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Effect of weight bearing exercise on selected muscular fitness variables among school girls

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Abstract

The purpose of this study was to investigate the impact of weight-bearing exercise on selected muscular fitness variables among school girls aged 15 to 17 in Chennai, Tamil Nadu. The primary objective was to determine whether a 6-week training program consisting of three days per week could lead to significant improvements in muscular fitness when compared to a control group. A total of 40 subjects were recruited for this study, all of whom were female higher secondary school students. The subjects were randomly divided into two groups: The Weight-Bearing Exercise Group (WBEG) and the Control Group (CG). The WBEG participated in a structured 6-week training program, while the CG did not engage in any specific exercise regimen during this period. The training procedure for the WBEG included weight-bearing exercises such as squats, lunges, leg presses, and calf raises. Each training session was conducted three days a week, with a total duration of 6 weeks. The control group maintained their regular daily routines. Selected muscular fitness variables, including muscular strength and endurance, were assessed before and after the intervention period using standardized fitness tests. The data collected were analyzed using analysis of covariance (ANCOVA) to determine if any significant differences existed between the two groups while controlling for baseline measurements. The results of the study revealed significant improvements in selected muscular fitness variables among the subjects in the Weight-Bearing Exercise Group compared to the Control Group. Specifically, the WBEG exhibited greater gains in muscular strength and endurance after the 6-week training program, while the CG showed no changes over the same period. The findings suggest that a 6-week weight-bearing exercise program, consisting of three days of training per week, can have a positive impact on muscular fitness among school girls. These results emphasize the importance of incorporating weight-bearing exercises into the physical education curriculum for adolescent girls to enhance their overall muscular fitness levels.

Keywords: Physical fitness, weight-bearing exercise, fitness, training program, school girls

Introduction

Physical fitness is a pivotal component of holistic well-being, contributing significantly to an individual's overall health and quality of life. Among the various dimensions of physical fitness, muscular fitness, characterized by muscular strength and endurance, holds particular importance as it plays a fundamental role in daily functioning, sports performance, and injury prevention (Garber *et al.*, 2011) ^[1]. Moreover, establishing a foundation of muscular fitness during adolescence can have lasting benefits, promoting a healthier and more active adulthood (Faigenbaum *et al.*, 2009) ^[2].

The adolescent years, marked by dynamic physiological changes and rapid growth, present a unique window of opportunity to optimize muscular fitness. However, contemporary lifestyles often pose challenges to this endeavour. Increasing sedentary behaviour, coupled with academic demands and shifting physical activity patterns, can compromise the development of muscular strength and endurance among adolescents (Dumith *et al.*, 2011) ^[3]. Consequently, there is a pressing need to design effective interventions that address these challenges and promote muscular fitness among this demographic group.

This research seeks to address this imperative by investigating the impact of weight-bearing exercise on selected muscular fitness variables among school girls aged 15 to 17 in Chennai, Tamil Nadu. The study's primary objective is to ascertain whether a structured 6-week training program, involving weight-bearing exercises conducted three days a week, can lead to significant improvements in muscular strength and endurance in this cohort.

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The initiative to undertake this study stems from the recognition that enhancing muscular fitness during adolescence holds far-reaching benefits. Beyond immediate health advantages, such as reduced risk of injury and improved physical performance, it may contribute to the establishment of lifelong physical activity habits, thereby reducing the burden of chronic diseases associated with a sedentary lifestyle (Faigenbaum *et al.*, 2009; Janssen and LeBlanc, 2010) [2, 4]. Therefore, this research endeavor, aims to provide valuable insights into the efficacy of weight-bearing exercise as a means of enhancing the muscular fitness of school girls, ultimately promoting their health and well-being.

In the subsequent sections, we will detail the methodology employed in this study, the training procedure implemented, the statistical tools used for data analysis, and the results obtained. These findings have the potential to inform physical education programs, policymakers, and educators, offering evidence-based strategies to foster muscular fitness among adolescent girls.

Methodology

The purpose of this study was to investigate the impact of weight-bearing exercise on selected muscular fitness variables among school girls aged 15 to 17 in Chennai, Tamil Nadu. The primary objective was to determine whether a 6-week training program consisting of three days per week could lead to significant improvements in muscular fitness when compared to a control group. A total of 40 subjects were recruited for this study, all of whom were female higher secondary school students. The subjects were randomly divided into two groups: The Weight-Bearing Exercise Group (WBEG) and the Control Group (CG). The WBEG participated in a structured 6-week training program, while the CG did not engage in any specific exercise regimen during this period. The training procedure for the WBEG included weight-bearing exercises such as squats, lunges, leg presses, and calf raises. Each training session was conducted three days a week, with a total duration of 6 weeks. The control group maintained their regular daily routines. Selected muscular fitness variables, including muscular strength and endurance, were

assessed before and after the intervention period using standardized fitness tests. The data collected were analyzed using analysis of covariance (ANCOVA) to determine if any significant differences existed between the two groups while controlling for baseline measurements.

