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Physical Fitness of Middle School Students in Selected American Public Charter Schools

Marijoy I. Vestil[1]* and Dennis V. Madrigal[2]

[1,2]University of Negros Occidental-Recoletos, Negros Occidental, Philippines

marijoyv@yahoo.com

Abstract. This study examines the relationship between sex, sleep, after-school physical activity, academic performance, and physical fitness among 320 middle school students in selected U.S. public charter schools. Using a descriptive-correlational design and FitnessGram assessments, results show that after-school activity participation is the strongest predictor of physical fitness, significantly outweighing the effects of sex, sleep, or academics. Guided by Social Cognitive Theory and Self-Determination Theory, the findings highlight how structured, supportive environments that foster self-efficacy and meet psychological needs contribute to sustained physical activity and better fitness outcomes. The study underscores the need for holistic, accessible physical education programs and recommends future longitudinal research and targeted interventions to improve adolescent fitness.

Keywords. Physical fitness, BMI, aerobic fitness, muscular endurance, middle school, descriptive-correlational

1.0 Introduction

Maintaining physical fitness is crucial for the healthy development of adolescents, a period marked by rapid physical and physiological changes [1]. Indeed, adolescent physical fitness is consistently linked to numerous health advantages, including reduced risks of chronic diseases, improved mental health, and enhanced cognitive function, which positively impacts academic performance [2]. Assessing this fitness requires a personalized approach that considers individual factors like age, gender, and lifestyle to ensure effective interventions. This focus on physical fitness is particularly important within physical education curricula, where structured programs can effectively foster healthy behaviors and empower adolescents towards lifelong well-being [3].

Building upon this understanding of the importance of physical fitness, physical education programs in schools emerge as a primary means of promoting it among students. Within the US curriculum, physical fitness education aims to instill lasting healthy habits by developing various fitness components through age-appropriate activities. These fundamental components—cardiovascular endurance, muscular strength and endurance, flexibility, and body composition—are highlighted by Walker et al. (2020) [4] and Matingwina (2018) [5]. Their development is essential for enhancing adolescents' health and functional capabilities, emphasizing the need for comprehensive evaluation and promotion within educational settings

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[6]. Despite challenges such as limited funding and PE hours, and the need to accommodate diverse student abilities, fitness education remains vital for physical and mental health, academic success, and social development, with current trends emphasizing functional fitness and technology integration.

The significance of the physical education curriculum extends to the broader American basic education system, where it aims to improve students' physical fitness and overall well-being [7]. By equipping students with skills for active lifestyles, it supports both their physical and mental health. Research indicates that consistent school-based physical education programs significantly improve adolescents' physical fitness and health [8]. Furthermore, these programs can help reduce socioeconomic disparities that limit access to fitness resources and physical activity opportunities. By creating positive and supportive environments with dedicated instructors, educators can develop effective, tailored programs that maximize student benefits and improve overall health [9].

On the other hand, observations from a Filipino physical education teacher and athletic director in the United States reveal a perceived lack of focus and structure in physical education, especially at the elementary and middle school levels. The implementation of the curriculum often appeared disorganized and lacked collaboration among teachers, with each academic year starting chaotically as individual teachers independently decided on curriculum initiation and teaching methods. These circumstances underscore the critical need to assess the current physical fitness levels of middle school students. Such an assessment is essential for gathering the necessary data to develop a cohesive and collaborative physical education program specifically tailored to the unique needs of this student population. Understanding their initial fitness levels will facilitate the creation of targeted strategies, the monitoring of progress, and ultimately the improvement of their overall health and well-being.

While the importance of adolescent physical fitness is well-documented, a gap exists in understanding the combined impact of gender, sleep duration, extracurricular activities, and physical fitness, particularly within American public charter schools [10]. Despite existing research on individual fitness components, the lack of studies examining their collective influence hinders the development of tailored interventions for middle school students in this specific educational context [11]. Addressing this gap is crucial for designing comprehensive physical fitness programs that effectively meet the unique needs of these adolescents and promote their overall well-being.

Therefore, this study aimed to assess the physical fitness of middle school students in selected American public charter schools, specifically focusing on body mass index, cardiovascular endurance, flexibility, and muscular strength and endurance. The findings were intended to serve as the foundation for developing an enhanced physical fitness program to foster the holistic development of each student.

