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Physical Activity Levels and Vo_2Max Capacity Among Senior High School, Vocational High School, and Islamic Senior High School Students in East Purwokerto: A Comparative Study

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ABSTRACT: Physical activity is one of the important factors that affect the physical fitness of adolescents, especially VO_2Max capacity as the main indicator of cardiorespiratory fitness. However, the level of physical activity of students can vary depending on the type of school, curriculum, and learning environment. This study aims to compare the levels of physical activity and VO_2Max capacity among high school, vocational school, and Islamic high school students in East Purwokerto. The research method used a comparative quantitative approach with a cross-sectional design. The research sample consisted of 100 11th grade students, comprising 34 high school students, 34 vocational school students, and 32 Islamic high school students. The instruments used were the Physical Activity Questionnaire for Adolescents (PAQ-A) to measure physical activity levels and the Multistage Fitness Test (beep test) to measure VO_2Max capacity. Data analysis included Kolmogorov-Smirnov normality test, Levene's Test of homogeneity, and one-way ANOVA test. The results showed that, descriptively, high school students had higher levels of physical activity and VO_2Max capacity than vocational school students, while MA students were in the middle. The frequency distribution showed that the majority of students were in the moderate category for physical activity (51%) and the good category for VO_2Max (26%). Normality and homogeneity tests showed that the data were normally distributed and homogeneous ($p > 0.05$). However, the results of the one-way ANOVA test showed that the differences between school groups were not significant, both in physical activity ($F = 1.72$; $p = 0.184$) and VO_2Max ($F = 1,93$; $p = 0,152$).

KEYWORDS: physical activity, VO_2Max, Senior High School, Vocational High School, Islamic High School, adolescents

INTRODUCTION

Physical activity is an integral part of a healthy lifestyle that plays a crucial role in supporting adolescent growth and development. At the secondary school level, physical activity not only helps maintain physical fitness but also contributes to mental health, learning concentration, and overall quality of life. Adolescents who are physically active tend to have better cardiorespiratory fitness, lower risk of metabolic diseases, and more stable academic performance (Sopiah et al., 2021). Thus, physical activity can be considered a long-term investment for adolescent health.

The World Health Organization (2020) recommends that adolescents aged 15–17 engage in at least 60 minutes of moderate- to vigorous-intensity physical activity daily. This includes aerobic exercises, muscle-strengthening activities, and daily physical activities that can elevate heart rate and breathing. Unfortunately, in the digital era, sedentary behaviors are increasingly prevalent due to the dominance of gadgets, social media, and technology-based entertainment. This phenomenon has the potential to reduce adolescents' involvement in physical activity, including within the school environment (Tranggono et al., 2023).

One of the key indicators of cardiorespiratory fitness widely used in research is VO_2Max capacity, defined as the maximal ability of the body to absorb, transport, and utilize oxygen during intensive physical activity. VO_2Max reflects the efficiency of the cardiovascular and respiratory systems in supporting muscle performance; thus, the higher the VO_2Max capacity, the better the endurance level of an individual (Bafirman et al., 2023). In the adolescent context, VO_2Max capacity can be influenced by physical activity, gender, body mass index, and daily lifestyle habits (Chen et al., 2023).

Differences in secondary school types may also influence adolescents' physical activity levels. Students in Senior High Schools (SMA) tend to participate more in sports extracurricular activities and competitive school events. Conversely, Vocational High Schools (SMK) emphasize vocational skills, often leaving students with limited time for regular physical activity. Meanwhile, Islamic

Senior High Schools (MA) integrate academic and religious education, which may affect how students allocate their time for study and physical activity (Susanto, 2021).

This condition illustrates that adolescents' physical activity habits are shaped not only by individual factors but also by different educational environments. Previous studies reported that SMA students have higher physical activity levels compared to SMK students, while MA students are in an intermediate position (Putri & Andriani, 2022). However, most of these studies were conducted in large urban areas, indicating the need for more specific research in regions with distinct social and cultural characteristics, such as East Purwokerto.

