Original Article

doi: 10.16926/par.2025.13.26

Physical activity avoidance as a predictor of anxiety and sleep quality in women

Adrianna Kosior-Lara [1ABDE], Dorota Ortenburger [2ACD], Małgorzata Kuchta [3B], Magdalena Korsak-Sabino Belo [1D], Jacek Wąsik [2ACD]

[1]Department of Nursing, Jan Dlugosz University in Częstochowa, Poland
[2]Institute of Physical Culture Sciences, Jan Dlugosz University in Częstochowa, Poland
[3]Institute of Technology, State University of Applied Sciences in Racibórz, Poland

Authors' Contribution: A – Study Design, B – Data Collection, C – Statistical Analysis, D – Manuscript Preparation, E – Funds Collection

Abstract: *Purpose:* The purpose of this study was to assess the relationship between women's attitudes toward intense physical exertion and subjectively perceived feelings of helplessness and symptoms of premature waking. Special attention was paid to the relationship between physical activity avoidance, anxiety and sleep quality. *Material and methods:* The study included 75 randomly selected women from Poland, aged 34-61 years (M = 53.11 ± 5.38), mostly married women with higher education. The STAI to assess anxiety, the International Physical Activity Questionnaire (IPAQ) were used. Cluster analysis, stepwise regression and Spearman correlation analysis were used for statistical evaluation. Statistical significance was taken at $p < 0.05$. *Results:* Significant differences were found between clusters in terms of physical activity levels, with no significant differences in anxiety levels. Avoidance of intense physical activity was a significant predictor of higher state anxiety ($B = 0.568$; $p < 0.001$). Wakefulness frequency and body mass showed no significant association with anxiety levels. Sleep disturbances were associated with higher levels of anxiety, and correlations suggested associations between anxiety, lifestyle and education. *Conclusions:* Avoidance of intense exercise is significantly associated with higher levels of state anxiety in women, independent of other variables. Subjective attitudes toward exercise are more important for psychological well-being than activity level alone. The results indicate the need to consider psychological factors - such as anxiety and sense of efficacy - in promoting women's mental and physical health.

Keywords: physical activity avoidance, anxiety, sleep quality, women's health, psychological well-being, state anxiety, exercise attitudes, lifestyle factors

Corresponding author: Adrianna Kosior-Lara, email: a.kosior-lara@ujd.edu.pl

Recevied: 29.06.07.2025; Accepted: 9.07.2025; Published online: 09.07.2025

Citation: Kosior-Lara A, Ortenburger D, Kuchta M, Korsak-Sabino Belo M, Wąsik J. Physical activity avoidance as a predictor of anxiety and sleep quality in women. Phys Act Rev 2025; 13(2): 129-138. doi: 10.16926/par.2025.13.26

INTRODUCTION

Human daily functioning is intrinsically governed by natural biological rhythms, with intentional behaviors—particularly physical exertion—playing a pivotal role in modulating physiological and psychological states [1,2]. A growing body of research underscores the intricate, reciprocal relationships between physical activity, sleep architecture, and stress reactivity, suggesting that movement serves as a critical regulator of homeostasis and overall well-being [3–7]. Empirical evidence increasingly supports the notion that structured physical activity not only enhances somatic health but also exerts profound neurobiological and affective benefits, acting as a protective factor against mood dysregulation and cognitive decline [8,9]. Despite the well-documented advantages of regular exercise, societal and individual perceptions of intense physical exertion remain ambivalent, particularly among female populations.

Extant literature highlights that women's engagement in physical activity is significantly influenced by self-perception and socio-cultural evaluative concerns, with body image dissatisfaction and fear of negative appraisal constituting substantial psychological barriers [10]. Comparative analyses further reveal that women exhibit a heightened sensitivity to physical discomfort during public exercise, alongside a pronounced tendency to avoid strenuous activities in observed settings—a phenomenon potentially linked to internalized gender norms and objectification theory [11]. This behavioral pattern persists even in contexts where the health benefits of vigorous exercise are well understood, suggesting a discord between knowledge and actualization of physical activity engagement.

Although women generally demonstrate greater health literacy regarding the advantages of regular exercise, adherence to high-intensity regimens remains disproportionately lower compared to male counterparts [11–13]. A critical determinant of this disparity lies in the construct of self-efficacy, defined as an individual's belief in their capacity to execute and sustain demanding physical tasks. Deficits in self-efficacy not only diminish motivation but also predispose individuals to premature exercise cessation, reinforcing a cycle of avoidance and disengagement [14]. Crucially, the decision to engage in physical activity transcends mere awareness of its benefits; it is equally contingent upon deeply ingrained cognitive schemas pertaining to exertion, perceived competence, and emotional valence. For women, psychological variables—particularly feelings of powerlessness and diminished agency—have been identified as salient moderators of exercise adherence, with downstream effects on affective regulation and sleep continuity [15].

