14 (1) (2025) 165 - 171
Journal of Physical Education, Sport, Health and Recreations
https://journal.unnes.ac.id/journals/peshr

Mood Changes and Physical Activity Patterns in Adolescents

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Article History

Received February 2025
Accepted February 2025
Published Vol.14 No.(1) 2025

Keywords:
Mood; Physical activity; Adolescents; Mental health; Cross-sectional.

Abstract

This study aims to analyze the relationship between physical activity patterns and mood changes in adolescents using an objective measurement approach. This cross-sectional study involved 50 adolescent participants. Physical activity was measured using the ActiGraph GT3X accelerometer, while mood changes were assessed using the Brunel Mood Scale (BRUMS). Data were analyzed using Spearman's correlation test with a significance level of $p < 0.05$. Findings indicate that participants spent most of their time engaged in sedentary behavior (M = 1194.42 minutes/day, SD = 42.543), while moderate-to-vigorous physical activity (MVPA) levels were relatively low (M = 47.06 minutes/day, SD = 17.873). Negative mood states were more dominant than positive ones, with the highest scores recorded for tension (M = 65.22, SD = 12.255) and anger (M = 63.06, SD = 10.033). Correlation analysis revealed no significant relationship between total MVPA and mood ($r = -0.021$, $p = 0.886$). However, sedentary behavior showed a significant negative correlation with moderate physical activity ($r = -0.626$, $p < 0.01$) and total MVPA ($r = -0.635$, $p < 0.01$), indicating that higher sedentary time was associated with lower levels of physical activity in adolescents. This study found no significant relationship between physical activity and mood changes in adolescents. The low levels of MVPA and high sedentary behavior may contribute to the dominance of negative mood states. Further longitudinal studies are needed to explore other factors that may influence adolescent emotional well-being.

How to Cite

Febrian, F., Sultoni, K., Zaky, M., & Jajat. (2025). Mood Changes and Physical Activity Patterns in Adolescents. Journal of Physical Education, Sport, Health and Recreation, 14 (1), 165-171.

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p-ISSN 2460-724X
e-ISSN 2252-6773

INTRODUCTION

Mood swings are a common phenomenon in adolescents and are influenced by various factors, one of which is physical activity (Shalahuddin, 2024) . Physical activity has been widely associated with various health benefits, including improved psychological well-being. Several studies have shown that physical activity can help improve mood, reduce stress, and reduce the risk of psychological disorders such as anxiety and depression (Dilorenzo et al., 1999; Myrna-Bekas et al., 2012; Warburton & Bredin, 2017) . In addition, physical activity plays a role in increasing the production of neurotransmitters such as endorphins and serotonin which contribute to feelings of happiness and relaxation (Dishman et al., 2006; Watson, 2000) .

In adolescents, physical activity not only contributes to physical health but also to emotional balance (I Gusti Ayu Putu Satya Laksmini, 2023) . Previous studies have shown that individuals who regularly engage in physical activity have more stable mood levels compared to those who are less active (Lane & Lovejoy, 2001; Rebar et al., 2015) . However, with the increasing sedentary behavior due to technological developments, the level of physical activity in adolescents has decreased significantly (Guthold et al., 2020; Leunes, 2000) . This can have a negative impact on their psychological well-being, especially in terms of managing emotions and moods.

Studies by (Rebar et al., 2015) have shown that physical activity can affect mood, however, there is still a gap in understanding the extent to which physical activity can affect mood changes specifically in adolescents. Most previous studies have focused more on the general relationship between physical activity and mental health, without examining differences in impact based on the level of intensity and duration of physical activity (Biddle & Asare, 2011; Thompson Coon et al., 2011) . In addition, previous studies conducted by (Prince et al., 2008) still used subjective methods in measuring physical activity levels, such as questionnaires or self-reports, which can cause bias in the results of the study. The use of objective devices such as the ActiGraph GT3x Accelerometer can provide more accurate results in measuring physical activity, allowing for a more valid analysis of the relationship between physical activity and mood changes in adolescents (Strath et al., 2013) . Then research by (Pascoe et al., 2019; Schuch et al., 2018) showed that moderate to high intensity physical activity is more effective in improving mood compared to light physical activity. However, further research is needed to understand how different types of physical activity contribute to changes in adolescent mood. Therefore, this study focuses exclusively on the relationship between physical activity and mood changes without considering other external factors.