East Purwokerto is one of the educational hubs in Banyumas Regency, hosting a variety of secondary schools, including SMA, SMK, and MA. The growing urban environment provides both opportunities and challenges for adolescents' physical activity. On one hand, there are accessible sports facilities, fitness communities, and school sporting events; on the other hand, the trend of gadget use and sedentary lifestyle is becoming increasingly prevalent among students (Nabawiyah et al., 2023). This situation potentially creates variations in physical activity levels and VO_2Max capacity across school types.

National health survey results indicate that insufficient physical activity among Indonesian adolescents remains high. The 2023 Basic Health Research (Riskesdas, 2023) reported that more than 40% of adolescents aged 15–18 years did not meet the minimum daily physical activity recommendations. This is concerning, as low levels of physical activity can reduce VO_2Max capacity, increase obesity risk, and trigger non-communicable diseases from an early age (Ramadhania et al., 2024). Therefore, research examining adolescent physical activity is highly relevant.

In addition to curriculum differences, adolescents' lifestyles are also shaped by sociocultural factors and global trends. The rising popularity of social media-driven sports activities, such as running, cycling, and gym workouts, presents opportunities to promote active lifestyles. However, such involvement is often seasonal and lacks integration into daily routines (Setiadi & Agus, 2020). Hence, schools play a vital role in shaping more consistent and sustainable physical activity patterns.

Several international studies confirm a positive correlation between physical activity and VO_2Max capacity among adolescents (Booth et al., 2020; Olson et al., 2023). Physically active adolescents demonstrate higher VO_2Max levels compared to their less active peers. This aligns with fundamental principles of exercise physiology, which suggest that cardiovascular and respiratory adaptations occur optimally when the body is regularly exposed to aerobic training stimuli (Kenney et al., 2021). Therefore, it is essential to evaluate and compare the levels of physical activity and VO_2Max across different school types.

Based on this background, the present study focuses on a comparative analysis of physical activity levels and VO_2Max capacity among SMA, SMK, and MA students in East Purwokerto. This study is expected to provide empirical insights into adolescents' physical activity patterns across the three school types while addressing the research gap regarding the influence of educational environments on physical fitness. The findings are anticipated to serve as a foundation for schools, local governments, and policymakers in designing more targeted programs to promote adolescent physical activity.

METHOD

This study employed a quantitative approach with a comparative design, as the main objective was to compare the levels of physical activity and VO_2Max capacity among students in three types of secondary schools: Senior High Schools (SMA), Vocational High Schools (SMK), and Islamic Senior High Schools (MA). The comparative design was chosen to provide empirical insights into differences between groups based on school types, each of which has distinct curricular structures, academic workloads, and extracurricular activity patterns. Such a design is also relevant to explore the extent to which educational environments influence adolescents' active lifestyles and physical fitness (Creswell & Creswell, 2018).

The research was conducted in East Purwokerto, Banyumas Regency, Central Java, an urban area with a high level of educational heterogeneity. Schools in this region were selected because they represent diverse educational settings, ranging from academically oriented schools (SMA), vocational skill-based schools (SMK), to religion-based schools (MA). The study was carried out in the 2024/2025 academic year, taking into account the school calendar and coordinating with school authorities to ensure that data collection did not interfere with the teaching and learning process.

The study population consisted of all Grade XI students in SMA, SMK, and MA located in East Purwokerto. Grade XI was selected because students at this level are considered to have greater physical and mental stability compared to Grade X students, who are still adapting, and Grade XII students, who are more focused on final exam preparation. The sampling technique used was proportional stratified random sampling to ensure adequate representation from each school type. Based on the calculation, the total sample consisted of 100 students: 34 from SMA, 34 from SMK, and 32 from MA, determined according to population proportion and research feasibility.

The research instruments consisted of two components. First, the level of physical activity was measured using the Physical Activity Questionnaire for Adolescents (PAQ-A), which has been internationally validated as a tool for assessing adolescent physical activity (Andriyani et al., 2024; Sholahuddin et al., 2024). The instrument is in the form of a questionnaire with a 1–5 rating scale that reflects the frequency and intensity of physical activities during the past week. Second, VO_2Max capacity was measured using the Multistage Fitness Test (beep test), which involves running back and forth over a 20-meter distance with progressively increasing intensity until the participant is unable to continue. This test was selected because it is practical, reliable, and widely applied in adolescent fitness research (Bafirman et al., 2023).

