Exploring the Relationship between Physical Activity Patterns and the Prevalence and Severity of Anxiety

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ABSTRACT:

Objective: To measure/explore the relationship between physical activity patterns and the prevalence and severity of anxiety.

Methodology: This analytic cross-sectional study was conducted at Bahria University of Health Sciences, Karachi from 1/07/2024 to 31/12/2024. Using non-probability consecutive sampling, 136 participants between the ages of 20-23 voluntarily participated in this study. The participants were medical students of either gender, studying at Bahria University of Health Sciences, Karachi. To quantify anxiety, the Generalized Anxiety Disorder-7 (GAD-7) scale was utilized, and to measure physical activity, the Global Physical Activity Questionnaire (GPAQ) was utilized. SPSS-26 version was utilized for data analysis. P-value ≤ 0.05 was taken as statistically significant after correlation and stratification analyses.

Results: The mean age of participants was 20.75 ± 0.82 years and mean BMI was 25.38 ± 6.77 kg/m². The mean physical activity among the participants was 2939.71 ± 2167.54 MET-minutes/week, while the mean GAD-7 score was 9.21 ± 4.97. Moderate anxiety was the commonest type 52(38.2%), followed by minimum 34(25.0%), mild 27(19.9%), and severe 23(16.9%). The physical activity of participants was of low among 36(26.5%), moderate 34(25.0%) and high 66 (48.5%) levels. Physical activity and anxiety were shown to be strongly correlated negatively ($r = -0.898$, $p < 0.001$). Stronger associations were seen in females ($r = -0.922$) and overweight persons ($r = -0.952$).

Conclusion: Increased physical activity is a preventive, non-pharmacological strategy for reducing anxiety in adults, as evidenced by its high correlation with decreased anxiety levels.

Keywords: Anxiety; Body Mass Index; Exercise; Generalized Anxiety Disorder-7; Physical Activity; Psychological Well-being; Sedentary Behavior.

Cite as: Memon RZ, Muhammad S. Exploring the Relationship between Physical Activity Patterns and the Prevalence and Severity of Anxiety. J Muhammad Med Coll. 17(1) April-Oct 2026.

Introduction:

Generalized anxiety disorder (GAD), separation/social anxiety disorder, agoraphobia, panic disorder, specific phobias and selective mutism are commonest mental illnesses, affecting 10-14% of the population at any given moment.[1] A study on anxiety disorder was conducted using the "global burden of diseases (GBD), injuries and risk factors". It estimated the prevalence to be 194.9 (165.1-231.2) per million people in 1990 and projected it to be 301.4 (252.6-356.0) per million people in 2040.[2] These mental states have a profound impact on society and on individuals due to their negative outcomes including reduced quality of life, earlier mortality, decreased work productivity and higher chances of suicide.[3] Exercise is recommended by both the "Royal Australian" and "New Zealand College of Psychiatrists" as a possible course of treatment for anxiety.[4]

Sedentary lifestyles were substantially associated with more anxiety symptoms, especially in adults, according to a meta-analysis of thirty-one studies. The risk of anxiety at any given level of sedentary behavior is consistently greater across groups, with follow-up studies showing severe anxiety among people having sedentary lifestyle.[5] Through elevated neurotrophic factors, better hypothalamic-pituitary -adrenal (HPA) axis modulation, and decreased inflammation, physical activity may help lessen anxiety symptoms and improve emotional control.[6]

Physical activity might alleviate the symptoms of generalized anxiety disorder (GAD), but the amount of physical activity and its impact, and the significance of the relationship, remains unknown in studies. Some large-scale digital phenotyping studies have shown a protective relationship between physical activity (as determined by an activity tracker) and increased GAD-7 anxiety scores (n>10,000).[7] Hence, this study was planned to measure the intensity of anxiety and investigate the association among anxiety levels and patterns of physical activity among medical students.

Objective:

The aim of the study was to measure/explore the relationship between physical activity patterns and the prevalence and severity of anxiety.

Methodology:

Total 136 students participated in this analytical cross-sectional study. Non-probability consecutive sampling was used. From July 1, 2024, to December 31, 2024, the study was carried out at Bahria University of Health Sciences in Karachi. The WHO sample size calculator was used to determine the sample size using the formula for estimation of a single population proportion based on a 9.8%.[8] The prevalence of anxiety among those who do not engage in regular physical exercise was evaluated with a 95% confidence level and a 5% margin of error. The participants, who voluntarily participated in the study, were medical students of either gender studying at Bahria University of Health Sci-

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Received: September 2026.
Accepted: October 2026

ences, Karachi. If any individuals who were addicted to alcohol or drugs, had severe physical conditions, or had mental illnesses that needed specialized care were informed not to participate in the study and hence were automatically excluded. Data were gathered using a standardized questionnaire after informed consent and Institutional Ethical Review Committee permission (ERC/2023/PSY-2023-169-RTMC-PSY-2023-197-1036 Dated: 24th January 2024). Prior to data collection, every participant was asked to provide written informed consent. Their data would be kept confidential.

