

Body Mass Index and Physical Activity of High School Adolescents with Different Learning Motivation

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Abstract: During adolescence, individuals experience significant physical growth and development with changes in body composition that can affect their physical activity and learning motivation. This study aims to determine the effect of body mass index (BMI) and physical activity (PA) on the learning motivation of physical education students aged 15-17 years in different schools. This research design uses a quantitative descriptive approach. The sample consisted of 202 male and female at high-school Students 1 Sukoharjo, Central Java, aged 15 to 17 years, selected through purposive sampling. The instruments used in the research were BMI variables, PA, and learning motivation. Using multinomial logistic regression analysis for data analysis it is possible to find physical education students' learning motivation in a different category from the BMI category and PA category based on the p-value (0.05). The results of the descriptive data found that the most BMI research samples were in the normal category with 45.0%, then PA was in the moderate category with 49.5% doing moderate PA, and the learning motivation of physical education students was in the high category with 42.6%. multinomial logistic regression analysis showed, 1) there was no effect of BMI categories on different learning motivations (p-value: 0.920); 2) there is an effect of PA categories on physical education students' learning motivation (p-value: 0.009); 3) there is a significant effect between the categories of BMI and PA categories on the learning motivation of different physical education students (p-value: 0.000). A higher percentage of BMI is associated with decreased PA. In addition, low learning motivation was observed among students with low levels of PA and a higher percentage of BMI in the overweight category.

Keywords: Body Mass Index, Learning Motivation, Physical Activity, Senior High School

A. Introduction

Physical education is an integral part of overall education through various physical activities aimed at developing individuals in a real, neuromuscular, intellectual and emotional way (Metzler et al., 2013). Within an educational setting, physical education aims to enhance physical fitness, knowledge, active lifestyle, and motor skills. These

classes are delivered in a structured and progressive manner, promoting positivity, desirable behavior, and an understanding of the benefits of PA (Poobalan et al., 2012). By engaging in physical education, students develop various facets of their well-being, including health, physical fitness, skills, coordination, social competence, logical thinking, and behavior (Ullrich-French et al., 2012). Learning in physical education is measured by the integration of PA as a means to achieve educational objectives, fostering the growth of well-rounded individuals within a school setting (Trudeau & Shephard, 2008). Physical education in schools focuses on nurturing students' potential by prioritizing the establishment of strong connections between their socio-emotional development, cognitive abilities, motor skills, and psychological well-being (Quennerstedt, 2019).

Physical education learning plays a significant role in education, as outlined in the Regulation of the Minister of Education of the Republic of Indonesia Number 22 of 2006. The effectiveness of physical education learning depends on various factors such as teachers, students, curriculum, facilities, infrastructure, objectives, methods, and the learning environment. It is crucial to address issues of student disinterest, as student engagement can impact the success of physical education learning. Success in physical education learning is influenced by both internal and external factors. Internal factors encompass biological aspects (mental health) and psychological aspects (intelligence, talents, interests, attention, and motivation of students) (Metzler et al., 2013). Also highlights the influence of these internal factors on students' aptitude, interest, and motivation to learn physical education. Among psychological factors, learning motivation in physical education plays a pivotal role in achieving optimal learning goals and improving overall academic performance (Jankauskiene et al., 2023). Demonstrate that students at exhibit inadequate learning motivation, which subsequently affects their learning outcomes. While research outcomes may vary, it is evident that learning motivation plays a significant role in influencing physical education learning outcomes, thereby emphasizing the importance of motivation in achieving successful learning outcomes.

Motivation serves as the fundamental drive that compels individuals to take action (Metzler et al., 2013). Self-Determination Theory (SDT) is a motivational theory that distinguishes between intrinsic and extrinsic dimensions of motivation (Ryan & Deci, 2020). The level of comfort experienced during physical education learning and PA mediates the relationship between motivation in physical education and leisure-time PA (Cox et al., 2008). Gu et al., (2018) found that student motivation in physical education learning significantly influences their participation in PA and skill development. Determined that PA has a direct impact on students' motivation in physical education learning, with a coefficient value of 0.325. It is evident that student engagement in physical education classes is influenced and shaped by motivational factors (Chen et al., 2014). Demonstrated that student learning motivation is influenced by the PA levels of both male and female students. Factors such as PA are influenced by the growth and development of the body (Brustad, 1988). Furthermore,

students' learning motivation can be influenced by their nutritional status, which in turn relates to body shape and affects growth and development (Jankauskiene et al., 2023). Optimal nutritional status plays a crucial role in promoting optimal growth and development, ultimately impacting cognitive abilities, concentration, and academic achievements (Verjans-Janssen et al., 2018). Therefore, it is essential to assess students' growth and development to understand their physical attributes (Quennerstedt, 2019). Measuring students' BMI serves as a preliminary data point for evaluating their body dimensions and composition (Verjans-Janssen et al., 2018).

