between the research variables in all female students. The level of physical activity significantly correlated with the WHR, nutrition knowledge, eating disorders, and COVID-19-related anxiety in female students. In addition, COVID-19-related anxiety significantly correlated with eating disorders ($P<0.05$).

Table 3
Correlation Between Research Variables in Female Students Participating in This Study

Variables	BPAT		CDAS	
	r	p	r	p
WHR	-0.0161	0.011*	-0.038	0.548
BMI	0.011	0.862	-0.047	0.463
GNK	0.195	0.002**	0.082	0.199
EAT	-0.200	0.002**	0.281	0.001**
CDAS	-0.412	0.001**	-	
* P<0.05, **P<0.01				
BPAT: Baecke Physical Activity Total, CDAS: Corona Disease Anxiety Scale, WHR: Waist-to-hip Ratio, BMI: Body Mass Index, GNK: General Nutrition Knowledge, EAT: Eating Attitudes Test, CDAS: Corona Disease Anxiety Scale.				

Table 4 shows that eating disorders significantly correlated with COVID-19-related anxiety and different dimensions of physical activity in female students ($P<0.05$). However, there was no significant correlation between eating disorders and nutrition knowledge ($P>0.05$).

Table 4
Correlation of Eating Disorders With Different Dimensions of Physical Activity and Nutrition Knowledge

Variables	EAT	
	r	p
CDAS	0.281	0.001*
GNK	-0.070	0.273
BPAT	-0.200	0.002*
WA	-0.206	0.001*
SA	-0.170	0.007
LA	-0.173	0.006
* P<0.01		
EAT: Eating Attitudes Test, CDAS: Corona Disease Anxiety Scale, GNK: General Nutrition Knowledge, BPAT: Baecke Physical Activity Total, WA: Work Activity, SA: Sports Activity, LA: Leisure Activity.		

According to Table 4-1,2, the results of the analysis of variance (ANOVA) showed that there was a significant relationship between predictor and criterion variables ($F=4.443$; $P<0.001$). The results of ANOVA and regression statistics showed that 10% of the variance of eating disorders or nutrition attitudes in female students could be explained by anxiety ($R^2=0.1$). The beta coefficient of anxiety ($\beta = 0.259$) showed that this variable could predict the variance of eating disorders in female students with 95% confidence, indicating a relationship between an increase in anxiety level and the incidence of eating disorders in female students.

Table 4-1. Summary of Regression Model and Analysis of Variance Results

Variables	R	R ²	F-value	P-value
EAT	0.316	0.100	4.443	0.001*

* $P<0.01$

EAT: Eating Attitudes Test.

Table 4-2. Results of Regression Model Analysis Between COVID-19-related Anxiety and Physical Activity Level

Variables	B	SE	Beta	T	p
Constant	27.261	2.827		9.642	0.001*
CDAS	0.201	0.054	0.259	3.795	0.001*
BPAT	-0.142	0.332	-0.274	-0.427	0.670
WA	-0.072	0.451	-0.070	-0.160	0.873
SA	0.674	0.426	0.351	1.584	0.114
LA	-0.161	0.356	-0.083	-0.451	0.652
GNK	-0.053	-0.069	-0.049	-0.769	0.443

* $P<0.01$

Predictor variables: Coronavirus-disease-2019-related anxiety, physical activity level, and nutrition knowledge

Criterion variable: Eating disorders

Discussion

The results of the present study showed that the differences in the means of health-related anthropometric indices (i.e., BMI and WHR) were not statistically significant between active and inactive female students. However, there were significant differences between active and inactive students regarding COVID-19-related anxiety, occupation-related physical activity, sports physical activity, leisure-time physical activity, and overall physical activity. Correlation analysis demonstrated that the incidence of eating disorders had a significant negative correlation with different dimensions of physical activity and a significant positive correlation with COVID-19 anxiety. Additionally, the overall physical activity correlated significantly and negatively with the WHR and COVID-19 anxiety and directly with nutrition knowledge.

The regression model results presented to predict eating disorders in female students based on the level of physical activity and COVID-19-related anxiety revealed that only the latter could predict eating disorders or nutrition attitudes among the participants. In other words, an increase in the level of COVID-19-related anxiety in female students was associated with the elevated risk of eating disorders and could predict changes in nutrition attitudes or eating disorders. The aforementioned results are similar to the results of a study performed by Thomas et al. examining the relationship between nutrition attitudes or eating disorders and mood among high school students in the UK [32]. Moreover, Mollazadeh Esfahani et al., who assessed the relationship between mental health and eating disorders in the female students of Guilan University, Iran, highlighted the predictive role of anxiety in eating disorders [33].