Results on Muscular Strength

Table 1: Computation of analysis of covariance of pre-test post-test and adjusted post- test on muscular strength on weight bearing exercise group and control group

Test	WBEG	CG	Source of Variance	Sum of Square	df	Mean Square	"F"
Pre	33.90	34.15	BG	0.63	1	0.63	0.17
			WG	144.35	38	3.80	
Post	36.80	34.50	BG	52.90	1	52.90	13.94*
			WG	144.20	38	3.79	
Adjusted	36.90	34.39	BG	62.98	1	62.98	62.12*
			WG	37.51	37	1.01	

*significant at 0.05 level of confidence. (Table value required for significant at 0.05 level of confidence with df (1, 38) and df (1,37) was 3.16 correspondingly).

BG - Between Groups, WG - Within Groups, df - Degrees of Freedom.

For the pre-test, the F-value is 0.17, which is not significant at the 0.05 level, meaning there is no significant difference between weight bearing group and control group in terms of muscular strength before any intervention.

For the post-test, the F-value is 13.94, which is highly significant. It indicates that there is a significant difference in muscular strength scores between weight bearing group and control group after the intervention.

For the adjusted post-test, the F-value is 62.12, also highly significant. This suggests that even after adjusting for the covariate (pre-test scores), there is still a significant difference in muscular strength between the weight bearing group and control group.

The pre, post, and adjusted means on muscular strength were presented through a bar diagram for a better understanding of the results of this study in Figure-1.

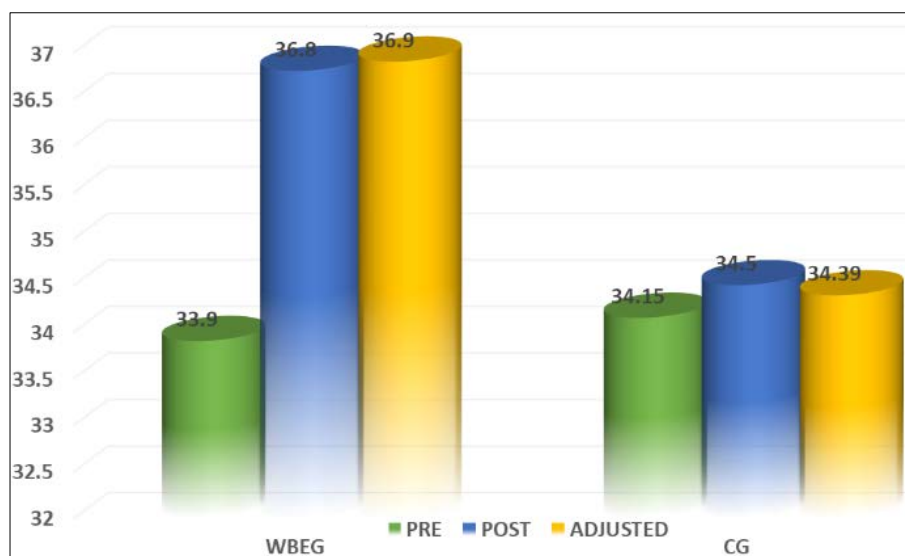


Fig 1: Pre, post and adjusted post-test differences of the WBEG and CG on muscular strength

Results on Muscular Endurance

Table 2: Computation of analysis of covariance of pre-test post-test and adjusted post- test on muscular endurance on weight bearing exercise group and control group

Test	WBEG	CG	Source of Variance	Sum of Square	df	Mean Square	“F”
Pre	23.70	24.00	BG	0.90	1	0.90	0.22
			WG	154.20	38	4.06	
Post	28.20	24.35	BG	148.23	1	148.23	30.32*
			WG	185.75	38	4.89	
Adjusted	28.32	24.22	BG	167.553	1	167.55	83.64*
			WG	74.119	37	2.00	

*significant at 0.05 level of confidence. (Table value required for significant at 0.05 level of confidence with df (1,38) and df (1,37) was 3.16 correspondingly).

BG - Between Groups, WG - Within Groups, df – Degrees of Freedom.