Several studies have emphasized the significance of BMI as a fundamental measure for understanding students and their growth and development (Hermawan et al., 2021). In adolescents, maintaining a healthy nutritional status is crucial for ensuring normal and continuous growth (Langford et al., 2015). The assessment of weight and height provides a BMI, which serves as an indicator frequently used to determine nutritional status and assess body composition (Schwarzfischer et al., 2017). Both BMI and PA are intertwined and play essential roles in the context of physical education learning (Hwang & Kim, 2013; Reilly et al., 2000). Hsieh et al., (2014) conducted research that demonstrated a significant connection between BMI, PA, and immune levels.

PA is a crucial determinant of an individual's quality of life, particularly for children and adolescents (Jankauskiene et al., 2023). Global data from the World Health Organization reveals that insufficient PA ranks as the fourth most significant risk factor for mortality, contributing to over 2 million deaths. The 2018 Health Report of Indonesia highlights that adolescents in this age group, based on BMI, predominantly face issues of obesity or being overweight (Risksedes Kemenkes RI, 2019). Furthermore, in Central Java, specifically Sukoharjo Regency, the health profile in 2018 reveals that 15.41% of adolescents aged 15-17 years are classified as overweight or obese based on BMI (Risksedas Jawa tengah, 2019). The sedentary lifestyle poses a significant threat to the physical, social, and mental growth and development of students, adversely affecting their overall health (Skrypnik et al., 2019). These findings indicate low levels of PA, which can be attributed to poor health quality and a sedentary lifestyle. PA plays a crucial role in the development of sports skills and personal achievement for students (Jankauskiene et al., 2023; Metzler et al., 2013). Demonstrates that PA has an impact on students' academic performance, as excessive fatigue resulting from low PA levels leads to decreased learning achievement (Jankauskiene et al., 2023). Highlights that reduced PA among adolescents is often associated with excessive use of technology, which can result in social, physical, academic, psychological, and mental problems (Schwarzfischer et al., 2017).

Based on the previous explanation, it can be concluded that PA plays a significant role in influencing the motivation for physical education learning, which is currently relatively low due to the decreasing level of PA attributed to the influence of technology. Therefore, physical education learning becomes crucial in maintaining

physical fitness and promoting regular exercise, ensuring that students remain healthy even while at school. Physical education learning entails structured, planned, and continuous physical activities involving body movements. Its importance lies in its support for the PA process in students' learning at school, as excellent stamina is required to enhance learning motivation.

B. Methods

The research was conducted using a quantitative descriptive research design and employed logistic regression analysis as the analytical method. Logistic regression analysis was chosen due to its ability to examine the relationship between one dependent variable and multiple independent variables (Ghozali, 2018). The collection of data is a crucial step in research, as the primary objective is to obtain relevant and reliable data (Sugiyono, 2017). Without a clear understanding of data collection techniques, researchers may not gather data that adheres to established standards. In this study, a research questionnaire was employed as the data collection technique. A questionnaire involves presenting a set of questions to respondents for completion (Sugiyono, 2017). Questionnaires are particularly efficient when researchers possess a clear understanding of the variables to be measured and have predetermined expectations from the respondents.

Study participants

As elucidated by Sugiyono (2017b), the sample utilized in this study constituted a subgroup of the population characterized by specific attributes. The sample encompassed 202 respondents' classes of Grade X students at SMA Negeri 1 Sukoharjo, Central Java aged between 15 and 17 years, who were in sound health in the week preceding the study.

Instruments Date

Research instruments are essential tools used to measure the values of the variables under study (Sugiyono, 2017). The research procedure involved measuring height, weight, and calculating body mass index (BMI) (Jawis et al., 2005). The BMI calculation was used to determine the ideal body condition, whether underweight or overweight (Hermawan et al., 2021; Utama, Doewis, et al., 2023). The International Physical Activity Questionnaire (IPAQ) was developed by the IPAQ Group to assess physical activity (PA) worldwide. Specifically, the Physical Activity Questionnaire Adolescent (PAQ-A) is designed for upper secondary students (IPAQ, 2005; Kowalski et al., 2004). According to the Guidelines for Data Processing and Analysis of the IPAQ, PA levels are classified as follows using MET (metabolic equivalents of task) as the unit: a) High, b) Moderate, c) Low (Kowalski et al., 2004). The development of items for the physical education learning motivation instrument is based on the conceptual framework of sports motivation theory (Metzler et al., 2013). The validity test yielded a valid

correlation coefficient of $r_{table} = 0.312$. The reliability of the instrument was assessed using the Alpha-Cronbach formula, resulting in a coefficient of 0.878 (Sulaksono, 2017). To facilitate the interpretation of the research findings, the results were described using categorization based on research assessment criteria (Sugiyono, 2017). The assessment categories consisted of four criteria: 1) very low, 2) low, 3) high, and 4) very high, which were determined to maintain consistency in the Likert scale research (Nopiyanto et al., 2021; Sulaksono, 2017).

