

Influence of Swimming Training on Selected Anthropometric Measures among Adolescent Boys

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Abstract

Swimming is a whole body physical activity that can contribute to healthy body development and favorable changes in body composition among adolescents. The present study examined the effect of an eight week swimming training programme on selected anthropometric parameters among adolescent male students. Initially 100 adolescent male students aged 14 – 17 years were screened from whom 80 overweight students were identified. Forty (N = 40) participants were randomly selected and equally assigned to a Swimming Training Group (STG, n = 20) and a Control Group (CG, n = 20). The STG participated in a structured swimming training programme for eight weeks, while the CG continued their routine activities without additional training. The selected anthropometric variables were Body Mass Index (BMI) and Body Fat Percentage (BFP). BMI was assessed using body mass and standing height, while body fat percentage was measured using an OMRON BF-306 body fat analyser. Pre and post training measurements were obtained using standardized procedures. The data were analyzed using the paired t-test at the 0.05 level of significance. The findings revealed significant reductions in BMI and body fat percentage in the Swimming Training Group whereas no significant changes were observed in the Control Group. The results indicate that systematic swimming training can be an effective intervention for improving selected anthropometric characteristics among overweight adolescent male students.

Key words: Body Mass Index, Body Fat Percentage, Swimming Training and Adolescent Male Students.

Introduction

Adolescence is an important stage of human growth characterized by considerable changes in body size, shape and composition. Regular participation in physical activity during this period plays an important role in maintaining healthy body composition and developing physical fitness. Anthropometric assessment provides useful information regarding body size and composition and is widely used to monitor growth, nutritional status and adaptations to physical training. Anthropometric involves the measurement and evaluation of human body dimensions, proportions and composition in relation to movement and physical performance (Norton & Olds, 2001). Swimming is a whole-body form of exercise that involves continuous coordinated movements of the upper and lower limbs and requires substantial participation of the trunk musculature. The resistance provided by water increases the muscular demand of swimming movements while the buoyancy of water reduces mechanical loading on the joints. Consequently, swimming provides an appropriate form of exercise for adolescents including those with excess body weight. Regular swimming may increase energy expenditure improve cardiorespiratory fitness and contribute to favorable changes in body composition. Swimming training involves repeated arm strokes, leg kicking, trunk stabilization and controlled breathing. These activities engage large muscle groups and may contribute to increased energy expenditure and improved muscular conditioning. Previous research has indicated that swimming and other structured physical activities can positively influence physical fitness, body composition and anthropometric characteristics in young populations. The adolescent period may be particularly suitable for examining such adaptations because of the rapid physiological and morphological changes occurring during growth.

Body Mass Index (BMI) and Body Fat Percentage (BFP) are commonly used indicators for assessing body composition. Although BMI does not directly distinguish between fat mass and lean mass, it provides a useful screening measure when combined with body fat assessment. Therefore, examining both BMI and body fat percentage can provide a broader understanding of changes in body composition following a structured swimming intervention. In this context, the present study was designed to determine the effect of an eight week swimming training programme on selected anthropometric parameters among overweight adolescent male students.

Methodology

To achieve the objective of the study, a total of 100 adolescent male students aged 14 –17 years were initially screened from the Bharathiar university swimming pool district. All participants underwent body mass index (BMI) assessment to identify overweight individuals for further analysis. From this pool 80 students classified as overweight were selected for the study. Out of these (N = 40) participants were randomly allocated into two groups of equal size. The Swimming Training Group (STG) (n = 20) and the Control Group (CG) (n = 20). The experimental group participated in a structured swimming training programme conducted five days per week for a duration of eight weeks while the control group continued with their regular daily activities without any additional training intervention. The selected anthropometric variables assessed in the study included body mass index and body fat percentage. BMI was determined using a standard calibrated weighing scale and stadiometer, expressed in kg/m². Body fat percentage was measured using an OMRON BF-306 hand held body fat monitor. These measurements were recorded following standard testing procedures to evaluate the impact of swimming training on the selected variables.

Training Programme

An 8 week swimming training programme was designed to improve selected anthropometric parameters among adolescent male students. The training was conducted five days per week with each session lasting 60 to 75 minutes. During the first two weeks the students performed basic warm-up activities breathing drills and low intensity lap swimming to develop water familiarity and improve cardiovascular endurance. Weeks three and four included progressive skill development such as freestyle and backstroke technique drills, kicking sets and moderate intensity interval swimming. In weeks five and six the training intensity was gradually increased by incorporating higher volume lap swimming, stroke refinement exercises and speed drills. The final two weeks focused on advanced

interval training, endurance sets and continuous swimming to maximize aerobic capacity and muscular efficiency. Each session concluded with cool down activities and stretching exercises. The progression of the training load across the eight weeks ensured gradual adaptation improved swimming performance and positive changes in the selected anthropometric parameters of the adolescent male students.