Chronic stress and perceived lack of autonomy have been empirically linked to sleep fragmentation, particularly in the form of premature awakenings—a symptom cluster frequently comorbid with subclinical depressive symptomatology and sustained hyperarousal [16]. Longitudinal investigations posit that sleep quality mediates the relationship between physical activity and emotional stability, wherein restorative sleep facilitates enhanced top-down regulation of stress responses, thereby fostering greater exercise engagement [17]. This bidirectional dynamic suggests that interventions targeting sleep hygiene may indirectly potentiate physical activity participation by ameliorating affective disturbances. Conversely, individuals with impaired self-regulatory capacity are more susceptible to behavioral disinhibition, manifesting in maladaptive nocturnal habits (e.g., excessive digital consumption, hedonic eating) that further degrade sleep architecture and perpetuate sedentarism [18,19].

Notably, women who internalize exercise as a positive, self-affirming behavior report elevated levels of vitality and superior sleep quality relative to their ambivalent or avoidant peers [20,21]. Contemporary theoretical frameworks posit that attitudes toward intense exercise are sculpted by a confluence of intrapersonal (e.g., self-concept, affect tolerance), interpersonal (e.g., social comparison, support networks), and macrosystemic (e.g., cultural beauty standards, media representation) factors [22,23]. A granular

understanding of these determinants is imperative for the development of tailored psychoeducational interventions that reframe physical activity as an empowering, rather than punitive, mechanism for bolstering psychological resilience and physiological equilibrium.

This study aims to examine the relationship between women's attitudes toward intense physical activity and their subjective experiences of powerlessness and premature awakenings. Specifically, it addresses the following research questions:

1. Which experiences are more frequently reported by women: premature awakenings or the number of hours spent engaging in strenuous exercise in the past week?
2. What are the relationships between avoidance of intense exercise and (a) state anxiety, (b) body weight, and (c) sleep disturbances?

MATERIAL AND METHODS

Participants

The study population comprised 75 women who were randomly selected from a larger group of Polish residents, with a mean age of 53.11 ± 5.38 years (median: 51 years; Q1: 48 years; Q3: 55 years; range: 34-61 years). The mean body mass index (BMI) of the study participants was 31.32 ± 11.80. The participants hailed from diverse geographical locations, with the majority being married (67%) and possessing a high school diploma or higher (85%). The majority of the group was professionally engaged in the health and education sectors, predominantly as nurses and teachers. With respect to menopausal status, 45% of the women were postmenopausal (no menstruation for more than 3 years), 38% were perimenopausal (no menstruation for 1 to 3 years), and 17% were perimenopausal (no menstruation for less than 12 months). The vast majority of the participants (97%) had experienced at least one childbirth, with only two women reporting no such experience.

The measurement conducted was entirely voluntary, and the subjects were informed of the procedure and gave their consent prior to participation. The respondent was informed about the testing procedures and voluntarily participated in data collection. The research was conducted in accordance with ethical principles based on the Declaration of Helsinki.

Research tool

The STAI Inventory was utilized in the present study to assess anxiety, which is conceptualized as a transient and situational condition of the individual. This scale is particularly advantageous in experimental studies that necessitate the documentation of fluctuations in the severity of anxiety [23]. The International Physical Activity Questionnaire (IPAQ) is a tool employed to assess the level of physical activity of an individual.

Statistics

The sample size was estimated using G*Power software (version 3.1.9.2; Kiel University, Kiel, Germany) [24], which returned a minimum of 34 participants for an alpha level of 0.05, an effect size of 0.8, and a power (1 - β) of 0.95.

To address this question, we implemented a k-means cluster analysis, which yielded a two-cluster solution. The identification of all clusters within the data set was conducted in the following manner: anxiety status and physical activity. The statistical analysis model was meticulously adopted, contingent upon the data available, thereby facilitating the discernment of underlying relationships. The analysis employed regression analysis in the form of a forward selection stepwise method, adding variables to improve model fit based on statistical criterion, such as F-statistics and R-squared. Furthermore, Spearman correlation tables and one-way analysis of variance (ANOVA) were performed.

The statistical significance was assumed at $p<0.05$. Statistical analysis was performed using Statistica v. 12 (StatSoft, Tulsa, OK, USA).