Analysis Date

The collected data was then processed and analyzed using multiple correlation analysis in the SPSS program. In this study, the data was subjected to multinomial logistic regression analysis for statistical analysis. Logistic regression analysis is a suitable approach in such cases. According to Ghozali (2018), logistic regression analysis tests the probability of predicting a dependent variable using independent variables. Unlike linear regression analysis, logistic regression analysis does not require the assumption of normal distribution for independent variables. Therefore, normality tests, heteroskedasticity tests, and classical assumption tests are not necessary for the independent variables in logistic regression analysis. Logistic regression analysis includes four tests: Overall Model Fit, Goodness of Fit Test, Nagelkerke's R Square (Coefficient of Determination), and Classification Matrix (Ghozali, 2018).

C. Results and Discussion

The research was conducted in February 2023 at SMAN 1 Sukoharjo, Central Java involving a total sample of 202 individuals from classes X students.

Table 1. Descriptive Research Sample Data by Gender, Age, and Class

Respondents (n=202)	Kind	Sum	Percent
Gender	Male	62	31%
	Female	140	69%
Age (Years)	15	96	48%
	16	103	51%
	17	3	1%

The sample was selected purposively, consisting of both male and female participants. The male respondents accounted for 31% of the total sample, with a total of 62 participants, while the female respondents accounted for 69% of the total sample, with a total of 140 participants. The age distribution of the participants was as follows: 48% were 15 years old (n=96), 51% were 16 years old (n=103), and 1% was 17 years old (n=1). These details are presented in the table below.

Table 2 Descriptive static research sample of grade X students of SMAN 1 Sukoharjo

Variable	N	Mo	Min	Max	Mean	Med	SD
BMI	202	21.08	1	34.95	20.6879	19.9	4.7
PA	202	13	8	40	18.50	17.8	3.9
Learning Motivation	202	87	34	136	104.49	104.6	11.4

Based on the data presented in Table 2, it is evident that the variable BMI has a highest score of 34.95 and a lowest score of 1, with a mean of 20.68, a median of 19.9, a mode of 21.08, and a standard deviation of 4.7. As for the PA variable, the highest score recorded is 40, while the lowest score is 8, with a mean of 18.50, a median of 17.8, a mode of 13, and a standard deviation of 3.9. Moreover, regarding the learning motivation variable, the highest score obtained is 136, whereas the lowest score is 34, with a mean of 104.4, a median of 104.6, a mode of 87, and a standard deviation of 11.4.

The obtained data were classified into four categories based on learning motivation: (1) very low, (2) low, (3) high, and (4) very high. Additionally, the PA questionnaire was filled out, and the assessment yielded three classifications: (1) low, (2) moderate, and (3) high. Furthermore, the BMI was categorized into four groups: (1) thin, (2) average, (3) overweight, and (4) obese. The results are presented in the table below:

Table 3. Frequency Distribution of Learning Motivation, BMI, and PA

		Range	Sample (n=202)	Marginal Percentage
Learning Motivation (Y) (Sulaksono, 2017)	Very Low	< 86	0	0%
	Low	87 - 98	68	33.7%
	High	99 -110	86	42.6%
	Very High	> 111	48	23.8%
BMI (X1) (Kemenkes RI, 2017)	Thin	< 18,4	74	36.6%
	Normal	18,5 - 25,0	91	45.0%
	Overweight	25,1 - 27,0	10	5.0%
	Obese	> 27,0	27	13.4%
PA (X2) (Piccinno & Colella, 2017)	Low	< 600 METs-minutes/week	75	37.1%
	Moderate	> 600 METs-minutes/week	100	49.5%
	High	>3000 METs-minutes/week	27	13.4%

Based on the table presented above (Table 3), the sample of respondents consisted of six classes of students from SMAN 1 Sukoharjo who were enrolled in the 10th grade. The data and findings obtained from a sample of 202 students (100%) are summarized as follows:

Learning motivation questionnaire (Y): 68 students (33.7%) were classified in the Low category; 86 students (42.6%) were classified in the High category; 48 students (23.8%) were classified in the Very High category.

BMI measurements (X1): 74 students (36.6%) were classified as Thin; 91 students (45.0%) were classified as Normal; 10 students (5%) were classified as Fat; 27 students (13.4%) were classified as Obese.

PA questionnaire (IPAQ) results (X2): 75 students (37.1%) were classified in the Low category; 100 students (49.1%) were classified in the Moderate category; 27 students (13.4%) were classified in the High category.

Multinomial Logistic Regression Analysis

The Information Fitting Model allows us to assess whether the inclusion of independent variables in a multinomial logistic model improves the model's fit compared to models that only include intercept data.