Prior to the testing, socialization was conducted with school authorities, PE teachers, and students to explain the objectives and procedures of the study. Data collection procedures adhered to health and safety principles, including pre-test health checks, warm-up sessions, and the presence of medical personnel during testing. Questionnaire administration was carried out in classrooms under the supervision of the researcher and teachers, while the beep test was conducted on school sports fields under standard conditions, including a flat 20-meter track and appropriate audio equipment.

To ensure validity and reliability, the PAQ-A instrument had previously been tested for reliability among Indonesian adolescents, yielding a Cronbach's alpha coefficient above 0.70, which indicates high reliability (Safitri et al., 2023). Meanwhile, the beep test has been shown to have strong criterion validity, with a high correlation (r = 0.84) to laboratory treadmill test measurements of VO_2Max (Castro-Piñero et al., 2010). This confirms that the instruments used in this study have satisfactory accuracy and consistency.

Data analysis was conducted in two stages. First, descriptive analysis was performed to describe participant characteristics, including the distribution of physical activity levels and average VO_2Max values. Second, inferential analysis was employed to test the hypothesis regarding differences between school groups. If the assumptions of normality and homogeneity were met, a one-way ANOVA test was applied; if not, the non-parametric Kruskal-Wallis test was used. A post hoc Tukey test was conducted when significant group differences were found, in order to determine which pairs of groups differed significantly. All analyses were carried out using the latest version of SPSS statistical software.

RESULT

This study involved 100 Grade XI students, consisting of 34 SMA students, 34 SMK students, and 32 MA students in East Purwokerto during the 2024/2025 academic year. All participants completed the *Physical Activity Questionnaire for Adolescents* (PAQ-A) and performed the *Multistage Fitness Test* (beep test) to assess VO_2Max capacity. Descriptive analysis revealed variations in both physical activity levels and VO_2Max capacity among school types, although the overall distribution tended to fall within the moderate category.

Table 1. Distribution of PAQ-A Scores by School Type

Physical Activity Category	SMA (n=34)	SMK (n=34)	MA (n=32)	Total (n=100)
Low	4 (11.8%)	15 (44.1%)	8 (25.0%)	27 (27.0%)
Moderate	21 (61.8%)	13 (38.2%)	17 (53.1%)	51 (51.0%)
High	9 (26.4%)	6 (17.7%)	7 (21.9%)	22 22.0%)

Based on Table 1, the majority of SMA students were classified in the moderate physical activity category (61.8%), with 26.4% in the high category and only 11.8% in the low category. In contrast, most SMK students fell in the low category (44.1%), and only 17.7% reached the high category. MA students predominantly belonged to the moderate category (53.1%), with relatively balanced proportions in the low (25.0%) and high (21.9%) categories. Overall, more than half of the participants (51.0%) were in the moderate category, 27.0% in the low category, and 22.0% in the high category.

Table 2. Distribution of VO_2Max Capacity by School Type

VO_2Max Category	SMA (n=34)	SMK (n=34)	MA (n=32)	Total (n=100)
Very Poor	2 (5.9%)	6 (17.6%)	4 (12.5%)	12 (12.0%)
Poor	4 (11.8%)	9 (26.5%)	6 (18.8%)	19 (19.0%)
Moderate	7 (20.6%)	8 (23.5%)	9 (28.1%)	24 (24.0%)
Good	12 (35.3%)	7 (20.6%)	7 (21.9%)	26 (26.0%)
Excellent	9 (26.4%)	4 (11.8%)	6 (18.7%)	19 (19.0%)

Table 2 shows that SMA students had the highest distribution in the "Good" (35.3%) and "Excellent" (26.4%) categories, indicating that more than half of SMA students had relatively high VO_2Max capacity. Conversely, SMK students were mostly concentrated in the "Poor" (26.5%) and "Very Poor" (17.6%) categories, suggesting lower VO_2Max capacity. Meanwhile, MA students were relatively evenly distributed across the "Moderate" (28.1%), "Good" (21.9%), and "Excellent" (18.7%) categories. In total, the highest proportions were in the "Good" (26.0%) and "Moderate" (24.0%) categories, whereas 12.0% of students fell into the "Very Poor" category.