RESULTS

A subsequent statistical analysis revealed significant disparities in physical activity between the two groups (Cluster 1 and Cluster 2), while state anxiety levels did not demonstrate statistical significance (see Figure 1). The mean level of state anxiety in Cluster 1 was 44.53 points (SD = 6.87), while in Cluster 2 it reached 41.63 points (SD = 10.13). However, this difference did not prove to be statistically significant ($F = 0.922$; $p = 0.343$), indicating that the division into clusters was not associated with differences in anxiety. Conversely, discernible disparities were evident among the groups with respect to physical activity. The average physical activity in Cluster 1 was 450.67 units (SD = 840.49), while in Cluster 2 it reached a much higher value of 8070.00 units (SD = 2533.23). This discrepancy was found to be statistically significant ($F = 201.808$; $p < 0.001$), thereby substantiating substantial inter-cluster variation with respect to this particular indicator. The findings indicate a robust correlation between clustering and physical activity levels, while state anxiety did not demonstrate a statistically significant divergence among the subjects. The absence of a statistically significant correlation between anxiety levels and physical activity, despite considerable variation in both measures, suggests the possibility of an absence of a direct relationship between these variables within the sample. To provide a more comprehensive explanation of this relationship, it would be necessary to consider additional factors, such as the type of physical activity, the duration of the study, and the socio-demographic characteristics of the participants.

To identify predictors of state anxiety levels, a multiple regression analysis was conducted, taking into account selected behavioral and demographic variables. In the initial regression model (Model 1), three predictors were incorporated: frequency of avoidance of intense physical activity, overall level of physical activity, and frequency of awakening during the night. The statistical significance of this model was confirmed by a significant F-ratio ($F(3,64) = 0.341$; $p < 0.001$). The model accounted for 31.0% of the variance in state anxiety levels ($R^2 = 0.341$; adjusted $R^2 = 0.310$). Among the variables examined, the frequency of avoiding intense physical activity emerged as a significant predictor of state anxiety ($B = 0.568$; $SE = 0.102$; $p < 0.001$). The remaining variables, including the general level of physical activity ($p = 0.187$) and the frequency of nocturnal awakenings ($p = 0.631$), did not attain statistical significance.

In the second model (Model 2), additional variables were incorporated into the analysis, including the amount of time spent in a seated position, body mass, and marital status. The model demonstrated statistical significance ($F(6,56) = 0.637$; $p < 0.00004$) and explained a slightly larger percentage of the variance ($R^2 = 0.406$; adjusted $R^2 = 0.342$). As in model one, frequency of avoidance of intense physical activity remained a significant predictor of state anxiety ($B = 0.568$; $SE = 0.102$; $p < 0.001$). The remaining variables, including total physical activity ($p = 0.077$) and marital status ($p = 0.088$), demonstrated a trend toward statistical significance. However, these variables did not attain the established threshold of statistical significance, $\alpha = 0.05$, thereby failing to meet the established criterion for statistical significance. The remaining variables, including the frequency of nocturnal awakenings ($p = 0.386$), the duration of sedentary behavior ($p = 0.342$), and body mass ($p = 0.865$), demonstrated no substantial correlation with state anxiety.

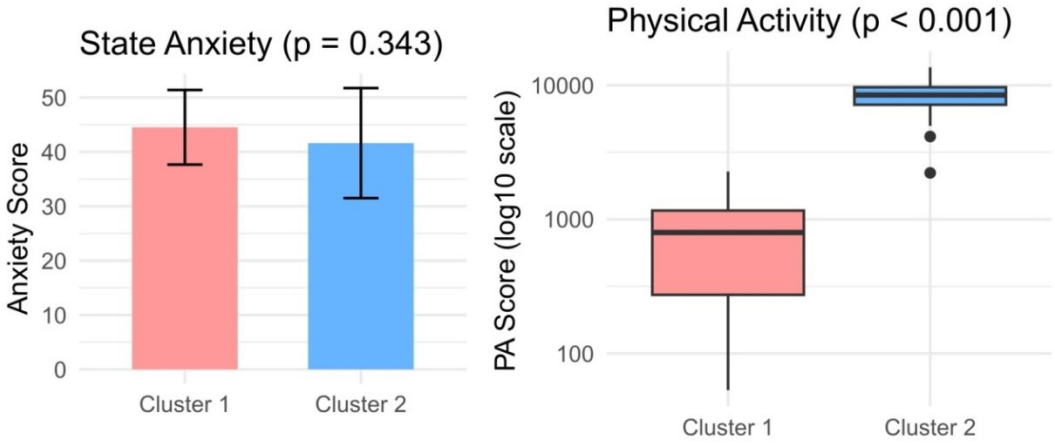

Figure 1. The graphical representation of made between the anxiety levels and physical activity levels of the respective clusters.