2.0Literature Review

Physical fitness is a cornerstone of adolescent health and development, encompassing not just physical attributes like cardiorespiratory fitness and body composition, but also the crucial element of physical literacy [12]. This multifaceted aspect of well-being profoundly influences their physical and mental health, shaping their self-perception and overall quality of life [13]. Compelling research further illuminates the tangible benefits of robust cardiorespiratory fitness, demonstrating its association with enhanced self-concept, a reduction in depressive and anxious symptoms, and an elevated health-related quality of life during these formative years [14].

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Beyond cardiorespiratory health, physical literacy plays a vital role, acting as a gateway to increased physical activity engagement and contributing to healthier body composition [15]. It's important to recognize that the landscape of adolescent well-being is also shaped by broader socioeconomic factors, with parental education and migration background emerging as influential determinants of psychosocial health [16]. Furthermore, studies examining diverse populations, such as Chinese adolescents, reveal a significant link between weight status, specific physical fitness components, and their health-related quality of life [17].

Body Mass Index (BMI) stands as a vital metric for assessing the health status of adolescents by correlating their weight and height, thereby indicating their nutritional status. The alarming rise in obesity rates among youth in the United States, which has tripled over the past three decades [18], underscores the urgency of effective interventions. School-based programs have emerged as promising avenues to address this critical issue, with systematic reviews demonstrating significant positive effects on BMI through multi-component strategies encompassing health education and physical activity promotion [19].

These interventions are particularly crucial given the established link between obesity during adolescence and long-term health risks, including the development of cardiovascular diseases and diabetes in later life [20]. Recognizing the multifaceted nature of adolescent obesity, a comprehensive approach that extends beyond the school environment to actively involve families and communities is deemed essential for the effective prevention and management of this significant health challenge [21].

Cardiovascular endurance stands as a cornerstone of adolescent health and development, with a robust body of research consistently underscoring its significance not only for physical well-being but also for cognitive functions that impact academic performance. Studies have observed a positive trajectory in cardiorespiratory fitness (CRF) throughout the academic year, suggesting the beneficial influence of the school environment and routine physical activity; however, these gains may stagnate during the less structured summer months [22]. The Progressive Aerobic Cardiovascular Endurance Run (PACER) remains a widely utilized and valuable tool for assessing CRF levels, with compelling evidence linking higher scores to tangible benefits such as improved mathematical abilities [23] and a greater propensity for engaging in physical activity beyond the school day [24].

The development of CRF during adolescence is a complex process influenced by a confluence of factors. Biological variables, such as gender, play a role, with research indicating distinct CRF growth curves for boys and girls as they mature [25]. Environmental factors within the school setting also exert an influence, with studies suggesting that longer school days may be associated with higher CRF levels, potentially due to increased opportunities for physical activity or a more structured routine [26]. Moreover, targeted interventions like after-school exercise programs have demonstrated significant efficacy in enhancing CRF and overall physical fitness in adolescents [27]. The intensity and engagement within physical education classes, as well as participation in organized sports, further contribute positively to the development of robust cardiovascular endurance [28].

Flexibility, a fundamental component of physical fitness, plays a crucial role in adolescents' overall health and physical capabilities [29]. Research indicates that a significant portion of adolescents maintain adequate flexibility levels [30]. Notably, flexibility often differs between genders, with girls typically exhibiting greater flexibility than boys [31].

Furthermore, flexibility is interconnected with other aspects of physical fitness, showing associations with muscle strength and overall motor competence [31]. Engaging in regular flexibility training offers substantial benefits, including improved range of motion, a

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reduced risk of injuries during physical activities, and enhanced physical performance [32]. Even static stretching, a common flexibility exercise, has been shown to positively influence muscle strength, power, and hypertrophy [33].

Muscular Strength and Endurance. Research strongly supports the vital role of muscular strength and endurance in fostering adolescents' physical fitness and overall health. Notably, school-based interventions, particularly through physical education programs, have demonstrated significant improvements in these key areas. For instance, synchronous online classes incorporating Tabata training during the recent pandemic effectively enhanced muscle mass and strength in adolescents [34].

Similarly, functional strength training has been shown to improve movement quality and overall physical fitness in middle and high school students [35]. A variety of interventions, encompassing comprehensive strength training and circuit training protocols, have also yielded positive effects on muscular fitness and adolescents' perceived physical competence [36]. Furthermore, school-based exercise programs specifically targeting muscular fitness have resulted in moderate increases in local muscular endurance, strength, and power [37].

