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Original research papers

MOTOR ABILITY IN ACTIVE AND LESS ACTIVE STUDENTS AGED 12-13 IN THE MEKONG DELTA, VIETNAM

CHANH THUC DAO

An Giang University, Physical Education Department, Vietnam

Mailing address: Chanh Thuc Dao, Physical Education Department, 18 Ung Van Khiem, Dong Xuyen 900000, An Giang Province, Vietnam, e-mail: thuchus@gmail.com

Abstract
Introduction. Physical activity (PA) plays a crucial role in childhood and adolescent development, influencing motor competence and overall health. Despite extensive research on PA benefits, inconsistencies remain regarding its impact on specific motor skills among adolescents in different socioeconomic contexts. This study aims to examine the differences in motor abilities between physically active and less active students aged 12-13 in the Mekong Delta, Vietnam. ***Material and Methods.*** A total of 125 students (68 males, 57 females) participated in this cross-sectional study. PA levels were assessed using the Physical Activity Questionnaire for Children (PAQ-C), classifying students into active (PAQ-C ≥ 2.73) and less active (PAQ-C < 2.73) groups. Anthropometric measurements, including height, body mass, and BMI, were recorded. Motor competence was evaluated using a modified EUROFIT test battery, assessing abdominal, lower back, upper limb, and lower limb strength, as well as explosive leg power. Data were analyzed using the Student's t-test ($p < 0.05$). ***Results.*** Physically active students exhibited significantly higher body mass, BMI, and superior performance in abdominal strength ($p < 0.001$), upper limb strength ($p < 0.001$), and standing long jump ($p < 0.001$). No significant differences were observed in lower back ($p = 0.252$) and lower limb strength ($p = 0.098$). ***Conclusions.*** Higher PA levels correlate with improved motor competence, particularly in core strength and explosive power. These findings highlight the need for targeted PA interventions in school curricula to enhance students' physical development.

Key words: physical activity, motor competence, adolescents, fitness assessment, Mekong Delta

Introduction

Physical activity, defined as any bodily movement produced by skeletal muscles that increases energy expenditure [1], is widely recognized as a cornerstone of health and development [2]. In recent decades, an extensive body of research has elucidated the myriad benefits of regular physical activity, ranging from enhanced cardiovascular and metabolic health [3] to improved mental health and psychosocial well-being [4]. Moreover, during childhood and adolescence, regular participation in physical activities is critical for achieving optimal peak bone mass and supporting overall motor development [5, 6]. Despite these well-documented benefits, current trends indicate a significant decline in the daily energy expenditure of adolescents, with many failing to meet the World Health Organization's recommendation of at least 60 minutes of moderate-to-vigorous physical activity per day [7]. This decline raises concerns about the long-term health consequences, including an increased risk for obesity and cardiovascular-metabolic diseases [8] and compromised motor development [9].

While the positive effects of physical activity are well established, there remains a gap in our understanding of how varying levels of activity impact specific motor competence parameters among adolescents, particularly in regions where socioeconomic and cultural factors may influence PA levels [10]. Previous studies have provided conflicting evidence regarding the relationship between physical activity and motor skills. For instance, several investigations have documented that physically active adolescents outperform their less active counterparts in various domains of motor competence, such as strength and explosive power [11]. In contrast, other studies have not found significant differences between the two groups [12]. These discrepancies highlight the need for further research to clarify the influence of physical activity on motor ability, especially within specific contexts where data remain scarce [10].

The present study is situated in the Mekong Delta region of Vietnam – a locale characterized by rapid socioeconomic changes and evolving lifestyle patterns that may affect physical activity levels among youth [13]. In this region, as in many parts of the world, traditional lifestyles are increasingly giving way to more sedentary behaviors, driven by technological advancements and urbanization [14]. Against this backdrop, it becomes imperative to assess the current status of motor competence in adolescents and to determine whether disparities in physical activity levels translate into measurable differences in physical development and performance [15].

In addition to its regional relevance, the study addresses an important public health issue. Insufficient physical activity during formative years not only compromises immediate health outcomes but also predisposes individuals to chronic conditions later in life [8]. Therefore, understanding the link between physical activity and motor competence in this critical age group can inform targeted interventions aimed at promoting healthier lifestyles and preventing future health problems.