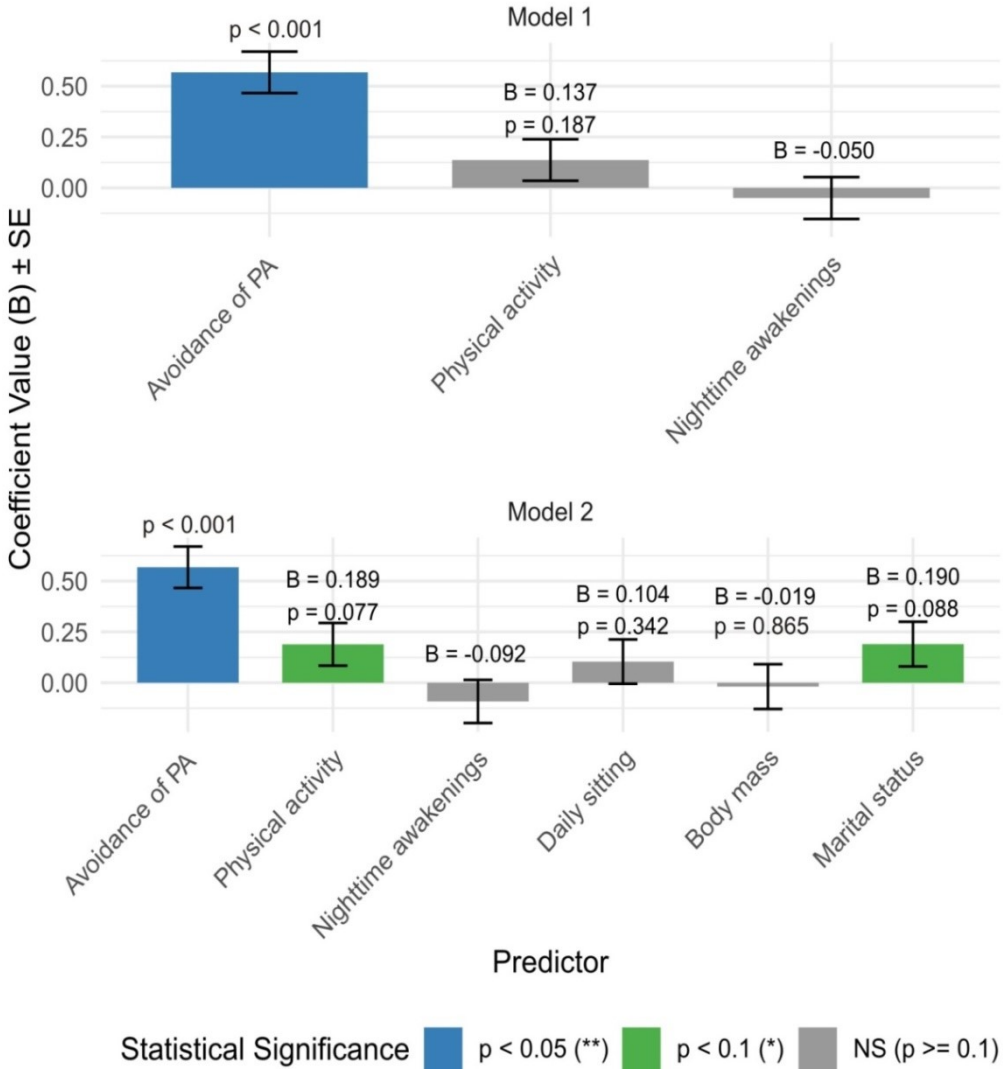

Figure 2. Multiple regression models of state anxiety level in the context of selected predictor variables.

The findings suggest that frequent avoidance of strenuous physical activity may be a substantial contributor to elevated levels of state anxiety, irrespective of the other variables examined.

A subsequent analysis of Spearman correlation coefficients ($p < 0.05$) revealed several statistically significant, though generally weak, correlations between the sociodemographic, anthropometric, psychological, and lifestyle variables studied. A positive correlation was observed between place of residence (PR) and place of birth (PB; $r = 0.25$) and physical activity level (PA; $r = 0.25$). These findings may indicate a relationship between living environment and frequency of physical activity. A positive yet weak correlation was identified between higher education (EDU) and place of birth (PB; $r = 0.19$) and body height (BH; $r = 0.14$). Conversely, a negative correlation was observed between higher education and body mass (BM; $r = -0.21$). These findings suggest that individuals with higher education may prioritize maintaining a lower body mass.

Table 1. Spearman's table of correlations between selected variables.