Sex and physical fitness. Research consistently highlights significant sex-based differences in physical fitness among adolescents, with males generally demonstrating higher levels of strength, power, speed, and endurance compared to their female counterparts [38]. These disparities often become more pronounced during puberty and are largely attributed to biological factors, notably the influence of hormones such as testosterone [39].

Conversely, females typically exhibit greater flexibility [40]. It's also important to note concerning trends of declining youth physical fitness over time, particularly in cardiorespiratory endurance [41]. The recent COVID-19 pandemic has further exacerbated these issues, with lockdown measures negatively impacting muscular fitness, especially among boys [42]. Furthermore, gender differences extend to physical self-perception, with boys generally reporting more positive perceptions across various physical domains [43].

Sleeping hours and physical fitness. Adequate sleep duration and quality are strongly associated with higher levels of physical fitness, encompassing both cardiorespiratory and muscular fitness [44]. Conversely, insufficient sleep has detrimental effects on adolescent functioning, negatively impacting physical performance, increasing the risk of injuries, and hindering recovery processes [45]. Furthermore, sleep deprivation is linked to the development of poor eating habits, obesity, and various metabolic health issues in adolescents [46]. Several factors influence adolescent sleep patterns, including natural biological changes associated with puberty, excessive screen time, and early school start times that often disrupt natural sleep cycles [47].

Emphasizing and practicing good sleep hygiene are associated with significant benefits, such as improved post-training recovery, a reduced likelihood of injuries, enhanced concentration during the day, and better overall health, particularly in physically active individuals [48]. Notably, sleep loss can directly impair crucial aspects of physical performance, including muscular strength, speed, and even cognitive functions relevant to sports and physical activities [49]. Therefore, promoting and prioritizing healthy sleep habits is absolutely essential for optimizing the physical fitness and overall well-being of adolescents in this community and worldwide.

Participation in after-school physical activity and physical fitness. School-based interventions have demonstrated the capacity to improve various aspects of physical fitness, such as cardiovascular endurance and muscular strength [50]. Structured programs, like those

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incorporating jump rope-based activities, have been shown to enhance multiple components of fitness [51].

Furthermore, both before- and after-school programs contribute significantly to students' daily physical activity levels and offer valuable cognitive and social-emotional benefits in addition to physical ones [52]. High-intensity, short-duration physical activities have proven particularly effective for improving muscle fitness in children and adolescents [53]. To achieve broad and lasting impact, multi-faceted interventions that target school policies, curricula, and teacher training are crucial for enhancing overall physical fitness [54].

Interestingly, students who already possess higher levels of fitness tend to participate in more physical activity after school, suggesting a positive feedback loop [55]. To maximize participation rates and achieve optimal outcomes, it is essential that after-school programs are designed to be inclusive, culturally sensitive, and tailored to meet the diverse needs and preferences of all students within the community [56].

Academic performance and physical fitness. Engaging in regular physical activity is associated with improvements in key cognitive functions, including attention, memory, and executive functions, which are fundamental for academic success [57]. Numerous studies have identified significant correlations between specific physical fitness components, particularly cardiorespiratory fitness, and academic achievement [58]. Furthermore, intervention studies have shown that increasing physical activity levels can lead to enhanced cognitive performance and improved academic outcomes [59].

It's important to note that the strength of this relationship can vary depending on several factors, such as the type of physical activity, its duration, and intensity. Additionally, the qualifications of the individuals administering physical activity interventions can influence the results, with more highly qualified practitioners often achieving better outcomes [60]. Research also suggests that working memory may play a mediating role in the link between physical activity and academic performance, particularly in subjects like science [61]. While some inconsistencies exist in the broader literature, the majority of findings support a positive or at least a neutral association between physical activity and academic achievement [62].

3.0 Philosophical Assumptions

The study proposes that physical fitness in American middle school students is influenced by sex, sleeping hours, participation in after-school physical activities, and academic performance. This research is grounded in the Social Cognitive Theory (SCT) [63] and Self-Determination Theory (SDT) [64]. Social Cognitive Theory (SCT) explains how individual health behaviors are influenced by a dynamic and reciprocal interaction between personal factors (including self-efficacy, behavioral capability, expectations, expectancies, and self-control), environmental factors (such as observational learning and reinforcements), and the behavior itself. This theory emphasizes that individuals learn through observing others, developing beliefs about their ability to perform behaviors, and experiencing the consequences of those behaviors, highlighting the importance of addressing these interacting factors to promote positive behavior change.