Table 4. Model match data -2 Log Likelihood

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	88.759			
Final	72.648	16.111	8	.041

Based on the data presented in Table 5, it is evident that there was a decrease in the value of -2 log likelihood from the intercept-only model to the final model, specifically from 88.759 to 72.648, with a significance level of $p = 0.041$. This indicates that the inclusion of an independent variable improves the model's fit. Therefore, it can be concluded that the model is deemed suitable for the analysis. The goodness-of-fit analysis in match test consists of multiple criteria, and researchers are not required to use all of these criteria to assess the suitability of the research model.

Table 5. Results Chi Square Goodness-Of-Fit Test

	Chi-Square	df	Sig.
Pearson	14.343	20	.813
Deviance	15.043	20	.774

Based on the values in Table 6, the Chi-Square statistic of 14.761 with 20 degrees of freedom yields a probability of 0.813. Since this value is greater than the significance level of 0.05 ($\alpha = 0.05$), it can be concluded that the logistic regression model is a good fit for the research data.

Table 6. Pseudo R Square Test

Cox and Snell	.094
Nagelkerke	.106
McFadden	.045

Table 7 presents three models: Cox and Snell, Nagelkerke, and McFadden. The choice of which model to use is flexible, but in this study, the researchers opted for the Nagelkerke model, which had the highest R Square. This indicates that the

independent variables, namely BMI and PA, had a modest influence on the dependent variable, represented by a Z-score of 10.6%. However, it should be noted that the remaining 89.4% of the influence is attributed to other variables not included in the study, suggesting a relatively weak relationship.

Table 7. Likelihood Ratio Tests

Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	66.380 ^a	.000	0	0.000
BMI Criteria	68.372	1.992	6	.920
PA Criteria	79.973	13.594	4	.009

Based on the data in Table 8, the following findings can be observed:

1. The intercept value has a significance value of 0.000, which is less than 0.05. This indicates that the intercept value has a significant influence on learning motivation (Y);
2. The significance value of the BMI Category variable (X1) is 0.920. This value is greater than the alpha value of 0.05, suggesting that the BMI Categories do not have a partial effect on learning motivation (Y);
3. The significance value of the PA variable (X2) is 0.009. This value is less than the alpha value of 0.05, indicating that the PA ratio has a partial effect on the Learning motivation category (Y);
4. The variable X1 is deemed insignificant, and therefore, the regression coefficient does not need to be interpreted as it lacks meaning.

Effect of Body Mass Index (BMI) on physical education Learning Motivation

The analysis of the effect of BMI on physical education learning motivation reveals that there is no significant influence. Therefore, the regression equation does not have any causal meaning. However, according to Table 9, it can be concluded that individuals with a normal BMI category have 1,802 times higher risk of experiencing a decrease in low learning motivation compared to those with a thin or overweight BMI. Contrary to this finding, previous research by Lee et al (2018) defined obesity as a disease and found a correlation between obesity and a decrease in learning motivation, leading to lower academic performance. Zoghbi et al (2022) observed a trend during the pandemic where individuals with higher BMI had lower levels of PA and increased body mass. This suggests that students and adults with low intrinsic and extrinsic motivation for exercise are more likely to be affected. Overweight individuals are often stigmatized as lazy, lacking self-control, and having poor work or study abilities (Beck, 2016). Teachers play a crucial role in overcoming this stigma and improving the quality of education by implementing strategies that maximize student learning motivation (Ciao & Latner, 2011). Research conducted by Bottamini & Ste-Marie (2006) focused on men and found that having an ideal body fosters high motivation, particularly in social aspects such as gaining acceptance from others, making a positive impression, and competing with peers. However, it is important to

note that BMI is just one of many variables that influence learning motivation, and its impact should be considered alongside other factors.

No significant differences were observed in other subjects, but it is worth noting that students with obesity had lower scores specifically in physics compared to normal-weight students. The author does not entertain hypotheses or provide additional explanations for these findings. However, it is understood that improper nutrition, such as consuming fast food or skipping breakfast, can lead to changes in students' body shape and negatively impact their well-being. Additionally, research by Lee et al. (2018) suggests that exercise has a positive effect on cognitive function in students. Therefore, it can be inferred that students who lack exercise may experience lower learning motivation, ultimately affecting their academic performance. Regarding the diagnostic criteria for obesity in children and adolescents, further investigation is required.