This study aims to examine the relationship between physical activity and mood changes in adolescents using objective measurement methods. By using the ActiGraph GT3x Accelerometer to measure physical activity levels and the Brunel Mood Scale (BRUMS) to assess mood changes, this study is expected to provide more accurate empirical data on the effect of physical activity on adolescent mood (Ainsworth et al., 2011; Terry & Lane, 2003) .

By focusing on the direct relationship between physical activity and mood without considering other external factors, this study can provide a clearer understanding of how much physical activity contributes to regulating adolescents' emotional balance. The findings of this study are expected to be the basis for the development of more structured and evidence-based physical activity programs to help adolescents improve their emotional well-being (Lubans et al., 2016).

METHODS

This study used a cross-sectional design , which aims to explore the relationship between mood changes and physical activity in adolescents over a period of time. This design allows simultaneous measurement of the independent variable (physical activity) and the dependent variable (mood) without intervention.

This study was conducted on students of the Sports Science Study Program, Universitas Pendidikan Indonesia with a total sample of 50 people consisting of 27 males and 23 females aged 19 to 20 years. The inclusion criteria in this study were students who were physically active, willing to participate in the study, and did not have medical conditions that could affect physical activity or mood. Participants were recruited using a purposive sampling method .

Mood changes were measured using the Brunel Mood Scale (BRUMS) (Terry & Lane, 2003) , which consists of 24 mood descriptor items, such as angry, energetic, nervous, and unhappy. Respondents are asked to indicate whether they feel these feelings on a 5-point scale (0 = not at all, 1 = a little, 2 = moderately, 3 = quite a lot, 4 = very much) . This scale is used to assess participants' mood at the time of filling out

the questionnaire after 7 days of physical activity monitoring.

Physical activity was measured objectively using the ActiGraph GT3x Accelerometer. (Chomistek et al., 2017) , which is able to record the duration and intensity of physical activity. Participants used this tool for 7 consecutive days to record the time spent in various categories of physical activity, including sedentary, light physical activity (LPA), total moderate-to-vigorous physical activity (TMVPA).

Research Procedures

1. Participant Consent: Participants were provided with information about the purpose and procedures of the study, then signed a consent form via Google Form .
2. Anthropometric Measurement: Body weight and height measurements were carried out using laboratory equipment at the Sports Science Study Program, Indonesian Education University.
3. Device Fitting: Each participant was provided with an ActiGraph GT3x device , which had to be worn continuously for 7 days, except during sleep or activities that could interfere with the sensor.
4. Questionnaire Completion: After the monitoring period was completed, participants completed the BRUMS questionnaire to evaluate their mood changes.

Data were analyzed using IBM SPSS Statistics 25 software. Pearson correlation test was used to assess the relationship between physical activity variables (sedentary, LPA, TMVPA) and mood changes (BRUMS). The level of significance was set at $p < 0.05$. Additional analyses were conducted to test for differences based on type, duration and level of physical activity.

In this study, all participants were given information about the purpose of the study and their rights as participants. Data confidentiality was guaranteed, and data was used only for academic purposes and was not distributed to third parties without the consent of the participants.

RESULTS AND DISCUSSION

The **Table 1** of descriptive statistical analysis results shows that the average total mood score in participants was 365.86 (SD = 47.855), with the negative mood category having a higher value (M = 305.38, SD = 44.450) compared to positive mood and vigor which had a lower average value (M = 60.48, SD = 8.187). This shows that participants in this study tended to experience more dominant negative moods than positive moods. In the negative mood component, the highest score was found in the tension category (M = 65.22, SD = 12.255), followed by anger (M = 63.06, SD = 10.033) and confusion (M = 62.52, SD = 10.541). Meanwhile, the lowest score was found in the fatigue category (M = 55.58, SD = 6.335), indicating that psychological exhaustion may not be the main factor influencing mood in this study sample. In terms of physical activity, the results showed that participants spent most of their time in sedentary activities (M = 1194.42 min/day, SD = 42.543), with significantly less time spent in light-intensity physical activities (M = 198.52 min/day, SD = 34.631), moderate-intensity physical activities (M = 42.37 min/day, SD = 15.002), and vigorous-intensity physical activities (M = 4.70 min/day, SD = 4.030). The total time of moderate-to-vigorous physical activity (MVPA) performed by participants in a day was also relatively low (M = 47.06 min/day, SD = 17.873), which is far below the daily physical activity recommendation suggested by the World Health Organization (WHO) for adolescents, which is at least 60 minutes per day. These results indicate that the majority of participants in this study had low levels of physical activity and tended to spend most of their time in sedentary activities. The low levels of physical activity observed in this study may also contribute to the predominance of negative moods reported by participants, as explained in previous studies showing a relationship between physical activity and psychological well-being.

