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The effect of 8 weeks of aerobic training on sedentary school boys: A study on physical fitness parameters

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Abstract
The increasing prevalence of sedentary lifestyles among adolescents has become a significant public health concern, contributing to obesity, cardiovascular diseases, and poor physical fitness. This study aims to evaluate the impact of an 8-week aerobic training program on the physical fitness of sedentary school boys aged 12 to 15. A total of 50 participants were randomly divided into two groups: an experimental group (n=25) that participated in a structured aerobic training regimen and a control group (n=25) that maintained their regular sedentary routines. The aerobic training included running, cycling, and jump rope exercises conducted four days a week for 45 minutes per session. Pre- and post-intervention assessments measured cardiovascular endurance (VO2 max), body mass index (BMI), and resting heart rate.
The results demonstrated a statistically significant improvement in VO2 max, with the experimental group exhibiting a 15% increase ($p < 0.001$). Additionally, a modest yet significant reduction in BMI (1.8%, $p < 0.05$) and an average decrease in resting heart rate by 8 bpm ($p < 0.001$) were observed. Conversely, no significant changes were found in the control group. These findings suggest that short-term aerobic training can positively influence physical health parameters in sedentary adolescents, emphasizing the need for incorporating aerobic exercises into school physical education programs. This study highlights the potential of structured aerobic training in mitigating the adverse effects of sedentary lifestyles, promoting long-term health benefits for school-aged children.

Keywords: Aerobic training, sedentary adolescents, physical fitness, cardiovascular endurance, school boys, BMI, VO2 max

Introduction

Background and Rationale

The sedentary lifestyle among children and adolescents has become a pressing global health concern, with substantial implications for their physical, mental, and social well-being. According to the World Health Organization (WHO, 2020) [9], over 80% of adolescents globally fail to meet the recommended levels of physical activity, leading to increased risks of obesity, cardiovascular diseases, and other health-related complications. This study focuses on understanding the potential of aerobic training to combat the detrimental effects of sedentary behavior in school-aged boys, a demographic particularly vulnerable due to their growing physiological and psychological needs.
A sedentary lifestyle is defined as a pattern of behavior characterized by low physical activity and high engagement in passive activities such as screen time or prolonged sitting. According to Tremblay *et al*. (2011) [7], sedentary behavior is a distinct construct from physical inactivity, with unique health risks. The growing prevalence of sedentary behavior among school-aged children is often attributed to the increasing reliance on digital technology and reduced emphasis on physical education programs in schools.
Aerobic training, on the other hand, is a form of physical exercise that relies on the sustained use of oxygen to meet energy demands. Activities such as jogging, cycling, and swimming are categorized as aerobic exercises due to their ability to improve cardiovascular endurance, enhance metabolic function, and promote overall physical fitness (Warburton *et al*., 2006) [8]. Aerobic training is particularly effective for children as it encourages heart and lung development while instilling lifelong habits of physical activity.
Sedentary behavior in adolescents has been linked to numerous health complications. Janssen and LeBlanc (2010) [4] reported that prolonged inactivity contributes to increased body fat, poor cardiovascular health, and a decline in musculoskeletal fitness. The Centers for Disease Control and Prevention (CDC, 2019) revealed that childhood obesity rates have tripled over the past three decades, with nearly 20% of children aged 6 to 19 classified as obese in the United States alone. This trend is mirrored in other parts of the world, making it a critical public health issue. Furthermore, sedentary lifestyles have been associated with poor mental health outcomes, including anxiety, depression, and reduced academic performance (Biddle &Asare, 2011) [3].
The role of physical activity in mitigating these risks cannot be overstated. Regular aerobic exercise has been shown to reduce the likelihood of developing non-communicable diseases, improve weight management, and enhance psychological well-being. The American Heart Association (AHA) recommends at least 60 minutes of moderate to vigorous physical activity daily for children and adolescents to promote optimal health (AHA, 2018). Despite these recommendations, many school systems lack structured physical activity programs, further exacerbating the problem.
Adolescence is a critical period for physical and emotional development, and the habits formed during this time often persist into adulthood. School boys, in particular, present a unique demographic for studying the effects of aerobic training. While boys are often perceived as more active than girls, research suggests a decline in physical activity levels as they approach adolescence (Ridgers *et al*., 2012) [6]. This

decline is partly attributed to increased academic pressures, social influences, and the allure of digital entertainment.

Additionally, boys in this age group are more likely to engage in competitive sports, which are often aerobic in nature, making it easier to design interventions that cater to their interests. Understanding the specific needs and responses of boys to aerobic training can help develop targeted strategies for promoting physical fitness in this group.