In a study conducted by Lubans et al (2016) on school-based obesity prevention programs, no significant results were found regarding BMI. While BMI is commonly used as a screening measure for evaluating excess body weight, it does not directly estimate body composition, as highlighted by Vanderwall et al. (2017). Thus, no changes in BMI were recorded among the participants in Lubans et al.'s study, which further supports the lack of significant BMI findings (Lubans et al., 2016). In the dissertation by Waites-Howard (2021) survey responses from students provide insights into their motivations and interests in engaging in PA to improve their overall health. There is no indication of an increase in BMI. The survey questions specifically encourage students to express their commitment to enhancing their overall health through PA. Furthermore, even though it was not a research question, student responses regarding conflict resolution were deemed relevant to health improvement (Utama, Doewes, et al., 2023). These findings collectively suggest that focusing on motivation, skill development, and support for PA may be more impactful in promoting overall health than solely targeting BMI as a measure of progress.

The Effect of Physical Activity (PA) on Learning Motivation

The research analysis revealed a significant influence of physical activity on learning motivation, indicating a causal relationship within the regression equation. Referring to Table 9, it can be concluded that individuals engaging in high PA exhibit a substantial 8.622- fold increase in high learning motivation compared to those with low or moderate PA. These findings align with previous research conducted by Cox et al (2008), which found a positive association between motivation and leisure-time PA, as well as the impact of self-determined motivation on engaging in physical activities during leisure. Additionally, the study by Pot et al (2018) emphasizes the importance of PA in enhancing cognitive performance, as physical appreciation continues to play a significant role alongside cognitive appreciation. It highlights that PA contributes to complex processes involving skill development, learning,

assimilation of values, norms, self-perception, and identity (Schwarzfischer et al., 2017).

Regular PA has been shown to have direct health benefits, including positive effects on body composition and musculoskeletal development (Ortega et al., 2008; Schou et al., 2015). In the school setting, physical education should be viewed as an opportunity to promote PA that complements other active opportunities available to students, such as before and after school, during lunch, breaks, and in community settings. This includes considering the educational aspect of the lesson and the potential impact of interventions on students' motivation and attitudes towards PA. Research has highlighted the positive effects of incorporating fitness activities into lessons focused on skill acquisition, leading to increased PA and motor development (Fairclough & Stratton, 2006). PA when integrated with physical education learning, promotes cooperation, tolerance, enjoyment, self-confidence, and ultimately enhances students' learning motivation. Physical education teachers play a crucial role in influencing students' motivation to be physically active during sports lessons (Wicaksono & Utama, 2020). It is important to bridge the gap between theoretical knowledge of motivation and its application in the context of PA (Rosenkranz et al., 2012).

The influence of body mass index (BMI) criteria and physical activity (PA) criteria on learning motivation

The overall analysis revealed that BMI and physical activity criteria have a limited influence on physical education learning motivation, accounting for only 33.4% of the variance with a low category. The remaining portion of the variance is attributed to other variables not considered in the study. Modern perspectives on motivation suggest that biologically based impulses and incentives can explain only a small fraction of human behavior. It is evident that behavior can occur even when there is no immediate biological need such as hunger, sexual arousal, or thirst. Therefore, understanding learned motives is crucial for comprehending the complexity of motivational behavior (Jolla, 2010). In the multinomial analysis, both BMI criteria and PA criteria showed an influence on physical education learning motivation. Interestingly, when the criteria were tested independently, only the PA variable was found to have a significant impact on learning motivation among physical education students. This highlights the interconnectedness of BMI and PA, suggesting that both factors need to be considered together rather than in isolation.

Nevertheless, the stigma surrounding BMI remains largely unchanged, resulting in students experiencing fatigue and a subsequent decline in their motivation to learn. Fortunately, the research findings suggest that BMI does not significantly impact learning motivation. However, these findings can contribute to prejudiced attitudes towards students, leading to disruptions in teacher-student relationships and a decrease in student motivation, ultimately compromising the quality of education. Moreover, students with an obese BMI often face personal blame for their poor

learning outcomes, attributed to a perceived lack of motivation. Therefore, teachers can enhance the quality of education by employing strategies that maximize learning motivation, creating a more engaging learning environment and fostering student motivation (Putri & Utama, 2021).

In reality, it is crucial to conceptually differentiate and measure BMI, PA, and student learning motivation separately to determine their actual impact on the desired outcomes. Both BMI and PA can be categorized as engagement, which refers to the outcomes that can be derived from active participation. BMI engagement and PA are integral components of the daily academic resilience process, providing students with an energetic resource to cope more effectively with the everyday stresses, challenges, and setbacks encountered in school. Through effective coping experiences, long-term motivational mindsets and skill sets can be developed, such as self-directed learning styles, mastery orientations, independent learning, and a positive academic identity. Ultimately, these contribute to the student's academic progress throughout the school year and their educational journey (Christenson et al., 2012). Therefore, engagement can be recognized as a crucial factor in fostering academic assets that evolve over time and shape the student's educational trajectory.