Furthermore, based on the **Table 1** of correlation analysis results based on Significance values (2-tailed) , several main findings can be presented as follows: Spearman correlation results show a significant relationship between various aspects of mood. Overall mood has a very strong correlation with negative mood ($r = 0.986$, $p < 0.01$), anger ($r = 0.875$, $p < 0.01$), confusion ($r = 0.916$, $p < 0.01$), and depression ($r = 0.840$, $p < 0.01$). This indicates that individuals with negative moods tend to experience an increase in various other negative emotional aspects. Conversely, positive mood and vigor have a lower correlation with overall mood ($r = 0.488$, $p < 0.01$). No significant correlation was found between total moderate to vigorous physical activity (MVPA) and mood ($r = -0.021$, $p = 0.886$). Sedentary behavior had a significant negative correlation with moderate physical activity ($r = -0.626$, $p < 0.01$) and total MVPA ($r = -0.635$, $p < 0.01$), indicating that the higher the time spent in sedentary behavior, the lower the level of moderate to high intensity physical activity.

Table 1. Results of Correlation Analysis of Mood and Physical Activity

Variables	N	Mean	Std.Deviation	1	2	3	4	5	6	7	8	9	10	11	12	13	1
1. Mood	50	365.86	47,855	1													
2. Negative	50	305.38	44.45	0.986**	1												
3. Anger	50	63.06	10,033	0.875**	0.880**	1											
4. Confusion	50	62.52	10,541	0.916**	0.924**	0.812**	1										
5. Depression	50	59	10,868	0.840**	0.865**	0.744**	0.748**	1									
6. Fatigue	50	55.58	6.335	0.792**	0.806**	0.738**	0.759**	0.612**	1								
7. Tension	50	65.22	12.255	0.856**	0.863**	0.742**	0.763**	0.714**	0.600**	1							
8. Positive	50	60.48	8.187	0.488**	0.367**	0.311*	0.341*	0.177	0.278	0.368**	1						
9. Vigor	50	60.48	8.187	0.488**	0.367**	0.311*	0.341*	0.177	0.278	0.368**	1,000**	1					
10. Sedentary	50	1194.42	42,543	-0.039	-0.048	0.045	-0.067	-0.014	-0.004	-0.075	-0.099	-0.099	1				
11. Light	50	198.52	34,631	0.046	0.048	0.038	0.036	0.039	-0.026	0.165	0.128	0.128	-0.876**	1			
12. Moderate	50	42.37	15,002	0.017	0.039	-0.117	0.084	0.009	0.024	-0.053	-0.032	-0.032	-0.626**	0.232	1		
13. Vigorous	50	4.7	4.03	-0.248	-0.233	-0.296*	-0.193	-0.249	-0.171	-0.359*	-0.109	-0.109	-0.434**	0.096	0.705**	1	
14.TMVPA	50	47.06	17,873	-0.021	0.005	-0.14	0.051	-0.029	0.014	-0.106	-0.062	-0.062	-0.635**	0.241	0.992**	0.767**	1

The results of the analysis showed that there was no significant correlation between various aspects of mood and physical activity in adolescents. This indicates that other factors may play a greater role in influencing adolescent physical activity patterns than emotional aspects alone.

The Relationship Between Physical Activity and Mood Changes in Adolescents

The results of this study indicate that there is no significant relationship between physical activity and mood changes in adolescents. This is indicated by the absence of a significant correlation between total moderate to vigorous physical activity (MVPA) and total mood ($r = -0.021$, $p = 0.886$). Although previous studies have reported that physical activity can improve psychological well-being by reducing anxiety and depression (Pascoe et al., 2019; Rebar et al., 2015) , the results of this study do not support this hypothesis. One possible reason for the lack of a significant relationship is the low level of physical activity of the participants. Based on the results of descriptive statistics, the total MVPA carried out by the participants was only M = 47.06 minutes/day (SD = 17.873), which is far below the World Health Organization (WHO) recommendation of at least 60 minutes per day for adolescents. These data indicate that adolescents in this study tend to be less physically active, which has the potential to affect their emotional well-being in the long term (Warburton & Bredin, 2017) .