Despite the acknowledged benefits of physical activity, the relationship between PA levels and specific aspects of motor competence remains inadequately explored, particularly in the context of the Mekong Delta [16, 17]. Motor competence encompasses a range of abilities, including abdominal strength, lower back strength, upper limb strength, lower limb strength, and explosive leg power (as measured by the standing long jump). These competencies are not only essential for sports and physical education but also play a vital role in everyday functional activities, such as running, jumping, and changing direction [18]. The inconsistent findings in the literature regarding the influence of PA on these specific motor abilities necessitate a focused investigation within this unique population.

To address this gap, the current study was designed to compare the motor competence of physically active versus less active students aged 12-13 years in the Mekong Delta, Vietnam. The research was conducted by categorizing students based on their self-reported physical activity levels using the Physical Activity Questionnaire for Children (PAQ-C) [19]. This validated instrument, administered during physical education classes, provided a reliable measure of PA over a 7-day period and facilitated the classification of participants into two groups: those with sufficient physical activity (PAQ-C score ≥ 2.73) and those with lower levels of activity (PAQ-C score < 2.73).

In tandem with assessing physical activity levels, comprehensive anthropometric measurements were obtained, including body mass, height, and body mass index (BMI), following the standardized protocols recommended by the World Health Organization [2]. These measurements provided a basis for understanding the physical development of the students and served as additional indicators of health status [20].

Motor competence was evaluated using a modified version of the EUROFIT test battery [21], which has been widely adopted in school settings due to its cost-effectiveness and ease of implementation [22]. The battery comprised tests for abdominal strength (sit-ups), lower back strength (back extensions), upper limb strength (push-ups), lower limb strength (sit-to--stand cycles), and explosive leg power (standing long jump) [23, 24]. These tests were selected because they capture key aspects of physical performance that are directly influenced by regular physical activity and are relevant for daily life and sports performance [25].

Data collected from these assessments were statistically analyzed using the Student's t-test to determine significant differences between the physically active and inactive groups, with a significance threshold set at $p < 0.05$. The Kolmogorov--Smirnov test was employed to ensure the normality of the data distribution, thereby validating the use of parametric statistical methods.

By focusing on a well-defined population and employing a robust methodological framework, this study aims to elucidate the specific impacts of physical activity on motor competence among adolescents. The findings are expected to provide region-specific insights that not only confirm global trends observed in previous research but also highlight unique aspects of motor development in the context of the Mekong Delta. This localized evidence is critical for developing targeted interventions and informing educational policies that promote physical activity and enhance motor skills in schools.

Furthermore, the study's approach – integrating self-reported physical activity levels with objective physical fitness assessments – offers a comprehensive perspective on how lifestyle factors influence physical development during adolescence. Given the ongoing global concerns about declining physical activity levels and the associated health risks, the outcomes of this research have the potential to contribute significantly to the broader discourse on adolescent health and physical education. This study was conceived to address a critical gap in the literature regarding the relationship between physical activity and motor competence among adolescents in the Mekong Delta region of Vietnam. By leveraging validated instruments for both PA assessment and motor competence evaluation, the research endeavors to provide compelling evidence on the benefits of regular physical activity. The ultimate goal is to inform the development of effective physical education programs and public health interventions that can foster improved motor skills and overall health among young individuals, thereby contributing to the long-term well-being of this population.

Material and Methods

Subjects and Research Procedure

This cross-sectional study was conducted during the 2023/2024 academic year at Global International School (GIS) Primary School, located in the Mekong Delta region of Vietnam. A total of 125 students (68 males and 57 females) aged 12-13 years participated in the study. Ethical approval was obtained from the school administration (Global International School – GIS, date: 01/05/2023 – No.24.01.TC), and the study adhered to the principles outlined in the Helsinki Declaration. Prior to participation, written informed consent was secured from the parents or legal guardians of all students.

Physical Activity Assessment

Physical activity (PA) levels were quantified using the validated Physical Activity Questionnaire for Children (PAQ-C) [19]. This self-administered instrument, which was completed during physical education classes under the supervision and assistance of a qualified physical education teacher, assesses PA over a 7-day period. The questionnaire includes items on various forms of physical activity – such as badminton, basketball, jogging, swimming, and cycling – and captures the frequency of participation during after-school hours and on weekends using a 5-point Likert scale (1 indicating low activity and 5 indicating high activity). The overall PAQ-C score was computed as the mean of the nine items. In accordance with established thresholds [19, 26], students were categorized into two groups: the Physically Active Group (PAQ-C score ≥ 2.73; n = 59 (32 males, 27 females)) and the Physically Inactive Group (PAQ-C score < 2.73; n = 66 (36 males, 30 females)).

