https://doi.org/10.7251/SSH2502296G
UDC: 613.72:616.89-008.441.1
Short notice
Kratko saopštenje

Relationships Between Physical Activity and Symptoms of Stress, Anxiety and Depression

Jovana Galić, Nikolina Kuruzović, Stanislava Popov, Nikolija Rakočević
Faculty of Sport and Psychology, Novi Sad, Serbia

Correspondence:
Nikolina Kuruzović
Faculty of Sport and Psychology, Novi Sad, Serbia, nikolina.kuruzovic@tims.edu.rs

Abstract: *This study examined the relationship between physical activity and symptoms of stress, anxiety, and depression in adults. The sample consisted of 194 participants, aged 18 to 65, of whom 66% were women and 34% were men, mostly from Belgrade, Novi Sad and Kikinda, with over 70% having a higher education degree. Data were collected using the International Physical Activity Questionnaire (IPAQ), the Depression Anxiety Stress Scale (DASS 21), and a Socio-demographic questionnaire. The results partially confirmed the hypotheses that physical activity negatively affects symptoms of stress, depression, and anxiety. A negative correlation was found between the intensity of physical activity and symptoms of stress and depression, while the association with anxiety was not significant. The results showed that light physical activity, such as walking, significantly predicted lower levels of depression, while moderate and vigorous physical activity did not show a significant effect. This study contributes to a better understanding of the relationship between physical activity and psychological symptoms by analyzing the results in the context of previous research and providing guideline for future studies.*

Keywords: *Physical Activity, Stress, Depression, Anxiety*

Introduction

Physical activity, defined as any body movement produced by the musculoskeletal system that leads to energy expenditure above resting levels, should be distinguished from exercise, which refers to planned and structured physical activity aimed at improving or maintaining physical fitness (Caspersen et al., 1985). Since physical activity is a broader concept than exercise, it is essential to consider their connection in the context of health. Regular physical activity improves both physical and mental health, a notion that dates back to ancient China and Greece. Conversely, physical inactivity today is one of the leading risk factors for chronic non-communicable diseases, which are the primary cause of death worldwide. According to data from the Institute of Public Health of Serbia in 2022, only 4.4% of the Serbian population meets the World Health Organization (WHO) recommendations for physical activity that promotes health (at least 150 minutes per week) unrelated to work activities. The average Serbian spends 4.7 hours per day sitting, with the highest rates observed in residents of Belgrade and urban areas, individuals over 75 years old, and those with higher education (Institute of Public Health "Dr Milan Jovanović Batut," 2023).

In addition to physical inactivity, depression, anxiety, and stress are significant contributors to reduced quality of life and shortened life expectancy in modern society (Ostojić et al., 2009). Research indicates a strong correlation between physical activity and mental health, linking it to improved physical health, life satisfaction, cognitive functioning, and psychological well-being (Goodwin, 2003). Exercise has shown greater efficacy compared to antidepressants as a first-line treatment for mild to moderate depression, and it has been proven to improve depressive symptoms when used as an adjunct to medication (Carek, Laibstain, & Carek, 2011). Interventional studies indicate that even a single instance of physical activity leads to reductions in symptoms of depression, anxiety, and stress immediately following the activity (Stonerock et al., 2015; Strickland & Smith, 2014).

There is evidence that prescribing physical activity as treatment for 26 different illnesses, including depression and anxiety, is beneficial (Pedersen & Saltin, 2015). Exercise reduces the secretion of the stress hormone cortisol, which adversely affects the health of various organs, including the brain. The body's stress response is mediated by enhanced activation of the hypothalamic-pituitary-adrenal (HPA) axis (Contrada, 2010). When the HPA axis is activated, the hypothalamus releases hormones that stimulate the anterior pituitary to secrete adrenocorticotropic hormones, which then stimulate the adrenal cortex to release cortisol into the bloodstream. Therefore, physical activity may prevent panic attacks even in healthy individuals (Strohle et al., 2005).

In socially adverse situations, such as during the COVID-19 pandemic, physical activity can reduce levels of stress and anxiety (Popov et al., 2021). A study investigating the importance of physical activity and coping strategies for stress in the context of mental health during isolation in Serbia showed that it is more important whether a person is physically active than how often they exercise (Popov et al., 2023). In addition to reducing the risk of many diseases, an active lifestyle provides energy, vitality, changes negative habits, improves health, and strengthens energy and the will to live (Krivokapić, 2011).

The primary issue of this study is to examine the relationship between levels of physical activity and mental health. The key question is whether different forms and intensities of physical activity can predict the presence and intensity of mental health issues. The study aims to examine the extent to which different forms of physical activity, such as walking, recreational exercise, or intense training, contribute to reducing symptoms of stress, anxiety, and depression in adults.