Variable	PB	PR	MS	EDU	BH	BM	SA	APA	PA	NA
PR	0.25*									
MS	0.01	0.08								
EDU	0.19	0.03	0.01							
BH	0.00	0.02	0.12	0.14						
BM	0.13	0.24*	0.13	-0.21	0.18					
SA	0.01	0.08	0.10	-0.03	0.08	0.18				
APA	-0.12	-0.08	-0.06	-0.12	0.01	0.10	0.49*			
PA	0.00	0.25*	0.13	-0.11	-0.03	0.05	0.16	-0.01		
NA	-0.06	-0.18	0.00	-0.20	-0.19	-0.37*	-0.10	-0.10	-0.03	
TSS	0.24*	-0.04	-0.24	0.11	-0.09	0.00	0.12	0.11	-0.08	0.02

PB - Place of birth, PR - Place of residence, MS - marital status, EDU - education, BH - body height, BM - body mass, SA - state anxiety, APA - avoidance of physical activity, PA - physical activity, NA - nighttime awakenings, TSS - Amount of time spent sitting, *statistically significant at the level of $p<0.05$

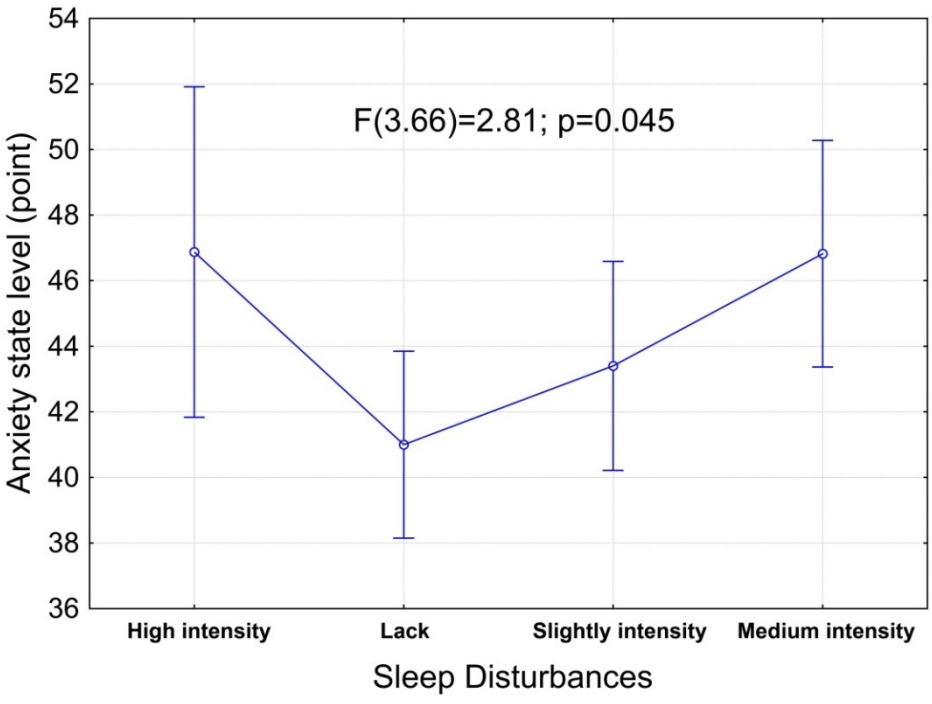

Figure 3. The graphical representation of sleep disorders compared to situational anxiety.

State anxiety (SA) exhibited a moderate positive correlation with physical activity avoidance (APA; r = 0.49), suggesting that elevated anxiety levels are associated with a propensity to evade exercise. Furthermore, a positive correlation was identified between body mass (BM) and place of residence (PR), with a correlation coefficient of 0.24. This finding may be indicative of environmental differences in lifestyle patterns. The present study found a positive correlation between time spent sitting (TSS) and place of birth (PB), with a correlation coefficient (r) of 0.24. Conversely, a negative correlation was observed between TSS and physical activity (MS), with an r of -0.24. These findings substantiate the association between sedentary lifestyles and diminished activity levels. The number of nocturnal awakenings (NA) exhibited a significant negative correlation with body mass (BM; r = -0.37), and a less pronounced correlation with education (EDU; r = -0.20) and height (BH; r = -0.19). These findings suggest a potential association between lower somatic parameters and education with poorer sleep quality. In summary, although the majority of the observed correlations were of a negligible magnitude, the findings suggest noteworthy associations between anxiety, lifestyle (particularly physical activity and sedentary behavior), and sociodemographic characteristics, and sleep quality.

The graph displays the anxiety state level (in points) according to the severity of sleep disorders. A subsequent analysis of variance (ANOVA) revealed statistically significant differences between groups ($F(3,66) = 2.81$; $p = 0.045$), thereby indicating that anxiety levels varied considerably according to the severity of sleep disorders.

