INFLUENCE OF 12-WEEK CIRCUIT AND COMBINED PACKAGE TRAINING ON PHYSIOLOGICAL VARIABLES AMONG ADOLESCENT MALE STUDENTS

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Abstract

This randomized controlled study explored the effects of a 12-week circuit training programme along with an integrated package training method (circuit integrated with plyometric exercises) on selected physiological parameters in adolescent school boys. Sixty healthy participants aged 15–17 years were randomly recruited from a Government Higher Secondary School in Parthibanur, Ramanathapuram District, Tamil Nadu, India, and evenly assigned to three groups (n = 10 each): Group I followed the Circuit Training programme, Group II participated in the Package Training regimen, and Group III served as the Control Group. Both experimental groups underwent supervised sessions of 90 minutes each, conducted three times per week for a duration of 12 weeks. In contrast, the control group continued with their regular daily activities and did not take part in any supplementary training programme. The physiological measures evaluated included resting pulse rate and breath holding capacity. Standardized testing procedures were followed, and measurement reliability was ensured through calibrated equipment, repeated practice sessions, expert supervision, and test–retest verification. Analysis of covariance (ANCOVA), applied to control for baseline differences, showed statistically meaningful improvements ($p < 0.05$) across all measured physiological variables in both experimental groups when compared to the control group. Importantly, the package training group exhibited comparatively larger gains, particularly in VO_2 max and anaerobic power, along with more pronounced reductions in resting pulse rate. These outcomes highlight the added benefits of incorporating plyometric exercises into circuit training to enhance aerobic capacity, cardiovascular efficiency, and anaerobic performance. Overall, combined circuit–plyometric training appears to be an effective, time-efficient, and practical strategy for improving physiological fitness among adolescents, especially within school environments with limited resources.

Keywords: Circuit training, plyometric training, package training, physiological parameters, resting pulse rate and breath holding capacity, adolescent boys, school-based intervention, cardiovascular fitness.

Introduction

Physical fitness is widely regarded as a fundamental requirement for maintaining good health and overall well-being. Beyond its contribution to bodily health, it also supports active thinking, creativity, and intellectual efficiency (Kennedy, 1960s). Sport includes a broad spectrum of physical activities, whether recreational or organized, that help develop and sustain fitness while simultaneously offering enjoyment, competition, and opportunities for skill enhancement (Harre, 1982). Although many schools and colleges provide facilities for games such as cricket and football, participation is often optional, and physical education receives limited importance within academic assessment systems. Such neglect overlooks the close interrelationship between mental and physical development and highlights the need to prioritize structured physical activity among young people.

Training can generally be described as a systematic process through which skills are acquired and refined, or as a series of planned exercises intended to improve performance capacity and physical competence for specific tasks (Hardayal Singh, 1991). In the context of sport, training represents a scientifically organized and educational process designed to enhance an individual's physical and psychological readiness for optimal performance (Harre, 1982). This process involves not only structured exercise but also supportive elements such as appropriate equipment, instructional guidance, recovery strategies, balanced nutrition, and psychological preparation to facilitate effective adaptation.

The central objective of sports training is to bring about favorable metabolic, physiological, and psychological changes that enable individuals to perform at their highest potential. Regular and properly designed training promotes adaptations such as improved aerobic energy production, increased muscular efficiency, and better overall endurance. These results are attained by systematically adjusting variables such as training volume, intensity, recovery intervals, and overall workload. Nutritional support to allow adequate recovery and super compensation (Harre, 1982). Moreover, successful training programs are guided by established principles, including individuality, progressive overload, gradual progression, adaptation, and specificity, which ensure safe and effective improvements tailored to the needs of each participant (Hardayal Singh, 1991; Harre, 1982).

Methodology

The primary objective of this study was to evaluate the impact of circuit training and combined package training (a combination of circuit and plyometric exercises) on selected physiological variables in school boys. To accomplish this objective, thirty students were recruited from the Government Higher Secondary School in Parthibanur, Tamil Nadu, India. The participants were randomly chosen and ranged in age from 15 to 17 years. All subjects were medically fit and free from any injuries or health conditions that might have interfered with their participation in the training or testing procedures. Before the study began, written informed consent was secured from all participants as well as from their parents or legal guardians. The entire research process was conducted in accordance with established ethical standards for studies involving adolescent human participants.