Anthropometric Measurements

Standardized procedures were employed to measure anthropometric variables, including body mass, height, and body mass index (BMI). Measurements were conducted with students barefoot and wearing light clothing.

- Body Mass: Measured to the nearest 0.1 kg using a calibrated electronic scale (TANITA TBF 300; TANITA, Middlesex, UK).
- Height: Determined to the nearest 0.1 cm using a wall-mounted stadiometer (SECA SE206; SECA, Hamburg, Germany).
- BMI: Calculated as weight (kg) divided by the square of height (m^2), following the guidelines provided by the World Health Organization [27].

Motor Competence Evaluation

Motor competence was assessed using a modified version of the EUROFIT test battery [21], which has been widely recognized for its practicality and cost-effectiveness in school settings. The following standardized tests were administered to evaluate specific domains of motor competence:

1. Abdominal Strength: measured by the maximum number of sit-ups performed in one minute.
2. Lower Back Strength: assessed via the maximum number of back extensions completed in one minute.

3. Upper Limb Strength: evaluated by counting the maximum number of push-ups executed in one minute.
4. Lower Limb Strength: determined by the maximum number of sit-to-stand cycles performed in one minute.
5. Standing Long Jump: assessed as the horizontal distance (in centimeters) achieved from a standing start, serving as an index of explosive leg power.

Data Analysis

Prior to statistical analyses, the normality of the data distribution for all variables was verified using the Kolmogorov--Smirnov (K-S) test, with all p-values exceeding 0.20, indicating adherence to normal distribution assumptions. Descriptive statistics (means, standard deviations, minimum and maximum values, skewness, and kurtosis) were calculated for both the physically active and inactive groups. Comparisons between groups were conducted using the Student's t-test to evaluate differences in anthropometric measurements and motor competence indicators. Statistical significance was set at $p < 0.05$, with further distinctions made for highly significant results ($p < 0.01$). All analyses were performed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA).

Results

The analysis results (Tab. 1 and 2) indicate that students with a high level of physical activity had an average body mass of 55.5 ± 11.2 kg and an average height of 1.62 ± 0.06 m, whereas the low physical activity group had a lower average body mass of 48.7 ± 10.5 kg and an average height of 1.60 ± 0.06 m. This difference reflects the impact of physical activity levels on the physical development of students aged 12-13, with the high physical activity group generally exhibiting greater overall body development.

The mean Body Mass Index (BMI) in the high physical activity group was 21.1 ± 3.9, compared to 18.5 ± 3.5 in the low activity group. The positive skewness coefficients (0.32 and 1.3 for the high and low activity groups, respectively) indicate that the BMI distributions tend to be right-skewed. This suggests that most students had BMIs lower than the average, although a few cases presented significantly higher BMI values.

Abdominal Strength

The high physical activity group achieved an average of 36.5 ± 3.5 repetitions, compared to 32.0 ± 6.8 repetitions in the low activity group. The low skewness and kurtosis values suggest that these data are approximately normally distributed.

Lower Back Strength

The high physical activity group averaged 13.2 ± 3.5 repetitions, while the low activity group averaged 12.5 ± 3.2 repetitions. However, the high skewness coefficient (1.5) observed in the low activity group indicates that some students performed significantly above the average.

Upper Limb Strength

A marked difference was observed in upper limb strength, with the high physical activity group recording an average of 9.5 ± 2.2 repetitions compared to 6.5 ± 4.0 repetitions in the low activity group. This finding underscores the pronounced effect of physical activity on the development of upper body musculature.

Lower Limb Strength

The high physical activity group recorded 30.0 ± 4.5 repetitions, while the low activity group recorded 28.0 ± 7.5 repetitions. Although the difference is not very large, it remains noteworthy.

Standing Long Jump

The standing long jump test, which reflects lower limb strength and muscular explosiveness, showed that the high physical activity group achieved an average distance of 190.5 ± 25.5 cm. This was significantly greater than the 160.0 ± 35.0 cm recorded by the low activity group. The negative skewness coefficient (–1.00) in the low activity group indicates that several individuals obtained very low scores, which affected the overall data distribution.

Normality Test (Kolmogorov–Smirnov Test)

All variables yielded p-values greater than 0.20, indicating that the data do not significantly deviate from a normal distribution. This finding ensures the reliability of the subsequent statistical tests.