To measure anxiety, Generalized Anxiety Disorder 7-item scale (GAD-7) was utilized to quantify the presence and intensity of anxiety symptoms.[9] The anxiety intensity was graded into: Minimum (0-4), Mild (5-9), Moderate (10-14), and Severe (15-21).[9,10] To evaluate physical activity, the Global Physical Activity Questionnaire (GPAQ) was used. A standardized questionnaire called the GPAQ was created to assess patterns of physical activity in a variety of contexts, such as work, travel, and leisure. Participants were categorized based on their degree of physical activity. It was quantified in terms of exercise frequency, duration, and intensity. In accordance with WHO-GPAQ recommendations, physical activity scores were computed as total Metabolic Equivalent of Task (MET)-minutes per week. The overall GPAQ score varied from 0 MET-minutes/week to no set upper limit. The individuals' levels of physical activity were divided into the following categories: Low (<600 MET-minutes/week), Moderate (600-2999 MET-minutes/week), or High (≥3000 MET-minutes/week).[11] The questionnaire used also gathered additional information such as age, body mass index (BMI) and gender. Data entry and analysis was accomplished by using SPSS-26 version. The study variables were summarized using descriptive statistics. The quantitative variables such as age, BMI, GAD-7 scores and GPAQ MET-minutes/week scores were presented as mean ± SD while the categorical variables such as gender, BMI-categories, Anxiety Severity and Physical Activity Level were presented as frequencies and percentages. The relationship between GPAQ MET-minutes/week scores and GAD-7 scores was assessed. Pearson's or Spearman's correlation coefficient was used based on the data normality. The data was stratified by age, gender, and BMI. A p-value of less than 0.05 was considered statistically significant.

Results:

With a mean age of 20.75 ± 0.82 years, the participants' ages varied from 20-23 years. The average BMI was 25.38 ± 6.77 kg/m², with a range of 18.8 to 37.8 kg/m². The mean physical activity measured by GPAQ was 2939.71 ± 2167.54 MET-minutes per week with a range of 240-8360 MET-minutes per week. The mean GAD-7 score was 9.21 ± 4.97 with a range of 1 to 19 (Table-I).

Out of the 136 participants, 96(70.6%) were males, 38 (27.9%) were obese, 15(11.0%) were overweight and 83 (61.0%) had a normal body weight. Among them, moderate anxiety was the most prevalent category, affecting 52 (38.2%) of participants, followed by minimal 34(25.0%), mild 27(19.9%), and severe anxiety 23(16.9%). While 36 (26.5%) participants had low, 34(25.0%) moderate and nearly half of them 66(48.5%) reported high levels of physical activity (Table-II).

A substantial negative association ($r = -0.898$, $p < 0.001$) was found between anxiety ratings and total physical activity (MET-minutes/week), indicating that the participants who were more physically active tended to be less anxious.

Table No 1: Descriptive statistics of the participants' age, BMI, GAD and MET-Min/Week (n=136).

	Age (Years)	BMI (Kg/m^2)	Total GAD	Total MET-Min/Week
Mean	20.75	25.38	9.21	2939.71
±SD	(±0.82)	(±6.77)	4.97	2167.54
Range	20-23 Years	18.80-37.80	1.00 - 19.00	240.00 - 8360.00

Table No 2: Socio-demographic characteristics, Anxiety severity and Physical activity level of the participants (n=136)

Variable	Category	n(%)
Gender	Male	96(70.6)
	Female	40(29.4)
BMI	Normal weight	83(61.0)
	Overweight	15(11.0)
	Obese	38(27.9)
Anxiety severity	Minimal	34(25.0)
	Mild	27(19.9)
	Moderate	52(38.2)
	Severe	23(16.9)
Physical activity level	Low	36(26.5)
	Moderate	34(25.0)
	High	66(48.5)

Table No 3: Correlation between Physical activity (MET-minutes/week) and Anxiety (GAD-7) Score among the participants (n=136)

Variable	Category	n	r	p-value
Overall	Total sample	136	-0.898	<0.001
Stratifications				
Age group	20 - <21years	59	-0.894	<0.001
	21 - <22 years	60	-0.900	<0.001
	22 - <23 years	17	-0.917	<0.001
Gender	Male	96	-0.889	<0.001
	Female	40	-0.922	<0.001
BMI-category	Normal weight	83	-0.902	<0.001
	Overweight	15	-0.952	<0.001
	Obese	38	-0.875	<0.001