For the pre-test, the F-value is 0.22, which is not significant at the 0.05 level, meaning there is no significant difference between weight bearing group and control group in terms of muscular endurance before any intervention.

For the post-test, the F-value is 30.32, which is highly significant. It indicates that there is a significant difference in muscular endurance scores between weight bearing group and control group after the intervention.

For the adjusted post-test, the F-value is 83.64, also highly significant. This suggests that even after adjusting for the covariate (pre-test scores), there is still a significant difference in muscular endurance between the weight bearing group and control group.

The pre, post, and adjusted means on muscular endurance were presented through a bar diagram for a better understanding of the results of this study in Figure-2.

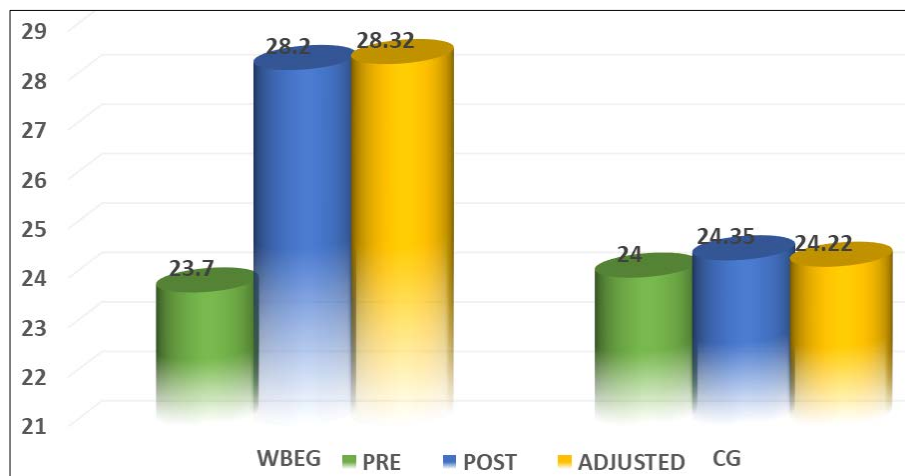


Fig 2: Pre, post and adjusted post-test differences of the WBEG and CG on muscular endurance

Discussion on Muscular Strength

In the pre-test analysis, the non-significant F-value (0.17) suggests that there was no significant difference in muscular strength between the weight-bearing exercise group (WBEG) and the control group (CG) before the intervention. This outcome indicates that the two groups had similar baseline muscular strength levels.

However, the significant F-value (13.94) in the post-test analysis demonstrates that a significant difference in muscular strength scores emerged between the WBEG and CG following the 6-week intervention. This outcome suggests that the weight-bearing exercise program was effective in enhancing muscular strength among the participants in the WBEG.

Furthermore, the adjusted post-test F-value (62.12) remains highly significant, even after controlling for the pre-test scores as a covariate. This finding underscores the robustness of the observed improvement in muscular strength among the WBEG, as it demonstrates that the difference cannot be solely attributed to initial variations in strength levels.

These results align with previous research highlighting the efficacy of weight-bearing exercises in enhancing muscular strength among adolescents (Faigenbaum *et al.*, 2009) [2]. The findings suggest that incorporating weight-bearing exercises into the physical education curriculum for school girls can lead to substantial improvements in muscular strength.

Muscular Endurance

Similar to the findings for muscular strength, the pre-test analysis for muscular endurance yielded a non-significant F-value (0.22), indicating no significant difference in muscular endurance between the WBEG and CG before the intervention.

However, in the post-test analysis, the highly significant F-value (30.32) suggests that a significant difference in muscular endurance scores emerged between the two groups after the 6-week intervention. This indicates that the weight-bearing exercise program had a substantial positive impact on muscular endurance among the participants in the WBEG.

The adjusted post-test F-value (83.64), also highly significant, reinforces the notion that the improvement in muscular endurance within the WBEG cannot be solely attributed to initial differences in endurance levels.

These findings align with the established benefits of weight-bearing exercises in enhancing muscular endurance (Garber *et al.*, 2011) [1]. The results imply that school girls can significantly improve their muscular endurance through regular participation in weight-bearing exercise programs, which have implications for promoting overall physical fitness and health in this demographic.

Conclusion

The findings suggest that a 6-week weight-bearing exercise program, consisting of three days of training per week, can

have a positive impact on muscular fitness among school girls. These results emphasize the importance of incorporating weight-bearing exercises into the physical education curriculum for adolescent girls to enhance their overall muscular fitness levels.

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