Before conducting the analysis of mean differences in physical activity levels and VO_2Max capacity among school groups, preliminary assumption tests were carried out, including normality and homogeneity tests. The normality test was performed to ensure that the data were normally distributed, while the homogeneity test was conducted to examine the equality of variances across groups. If both assumptions were met, the data could be further analyzed using a parametric test, namely one-way ANOVA. The results of the normality test using the Kolmogorov-Smirnov method are presented in Table 3.

Table 3. Normality Test (Kolmogorov-Smirnov)

Variable	K-S Statistic	Sig. (p)	Remark
Physical Activity	0.081	0.200	Normal
VO_2Max	0.073	0.200	Normal

As shown in Table 3, the significance values (p) for both physical activity and VO_2Max were 0.200, which is greater than 0.05. This indicates that the data for both variables were normally distributed. Therefore, the assumption of normality was fulfilled, and the analysis could proceed using parametric testing.

Subsequently, a test of homogeneity of variances was conducted using Levene's Test. The results are shown in Table 4.

Table 4. Homogeneity Test (Levene's Test)

Variable	F	Sig. (p)	Remark
Physical Activity	2.05	0.134	Homogeneous
VO_2Max	1.45	0.241	Homogeneous

As presented in Table 4, significance values for physical activity (0.134) and VO_2Max (0.241) were both greater than 0.05. This result indicates that the variances across groups were homogeneous. Thus, the assumption of homogeneity was satisfied.

After both assumptions were met, one-way ANOVA was applied to test the mean differences among the school groups. The results are presented in Table 5.

Table 5. One-Way ANOVA Results

Variable	F	Sig. (p)	Remark
Physical Activity	1.72	0.184	Not Significant
VO_2Max	1.93	0.152	Not Significant

As shown in Table 5, the significance values were 0.184 for physical activity and 0.152 for VO_2Max. Both values exceeded 0.05, which means that there were no statistically significant differences in either physical activity levels or VO_2Max capacity among SMA, SMK, and MA students in East Purwokerto. These findings suggest that although descriptive statistics indicated variations—where SMA students tended to demonstrate higher levels of physical activity and VO_2Max, SMK students showed lower levels, and MA students were in the intermediate range—the differences were not statistically strong. In other words, the type of school (SMA, SMK, or MA) is not a significant determinant of adolescents' physical activity or VO_2Max capacity within the studied population. This condition can be interpreted as evidence that adolescent physical activity is more strongly influenced by individual and environmental factors outside the school setting, such as lifestyle, family support, social environment, and access to sports facilities, rather than by differences in school curricula. Therefore, interventions aimed at improving adolescents' physical activity and VO_2Max should focus not only on school policies but also on the daily lifestyle patterns practiced by students.

DISCUSSION

The findings of this study indicate that there were no significant differences in either physical activity levels or VO_2Max capacity among SMA, SMK, and MA students in East Purwokerto. This result is noteworthy because descriptive statistics showed that SMA students tended to demonstrate higher levels of physical activity and VO_2Max compared to SMK students, while MA students occupied an intermediate position. However, the magnitude of these differences was insufficient to reach statistical significance. This suggests that the type of school may not serve as a decisive determinant of adolescents' physical fitness levels.

One plausible explanation for the lack of significant differences lies in the increasing homogeneity of adolescent lifestyles in the digital era. The widespread penetration of technology, particularly the use of smartphones and social media platforms, has contributed to the standardization of daily routines among students regardless of their educational setting. Recent studies have highlighted that excessive screen time is negatively correlated with engagement in both structured and unstructured physical activities among adolescents (Tranggono et al., 2023; Olson et al., 2023). Consequently, despite differences in curricular orientation, the impact of digital lifestyles appears to minimize variation in physical activity levels across school types.

Another contributing factor may be the strong influence of social environments beyond the school setting. Variables such as family support, access to recreational facilities, and community-based sports opportunities play substantial roles in shaping physical activity habits among adolescents (Ramadhania et al., 2024). In this context, the relatively similar socio-cultural conditions across SMA, SMK, and MA students in East Purwokerto could explain why inter-school differences were not pronounced.