Table 1. Descriptive statistical parameters for the physically active student group

Variable (n = 59)	Min	Max	M	SD	Asymmetry Coefficient	Excess Kurtosis	(K-S Test, p-value)
Body Mass (kg)	42	78	55.5	11.2	0.6	0.3	p > 0.20
Height (m)	1.5	1.75	1.62	0.06	-0.45	-0.55	p > 0.20
BMI	17	26	21.1	3.9	0.32	-1.5	p > 0.20
Abdominal Strength (repetitions)	30	42	36.5	3.5	0.45	-0.7	p > 0.20
Lower Back Strength (repetitions)	9	18	13.2	3.5	0.5	-1.5	p > 0.20
Upper Limb Strength (repetitions)	6	13	9.5	2.2	0.3	-0.6	p > 0.20
Lower Limb Strength (repetitions)	20	35	30	4.5	-1.1	1.3	p > 0.20
Standing Long Jump (cm)	150	220	190.5	25.5	0.2	-0.95	p > 0.20

Table 2. Descriptive statistical parameters for the less physically active student group

Variable (n = 59)	Min	Max	M	SD	Asymmetry Coefficient	Excess Kurtosis	(K-S Test, p-value)
Body Mass (kg)	38	70	48.7	10.5	1	-0.2	p > 0.20
Height (m)	1.48	1.73	1.6	0.06	2.1	5.5	p > 0.20
BMI	14	24	18.5	3.5	1.3	2	p > 0.20
Abdominal Strength (repetitions)	22	40	32	6.8	0.05	-0.9	p > 0.20
Lower Back Strength (repetitions)	8	18	12.5	3.2	1.5	4	p > 0.20
Upper Limb Strength (repetitions)	0	10	6.5	4	-1	-0.2	p > 0.20
Lower Limb Strength (repetitions)	15	40	28	7.5	0.15	-0.9	p > 0.20
Standing Long Jump (cm)	95	190	160	35	-1	0.05	p > 0.20

Table 3 delineates the outcomes of independent samples t--tests comparing mean values of key anthropometric and physical performance variables between physically active and inactive student groups. The findings reveal several statistically significant differences that underscore the impact of physical activity on physical development.

Anthropometric Measures

- Body Mass: The active group exhibited a significantly higher mean body mass (55.5 ± 11.2 kg) compared to the inactive group (48.7 ± 10.5 kg), with a t-value of 3.21 and a p-value of 0.002, indicating a highly significant difference.
- Height: Similarly, the active group demonstrated a modest but statistically significant greater mean height (1.62 ± 0.06 m) than the inactive group (1.60 ± 0.06 m; t = 2.05, p = 0.043).
- BMI: The BMI values further reflect these differences, with the active group registering a mean BMI of 21.1 ± 3.9 versus 18.5 ± 3.5 in the inactive group (t = 2.98, p = 0.004).

Muscular Strength and Endurance:

- Abdominal Strength: The active students outperformed their inactive peers in abdominal strength, achieving an average of 36.5 ± 3.5 repetitions compared to 32.0 ± 6.8 repetitions (t = 3.92, p < 0.001), which is highly statistically significant.
- Upper Limb Strength: A notable difference was also observed in upper limb strength, with the active group obtaining 9.5 ± 2.2 repetitions versus 6.5 ± 4.0 repetitions in the inactive group (t = 5.21, p < 0.001).
- Lower Back Strength: Although the active group demonstrated a slightly higher mean (13.2 ± 3.5 repetitions) relative to the inactive group (12.5 ± 3.2 repetitions), this difference was not statistically significant (t = 1.15, p = 0.252).
- Lower Limb Strength: For lower limb strength, the active group recorded 30.0 ± 4.5 repetitions against 28.0 ± 7.5 repetitions in the inactive group, with a trend towards significance (t = 1.67, p = 0.098), albeit not reaching the conventional threshold.

Explosive Power (Standing Long Jump):

The standing long jump results further accentuate the disparities, with the active group achieving a significantly greater average distance (190.5 ± 25.5 cm) than the inactive group (160.0 ± 35.0 cm; t = 4.88, p < 0.001). This result is particularly striking as it highlights the enhanced lower limb power and explosive strength associated with higher levels of physical activity.