Statistical Analysis

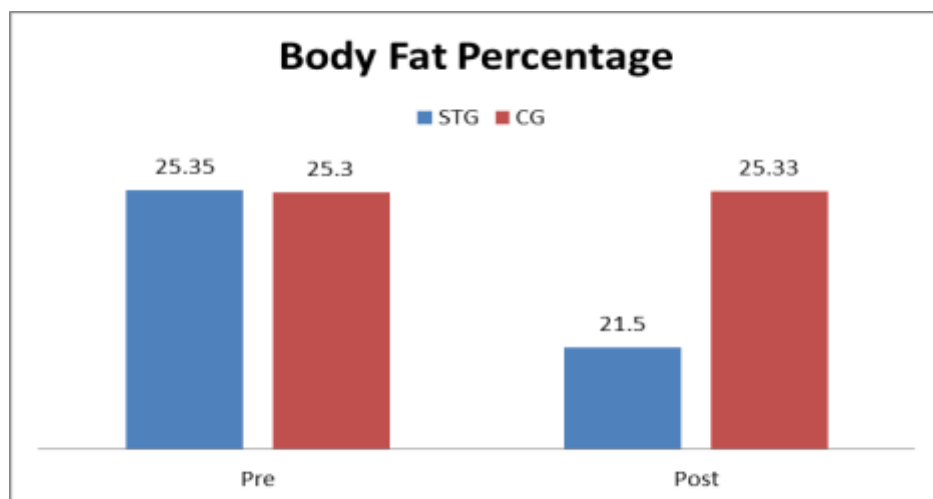
(BMI) and (BFP) in relation to the effects of the swimming training programme were statistically examined using the paired 't' test to determine whether significant differences existed between the pre-test and post-test measurements. For all analyses the level of significance was fixed at 0.05 ($p < 0.05$), which served as the criterion to identify meaningful improvements resulting from the training intervention.

Table - 1 Computation of 'T' Ratio on Kinanthropometric Variables of Adolescent Male Students of Experimental Group (Scores in numbers)

Group	Test	Mean	Std. Deviation	T - ratio
Experimental Group	BMI	Pre-Test	25.35	10.48*
		Post-Test	21.50	
	Body Fat Percentage	Pre-Test	24.45	11.87*
		Post-Test	22.10	

*Significant level 0.05 level (degree of freedom 2.09, 1 and 19)

Table - 1 presents the mean, standard deviation and calculated 't' values for the selected variables, namely Body Mass Index (BMI) and Body Fat Percentage (BFP) of the experimental group. The computed 't' ratios for BMI and BFP were 10.48 and 11.87, respectively. The critical table value required for significance at the 0.05 level with the degrees of freedom 19 was 2.09. Since the obtained 't' values exceeded the critical value, the differences observed were found to be statistically significant.



(Fig – 1) Bar Diagram Showing the Mean Value on Selected Kinanthropometric Variables of Adolescent Male Students

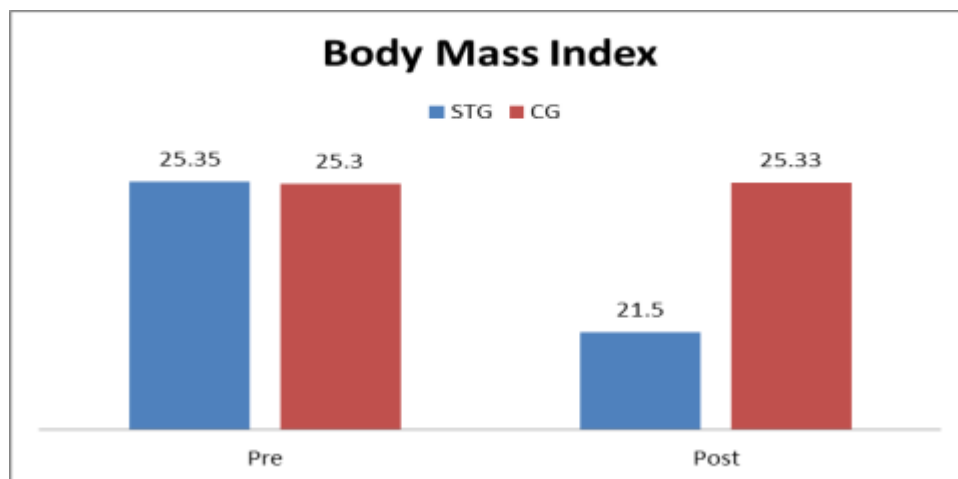
Table – 2 Computation of 'T' Ratio on Kinanthropometric Variables of Adolescent Male
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Students of Control Group (Scores in numbers)