The lowest levels of anxiety were observed in those declaring no sleep disorders ("Lack"), while the highest levels of anxiety were observed in those with high-intensity sleep disorders ("High intensity") and medium-intensity sleep disorders ("Medium intensity"). Individuals diagnosed with minor sleep disorders exhibited moderate levels of anxiety, which were higher than those observed in the group without sleep disorders, but lower than those observed in the group with severe symptoms.

The distribution of results indicates an existing relationship between the severity of sleep problems and the level of state anxiety, whereby more severe sleep disorders are associated with higher levels of anxiety. Therefore, it can be hypothesized that sleep disturbances represent a significant psychological factor associated with the onset of anxiety.

DISCUSSION

The study findings reveal a significant association between women's attitudes toward vigorous physical activity and both anxiety levels and sleep quality. A particularly robust observation was the strong correlation between frequent avoidance of strenuous exercise and elevated state anxiety. In regression analyses, exercise avoidance emerged as the most salient predictor, underscoring the psychological relevance of physical activity attitudes in mental health dynamics. These results align with prior research indicating that activity avoidance may function bidirectionally—both as a consequence and a perpetuating factor of emotional tension and perceived loss of control [17,25].

Notably, no substantial differences in anxiety levels were detected across clusters with divergent physical activity patterns. This suggests that activity volume may not directly modulate emotional state, but rather that subjective perceptions of exercise and affective readiness to engage play mediating roles. This interpretation resonates with self-regulation theory, wherein perceived autonomy and self-efficacy constitute central mechanisms governing health behaviors [21].

Contrary to established literature on somatized anxiety [25], no significant association emerged between premature awakenings and state anxiety. This discrepancy may imply that nocturnal awakenings correlate more strongly with chronic stress markers and contextual factors (e.g., age-related sleep architecture changes, circadian rhythm disruptions, or habitual behaviors) than with transient anxiety states captured by the STAI.

This finding highlights the need for future research to incorporate multidimensional anxiety assessments, including trait anxiety measures.

Spearman's correlation analysis yielded several statistically significant but weak associations. In contrast, ANOVA demonstrated pronounced differences in state anxiety across sleep disturbance severity levels, corroborating existing evidence on sleep quality as a determinant of psychological well-being [26,27]. The contemporary scientific discourse increasingly examines sedentary behavior modification through developmental lenses, investigating activity patterns across the lifespan from adolescence to adulthood [28,29].

Among shift-working nurses, sleep quality emerged as a critical moderator of BMI regulation, emphasizing the importance of stable sleep-wake cycles in metabolic health [30]. Correlation analyses confirmed a positive relationship between state anxiety (SA) and physical activity avoidance (APA), supporting previous observations that anxiety-prone individuals often eschew activities potentially beneficial for symptom alleviation. This reciprocal relationship may involve neurohormonal pathways, wherein inactivity exacerbates anxiety through physiological stress responses [24].

Demographic analyses revealed that lower educational attainment and higher body mass predicted more frequent nocturnal awakenings, consistent with literature identifying these as risk factors for sleep and mood disturbances. Figure 3 data further substantiated the sleep-anxiety nexus, showing graded increases in anxiety corresponding to sleep disturbance severity. These results reinforce the well-established role of sleep in emotional regulation, though the generally modest correlation strengths suggest mediating variables or measurement limitations inherent to cross-sectional designs.

Notably, among demographic factors, only sedentary behavior showed significant negative association with marital status, possibly reflecting lifestyle differences in domestic and occupational responsibilities. The absence of other expected correlations may indicate contextual specificity or measurement insensitivity, warranting methodological refinement in future studies.

Practical Implications and Future Directions

The findings advocate for multidimensional preventive strategies that move beyond generic physical activity promotion by specifically targeting exercise-related cognitions in women experiencing helplessness or dysphoria. Evidence-based interventions should incorporate self-efficacy enhancement protocols, social anxiety reduction techniques, and body image restructuring approaches, as such psychologically-informed programs have demonstrated efficacy in improving both exercise adherence and sleep quality. For healthcare practitioners, we recommend augmenting traditional exercise prescriptions with motivational interviewing to address activity-related apprehensions, cognitive restructuring of maladaptive exercise beliefs, and psychoeducation regarding sleep-activity interactions. At the policy level, effective interventions should integrate community-based stress reduction initiatives, workplace sleep hygiene programs, and gender-sensitive activity promotion frameworks. Several methodological limitations must be acknowledged, including homogeneous sampling (predominantly comprising educated, middle-aged women), a cross-sectional design precluding causal inference, and potential measurement error inherent in self-reported variables. Future research should employ longitudinal designs incorporating actigraphy-based sleep monitoring and physiological biomarkers (e.g., cortisol) while examining the role of social support networks and activity contexts (individual versus group settings). Additionally, studies should include more diverse demographic strata to enhance generalizability. These methodological advancements would elucidate the complex interplay between movement behaviors, sleep physiology, and affective states, ultimately facilitating the development of more precise, evidence-based intervention models.