D. Conclusion

The findings of this study suggest a relationship between Body Mass Index (BMI) and learning motivation. However, it was observed that changes in student BMI can also have a negative impact on learning motivation due to other factors. BMI is a crucial public health indicator that plays a significant role in finding creative and sustainable solutions for learning, considering the influence of PA on student motivation. This finding highlights the importance of student engagement in school activities, which significantly contributes to their learning experiences. It can be concluded that higher levels of PA are associated with increased learning motivation. This underscores the challenges faced in recruiting and retaining students in both educational and community settings.

Therefore, it can be concluded that while BMI and PA do have an impact on learning motivation, their influence is limited in comparison to other factors. Therefore, maintaining a healthy lifestyle becomes crucial as it indirectly affects learning motivation. However, it is essential to consider the level of PA undertaken by the student in conjunction with their BMI to gain a comprehensive understanding of the relationship. The findings of this study have implications that can be categorized into three themes identified through the analysis while nutrition or diet is not the primary focus of this study, it may be beneficial for future research to incorporate a focus on nutrition within the research design. Studies combining parental intervention with nutrition have demonstrated potential. Further research could explore the differential impact of parental involvement and peer influence on overall health.

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References

- Beck, A. R. (2016). Psychosocial Aspects of Obesity. *NASN School Nurse (Print)*, 31(1), 23–27. <https://doi.org/10.1177/1942602X15619756>
- Bottamini, G., & Ste-Marie, D. M. (2006). Male voices on body image. *International Journal of Men's Health*, 5(2), 109–132. <https://doi.org/10.3149/jmh.0502.109>
- Brustad, R. J. (1988). Affective Outcomes in Competitive Youth Sport : The Influence of Intrapersonal and Socialization Factors. *Journal of Sport and Exercise Psychology*, 10, 307–321.
- Chen, S., Sun, H., Zhu, X., & Chen, A. (2014). Relationship between motivation and learning in physical education and after-school physical activity. *Research Quarterly for Exercise and Sport*, 85, 468–477. <https://doi.org/10.1080/02701367.1989.10607423>
- Christenson, S. L., Wylie, C., & Reschly, A. L. (2012). Handbook of Research on Student Engagement. *Handbook of Research on Student Engagement*, 1–840. <https://doi.org/10.1007/978-1-4614-2018-7>
- Ciao, A. C., & Latner, J. D. (2011). Reducing obesity stigma: The effectiveness of cognitive dissonance and social consensus interventions. *Obesity*, 19(9), 1768–1774. <https://doi.org/10.1038/oby.2011.106>
- Cox, A. E., Smith, A. L., & Williams, L. (2008). Change in Physical Education Motivation and Physical Activity Behavior during Middle School. *Journal of Adolescent Health*, 43(5), 506–513. <https://doi.org/10.1016/j.jadohealth.2008.04.020>
- Fairclough, S. J., & Stratton, G. (2006). Effects of a physical education intervention to improve student activity levels. *Physical Education & Sport Pedagogy*, 11(1), 29–44. <https://doi.org/10.1080/17408980500467613>
- Ghozali, I. (2018). *Aplikasi Analisis Multivariate Dengan Program IBM SPSS 25* (Edisi 9). Badan Penerbit Universitas Diponegoro.
- Gu, X., Chen, Y. L., Jackson, A. W., & Zhang, T. (2018). Impact of a pedometer-based goal-setting intervention on children's motivation, motor competence, and physical activity in physical education. *Physical Education and Sport Pedagogy*, 23(1), 54–65. <https://doi.org/10.1080/17408989.2017.1341475>
- Hermawan, R., Sutarsyah, C., Dahlan, S., Nurseto, F., & Cahyadi, A. (2021). Anthropometry Profile and Physiological Characteristics of Athletes from Education and Sports Training Centre (PPLP) Lampung Province. *Linguistica Antverpiensia*, 3, 880–887.
- Hsieh, P. L., Chen, M. L., Huang, C. M., Chen, W. C., Li, C. H., & Chang, L. C. (2014). Physical activity, body mass index, and cardiorespiratory fitness among school