Method

Sample

The final sample consisted of 194 participants, aged 18-65 years (M = 36.6, SD = 12.0), of which 66% were women and 34% were men, from Belgrade, Novi Sad, and Kikinda. Over 70% of the participants have a higher education degree.

Data Collection

Data were collected during 2024 through an online battery of tests, which included two questionnaires and a demographic questionnaire. Participants were informed about the purpose of the study and the possibility of withdrawing at any time. The questionnaires were distributed via the Google Forms platform.

Variables and Measurement Instruments

Physical activity was measured using the International Physical Activity Questionnaire (IPAQ), which assesses the intensity, duration, and frequency of physical activity over the past seven days. The questionnaire was designed to allow the calculation of separate scores for each type of activity: vigorous, moderate, and light. Calculating the total score for physical activity involved summing the duration (in minutes) and frequency (in days) for all three types of physical activity.

Depression, anxiety, and stress were measured using the Depression Anxiety Stress Scale (DASS 21). This scale assesses symptoms of depression, anxiety, and stress through 21 items. The reliability of the scale is high, with a Cronbach's alpha of $\alpha = .93$ for the entire instrument.

Socio-demographic variables include gender, age, residence, and education, and the data were collected using a general questionnaire.

Results

Table 1 presents descriptive measures of the questionnaires for measuring depression, anxiety, and stress, as well as levels of physical activity.

Table 1. *Descriptive Measures of the Questionnaires for Measuring Depression, Anxiety, and Stress, as well as Levels of Physical Activity*

	Range (min, max)	Mean (M)	SD
Light physical activity	0 – 7 (dana)	4.6	2.3
Moderate physical activity	0 – 7 (dana)	2.9	2.5
Vigorous physical activity	0 – 7 (dana)	1.8	2.1
Anxiety	0 – 3	0.4	0.5
Depression	0 – 3	0.5	0.6
Stress	0 – 3	1.0	0.7

The analyses show that participants most commonly engaged in light physical activity, such as walking for more than 10 minutes, followed by moderate activity (e.g., carrying light loads, cycling), while fewer reported engaging in vigorous physical activity (e.g., lifting weights, aerobics). Regarding depression, anxiety, and stress, average values indicate low representation of all indicators, with moderate variations, and stress being the most frequently reported.

Table 2 shows the intercorrelations among the variables used in the study (physical activity, depression, anxiety, and stress).

Table 2. *Intercorrelations of Variables in the Study: Three Types of Physical Activity (Light, Moderate, and Vigorous) with Anxiety, Depression, and Stress*

	Anxiety	Depression	Stress
Light physical activity	-0.08	-.25**	-.19**
Moderate physical activity	-0.09	-0.09	-0.14
Vigorous physical activity	-.17*	-0.10	-0.03

Note. $p < .01$; * $p < .05$

The results show three statistically significant, low, and negative correlations between vigorous physical activity and anxiety, as well as between light physical activity and depression and stress. The negative direction of these correlations indicates that anxiety is lower when individuals engage in more vigorous physical activity, and that levels of depression and anxiety are lower when light physical activity, such as walking for more than 10 minutes, is practiced more frequently.

To examine whether the frequency and engagement in light, moderate, and vigorous physical activity can predict levels of depression, anxiety, and stress, three regression models were created. In these models, the predictors were light, moderate, and vigorous physical activity, while the criteria were anxiety, depression, and stress, respectively. The results of the first regression analysis are presented in Table 3.

Table 3. *Results of Multiple Regression Analysis: Model for Predicting Anxiety Based on Light, Moderate and Vigorous Physical Activity*

	Anxiety		
	B	SE	β
Intercept	0.55***	.09	
Light physical activity	-.01	.02	-.06
Moderate physical activity	-.003	.02	-.02
Vigorous physical activity	-.04	.02	-.15
F(df)	32.398 (3, 190), $p = .112$		
Adj. R^2	.016		

*Note.*** $p < .001$; ** $p < .01$

The analysis showed that light, moderate, and vigorous physical activity do not significantly predict anxiety levels among participants. Therefore, even though a low statistically significant negative correlation was found between anxiety and vigorous physical activity, it was shown that no level of physical activity predicts anxiety.

The results of the second regression analysis are presented in Table 4.