CONCLUSION

The analysis revealed that frequent avoidance of vigorous physical activity was significantly associated with elevated state anxiety levels in women, independent of covariates including body mass index, sedentary behavior, and marital status. Notably, while substantial variation existed in actual physical activity levels across study groups, these differences were not reflected in corresponding variations in anxiety measures. This pattern of findings suggests that subjective perceptions and attitudes regarding exercise may exert greater influence on emotional regulation than objective activity metrics. Contrary to expectations, the frequency of premature awakenings did not emerge as a significant predictor of state anxiety, implying that sleep fragmentation may be mediated by factors beyond transient emotional states. Collectively, these results highlight the critical importance of psychological factors - particularly exercise-related cognitions and beliefs - in understanding the complex relationships between physical activity, mental health, and sleep quality in female populations.

Funding Statement: This research received no external funding.

Acknowledgements: We sincerely thank all the athletes who participated and contributed to this study. The authors gratefully acknowledge the statistical guidance provided by peers.

Conflicts of Interest: The authors declare no conflict of interest.

REFERENCES

1. Horbacz A, Kručanica L, Kováčiková Z. The effect of 8-week multicomponent intervention on physical fitness in trained older women. Phys Act Rev 2023; 11: 1-8. doi: 10.16926/par.2023.11.16
2. Kuberski M, Góra T, Wąsik J. Changes in selected somatic indices in 10-12 year old girls under the influence of 3-year swimming training. Phys Act Rev 2024; 12: 143-9. doi: 10.16926/par.2024.12.13
3. Wagner-Gutiérrez N, Gonzalez SA, Rubio MA, Sánchez-Franco S, Palencia-Pérez L, Blanco M, et al. Quality of life, mental health and social relationships among older adults participating in the Recreovía physical activity community program. Int. J. Equity Health 2025; 24: 145. doi: 10.1186/s12939-025-02476-5.
4. Wang X, Wu H, Meng Q, Chen J, Liu T. The application of high-intensity interval training in college physical education and the improvement of students' physical and mental quality. J. Family Med. Prim. Care 2025; 14: 1513-20. doi: 10.4103/jfmpc.jfmpc_1376_24.
5. Badon SE, Oberman N, Ramsey M, Quesenberry CP, Kurtovich E, Gomez Chavez L, et al. Effect of a Tailored eHealth Physical Activity Intervention on Physical Activity and Depression During Postpartum: Randomized Controlled Trial (The Postpartum Wellness Study). JMIR Mental Health 2025; 12: e64507-e64507. doi: 10.2196/64507.
6. Dhahbi W, Briki W, Heissel A, Schega L, Dergaa I, Guelmami N, et al. Physical Activity to Counter Age-Related Cognitive Decline: Benefits of Aerobic, Resistance, and Combined Training-A Narrative Review. Sports Med. Open 2025; 11: 56. doi: 10.1186/s40798-025-00857-2.
7. Maruszczak K, Kasperek W, Kustra K, Baran J, Kochman M. Exploring the Science of Shape: How Physical Activity, Sleep, and Stress Affect Body Composition. Healthcare 2025; 13: 949. doi: 10.3390/healthcare13080949.
8. Kuberski M, Musial A, Choroszucho M. Longitudinal effects of swimming training on anthropometric characteristics in pre-adolescent girls. Phys Act Rev 2025; 13: 116-30. doi: 10.16926/par.2025.13.11
9. Kennedy DO, Haskell CF, Mauri PL, Scholey AB. Acute cognitive effects of standardized Ginkgo biloba extract complexed with phosphatidylserine. Human Psychopharmacology: Clinical and Experimental 2007; 22: 199-210. doi: 10.1002/hup.837.
10. Slater A, Tiggemann M. "Uncool to do sport": A focus group study of adolescent girls' reasons for withdrawing from physical activity. Psychol Sport Exerc 2010; 11: 619-26. doi: 10.1016/j.psychsport.2010.07.006.
11. Raglio A. More music, more health! J Public Health 2021; 43: e742-4. doi: 10.1093/pubmed/fdaa123.