Table 3. Comparison of means between physically active and inactive students, t-Test, and significance levels (p-value)

Variable	Active Group (M ± SD)	Inactive Group (M± SD)	t-value	p-value
Body Mass (kg)	55.5 ± 11.2	48.7 ± 10.5	3.21	0.002
Height (m)	1.62 ± 0.06	1.60 ± 0.06	2.05	0.043*
BMI	21.1 ± 3.9	18.5 ± 3.5	2.98	0.004
Abdominal Strength (repetitions)	36.5 ± 3.5	32.0 ± 6.8	3.92	<0.001
Lower Back Strength (repetitions)	13.2 ± 3.5	12.5 ± 3.2	1.15	0.252
Upper Limb Strength (repetitions)	9.5 ± 2.2	6.5 ± 4.0	5.21	<0.001
Lower Limb Strength (repetitions)	30.0 ± 4.5	28.0 ± 7.5	1.67	0.098
Standing Long Jump (cm)	190.5 ± 25.5	160.0 ± 35.0	4.88	<0.001

* – p < 0.05: Statistically significant; p < 0.01: Highly statistically significant

The t-value indicates the magnitude of difference between the two groups, with larger values representing more pronounced differences; a p-value less than 0.05 signifies that the differences between groups are statistically significant.

The statistically robust differences – especially those with highly significant p-values (p < 0.01) in body mass, BMI, abdominal strength, upper limb strength, and standing long jump – provide compelling evidence of the positive effects of a high level of physical activity on both anthropometric development and physical fitness among students aged 12-13 in the Mekong Delta region. These results not only reinforce the descriptive statistics presented in Tables 1 and 2 but also offer a rigorous quantitative affirmation of the relationship between increased physical activity and enhanced physical capabilities. Such findings underscore the importance of promoting physical activity in this demographic to support optimal physical development and performance.

Discussion

This study set out to investigate the influence of physical activity on anthropometric and physical fitness parameters among students aged 12-13 in the Mekong Delta, Vietnam. The original objective was to determine whether a higher level of physical activity was associated with improved physical development and performance outcomes. The findings, derived from both descriptive and inferential analyses, provide robust evidence that physically active students exhibit significantly better anthropometric profiles and physical fitness metrics compared to their less active peers.

The primary aim was to assess the impact of physical activity on various indicators of physical fitness and development. The results clearly align with this objective. Students in the active group demonstrated significantly higher body mass, BMI, and greater performance in key fitness tests such as abdominal strength, upper limb strength, and standing long jump. Notably, while differences in lower back and lower limb strength were observed, they did not reach statistical significance, suggesting that the influence of physical activity might be more pronounced on certain muscular groups than others.

The results indicate that although the physically active group exhibited higher mean values for lower back strength (13.2 ± 3.5 repetitions vs. 12.5 ± 3.2 repetitions) and lower limb strength (30.0 ± 4.5 repetitions vs. 28.0 ± 7.5 repetitions) compared to the less active group, these differences did not achieve statistical significance (p = 0.252 and p = 0.098, respectively). Several plausible explanations may account for this outcome. First, the sensitivity of the EUROFIT test battery used to assess these specific muscle groups might be insufficient to detect subtle, yet potentially meaningful, differences. Second, the physical activity patterns prevalent in the school environment may predominantly enhance core and upper body musculature, with less pronounced effects on lower back and lower limb strength, thus diluting the observable impact on these measures.

This nuanced outcome indicates that while physical activity broadly enhances physical development, specific aspects of muscular strength may require targeted interventions for measurable improvement. Such outcomes reinforce the initial hypothesis that a higher level of physical activity fosters improved physical development in adolescents.

The findings of this study are consistent with the broader literature on the benefits of physical activity in youth. For instance, Janssen & LeBlanc [28] reported that regular physical activity is associated with improved cardiovascular fitness, muscular strength, and overall physical development in children and adolescents. Similarly, Kohl & Cook [29] highlighted the multifaceted benefits of physical activity, emphasizing its role in not only enhancing physical fitness but also in mitigating risks associated with obesity and other metabolic disorders. Recent reviews have further underscored the importance of physical activity in fostering healthy growth trajectories during adolescence [30]. The significant differences observed in anthropometric measures and fitness tests, particularly in the standing long jump – a proxy for lower limb explosive strength – corroborate these findings and underscore the vital role of physical activity in optimizing physical performance [31]. The findings of the present study can be compared with international research, such as that conducted by Makaruk et al. [32], which indicates that cultural factors may result in significant differences in fundamental motor skills proficiency across countries.