Aerobic training offers numerous benefits for children and adolescents. Physiologically, it enhances cardiovascular endurance by improving the heart's efficiency in pumping blood and oxygen throughout the body. According to Armstrong and Welsman (2011) [1], regular aerobic exercise increases VO2 max, a measure of aerobic capacity that reflects an individual's overall fitness level. Improved VO2 max has been linked to better academic performance, as higher fitness levels correlate with improved cognitive function and concentration.

Aerobic training also supports weight management by increasing caloric expenditure and enhancing metabolic efficiency. A study by Bailey *et al*. (2013) [2] found that children who engaged in regular aerobic activities exhibited lower BMI levels and reduced visceral fat compared to their inactive peers. Additionally, aerobic exercise strengthens the immune system, improves sleep quality, and reduces symptoms of anxiety and depression, making it a holistic approach to health and wellness.

Despite the evident benefits of aerobic training, many schools lack structured programs that prioritize physical activity. A study by Pate *et al*. (2006) [5] found that only 21% of adolescents participated in daily physical education classes. This gap underscores the need for integrating aerobic training into school curricula, not only to combat sedentary behavior but also to instill lifelong habits of physical fitness.

Purpose of the Study

This study aims to examine the impact of an 8-week aerobic training program on selected physical fitness parameters in sedentary school boys. It focuses on improvements in cardiovascular endurance, BMI, and overall physical performance.

Objectives

- To evaluate changes in VO2 max (aerobic capacity).
- To measure changes in BMI (Body Mass Index).
- To assess changes in resting heart rate and physical activity tolerance.

Hypothesis

- H1: Aerobic training has no significant effect on the physical fitness of sedentary school boys.
- H2: Aerobic training significantly improves the physical fitness of sedentary school boys.

Methodology

Research Design

The study follows a quasi-experimental design involving pre- and post-intervention assessments.

Participants

- **Sample Size:** 50 school boys aged 12 to 15.
- **Inclusion Criteria:** Sedentary boys with no prior involvement in structured physical activity programs.
- **Exclusion Criteria:** Boys with pre-existing medical conditions limiting physical activity.

Procedure

- **Experimental Group (n=25):** Participated in an 8-week aerobic training program, including running, cycling, and jump rope exercises for 45 minutes, 4 days a week.
- **Control Group (n=25):** Maintained their regular sedentary lifestyle without additional exercise.

Training Protocol

- **Weeks 1-2:** Low-intensity jogging and light aerobic exercises.
- **Weeks 3-5:** Moderate-intensity activities including interval training and circuit exercises.
- **Weeks 6-8:** High-intensity aerobic workouts with progressive overload.

Assessment Parameters

1. VO2 Max (Measured using the 20-meter shuttle run test).
2. BMI (Calculated from height and weight measurements).
3. Resting Heart Rate (Measured before and after the intervention).

Data Analysis

Statistical analysis was performed using SPSS 26.0. Paired t-tests compared pre- and posttraining data within the experimental group, while independent t-tests assessed differences between the groups.

Results

The results of this study demonstrate the impact of an 8-week aerobic training program on the physical fitness parameters of sedentary school boys. Three key variables were measured: VO2 max (aerobic capacity), Body Mass Index (BMI), and Resting Heart Rate (RHR). The experimental group underwent structured aerobic training, while the control group maintained their sedentary lifestyle. The findings are summarized below, with an interpretation of the statistical data.

1. VO2 Max (Aerobic Capacity)

The results indicate a significant improvement in VO2 max in the experimental group compared to the control group.

Table 1: illustrates the mean values and standard deviations before and after the intervention.

Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Difference	t-value	p-value
Experimental Group	34.5 (3.2)	39.8 (3.5)	+5.3	7.85	<0.001**
Control Group	34.2 (3.1)	34.5 (3.0)	+0.3	0.98	0.341

Interpretation
The experimental group showed a 15% improvement in VO2 max, which is statistically significant ($p < 0.001$). The control group exhibited no meaningful changes. This suggests that aerobic training effectively enhances cardiovascular endurance in sedentary boys.

2. Body Mass Index (BMI)
BMI was measured to assess changes in body composition.

Table 2: summarizes the pre- and post-test BMI values.

Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Difference	t-value	p-value
Experimental Group	23.4 (2.1)	22.9 (2.0)	-0.5	2.45	0.018*
Control Group	23.2 (2.2)	23.3 (2.3)	+0.1	0.52	0.607

Interpretation
The experimental group exhibited a small but statistically significant reduction in BMI ($p = 0.018$), indicating improved body composition. The control group showed no significant change in BMI, underscoring the impact of aerobic training on weight management.