Furthermore, the present study's findings regarding the 72.1% prevalence of poor nutrition attitudes or eating disorders among female students are in line with girls' propensity to eating disorders. However, some researchers believe that anxiety disorders precede and might predispose individuals to eating disorders. Nevertheless, others believe that psychological disorders, such as anxiety and depression, might appear during periods of malnutrition and be the consequences of severe malnutrition [34, 35].

Regarding the link between anxiety and eating disorders among women, it seems that anxiety disorders can predispose them to anorexia nervosa. In addition, fear of gaining weight and subsequently avoiding eating are important factors involved in the pathogenesis of eating disorders. Limitations in calorie intake can also be stressful for these individuals. These hypotheses are supported by neurological biological processes, as an increase in serotonin has been noted to increase anxiety and decrease appetite. On the other hand, a decrease in serotonin during starvation can reduce anxiety; therefore, the restarting of eating can elevate serotonin levels and anxiety [34].

In some studies, Ahmadabadi (2021)[36] and Chang et al. (2020)[37] examined the mental health status and its effective factors in students during the COVID-19 pandemic. The aforementioned study showed that the overall rate of anxiety was 26.60%, and the rates of mild, moderate, and severe anxiety were 23.19%, 2.71%, and 0.70%, respectively. Moreover, the results of the present study demonstrated that there was a significant difference in COVID-19-related anxiety between active and inactive students, with a higher level of COVID-19-related anxiety in inactive than in active students. Therefore, the anti-anxiety effects of exercise based on various biological mechanisms can be considered. For example, exercise can improve physical fitness, modulate the levels of the neurotransmitters involved in anxiety and the hormones participating in stress development, and reduce muscle tension. Additionally, from a psychological point of view, the increased physical activity level following exercise can boost Positive reinforcement following a response and create a condition to distract the individual from threatening and stressful situations, such as disease outbreaks, paving the way for the reinforcement of self-confidence and self-empowerment and mitigating anxiety [38].

The results of this study showed that in addition to the overall level of daily physical activity, there were significant differences in occupation-related physical activity, sport, and leisure-time physical activity between active and inactive students. The aforementioned results are consistent with the results of

studies indicating the inadequate physical mobility and physical weakness of most students in some universities [39]. In this regard, the findings of a study performed by Tehrani et al. showed that individuals could benefit from physical and health advantages and develop their psychological and social functions by performing appropriate physical activities and participating in sports programs [40]. Immobility has been noted as one of the factors involved in the development of psychological and mental disorders, and numerous studies have confirmed a high prevalence of psychological disorders among sedentary individuals [41].

Mental health is one of the indicators for the assessment of the community, and the adolescence and youth periods are critical phases in the process of human development [42]. Physical activity is an essential tool for the improvement of public health; nevertheless, few studies have addressed the relationship between physical activity and mental health [43, 44].

Some of the limitations of this study were the lack of access to an equal number of active and inactive students and the precise control of other factors affecting students' health in addition to anxiety. Also, This study could not collect data from all campuses of Farhangian University, only one campus of Mashhad was chosen for this study. Future research should consider different groups of people to evaluate important factors affecting health in the COVID-19 pandemic.

Conclusions

Students are prone to lose their mental health due to various factors and the special conditions facing them, such as being away from the family, entering large and stressful environments, financial problems, and great volumes of courses. Particularly, during the post-coronavirus era, a heavy burden of disturbing and stressful news and students' anxiety of themselves or their relatives contracting the disease and suffering its consequences can further endanger students' mental health. The primary goal of public mental health is to help everyone achieve a better, happier, and more coherent life and better understand and prevent mood, emotional, and behavioral disorders; therefore, the prevention of psychological disorders to create a healthy society is one of the educational system's main duties; this goal will be achieved by encouraging individuals, especially students who are themselves the cornerstone of the educational system, to modify their sedentary lifestyles by performing appropriate levels of physical activity.

Declarations

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Ethics approval and consent to participate

This study was approved and registered with the ethics code **IR.MUMS.REC.1400.217** in the Research ethics committees of Mashhad University of Medical Sciences in Iran.

Authors' Contributions

SA was a major contributor in writing the manuscript. PS helped in the analysis of data and methodology. The authors read and approved the final manuscript.

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Consent for publication

All authors have agreed to published the manuscript in its current form.

Competing interests

The authors declare that they have no competing interests

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