Table 4. *Results of Multiple Regression Analysis: Model for Predicting Depression Based on Light, Moderate and Vigorous Physical Activity*

	Depression		
	B	SE	β
Intercept	.84***	.10	
Light physical activity	-.06**	.02	-.24
Moderate physical activity	.001	.02	.01
Vigorous physical activity	-.02	.02	-.07
F(df)	4.559 (3, 190)**		
Adj. R^2	.052		

*Note.*** $p < .001$; ** $p < .01$

Light, moderate, and vigorous physical activity significantly predict levels of depression, with the regression model explaining 5.2% of the variance. The only statistically significant predictor is light physical activity, which shows a negative association with depression—more frequent walks lasting longer than 10 minutes are associated with lower levels of depression. Moderate and vigorous physical activities did not have a significant impact. These results align with previous findings that highlight the negative correlation between light physical activity and depression.

The results of the third regression analysis are presented in Table 5.

Table 5. *Results of Multiple Regression Analysis: Model for Predicting Stress Based on Light, Moderate and Vigorous Physical Activity*

	Stress		
	B	**SE**	**β**
Intercept	1.26***	.11	
Light physical activity	-.05*	.02	-.16
Moderate physical activity	-.03	.02	-.10
Vigorous physical activity	.01	.02	.03
F(df)	2.849 (3, 190)*		
Adj. R^2	.028		

*Note.*** $p < .001$; ** $p < .01$

The regression model explains 2.8% of the variance and indicates that physical activity significantly predicts stress levels. The only significant predictor is light physical activity, which is negatively associated with stress—more frequent walks lasting longer than 10 minutes are associated with lower stress levels. Moderate and vigorous physical activity did not have a significant effect. These results confirm the previously established negative correlation between light physical activity and stress.

Discussion

This research aimed to examine the relationship between levels of physical activity and symptoms of depression, anxiety, and stress in adults. While a negative correlation was found between vigorous physical activity and anxiety, regression models did not demonstrate a significant effect of physical activity on anxiety, contradicting the initial expectations. The results are consistent with studies indicating variable effects of physical activity on anxiety. One possible explanation for these results could be that, although vigorous physical activity may temporarily reduce symptoms of anxiety, its overall effectiveness may be diminished by various factors. For example, individual differences in stress and anxiety perception may influence how people respond to physical activity (Asmundson et al., 2013). Additionally, variability in the type and frequency of exercise may further affect the efficacy of vigorous physical activity in reducing anxiety, as shown in previous research examining the effects of different forms of physical activity on anxiety (Stonerock et al., 2015). In this context, it can be speculated that consistency in exercise and a preference for forms of activity perceived as less stressful and more enjoyable may be more critical for reducing anxiety.

Light physical activity significantly predicts lower levels of depression, while moderate and vigorous activity did not show a significant effect, partially confirming initial expectations. Walking, as a form of light physical activity, may have a greater impact on depression due to its accessibility and lower level of physical exertion, contributing to the consistency of practicing this activity. Furthermore, the nature of walking, which often includes being outdoors and interacting with nature, may further contribute to mood improvement and reduced depression, as confirmed by studies examining the effects of nature exposure on mental health (Berman et al., 2012).

Light physical activity is the only significant predictor of lower stress levels, while moderate and vigorous activity did not have an impact, partially confirming initial expectations. One possible explanation for these results could be that more intense forms of physical activity may be perceived as additional stressors, especially for individuals who are not accustomed to high levels of physical exertion (Dishman et al., 2006). On the other hand, light physical activity, which does not require significant physical exertion, may contribute to stress reduction in a way that is more psychologically acceptable and sustainable for most individuals, as confirmed by studies examining the effects of light forms of activity on stress (Puterman et al., 2010).

Conclusion

The conclusions of this research highlight several key findings. First, participants most commonly engaged in light physical activity, while vigorous activity was the least represented. Psychological symptoms of depression, anxiety, and stress were low, which is expected given the non-clinical sample, but stress was the most frequently reported.

The results showed significant negative correlations between physical activity and psychological symptoms. Vigorous physical activity was associated with lower levels of anxiety, while light physical activity, such as walking, significantly reduced depression and stress. Although physical activity did not predict anxiety, light activity was a significant predictor of lower levels of depression and stress.

The practical contribution of this research lies in the potential for promoting mental health through light physical activity, which could be beneficial in preventive programs for reducing mild symptoms of depression and stress. The academic contribution of this research is deepening the understanding of the relationship between physical activity and mental health, especially in the context of our country, where this topic is under-researched. The findings of this study can serve as a foundation for future research with larger samples and more precise measurements.

References

World Health Organization. (2010). *Global recommendations on physical activity for health*. Geneva: WHO.

Caspersen, C., Powell, K., & Christenson, G. (1985). Physical Activity, Exercise, and Physical Fitness: Definitions and Distinctions for Health-Related Research. Public Health Reports, 100(2), 126–131.