In relation to physical fitness, Social Cognitive Theory (SCT) explains that an individual's physical fitness is determined by the dynamic interaction of personal, behavioral, and environmental factors; personal factors, such as sex, sleep hours, and academic performance, influence self-efficacy, expectations, and self-control, with sex impacting perceived athletic ability, sleep affecting behavioral regulation for exercise adherence, and academic success bolstering overall self-belief; behavioral factors, notably participation in

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after-school physical activities, directly affect personal factors like self-efficacy and also shape the environment; environmental factors, including school settings, peer influence, and cultural norms, mold behavior through observational learning and reinforcements, like praise or improved grades; these factors interact in complex ways, where societal messages (environmental) can diminish a female student's (personal) sports self-efficacy, thereby decreasing activity participation (behavior), while conversely, adequate sleep and academic achievement (personal), coupled with positive peer influence (environmental), can elevate self-efficacy and activity engagement (behavior), ultimately leading to improved physical fitness.

Moreover, Self-Determination Theory (SDT) explains that individual differences in motivation and personality arise from the fulfillment or thwarting of basic psychological needs for autonomy, competence, and relatedness, which are essential for fostering intrinsic motivation and sustained engagement, particularly in physical activity. SDT distinguishes between intrinsic and extrinsic motivation, further elaborating a continuum from amotivation to intrinsic regulation, with autonomous and controlled motivation as key distinctions, influenced by causality orientations and aspirations. To promote physical activity, SDT advocates for supportive environments that emphasize choice, enjoyment, constructive feedback, and belonging.

In the context of physical fitness, Self-Determination Theory (SDT) offers a lens to understand how sex, sleep, after-school activities, and academic performance influence student fitness by examining their impact on autonomy, competence, and relatedness. Offering choices in activities enhances autonomy, fostering intrinsic motivation. Constructive feedback in activities and academic success build competence, while team sports and positive social interactions satisfy relatedness. Conversely, rigid programs, academic stress, or sleep deprivation can undermine these needs. Sex influences these dynamics through societal expectations and perceived abilities. For example, students with adequate sleep and academic success may feel more autonomous and competent in physical activities. Promoting fitness requires creating environments that support these psychological needs, ensuring students feel empowered, capable, and connected. When these needs are met, students are more likely to engage in sustained physical activity, leading to improved fitness outcomes, regardless of sex or academic standing.

4.0 Methods

This study utilized a quantitative, descriptive-correlational design to investigate the relationships between sex, sleep hours, participation in after-school physical activities, and academic performance among middle school students [65]. This approach was specifically chosen because it allowed for the exploration of associations between these variables without manipulation, while also providing a detailed description of the study population. By collecting data through standardized measures, the research aims to establish a comprehensive understanding of these relationships, thereby contributing to the existing body of knowledge on adolescent health and fitness and informing the development of future interventions.

The respondents in this research were 320 middle school students from selected American public charter schools. Stratified random sampling was used to ensure adequate representation from various campuses. Using stratified random sampling with a 0.05 margin of error and a population of 1,650, a sample size of 320.

The study utilized a hybrid instrument that combined researcher-made and adapted tools. This instrument comprised two parts: Part 1, "Factors Influencing Physical Fitness," and Part 2, "Physical Fitness Components."

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The researcher-initiated communication with the school district head to introduce the study and its goals, seeking approval for conducting research within the district. Once district-level approval was obtained, the researcher secured permission from individual school principals through formal letters. These letters detailed the research objectives, methodology, expected duration, and any potential impact on school operations. After securing the necessary permissions, the researcher worked with school administrators to identify eligible middle school students within the target age range. Informed consent forms for parents or guardians and assent forms, tailored to the students' age and comprehension levels, were then prepared. Also, the physical environment was assessed before the research began to ensure the safety and well-being of the students.

During data collection, respondents underwent preliminary health screenings administered by school nurses or other qualified healthcare professionals. This ensured they were medically fit for the physical fitness assessments. Participants with pre-existing conditions or contraindications to physical activity were excluded from certain assessments or offered alternative activities.