3. Resting Heart Rate (RHR)
The resting heart rate was recorded as an indicator of cardiovascular efficiency.

Table 3: The results are presented

Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Difference	t-value	p-value
Experimental	76.8 (5.1)	68.4 (4.8)	-8.4	8.72	<
Group					0.001**
Control Group	77.1 (5.0)	76.9 (4.9)	-0.2	0.87	0.397

Interpretation
The experimental group experienced a significant reduction in resting heart rate by an average of 8.4 beats per minute ($p < 0.001$), reflecting enhanced cardiovascular efficiency.
No significant changes were observed in the control group.

Discussion
The findings of this study underscore the significant benefits of an 8-week aerobic training program on the physical fitness of sedentary school boys. Improvements were observed across key fitness parameters, including cardiovascular endurance (VO2 max), body composition (BMI), and resting heart rate (RHR). These results not only align with prior research but also emphasize the critical role of structured physical activity in reversing the adverse effects of sedentary lifestyles in adolescents.

- **Cardiovascular Endurance (VO2 Max)**

A notable 15% improvement in VO2 max among the experimental group reflects enhanced cardiovascular efficiency, as oxygen uptake capacity is a robust indicator of overall fitness. This finding is consistent with Armstrong and Welsman (2011) [1], who reported that aerobic training significantly improves aerobic capacity in children and adolescents. Enhanced VO2 max is associated with better heart health and reduced risk of developing cardiovascular diseases later in life. In contrast, the control group exhibited no significant changes, reinforcing the necessity of active intervention to achieve fitness improvements. The results suggest that aerobic training should be an integral part of school-based physical education programs.

- **Body Mass Index (BMI)**

The reduction in BMI by 0.5 in the experimental group, although modest, is statistically significant and highlights the program's potential for addressing childhood obesity. According to Bailey *et al*. (2013) [2], regular aerobic exercise facilitates energy expenditure and metabolic regulation, leading to improved body composition. While the reduction in BMI may appear small, it reflects a meaningful trend toward healthier weight management, especially over longer durations. The absence of BMI changes in the control group further highlights the role of exercise in mitigating sedentary lifestyle impacts.

- **Resting Heart Rate (RHR)**

The decrease in resting heart rate by an average of 8.4 beats per minute in the experimental group demonstrates improved cardiovascular efficiency. Warburton *et al*. (2006) [8] emphasized that aerobic training reduces the workload on the heart by increasing stroke volume, allowing the heart to pump more blood with fewer beats. A lower resting heart rate is a strong predictor of reduced cardiovascular morbidity and mortality. This improvement is particularly significant for adolescents, as it indicates better heart health and a reduced likelihood of developing hypertension in adulthood.

- **Comparative Analysis with Previous Studies**

The findings align with numerous studies that have highlighted the benefits of aerobic exercise in adolescents. For instance, a study by Janssen and LeBlanc (2010) [4] found that structured aerobic training programs significantly enhance physical fitness and metabolic health in inactive children. Similarly, Ridgers *et al*. (2012) [6] noted that school-based interventions focusing on aerobic activities led to sustained improvements in physical activity levels and fitness outcomes. These results underscore the importance of targeted interventions for promoting health in sedentary populations.

Implications for Schools and Policymakers

The outcomes of this study highlight the pressing need for schools to integrate structured aerobic training into their curricula. Physical inactivity in adolescents is a global health challenge, with over 80% of adolescents worldwide not meeting the recommended levels of physical activity (WHO, 2020). School-based interventions offer a practical and scalable solution for addressing this issue. By incorporating aerobic exercises into daily routines, schools can foster long-term health benefits for students, including improved fitness, mental health, and academic performance. Policymakers should prioritize the allocation of resources to physical education programs, ensuring that they are adequately equipped to deliver engaging and effective aerobic training. Furthermore, partnerships with parents and community organizations can help extend the reach of such interventions beyond school settings.

Limitations and Future Research Directions

While the study provides valuable insights, it is not without limitations. The sample size of 50 participants may limit the generalizability of the findings. Additionally, the study focused solely on boys aged 12 to 15, and future research should explore the effects of aerobic training on girls and other age groups to gain a more comprehensive understanding. Longitudinal studies are also recommended to examine the long-term effects of aerobic training on physical fitness and overall health.

Conclusion

This study reaffirms the effectiveness of aerobic training in enhancing physical fitness among sedentary adolescents. The significant improvements in VO2 max, BMI, and resting heart rate emphasize the transformative potential of structured exercise programs. Schools and policymakers must take proactive measures to incorporate aerobic training into daily schedules, addressing the rising concerns of sedentary behavior and fostering healthier generations. By prioritizing physical activity, we can not only improve the health of adolescents but also instill lifelong habits that benefit their overall well-being.

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