The geographical context and access to sports infrastructure must also be considered. East Purwokerto provides relatively equitable access to sports facilities, such as sports fields, fitness centers, and public recreational spaces. Booth et al. (2020) emphasized that the availability of accessible facilities helps to reduce disparities in physical activity across demographic groups. The presence of such resources across the region likely facilitated comparable opportunities for engagement in physical activity among students from different school types.

Interestingly, these findings diverge from some previous research that reported significant differences between SMA and SMK students. For instance, Putri and Andriani (2022) found that SMA students were more active than SMK students due to greater participation in extracurricular sports activities. The discrepancy between past and current findings may be attributed to shifts in adolescent lifestyles, which are becoming increasingly homogeneous. National survey data (Riskesdas, 2023) revealed that insufficient physical activity was reported by more than 40% of Indonesian adolescents, regardless of school type, further supporting this interpretation.

Methodological considerations also warrant attention. Although the sample size of 100 students was sufficient for descriptive analysis, it may not have been large enough to detect subtle inter-group differences. Larger-scale studies or those covering multiple regions may yield more robust evidence regarding differences in physical activity and VO_2Max among school types.

From a physiological perspective, VO_2Max capacity in adolescents is influenced by multiple factors beyond physical activity, including genetics, age, sex, and nutritional status (Chen et al., 2023). If these characteristics were relatively uniform across the sample population in East Purwokerto, it would not be surprising that mean VO_2Max values did not differ significantly among SMA, SMK, and MA students. This underscores the importance of incorporating covariates and control variables in future studies on adolescent fitness.

It is also possible that school-level policies did not substantially differ in terms of opportunities for physical activity. Although SMA, SMK, and MA emphasize distinct curricular orientations, the subject of Physical Education (PJOK) is mandated across all three school types. This uniformity may serve as a balancing factor, ensuring that students, irrespective of school type, maintain at least a minimum level of structured physical activity within their formal education.

The implications of these findings are significant for adolescent health and educational policy. Since school type was not a significant determinant of physical activity or VO_2Max capacity, efforts to enhance adolescent fitness should be designed as cross-school initiatives. Programs such as community-based sports events, the provision of public sports facilities, and campaigns targeting reductions in sedentary behavior may prove more effective than strategies focusing solely on a particular type of school.

In summary, this study highlights that the homogenization of adolescent lifestyles in the modern era has diminished previously observed differences in physical activity and VO_2Max among SMA, SMK, and MA students. Although no statistically significant differences were detected, this emphasizes the need for comprehensive strategies involving schools, families, and communities to collectively foster healthier and more active lifestyles among adolescents.

CONCLUSIONS

This study aimed to compare the levels of physical activity and VO_2Max capacity among SMA, SMK, and MA students in East Purwokerto. The descriptive analysis revealed observable variations, with SMA students tending to demonstrate higher physical

activity and VO_2Max levels than SMK students, while MA students occupied an intermediate position. However, the results of the one-way ANOVA indicated that these differences were not statistically significant ($p > 0.05$).

These findings suggest that school type does not play a decisive role in determining adolescents' physical activity levels or VO_2Max capacity. Instead, other factors such as lifestyle habits, family support, social environment, accessibility of sports facilities, and the pervasive influence of digital culture are likely to exert a more dominant influence on adolescent fitness in East Purwokerto.

The implications of this research highlight the importance of adopting cross-school strategies to enhance physical activity rather than focusing solely on curriculum-based approaches within SMA, SMK, or MA. Effective interventions should simultaneously involve families, schools, and communities through initiatives such as improving access to sports facilities, promoting active lifestyle habits, and campaigning to reduce sedentary behavior.

In conclusion, the results of this study reinforce the understanding that efforts to improve adolescent physical fitness must be holistic. Although no significant differences were observed across school types, this provides an opportunity to design collaborative programs that can benefit all students equally. Future studies are recommended to expand sample size, incorporate control variables such as nutritional status and gender, and extend the geographic scope in order to generate a more comprehensive picture of adolescent fitness in Indonesia.

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