Once cleared, participants completed the research instrument, which included self-reported measures on physical activity, sleep duration, and other pertinent factors. Before the activity, a safety briefing was conducted for respondents, followed by a warm-up. A cool-down was performed after the activity. The school's physical education teachers acted as data enumerators, supervising the physical fitness evaluations and ensuring standardized procedures and accurate data collection using the FitnessGram Standards for Healthy Fitness Zone® Version 10 assessments.

Upon completion of data collection, the researcher compiled and organized the data, ensuring its accuracy and completeness. Any inconsistencies were addressed, and both digital and physical data were securely stored to maintain confidentiality and integrity. The organized dataset was then prepared for statistical analysis to examine the relationships between the variables of interest, such as physical fitness, sleep duration, and academic performance. The analysis results were used to inform the development of targeted interventions and recommendations aimed at improving the physical fitness and overall well-being of middle school students in the district.

This study utilized descriptive and correlational analyses to investigate the relationships between key variables and physical fitness levels among middle school students in selected American public charter schools.

Descriptive statistics characterized the physical fitness of the participants, providing insights into the distribution of students across various fitness levels. The researcher comprehensively described these characteristics using frequency count, percentage distribution, mean, and standard deviation. Additionally, descriptive statistics summarized demographic factors such as sex, sleeping hours, after-school physical activity, and academic performance.

For the correlational analysis, a chi-square test of independence was conducted to examine the relationship between the independent variables (sex, sleeping hours, after-school physical activity, and academic performance) and the dependent variable (physical fitness levels).

Lastly, the researcher demonstrates adherence to the ethical criteria set forth by the Philippine Health Research Ethics Board (PHREB) and effectively incorporates the fundamental concepts of respect for persons, beneficence, and justice in order to ensure the ethical integrity of the study. This study on middle school students' physical fitness highlights its importance not only for individual health but also for broader social and educational

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outcomes. Designed with ethical rigor and community involvement, the research identified key factors influencing adolescent fitness, aiming to inform targeted interventions and policy reforms that promote healthier lifestyles and academic success. Informed consent was meticulously obtained from all stakeholders, with parents and students fully briefed on their rights and the voluntary nature of participation. Special care was taken to protect this vulnerable population, ensuring that participation had no impact on academic standing, and excluding students with health risks through pre-screenings. Despite minimal risks such as potential physical or emotional stress, close monitoring and support minimized discomfort. The study guaranteed privacy and confidentiality by de-identifying data and securing all records in compliance with U.S. data laws. A randomized, stratified sampling method ensured fair and inclusive participation across various campuses, while small incentives acknowledged student contributions. The researcher, a Doctor of Education candidate and experienced Filipino PE teacher in the U.S., leveraged strong academic training and cultural understanding to conduct the study with integrity and transparency, free from conflicts of interest. Advanced facilities and research tools in the U.S. supported the reliability of findings, while continuous collaboration with administrators, teachers, parents, and students reinforced ethical conduct and strengthened the study's relevance. Ultimately, the research contributes to evidence-based practices that can improve youth health, academic performance, and community well-being.

5.0 Results

The demographic profile of middle school students, highlights several key factors influencing their physical fitness. A slight majority of the respondents are male (55.6%, n=178), while females make up 44.4% (n=142), suggesting a potential need for gender-specific approaches in fitness programming. Notably, a significant portion of students exhibit abnormal sleep patterns (66.6%, n=213), which is concerning given that inadequate sleep impairs energy, recovery, and motor function—factors crucial for fitness. Most students (78.4%, n=251) participate in after-school activities, yet the benefits of such involvement depend on the nature and intensity of the activities rather than mere participation. High academic performance is also reported (55.6% superior, 44.4% excellent), but academic demands may contribute to sedentary behavior, possibly counteracting physical activity efforts. These findings align with existing research: male adolescents typically engage more in physical activities than females [66], and poor sleep correlates with decreased physical capabilities [67]. Furthermore, academic pressures can restrict physical movement, reducing fitness [68]. To support adolescent well-being, future interventions should promote balanced academic management, structured physical activity, and proper sleep hygiene [69].

6.0 Discussions

This study highlights a strong link between after-school activity participation and higher physical fitness in middle school students [69]. However, limitations include a sample from select charter schools, potential biases from self-reported data, and a correlational design that prevents causal conclusions. The 320-student sample may also not fully represent all charter school students nationwide.