Among the various outcomes, several key findings merit special attention. First, the active group's significantly higher body mass and BMI might seem counterintuitive at first glance; however, these findings likely reflect a greater lean body mass rather than an unhealthy accumulation of adipose tissue. This is in line with the literature suggesting that physically active adolescents often develop increased muscle mass, which contributes to a higher BMI yet signifies a healthier body composition [33]. Second, the marked differences in abdominal and upper limb strength between the two groups provide compelling evidence of the specific benefits of regular physical activity on core and upper body musculature [34]. Third, the superior performance in the standing long jump among active students highlights the enhanced explosive power and coordination that regular physical activity can foster [31]. The data reveal that the physically active group had a higher mean BMI (21.1 ± 3.9) compared to the less active group (18.5 ± 3.5). However, a higher BMI does not necessarily indicate an excess of adipose tissue; it may instead reflect an increase in lean body mass. While the current study hypothesizes that the elevated BMI in the active group is attributable to superior muscular development, the absence of direct body composition analysis precludes a definitive conclusion. Future studies should employ techniques such as bioelectrical impedance analysis (BIA) or dual-energy X-ray absorptiometry (DXA) to accurately differentiate between lean mass and fat mass. This would elucidate the precise relationship between physical activity, muscle development, and BMI, thereby contributing to a more comprehensive understanding of adolescent physical development.

These unique findings are particularly significant given the study's regional context; they not only confirm existing theories but also extend them by providing localized data from the Mekong Delta region, an area where such empirical evidence has been limited.

As noted by the reviewers, factors such as socioeconomic status, family environment, and access to sports infrastructure are critical variables that may influence students' physical activity levels. In the current study, the lack of control for these extraneous variables might have obscured minor yet relevant differences between the groups. Future investigations should incorporate control measures for variables such as household income, familial support for physical activity, and the availability of sports facilities. Such an approach would not only refine the statistical precision of the analyses but also enhance the overall academic rigor and interpretative value of the research findings.

While the benefits of physical activity have been well-documented in global literature, this study serves a crucial purpose by contextualizing these findings within the Mekong Delta region of Vietnam. In a setting where socioeconomic and environmental factors may influence the availability and quality of physical education, the present study provides valuable insights into the localized impact of physical activity on adolescent development. By confirming that increased physical activity is associated with improved physical performance, the study supports the implementation of targeted physical education programs and interventions tailored to the unique needs of students in this region. Moreover, the findings contribute to the growing body of literature by highlighting that even modest increases in daily physical activity can yield significant improvements in physical health and performance, thus providing a persuasive argument for policymakers and educators to prioritize physical activity in school curricula.

Recommendations

Based on the results and the insights garnered from the study, several recommendations emerge:

Enhanced Physical Education Programs: Schools in the Mekong Delta should consider integrating structured physical education programs that emphasize both aerobic and strength-training activities. Given the significant improvements observed in muscle strength and explosive power, a balanced curriculum that addresses various aspects of fitness could maximize health benefits for students.

Targeted Interventions: While the study highlighted overall benefits of physical activity, the non-significant differences in lower back and lower limb strength suggest that these areas may benefit from targeted intervention. Implementing specific exercises to strengthen these muscle groups could further enhance overall physical performance.

Regular Monitoring and Evaluation: It is recommended that educational authorities adopt regular fitness assessments to monitor students' progress. Such evaluations can help in tailoring interventions to individual needs and in ensuring that the benefits of physical activity are sustained over time.

Community and Parental Involvement: Promoting physical activity should extend beyond the classroom. Engaging parents and community organizations in physical activity programs can foster an environment that supports active lifestyles both in and out of school.

Further Research: Future studies should explore the longitudinal impact of physical activity on adolescent development, incorporating additional variables such as nutritional status and socioeconomic factors. Such research could provide deeper insights into the causal relationships and help in refining intervention strategies.

Conclusions

In summary, the study confirms that regular physical activity is significantly associated with improved anthropometric and physical performance measures among adolescents in the Mekong Delta. These findings not only fulfill the original research objectives but also resonate with existing literature, thereby reinforcing the global consensus on the benefits of physical activity. By providing region-specific data, this study underscores the importance of integrating structured physical activity programs into school curricula and offers a foundation for future research and policy-making aimed at enhancing adolescent health and performance.

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