

Comparative Effects of Circuit Training and Package Training on Selected Physical Fitness Variables Among School Boys

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Abstract- The present study investigated the effect of circuit training and package training on selected physical fitness variables among school boys. A total of 60 school boys aged 15–17 years from Government Higher Secondary School, Parthibanur, Tamil Nadu, were selected and randomly divided into three equal groups: circuit training group, package training group, and control group, with 20 participants in each group. The circuit training group underwent a structured circuit training programme, while the package training group underwent a combined programme consisting of circuit training and plyometric training. The training interventions were carried out for 12 weeks, three days per week, whereas the control group continued only routine activities without any special training. The selected physical fitness variables were speed, muscular strength endurance, and cardiorespiratory endurance. Speed was assessed using the 50 m dash, muscular strength endurance through sit-ups, and cardiorespiratory endurance through the Cooper 12-minute run/walk test. Pre-test and post-test data were collected before and after the intervention period. The data were analysed using analysis of covariance, and Scheffe's post hoc test was applied wherever significant differences were found. The results revealed that both circuit training and package training significantly improved the selected physical fitness variables when compared with the control group. Package training produced better overall improvement, particularly in speed and cardiorespiratory endurance, while both training methods were effective in improving muscular strength endurance. The findings suggest that package training may be recommended as an effective school-based training method for enhancing physical fitness among adolescent boys.

Keywords: Circuit Training, Package Training, Plyometric Training, Speed, Muscular Strength Endurance, Cardiorespiratory Endurance, School Boys.

I. INTRODUCTION

Physical fitness is an essential foundation for health, motor development, and sports performance among school boys. During adolescence, students experience rapid changes in growth, neuromuscular coordination, muscular strength, endurance capacity, and movement efficiency. Therefore, structured physical training during this stage can play a significant role in improving physical performance and developing lifelong fitness habits. School-based training programmes are especially important because they provide a systematic opportunity to improve fitness qualities in a controlled and progressive manner.

Among the major components of physical fitness, speed, muscular strength endurance, and cardiorespiratory endurance are highly important for school-age boys. Speed is the ability to perform movement in the shortest possible time and is required in almost all sports and games. Muscular strength endurance refers to the ability of the muscles to perform repeated contractions against resistance without early fatigue. Cardiorespiratory endurance reflects the efficiency of the heart, lungs, and circulatory system in supplying oxygen during prolonged physical activity. These variables are not only important for athletic performance but also for general physical health and functional capacity.

Circuit training is one of the most practical and effective methods used to improve physical fitness. It involves a series of exercises performed in sequence with limited rest between stations. This method can improve muscular endurance, movement coordination, cardiovascular fitness, and overall conditioning. Since circuit training can be performed

with minimal equipment and can accommodate groups of students at the same time, it is especially suitable for school settings. Previous studies have suggested that circuit-based training can improve physical fitness and body composition among children and adolescents (Marinho et al., 2022; Pinho et al., 2024).

Package training, in the present study, refers to a combined training approach involving circuit training and plyometric training. Plyometric training is commonly used to improve explosive movement, speed, power, and neuromuscular efficiency. When plyometric activities are combined with circuit training, the training stimulus may become broader and more effective because it targets both endurance-based conditioning and power-oriented movement. This type of training can be particularly useful for adolescent boys because it improves multiple physical fitness components within a short and structured training period.

The thesis methodology clearly states that the selected physical variables were speed, muscular strength endurance, and cardiorespiratory endurance. These were measured using the 50 m dash, sit-ups, and Cooper 12-minute run/walk test, respectively. The study involved 60 school boys aged 15–17 years from Government Higher Secondary School, Parthibanur, Tamil Nadu, divided into circuit training, package training, and control groups. The experimental groups underwent their respective training programmes for 12 weeks.

Although circuit training and plyometric-based training have been studied separately, there is a need to compare the effects of circuit training and package training on selected physical fitness variables among school boys. Such a comparison can help physical education teachers, coaches, and trainers identify which training method is more effective for improving school-level physical performance. Therefore, the present study was designed to investigate the effect of circuit training and package training on selected physical fitness variables among school boys.

The selected physical fitness variables for this article were speed, muscular strength endurance, and

cardiorespiratory endurance. The findings of this study may provide practical evidence for developing effective school-based training programmes to improve physical fitness and performance among adolescent boys.

II. METHODOLOGY

Study Design

The present study adopted a pre-test and post-test experimental design to examine the effect of circuit training and package training on selected physical fitness variables among school boys. The independent variables were circuit training and package training, while the dependent variables were speed, muscular strength endurance, and cardiorespiratory endurance.