Despite this, the findings show after-school activities are a better predictor of fitness than sex, sleep, or academics. Students not involved in these activities had lower fitness and higher BMI risks, suggesting PE programs should expand and ensure access to after-school opportunities [70].

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Integrating Social Cognitive Theory (SCT) [71] and Self-Determination Theory (SDT) [72] in PE curricula is vital, promoting self-efficacy and fulfilling psychological needs in supportive environments. PE should adopt a holistic approach, including varied activities, nutrition, and sleep education to support overall health and sustained engagement [73].

Future research should use longitudinal designs to confirm causal links and explore psychological motivators like self-efficacy and autonomy [74]. Targeted interventions are needed for students at risk, especially non-participants, alongside evaluations of sleep hygiene and curriculum enhancements. Examining different after-school activities can help optimize programs [75].

Expanding research to address socioeconomic, cultural, and environmental factors—including diverse student needs and school policies—is crucial to ensure equitable and effective fitness interventions for all middle schoolers.

7.0 Conclusions

This study, informed by Social Cognitive Theory and Self-Determination Theory, demonstrates that students' physical fitness is significantly influenced by the interaction of personal, behavioral, and environmental factors. Specifically, participation in after-school activities, which provides structured environments, enhances perceived self-efficacy, and fulfills psychological needs like autonomy, competence, and relatedness, strongly correlates with higher fitness levels. While academic performance and sleep have weaker direct associations, they indirectly impact engagement by affecting self-efficacy and need satisfaction. Consequently, fostering students' belief in their abilities, creating supportive environments, and promoting intrinsic motivation through need fulfillment are crucial for sustained physical activity and improved fitness outcomes, highlighting the necessity of holistic interventions that address both cognitive and motivational aspects in adolescent fitness programs.

8.0 Limitations of Findings

The generalizability of the findings may be limited due to the study's focus on selected American public charter schools, which may not fully represent the diverse student population and educational contexts across the entire United States. Additionally, the reliance on self-reported data for factors like sleep duration and participation in after-school activities introduces potential for recall bias or social desirability bias. While the study utilized a descriptive-correlational design, it cannot establish causal relationships between the variables, meaning that observed associations do not necessarily imply that one factor directly causes a change in another. Finally, despite efforts to ensure adequate representation through stratified random sampling, the specific characteristics of the 320 middle school students surveyed might not be entirely reflective of all middle schoolers in American public charter schools.

9.0 Practical Value of the Paper

The study reveals a strong correlation between after-school activity participation and higher physical fitness levels in middle school students, surpassing the influence of sex, sleep, or academic performance. Conversely, a significant portion, particularly those not involved in after-school activities, displayed low fitness and BMI-related risks. To effectively address this, physical education programs should prioritize integrating and expanding after-school activities, ensuring accessibility for all students.

Applying Social Cognitive Theory (SCT) and Self-Determination Theory (SDT) is crucial for curriculum development. This involves fostering student self-efficacy, satisfying

psychological needs like autonomy, competence, and relatedness, and creating supportive environments. PE programs should shift from traditional skill-based instruction to a holistic approach, encompassing diverse activities, nutrition education, and sleep hygiene, thereby promoting overall well-being and sustained engagement in physical activity.

10.0 Direction for Future Research

Future research should prioritize longitudinal studies to establish causal relationships between after-school activity participation and long-term physical fitness, moving beyond the current correlational findings. This includes tracking the impact of early interventions and changes in activity availability on students' health trajectories. Additionally, in-depth analyses of psychological factors, particularly those outlined in SCT and SDT, are needed to understand how self-efficacy, autonomy, competence, and relatedness influence physical activity engagement. Investigating the role of parental involvement and the specific mechanisms of different activity types will refine intervention strategies.

Targeted interventions and program evaluations are crucial for addressing low fitness and BMI-related risks, especially among students not participating in after-school activities. Research should focus on developing and testing interventions that improve sleep hygiene and evaluate the effectiveness of PE curriculum modifications, including the integration of diverse activities, nutrition, and technology. Furthermore, analyzing the specific benefits of various after-school activities will help optimize program designs.

Expanding the scope of study is essential to encompass socioeconomic, cultural, and environmental influences on physical fitness. This includes investigating the impact of school policies, technology use, and diverse student populations (e.g., those with disabilities). Further research should aim to identify the most effective types of after-school activities for physical fitness improvement and ensure that interventions are equitable and accessible to all middle school students.

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