Discussion:

Physical activity and anxiety levels were shown to be strongly inversely correlated overall ($r = -0.898$, $p<0.001$). Using the GAD-7 to measure anxiety, the increased physical activity was linked to significantly lower levels of anxiety. This association was observed in all age groups, genders and BMI categories, suggesting that physical activity has a high protective effect against anxiety regardless of

these factors. Our results match with a systematic analysis of 42 RCTs with 2,974 participants, which showed that mind-body workouts significantly decreased anxiety ($p<0.05$) and depression ($p<0.05$) when compared to the control group. Among the different exercise modalities, Tai Chi ranked as the best method for reducing anxiety.[12] This study also demonstrated a strong inverse association amid anxiety and physical activity ($p<0.001$).

A recent systematic review among healthy adults reported that anxiety was reduced in 53% (7 of 13) of the exercise conditions, although no single exercise mode, duration, or intensity consistently produced superior outcomes. These results corroborate our findings, which showed a significant inverse connection ($r = -0.898$, $p<0.001$) between anxiety and physical activity. Therefore, it is possible that medical students who engage in more physical exercise have lower levels of anxiety.[13]

In this study, greatest inverse association was observed between overweight and obese subjects ($r = -0.952$, $p < 0.001$ and $r = -0.875$, $p < 0.001$, respectively). This result is in line with other research that suggests that students with higher BMIs frequently have more discomfort that is psychological. Moreover, the exercise may have a stronger proportional influence on improving psychological health.[14]

The increased sensitivity to the anxiolytic effect of physical activity in women, reported in this study, is in line with data showing that women often have higher baseline anxiety levels. Thus more responsive to the anxiolytic effect of exercise when compared to men.[15] Inverse relationships were observed in all age groups in the age-stratified analyses, consistent with previous studies that indicate that physical activity reduces anxiety symptoms at all ages.

There is a gradual downward trend in the rate of anxiety disorders with higher physical activity level. This is a finding that supports a graded biological relationship, which is similar to the strong relationship that was demonstrated in this study.[16] Another systematic review revealed that physically active individuals were significantly less expected to have anxiety symptoms (Odds Ratio = 0.87) than inactive people. This finding also aligns with our observation.[17] A recent network meta-analysis (2026) of various exercise techniques discovered that strength training, aerobic activity, yoga and tai chi significantly reduced anxiety symptoms at the levels of -0.39 to -0.72. This study provides important context for our results, reinforcing that physical exercise is highly effective at alleviating psychological distress.[18]

Finally, a larger study shows that the protective effect remains highly stable across all age and BMI categories, peaking among overweight students ($r = -0.952$).[19] This correlation was consistent with this study for age groups, gender and BMI indicating that frequent exercise may be protective of mental health.

In contrast to our findings, a recent study among 593 college students reported no noteworthy relationship amid anxiety and physical activity. Instead, impulsivity traits and year of study were identified as the main factors associated with anxiety. This finding is opposite to our findings, where anxiety and physical exercise have a significant inverse association. ($r = -0.898$, $p < 0.001$). It represents that greater physical activity was connected with lower anxiety levels among medical students.[20] The association in our study was greater than has been typically reported in the literature (most of the literature reports moderate associations), and this may be attributed to the homogeneity of the activity in the study, culture and lifestyle, and/or GPAQ MET minutes as a more sensitive measure of activity levels. Nonetheless, more multicenter, long-term research with bigger, more varied sample sizes is advised recommended to conclude causal relationships, identify the best kind and amount of physical activity to reduce anxiety and to investigate other psychological and lifestyle factors that may affect this relationship.

Limitations of the Study

Small sample size, a cross-sectional design that prevents causal inferences, and the inability to discern the direction of the causative arrow when examining the association between anxiety and physical activity are the limitations of this study. Recall bias may have occurred in the self-reported physical activity and unmeasured confounders like diet, chronic illness, and psychosocial stressors could have affected the results.

Conclusion:

The present research revealed that moderate anxiety was the most often observed level of anxiety, and that physical activity had an inverse correlation with anxiety across all demographic categories. These discoveries underscore the potential safeguarding influence of consistent physical exercise on mental well-being. It underscores and emphasizes the significance of physical activity within the framework of routine public health and mental well-being.

Conflict of interest: The authors declare no conflict of interest.

Funding source: None

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Authors' Contribution	
Rubab Zehra Memon	Designing the study, acquiring the data, drafting and revising the manuscript.
Shahab Muhammad	Evaluating the data and paper critically before approving it.
Authors agree to be responsible for all aspects of the work.	