Experimental Design

A total of sixty subjects were selected for the investigation and randomly assigned in equal numbers to three groups. Experimental Group I undertook a circuit training programme, whereas Experimental Group II engaged in an integrated package training regimen consisting of circuit and plyometric exercises. Group III functioned as the control group and did not participate in any additional organized training. Both experimental groups performed their respective training sessions for 90 minutes per day, three times a week, across a twelve-week period. Meanwhile, the control group maintained their normal daily routine without any specific exercise intervention. At the end of the training period, all participants were reassessed on the chosen dependent variables. The impact of the training programmes was evaluated by comparing pre-intervention and post-intervention mean scores, with the differences indicating the effectiveness of the circuit and combined training methods among the school boys.

Independent variables

- Circuit training
- Package training (Circuit training and Plyometric Training)

Dependent variables (physiological)

- Resting pulse rate
- Breath holding capacity

These were selected based on literature showing circuit and plyometric training effectively enhance cardiovascular efficiency and anaerobic capacity in adolescents (Villa-González et al., 2023; Fitriani et al., 2025).

TABLE I Criterion Measures

S.no	Variables	Name of the test
1	Resting pulse rate	Pulse count
2	Breath holding capacity	Holding time

Statistical Analysis

The pre- and post-training scores were analyzed using the t-ratio to determine statistical differences. A 0.05 level of significance was established as the criterion for testing the results.

THE SUMMARY OF MEAN AND DEPENDENT 't' TEST FOR THE PRE AND POST TESTS ON RESTING PULSE RATE ON CIRCUIT TRAINING, PACKAGE TRAINING AND CG

	Circuit Training Group	**Package Training Group**	**Control Group**
Pre - test Mean ± SD	73.20 ± 3.16	74.66 ± 2.50	71.80 ± 3.46
Post- test Mean ± SD	70.00 ± 3.53	70.40 ± 2.46	72.40 ± 3.37
't' test	**9.78***	**21.00***	0.76
Table Value	2.26	2.26	2.26

* Statistically significant at the 0.05 level.

The table indicates that the pre-test mean values of resting pulse rate for the circuit training, package training, and control groups were 73.20, 74.66, and 71.80 respectively. Following the intervention, the post-test mean values were 70.00 for the circuit training group, 70.40 for the package training group, and 72.40 for the control group.The calculated dependent t-ratio values comparing pre- and post-test means were 9.78* for the circuit training group, 21.00* for the package training group, and 0.76 for the control group. The critical t value required for significance at the 0.05 level with 9 degrees of freedom is 2.26. Since the obtained t-values for both experimental groups exceeded the critical value, it is evident that circuit training and package training produced significant improvements in resting pulse rate. In contrast, the control group did not demonstrate a statistically significant change,

as its calculated t-value was lower than the required table value, likely due to the absence of any structured training programme.

THE SUMMARY OF MEAN AND DEPENDENT 't' TEST FOR THE PRE AND POST TESTS ON BREATHE HOLDING TIME ON CIRCUIT TRAINING, PACKAGE TRAINING AND CONTROL GROUPS

	Circuit Training Group	**Package Training Group**	**Control Group**
Pre test Mean ± SD	25.20 ± 1.32	26.00 ± 1.76	27.50 ± 2.42
Post test Mean ± SD	28.80 ± 1.03	31.60 ± 2.46	27.00 ± 2.87
't' test	**8.43***	**10.34***	0.89
Table Value	2.26	2.26	2.26

* Significant 0.05 level of confidence.

Table indicates that the pre-test mean values for breath-holding time were 25.20 seconds for the circuit training group, 26.00 seconds for the package training group, and 27.50 seconds for the control group. After the training period, the post-test means increased to 28.80 seconds and 31.60 seconds for the circuit and package training groups respectively, while the control group recorded a mean of 27.00 seconds.The calculated dependent t-values comparing pre- and post-test scores were 8.43* for the circuit training group, 10.34* for the package training group, and 0.89 for the control group. The critical t value required for significance at the 0.05 level with 9 degrees of freedom is 2.26. Since the obtained t-values for both experimental groups exceeded the critical value, it is evident that circuit and package training produced significant improvements in breath-holding capacity. In contrast, the control group did not show a meaningful change, as its calculated t-value was lower than the required table value, likely due to the absence of any structured training intervention.

Conclusion

The findings of the study reveal that both experimental groups circuit training and package training showed significant improvements in the selected dependent variables, namely resting pulse rate and breath-holding time, in comparison with the control group.

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