Institut za javno zdravlje Srbije „Dr Milan Jovanović Batut“. (2022). *Zdravstveno-statistički godišnjak Republike Srbije 2022*. Beograd: Institut za javno zdravlje Srbije. [in Serbian]

Ostojić, S. M., Stojanović, M., Veljović, D., Stojanović, M. D., Međedović, B., & Ahmetović, Z. (2009). Fizička aktivnost i zdravlje: definicija problema, savremena zapažanja i preporuke. *TIMS Acta, 3*, 1–13. [in Serbian]

Goodwin, R. D. (2003). Association between physical activity and mental disorders among adults in the United States. *Preventive Medicine, 36*(6), 698–703. https://doi.org/10.1016/S0091-7435(03)00042-2

Carek, P. J., Laibstain, S. E., & Carek, S. M. (2011). Exercise for the treatment of depression and anxiety. *International Journal of Psychiatry in Medicine, 41*(1), 15–28. https://doi.org/10.2190/PM.41.1.c

Stonerock, G. L., Hoffman, B. M., Smith, P. J., & Blumenthal, J. A. (2015). Exercise as treatment for anxiety: Systematic review and analysis. *Annals of Behavioral Medicine, 49*(4), 542–556. https://doi.org/10.1007/s12160-014-9685-9

Strickland, J. C., & Smith, M. A. (2014). The anxiolytic effects of resistance exercise. *Frontiers in Psychology, 5*, 753. https://doi.org/10.3389/fpsyg.2014.00753

Pedersen, B. K., & Saltin, B. (2015). Evidence for prescribing exercise as therapy in chronic disease. *Scandinavian Journal of Medicine & Science in Sports, 25*(S3), 1–72. https://doi.org/10.1111/sms.12506

Contrada, R., & Baum, A. (2010). *The Handbook of Stress Science: Biology, Psychology, and Health*. New York: Springer Publishing Company.

Strohle, A., Feller, C., Onken, M., Godemann, F., Heinz, A., & Dimeo, F. (2005). The acute antipanic activity of aerobic exercise. *American Journal of Psychiatry, 162*(12), 2376–2378. https://doi.org/10.1176/appi.ajp.162.12.2376

Popov, S., Sokić, J., & Stupar, D. (2021). Activity matters: Physical exercise and stress coping during the 2020 COVID-19 state of emergency. *Psihologija, 54*(3), 307–322. https://doi.org/10.2298/PSI200804002P

Popov, S., Volarov, M., & Rakočević, N. (2023). The relationship between physical activity and mental health: Is more always better?. *Primenjena Psihologija, 16*(3), 349–374. https://doi.org/10.19090/pp.v16i3.2461

Krivokapić, D., & Popović, S. (2011). Uticaj rekreativnih aktivnosti na psihičko zdravlje. Zbornik naučnih i stručnih radova „*Sport i zdravlje“, IV*, 10–13. [in Serbian]

Asmundson, G. J., Fetzner, M. G., Deboer, L. B., Powers, M. B., Otto, M. W., & Smits, J. A. (2013). Let's get physical: A contemporary review of the anxiolytic effects of exercise for anxiety and its disorders. *Depression and Anxiety, 30*(4), 362–373. https://doi.org/10.1002/da.22043

Berman, M. G., Kross, E., Krpan, K. M., Askren, M. K., Burson, A., Deldin, P. J., Kaplan, S., Sherdell, L., Gotlib, I. H., & Jonides, J. (2012). Interacting with nature improves cognition and affect for individuals with depression. *Journal of Affective Disorders, 140*(3), 300–305. https://doi.org/10.1016/j.jad.2012.03.012

Dishman, R. K., Berthoud, H. R., Booth, F. W., Cotman, C. W., Edgerton, V. R., Fleshner, M. R., Gandevia, S. C., Gomez-Pinilla, F., Greenwood, B. N., Hillman, C. H., Kramer, A. F., Levin, B. E., Moran, T. H., Russo-Neustadt, A. A., Salamone, J. D., Van Hoomissen, J. D., Wade, C. E., York, D. A., & Zigmond, M. J. (2006). Neurobiology of exercise. *Obesity, 14*(3), 345–356. https://doi.org/10.1038/oby.2006.46

Puterman, E., Lin, J., Blackburn, E., O'Donovan, A., Adler, N., & Epel, E. (2010). The power of exercise: Buffering the effect of chronic stress on telomere length. *PloS One, 5*(5), e10837. https://doi.org/10.1371/journal.pone.0010837

Primljen: 08. septembar 2025. / Received: September 08, 2025
Prihvaćen: 27. oktobar 2025. / Accepted: October 27, 2025