In contrast, sedentary behavior had a very high duration, M = 1194.42 minutes/day (SD = 42.543), indicating that adolescents in this study spent more time with sedentary activities such as sitting or lying down. This finding supports previous studies showing that increased sedentary behavior in adolescents can contribute to decreased emotional well-being (Guthold et al., 2020) . This finding also indicates that physical activity may not be the only factor influencing adolescent mood, as suggested in a study by (Biddle & Asare, 2011) which highlighted the existence of other variables such as individual social and psychological conditions.

Comparison with Previous Research

The findings in this study differ from the results of a study by (Rebar et al., 2015) , which showed that physical activity can significantly improve mood and reduce stress levels. The study revealed that individuals who regularly participate in sports have lower levels of anxiety and depression compared to those who are less physically active. Studies by (Myrna-Bekas et al., 2012; Stefaniak & Cornell, 2011) revealed that participation in various forms of physical activity can improve mood positively regardless of the type of exercise performed. However, these studies showed different results, indicating that other factors such as social environment, academic stress, and sleep habits may play a more dominant role in determining adolescent mood. In addition, research conducted by (Craft & Perna, 2004) also showed that exercise can act as a natural antidepressant by increasing the production of endorphins and neurotransmitters that contribute to positive feelings.

However, these differences in findings may be explained by factors such as the duration and intensity of the physical activity performed. In a study conducted by (Salmon, 2001) , it was stated that the psychological benefits of physical activity can only be felt if it is done regularly with a duration of at least 30 minutes per session. In this study, participants had very low levels of moderate to vigorous physical activity, which is likely not enough to produce positive effects on their mood.

Furthermore, a study by (Hansen et al., 2001) showed that the duration of physical activity plays an important role in influencing mood, where physical exercise with a duration of more than 20 minutes is more effective in improving mood compared to shorter exercises. Another study by (Reed & Ones, 2006) also showed that increasing the intensity of exercise can improve emotional well-being, but if the intensity is too high, the opposite effect can occur, causing mental and physical fatigue which leads to decreased mood.

Studies by (Saputra et al., 2024; Schuch et al., 2018) support the idea that regular physical

activity is associated with decreased depressive symptoms, especially in adolescent populations. However, they also note that this effect is highly dependent on the individual's motivation to exercise and consistency in performing physical activity. A study by (Lubans et al., 2016) added that physical activity performed in a supportive social environment is more likely to provide emotional benefits than physical activity performed alone.

Research Implications

Although the results of this study did not find a significant correlation between physical activity and mood, these findings still provide important insights into physical activity patterns in adolescents. This study confirms that physical activity levels among adolescents are still relatively low, which may be of concern to health and education practitioners in designing strategies to increase adolescent participation in physical activity. Given that previous studies have shown the benefits of physical activity on emotional well-being, more effective interventions are needed to encourage adolescents to be more physically active.

Research by (Dishman et al., 2006; Rosalina, 2024) emphasizes that intrinsic motivation plays an important role in determining whether someone can maintain an exercise habit. Therefore, a more holistic approach is needed in encouraging adolescent physical activity, for example through the integration of sports into the educational curriculum, the provision of attractive sports facilities for adolescents, and the promotion of a healthy lifestyle through social media and peer communities (Hasibuan et al., 2024) .

Recommendations from this study include the need for a more comprehensive approach to assessing the relationship between physical activity and emotional well-being. Future studies could consider using a longitudinal design to observe changes in mood in more detail as adolescents' physical activity patterns change. Further research could also examine which types of physical activity are more effective in improving mood, and how the frequency and duration of exercise can be optimized to produce greater psychological impact (Rahayu et al., 2024).

Overall, although this study did not find a significant association between physical activity and mood, these findings remain relevant in informing health policies and interventions that focus on improving adolescent mental well-being through more targeted strategies to increase their physical activity. Given the findings from previous studies, it is important to continue exploring factors that may maximize the benefits of physical activity on adolescent psychological well-being.

CONCLUSION

This study explored the relationship between mood changes and physical activity patterns in adolescents. The results of the analysis showed that negative mood was more dominant than positive mood in this study population. Although previous studies have shown that physical activity can contribute to improved psychological well-being, the results of this study did not find a significant relationship between physical activity and mood. Other factors, such as academic pressure, sleep patterns, and social support, may play a greater role in influencing adolescents' emotional well-being.

The main limitation of this study is the cross-sectional design , which only allows for correlational analysis without identifying causal relationships. In addition, the relatively small sample size may limit the generalizability of the study results to a broader population of adolescents.

These findings have important implications for adolescent mental health interventions. Efforts to improve psychological well-being should not only focus on increasing physical activity, but also consider more holistic approaches, such as stress management strategies, mental health education, and stronger social support.

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