- children in Taiwan: A cross-sectional study. *International Journal of Environmental Research and Public Health*, 11(7), 7275–7285.
<https://doi.org/10.3390/ijerph110707275>
- Hwang, J., & Kim, Y. H. (2013). Physical activity and its related motivational attributes in adolescents with different BMI. *International Journal of Behavioral Medicine*, 20(1), 106–113. <https://doi.org/10.1007/s12529-011-9196-z>
- IPAQ. (2005). *Guidelines For Data Processing and Analysis of The International Physical Activity Questionnaire (IPAQ) Short and Long Forms*.
- Jankauskiene, R., Urmanavicius, D., & Baceviciene, M. (2023). Association between Motivation in Physical Education and Positive Body Image: Mediating and Moderating Effects of Physical Activity Habits. *International Journal of Environmental Research and Public Health*, 20(1).
<https://doi.org/10.3390/ijerph20010464>
- Jawis, M. N., Singh, R., Singh, H. J., & Yassin, M. N. (2005). Anthropometric and physiological profiles of sepak takraw players. *British Journal of Sports Medicine*, 39(11), 825–829. <https://doi.org/10.1136/bjism.2004.016915>
- Jolla, L. (2010). Historical Views on Motivation. *Elsevier*, 261–266.
- Kemenkes RI. (2017). *Nutritional status assessment*. Kementerian Kesehatan RI.
- Kowalski, K. C., Crocker, P. R. E., & Donen, R. M. (2004). *The Physical Activity Questionnaire for Older Children (PAQ-C) and Adolescents (PAQ-A) Manual* (Issue August). University of Saskatchewan. <papers://305a9bed-f721-4261-8df7-5414758c1624/Paper/p910>
- Langford, R., Bonell, C., Jones, H., & Campbell, R. (2015). Obesity prevention and the Health promoting Schools framework: Essential components and barriers to success. *International Journal of Behavioral Nutrition and Physical Activity*, 12(1), 1–17. <https://doi.org/10.1186/s12966-015-0167-7>
- Lee, S. Y., Kim, J. H., Geum, C. R., Wu, S. J., & Kim, J. S. (2018). The association between body mass index and academic performance. *Saudi Medical Journal*, 39(2), 217. <https://doi.org/10.15537/smj.2018.2.21918>
- Lubans, D., Richards, J., Hillman, C., Faulkner, G., Beauchamp, M., Nilsson, M., Kelly, P., Smith, J., Raine, L., & Biddle, S. (2016). Physical activity for cognitive and mental health in youth: A systematic review of mechanisms. *Pediatrics*, 138(3). <https://doi.org/10.1542/peds.2016-1642>
- Metzler, M. W., McKenzie, T. L., van der Mars, H., Barrett-Williams, S. L., & Ellis, R. (2013). Health Optimizing Physical Education (HOPE): A New Curriculum for School Programs – Part 1: Establishing the Need and Describing the Model. *Journal of Physical Education, Recreation & Dance*, 84(4), 41–47. <https://doi.org/10.1080/07303084.2013.773826>
- Nopiyanto, Y. E., Sutisyana, A., Raibowo, S., & Yarmani. (2021). Blended learning with jigsaw in increasing interest, motivation, and learning outcomes in sports sociology learning. *Kinestetik: Jurnal Ilmiah Pendidikan Jasmani*, 5(1), 26–34. <https://doi.org/https://doi.org/10.33369/jk.v5i1.13905>
- Ortega, F. B., Ruiz, J. R., Castillo, M. J., & Sjörström, M. (2008). Physical fitness in childhood and adolescence: A powerful marker of health. *International Journal of*

- Obesity*, 32(1), 1–11. <https://doi.org/10.1038/sj.ijo.0803774>
- Piccinno, A., & Colella, D. (2017). Differences in cardiovascular fitness of Italian high-school adolescents according to different physical activity levels assessed by IPAQ-A: a cross-sectional study. *Sport Sciences for Health*, 13(1), 149–155. <https://doi.org/10.1007/s11332-016-0326-5>
- Poobalan, A. S., Aucott, L. S., Clarke, A., & Smith, W. C. S. (2012). Physical activity attitudes, intentions and behaviour among 18–25 year olds: A mixed method study. *BMC Public Health*, 12(640), 1–10. <https://doi.org/http://www.biomedcentral.com/1471-2458/12/640>
- Pot, N., Whitehead, M. E., & Durden-Myers, E. J. (2018). Physical literacy from philosophy to practice. *Journal of Teaching in Physical Education*, 37(3), 246–251. <https://doi.org/10.1123/jtpe.2018-0133>
- Putri, A. R., & Utama, D. D. P. (2021). Physical Fitness of Elementary School Students: Which is better, Circuit Training A and Circuit Training B? *Jp.Jok (Jurnal Pendidikan Jasmani, Olahraga Dan Kesehatan)*, 5(1), 91–100. <https://doi.org/10.33503/jp.jok.v5i1.1379>
- Quennerstedt, M. (2019). Physical education and the art of teaching: transformative learning and teaching in physical education and sports pedagogy. *Sport, Education and Society*, 24(6), 611–623. <https://doi.org/10.1080/13573322.2019.1574731>
- Reilly, T., Bangsbo, J., & Franks, A. (2000). Anthropometric and physiological predispositions for elite soccer. *Journal of Sports Sciences*, 18(9), 669–683. <https://doi.org/10.1080/02640410050120050>
- Riskesdas Jawa tengah. (2019). Central Java Province Report Riskesdas 2018. In *Kementerian Kesehatan RI. Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI*.
- Riskesdes Kemenkes RI. (2019). *Central Java Province Report Riskesdas 2018* (pp. 1–674). Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI. http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan_Nasional_RKD2018_FINAL.pdf
- Rosenkranz, R. R., Lubans, D. R., Peralta, L. R., Bennie, A., Sanders, T., & Lonsdale, C. (2012). A cluster-randomized controlled trial of strategies to increase adolescents physical activity and motivation during physical education lessons: The Motivating Active Learning in Physical Education (MALP) trial. *BMC Public Health*, 12(1), 1. <https://doi.org/10.1186/1471-2458-12-834>
- Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, 61, 101860. <https://doi.org/10.1016/j.cedpsych.2020.101860>
- Schou, H. A. J., Klakk, H., Husby, S., Wedderkopp, N., & Mølgaard, C. (2015). The Influence of Anthropometry and Body Composition on Children ' s Bone Health : The Childhood Health , Activity and Motor Performance School (The CHAMPS) Study , Denmark. *Calcified Tissue International*, 96, 97–104. <https://doi.org/10.1007/s00223-014-9941-9>