Participants

A total of 60 school boys were selected randomly from Government Higher Secondary School, Parthibanur, Tamil Nadu. The age of the participants ranged between 15 and 17 years. The selected subjects were randomly divided into three equal groups, with 20 participants in each group.

Grouping of Subjects

Group	Treatment	Number of Subjects
Group I	Circuit Training	20
Group II	Package Training	20
Group III	Control Group	20

Selection of Variables

For the present article, only the physical fitness variables from the thesis were considered. The selected physical variables were:

1. Speed
2. Muscular strength endurance
3. Cardiorespiratory endurance

Criterion Measures

Physical Variable	Test Used	Unit of Measurement
Speed	50 m Dash	Seconds
Muscular Strength Endurance	Sit-ups	Counts per minute
Cardiorespiratory	Cooper 12-	Metres

Endurance	minute Run/Walk Test	
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The criterion measures were selected after reviewing relevant literature and consulting experts in physical education and sports sciences.

Training Programme

The experimental groups underwent their respective training programmes for a period of 12 weeks. The circuit training group trained for 90 minutes per day, three days per week, on Monday, Wednesday, and Friday. Each session consisted of 15 minutes warm-up, 60 minutes training, and 15 minutes cool-down/correction. The package training group also trained for 90 minutes per day, three days per week, on Tuesday, Thursday, and Saturday. Training load progression was introduced every four weeks.

The circuit training group performed eight drills: press-ups, prone trunk extensions, sit-ups, abdominal crunches, skipping, squat jumps, high-knee sprints, and burpees. The training intensity progressed from 60% in the first four weeks, to 70% in weeks five to eight, and 80% in weeks nine to twelve.

The package training group performed a combination of circuit training and plyometric training. The package included exercises such as press-ups, sit-ups, abdominal crunches, squat jumps, high-knee jumps, bounds, hurdle hopping, single-leg hopping, box jumps, and depth jumps. The training programme was progressively modified every four weeks in terms of repetitions, sets, duration, and intensity.

The control group did not participate in any special training programme and continued only their routine activities during the study period.

Test Administration

Speed was assessed using the 50 m dash, where the time taken to complete the distance was recorded in seconds. Muscular strength endurance was assessed using the sit-ups test, where the number of correct sit-ups completed in one minute was recorded.

Cardiorespiratory endurance was assessed using the Cooper 12-minute run/walk test, where the total

distance covered in 12 minutes was recorded in metres.

Reliability of the Tests

The reliability of the selected physical fitness tests was established through the test-retest method. The intra-class reliability coefficients were reported as 0.91 for speed, 0.88 for muscular strength endurance, and 0.93 for cardiorespiratory endurance, indicating acceptable reliability of the selected test items.

Collection of Data

Pre-test data were collected from all three groups before the commencement of the training programme. After the completion of the 12-week intervention, post-test data were collected using the same testing procedures. The difference between the initial and final scores was used to determine the effect of circuit training and package training on the selected physical fitness variables.

Statistical Analysis

The collected data were analysed using analysis of covariance (ANCOVA) to determine the significant differences among the adjusted post-test means of the three groups. Whenever the obtained F-ratio was significant, Scheffe's post hoc test was applied to identify the paired mean differences. The level of significance was fixed at 0.05.

III. RESULTS

The collected data were analysed using analysis of covariance (ANCOVA). When the adjusted post-test means showed significant differences, Scheffe's post hoc test was applied. The level of significance was fixed at 0.05. The physical variables analysed in this article were speed, muscular strength endurance, and cardiorespiratory endurance. Chapter IV confirms that the study used ANCOVA and Scheffe's post hoc test to compare circuit training, package training, and control groups.

Table 1
 Pre-test, post-test and adjusted post-test means of selected physical variables

Variable	Group	Pre-test Mean ± SD	Post-test Mean ± SD	Adjusted Post-test Mean
Speed	Circuit Training	7.7870 ± 0.3212	7.5420 ± 0.3100	7.491
	Package Training	7.7345 ± 0.3496	7.3165 ± 0.2617	7.310
	Control Group	7.6575 ± 0.5625	7.7190 ± 0.5582	7.777
Muscular Strength Endurance	Circuit Training	27.05 ± 2.6051	29.75 ± 3.7539	29.734
	Package Training	26.70 ± 3.6720	30.50 ± 2.9642	29.692
	Control Group	26.30 ± 3.6706	26.00 ± 3.6706	26.374
Cardiorespiratory Endurance	Circuit Training	2041.0 ± 196.76	2132.5 ± 155.35	2133
	Package Training	2048.0 ± 157.66	2178.0 ± 95.12	2173
	Control Group	2035.5 ± 152.67	2025.0 ± 95.12	2029