Group	Test	Mean	Std. Deviation	T - ratio
Control Group	BMI	Pre-Test	25.30	1.57
		Post-Test	25.33	
	Body fat Percentage	Pre-Test	24.55	0.95
		Post-Test	24.60	

*Significant level 0.05 level (degree of freedom 2.09, 1 and 19)

Table - 2 presents the mean, standard deviation and calculated 't' values for the selected parameters. Body Mass Index (BMI) and Body Fat Percentage (BFP) of the control group were computed. The obtained 't' ratios for BMI and BFP were 1.57 and 0.95, respectively. The critical table value required for significance at the 0.05 level with 19 degrees of freedom was 2.09. Since the calculated 't' values were lower than the table value, the differences observed in the control group were statistically not significant.



(Fig – 2) Bar Diagram Showing the Mean Value on Selected Kinanthropometric Variables of Adolescent Male Students

Discussion and Findings

The findings of the present study demonstrate that an 8 week swimming training programme produced significant improvements in the selected anthropometric parameters specifically body mass index (BMI) and body fat percentage among adolescent male students. Physiologically swimming is a whole body aerobic activity that increases calorie expenditure, enhances cardiovascular efficiency and stimulates metabolic adaptations that promote fat utilization. Regular swimming improves oxygen uptake elevates basal metabolic rate and facilitates greater lipid oxidation thereby contributing to reductions in excess body fat. Biomechanically, swimming involves coordinated movements of both the upper and lower extremities generating continuous resistance from water which is 12 – 14 times denser than air. This resistance results in increased muscular engagement improved lean body mass and enhanced energy expenditure during each stroke cycle. Additionally, the non weight bearing nature of swimming reduces joint stress, allowing overweight adolescents to exercise safely while maintaining high training volume and intensity. Over time, these combined physiological and biomechanical mechanisms contribute to favorable changes in BMI and body fat percentage.

supporting the effectiveness of swimming as an intervention for improving body composition in adolescent male populations.

The results of the study clearly indicate that an 8 week swimming training programme brought significant improvements in BMI and body fat percentage among adolescent male students. Physiologically, swimming acts as a high efficiency aerobic and anaerobic exercise, stimulating increased caloric expenditure and enhancing the body's ability to utilize fat as a primary energy source during prolonged activity. The hydrostatic pressure of water improves venous return and cardiac output enabling better oxygen delivery to working muscles and supporting higher metabolic efficiency. Regular swimming also enhances mitochondrial density and enzymatic activity which collectively increase lipid metabolism and contribute to a reduction in excess adipose tissue. Biomechanically, swimming requires continuous coordinated movements involving major muscle groups such as the latissimus dorsi, deltoids, pectorals, quadriceps and hamstrings. The natural resistance of water creates a low impact but high resistance training environment, promoting lean muscle development without placing excessive stress on growing joints. This increase in lean muscle mass further elevates resting metabolic rate thereby contributing to improved body composition.

Swimming involves repeated stroke cycles and kicking patterns that strengthen the core improve postural stability and enhance neuromuscular coordination all of which support efficient movement and increased energy expenditure. For overweight adolescents the buoyancy of water reduces mechanical load on the musculoskeletal system, allowing them to train for longer durations with reduced fatigue and lower injury risk thus ensuring greater consistency in participation. Improved cardiorespiratory endurance achieved through swimming also contributes to enhanced fat-oxidation capacity during both exercise and rest. Psychologically water based exercises increase exercise enjoyment, reduce perceived exertion and motivate sustained effort, indirectly supporting better body weight management. Collectively these physiological, biomechanical and psychosocial mechanisms explain the significant reductions observed in BMI and body fat percentage following the structured swimming training programme in adolescent male students.

Conclusions

From the results of the study and discussion the following conclusions were drawn.

1. Out of 100 adolescent male students 80 overweight students were selected and their baseline assessments showed unhealthy levels of BMI and body fat percentage indicating a need for structured physical intervention.
2. Before the training the selected students demonstrated higher than normal body mass index and body fat levels confirming the presence of excess adiposity and associated health risks.
3. The 8 week swimming training programme provided a scientifically structured, low impact, full body exercise regimen suitable for overweight adolescents.
4. After the training period significant reductions were observed in both BMI and body fat percentage demonstrating the effectiveness of swimming as a weight management and body composition improvement strategy.
5. Overall the 8 week swimming training programme produced meaningful positive changes in the health status of overweight adolescent boys confirming swimming as an effective intervention for improving body mass index and body fat percentage.
6. The findings suggest that regular structured swimming training can be recommended in school based physical education programmes for promoting better health and well being among overweight adolescents.

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