- Schwarzfischer, P., Weber, M., Gruszfeld, D., Socha, P., Luque, V., Escribano, J., Xhonneux, A., Verduci, E., Mariani, B., Koletzko, B., & Grote, V. (2017). BMI and recommended levels of physical activity in school children. *BMC Public Health*, 17(1), 1-9. <https://doi.org/10.1186/s12889-017-4492-4>
- Skrypnik, D., Bogdański, P., Skrypnik, K., Mądry, E., Karolkiewicz, J., Szulińska, M., Suliburska, J., & Walkowiak, J. (2019). Influence of endurance and endurance-strength training on mineral status in women with abdominal obesity: a randomized trial. *Medicine*, 98(12), e14909-e14909. <https://doi.org/10.1097/MD.00000000000014909>
- Sugiyono. (2017). *Statistics for Research* (Ed. 29). Alfabeta Publisher.
- Sulaksono, T. I. (2017). *Motivation of Class XI Students in Participating in Physical Education Learning at Yogyakarta City High School in 2016*. Universitas Negeri Yogyakarta.
- Trudeau, F., & Shephard, R. J. (2008). Physical education, school physical activity, school sports and academic performance. *International Journal of Behavioral Nutrition and Physical Activity*, 5(1), 10. <https://doi.org/10.1186/1479-5868-5-10>
- Ullrich-French, S., McDonough, M. H., & Smith, A. L. (2012). Social connection and psychological outcomes in a physical activity-based youth development setting. *Research Quarterly for Exercise and Sport*, 83(3), 431-441. <https://doi.org/http://dx.doi.org/10.1080/02701367.2012.10599878> PLEASE
- Utama, D. D. P., Doewes, M., Ekawati, F. F., & Riyadi, S. (2023). Physical Activity and Learning Motivation of Middle School Students: An Overview of Nutritional Status. In R. Perdana (Ed.), *Prosiding Seminar Nasional Fakultas Keguruan dan Ilmu Pendidikan* (pp. 98-116). Fakultas Keguruan dan Ilmu Pendidikan.
- Utama, D. D. P., Doewis, M., Ekawati, F. F., & Riyadi, S. (2023). The Effect of Anthropometry and Physical Activity toward Elementary School Students ' Interest in Learning Sport. *Jurnal Pendidikan Progresif*, 13(2), 659-668. <https://doi.org/10.23960/jpp.v13.i2.202339>
- Vanderwall, C., Randall Clark, R., Eickhoff, J., & Carrel, A. L. (2017). BMI is a poor predictor of adiposity in young overweight and obese children. *BMC Pediatrics*, 17(1), 4-9. <https://doi.org/10.1186/s12887-017-0891-z>
- Verjans-Janssen, S. R. B., Van De Kolk, I., Van Kann, D. H. H., Kremers, S. P. J., & Gerards, S. M. P. L. (2018). Effectiveness of school-based physical activity and nutrition interventions with direct parental involvement on children's BMI and energy balance-related behaviors - A systematic review. *PLoS ONE*, 13(9), 1-24. <https://doi.org/10.1371/journal.pone.0204560>
- Waites-Howard, S. J. (2021). *A Case Study Exploring the Influence of Self-Efficacy, Physical Activity, and Health Education on Body Mass Index and Latino Middle Student Overall Health*. Trident University International.
- Wicaksono, L., & Utama, D. D. P. (2020). Utilization of ICT-Based Learning Media by Physical Education Teachers in Bandar Lampung City. *Jurnal Kejaora (Kesehatan Jasmani Dan Olah Raga)*, 5(1), 41-49. <https://doi.org/10.36526/kejaora.v5i1.846>
- Zoghbi, A. El, Milanović, I., Janić, S. R., Mirkov, D., & Kukić, F. (2022). Effects of a Three-Month COVID-19 Lockdown on Body Mass and Nutritional Status of

Lebanese Students Who Study Physical Education. *Sustainability (Switzerland)*,
14(3). <https://doi.org/10.3390/su14031196>