Table 2
 ANCOVA summary of selected physical variables

Variable	Pre-test F-ratio	Post-test F-ratio	Adjusted Post-test F-ratio	Result
Speed	0.470	5.13*	37.16*	Significant
Muscular Strength Endurance	0.273	8.41*	31.58*	Significant
Cardiorespiratory Endurance	0.03	6.33*	21.65*	Significant

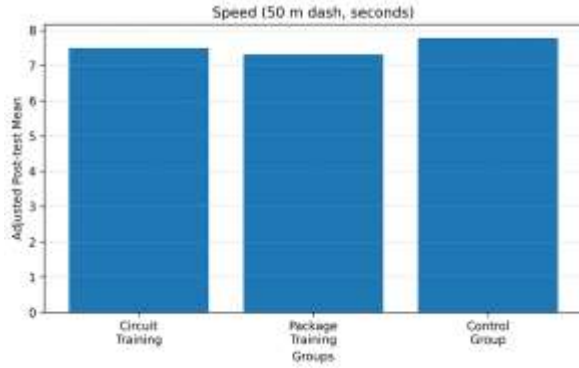
*Significant at 0.05 level.

The pre-test F-ratios were not significant, showing that the groups were similar before the intervention. However, the post-test and adjusted post-test F-ratios were significant for speed, muscular strength endurance, and cardiorespiratory endurance, indicating that the training interventions produced significant improvements in the selected physical variables.

Speed

The adjusted post-test means for speed were 7.491 seconds for the circuit training group, 7.310 seconds for the package training group, and 7.777 seconds for the control group. Since speed was measured in seconds, the lower value indicates better performance. The package training group showed the best improvement in speed, followed by the circuit training group. The adjusted post-test F-ratio of 37.16 was significant at the 0.05 level. Scheffe's test also showed significant mean differences among the groups, and the thesis interpretation states that package training produced more positive effects on speed than circuit training and control.

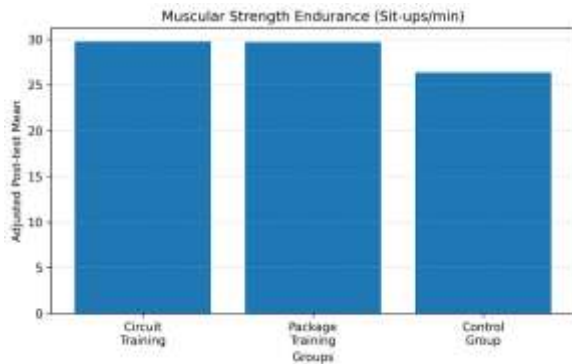
Figure 1:



Muscular Strength Endurance

The adjusted post-test means for muscular strength endurance were 29.734 for the circuit training group, 29.692 for the package training group, and 26.374 for the control group. The adjusted post-test F-ratio of 31.58 was significant at the 0.05 level, indicating a significant difference among the groups. Scheffe's test showed that both experimental groups differed significantly from the control group. However, the difference between circuit training and package training was very small and not meaningful, showing that both training methods were effective in improving muscular strength endurance.

Figure 2:

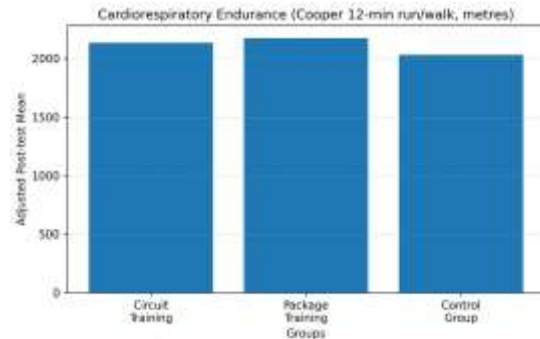


Cardiorespiratory Endurance

The adjusted post-test means for cardiorespiratory endurance were 2133 metres for the circuit training group, 2173 metres for the package training group, and 2029 metres for the control group. Since cardiorespiratory endurance was measured through the Cooper 12-minute run/walk test, a higher distance indicates better performance. The package training group showed the highest improvement, followed by the circuit training group. The adjusted post-test F-

ratio of 21.65 was significant at the 0.05 level. Scheffe's test showed that both circuit training and package training were significantly better than the control group, while the package training group showed a more favourable adjusted mean.