12. Steenland M, Sinaiko A, Glynn A, Fitzgerald T, Cohen J. The effect of the Affordable Care Act on patient out-of-pocket cost and use of preventive cancer screenings in Massachusetts. Prev Med Rep 2019; 15: 100924. doi: 10.1016/j.pmedr.2019.100924.
13. Hughes C. Sports Injury Prevention and Rehabilitation. Med Sci Sports Exerc 2002; 34: 1055. doi: 10.1097/00005768-200206000-00025.
14. Velde BP, Wittman PP, Lee H, Lee C, Broadhurst E, Caines M. Quality of Life of Older African American Women in Rural North Carolina. J Women Aging 2003; 15: 69-82. doi: 10.1300/J074v15n04_06.
15. Alnawwar MA, Alraddadi MI, Algethmi RA, Salem GA, Salem MA, Alharbi AA. The Effect of Physical Activity on Sleep Quality and Sleep Disorder: A Systematic Review. Cureus 2023. doi: 10.7759/cureus.43595.
16. Semplonius T, Willoughby T. Long-Term Links between Physical Activity and Sleep Quality. Medicine & Science in Sports & Exercise 2018; 50: 2418-24. doi: 10.1249/MSS.0000000000001706.
17. Kroese FM, Evers C, Adriaanse MA, de Ridder DT. Bedtime procrastination: A self-regulation perspective on sleep insufficiency in the general population. J Health Psychol 2016; 21: 853-62. doi: 10.1177/1359105314540014.
18. Meldrum RC, Barnes JC, Hay C. Sleep Deprivation, Low Self-Control, and Delinquency: A Test of the Strength Model of Self-Control. J Youth Adolesc 2015; 44: 465-77. doi: 10.1007/s10964-013-0024-4.
19. Kredlow MA, Capozzoli MC, Hearon BA, Calkins AW, Otto MW. The effects of physical activity on sleep: a meta-analytic review. J Behav Med 2015; 38: 427-49. doi: 10.1007/s10865-015-9617-6.
20. Wahb S, ElDeeb A, Kamel H, El-Shafei M. Effect of Circuit Training on Calcium Level and Physical Fitness in Pregnant Women with Hypocalcemia: A randomized controlled trial. Phys Act Rev 2024; 12: 22-31. doi: 10.16926/par.2024.12.03.
21. Eagly AH, Wood W. The Nature-Nurture Debates. Perspect Psychol Sci 2013; 8: 340-57. doi: 10.1177/1745691613484767.
22. Markland D, Ingledew DK. The relationships between body mass and body image and relative autonomy for exercise among adolescent males and females. Psychol Sport Exerc 2007; 8: 836-53. doi: 10.1016/j.psychsport.2006.11.002.
23. Wrześniewski K, Sosnowski T, Jaworska A, Fecenec D. State and Trait Anxiety Inventory. Polish Adaptation of the STAI. Warsaw: Psychological Testing Laboratory of the Polish Psychological Association; 2011.
24. Faul F, Erdfelder E, Lang A-G, Buchner A. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods 2007; 39: 175-91. doi: 10.3758/BF03193146.
25. Alnawwar MA, Alraddadi MI, Algethmi RA, Salem GA, Salem MA, Alharbi AA. The Effect of Physical Activity on Sleep Quality and Sleep Disorder: A Systematic Review. Cureus 2023; 15: e43595. doi: 10.7759/cureus.43595.
26. Kim Y. The effect of regular Taekwondo exercise on Brain-derived neurotrophic factor and Stroop test in undergraduate student. J Exerc Nutr Biochem 2015. doi: 10.5717/jenb.2015.15060904.
27. Koolhaas CM, Kocevska D, te Lindert BHW, Erler NS, Franco OH, Luik AI, et al. Objectively measured sleep and body mass index: a prospective bidirectional study in middle-aged and older adults. Sleep Med 2019; 57: 43-50. doi: 10.1016/j.sleep.2019.01.034.
28. Pippi R, Mortati A, Fruttini D, Pasqualini L, Gatti A, Vandoni M, et al. Physical activity, sedentary time and motivation to change: an Italian survey. Phys Act Rev 2024; 12: 161-75. doi: 10.16926/par.2024.12.15.
29. Ružbarská I. Gross motor coordination and physical fitness in overweight and obese primary school children compared with normal weight peers. Phys Act Rev 2024; 12: 53-64. doi: 10.16926/par.2024.12.21.
30. Chang W.P, Yang C.M. Influence of sleep-wake cycle on body mass index in female shift-working nurses with sleep quality as mediating variable. Ind Health 2020; 58: 161-9. doi: 10.2486/indhealth.2019-0066.