Figure 3:



The results clearly indicate that both circuit training and package training significantly improved selected physical fitness variables among school boys when compared with the control group. Package training produced the most favourable improvement in speed and cardiorespiratory endurance, while both circuit training and package training showed strong improvement in muscular strength endurance. Overall, package training may be considered more effective for improving selected physical fitness variables among school boys.

IV. DISCUSSION

The present study examined the effect of circuit training and package training on selected physical fitness variables among school boys. The selected physical variables were speed, muscular strength endurance, and cardiorespiratory endurance, measured through the 50 m dash, sit-ups, and Cooper 12-minute run/walk test, respectively. The study involved school boys aged 15–17 years who underwent a 12-week intervention, with circuit training, package training, and control groups.

The results showed that both circuit training and package training significantly improved the selected physical fitness variables when compared with the control group. This indicates that systematic and progressive training can produce meaningful physical fitness adaptations among adolescent boys. The

improvement may be due to repeated muscular effort, increased movement efficiency, better neuromuscular coordination, and improved tolerance to fatigue developed through regular training. The findings are in line with the view that structured exercise programmes can improve physical fitness components among children and adolescents (Pinho et al., 2024).

In speed, the package training group showed the most favourable improvement, followed by the circuit training group and control group. Since speed was measured in seconds, the lower adjusted post-test mean of the package training group indicates better performance. This improvement may be attributed to the inclusion of plyometric movements in package training. Plyometric exercises involve quick stretch-shortening actions that improve explosive force production, reaction ability, and movement speed.

Previous research also suggests that plyometric and power-oriented training can improve speed and explosive performance in youth populations (Behm et al., 2017; Lesinski et al., 2016). The thesis results also confirmed that package training produced a greater positive influence on speed than circuit training and the control condition.

In muscular strength endurance, both circuit training and package training produced significant improvement compared with the control group. The adjusted post-test means of the circuit training and package training groups were very close, showing that both methods were effective for improving repeated muscular effort. This improvement may be due to the repeated use of exercises such as sit-ups, press-ups, abdominal crunches, skipping, squat jumps, high-knee sprints, and burpees, which repeatedly activate the abdominal, lower-limb, and trunk muscles. Circuit-based training is especially useful for developing muscular endurance because it involves repeated exercise stations with limited rest intervals. Similar findings have been reported by Marinho et al. (2022), who observed that circuit-based training in school settings improved fitness-related outcomes among children.

The improvement in cardiorespiratory endurance also showed the effectiveness of the training

interventions. The package training group recorded the highest adjusted post-test mean in the Cooper 12-minute run/walk test, followed by the circuit training group and control group. This suggests that the combination of circuit and plyometric activities may have created a stronger training stimulus for improving aerobic capacity and whole-body endurance. Circuit training may have improved cardiovascular efficiency through continuous movement and repeated exercise stations, while plyometric activities may have enhanced lower-limb power and running economy. The thesis results also stated that package training produced greater improvement in cardiorespiratory endurance than circuit training and the control group.

The superiority of package training may be explained by its combined training nature. Package training included both circuit training and plyometric training, thereby providing both conditioning-based and power-based stimuli. Circuit training improves general conditioning, muscular endurance, and fatigue resistance, while plyometric training improves explosive strength, speed, and neuromuscular efficiency. When these two methods are combined, they may produce broader adaptations than circuit training alone. This explains why package training showed better overall improvement in speed and cardiorespiratory endurance, while both circuit and package training were effective for muscular strength endurance.

The control group showed comparatively less improvement, which indicates that routine school activities alone may not be sufficient to produce significant enhancement in physical fitness. This highlights the importance of planned, progressive, and supervised training programmes in school physical education. The thesis conclusion also supports that both circuit training and package training improved physical variables compared with the control group, and that package training was generally better than circuit training in improving the selected parameters.

Overall, the findings suggest that circuit training and package training are effective methods for improving physical fitness among school boys. However, package training appears to be more effective overall,

particularly for improving speed and cardiorespiratory endurance. Therefore, package training may be recommended as a useful school-based training approach for enhancing physical fitness and performance among adolescent boys.

CONCLUSION

The present study concluded that both circuit training and package training significantly improved selected physical fitness variables among school boys. Improvements were observed in speed, muscular strength endurance, and cardiorespiratory endurance when compared with the control group. Among the two training methods, package training produced better overall improvement, particularly in speed and cardiorespiratory endurance, while both circuit training and package training were effective for muscular strength endurance. Therefore, package training, which combines circuit and plyometric activities, may be recommended as an effective school-based training method for enhancing physical fitness among adolescent boys.

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