OPEN ACCESS

Journal of Advances in Sports and Physical Education

Abbreviated Key Title: J Adv Sport Phys Edu
ISSN 2616-8642 (Print) |ISSN 2617-3905 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Effect of Circuit Training and Cardio Aerobic Circuit Training on Selected Motor Fitness among College Level Men Football Players

P. Gopalakrishna[1]*, Dr P. K. Kavithashri[2], Dr S. Saraboji[3], Dr.S. Rameshkumar[4]

[1]PhD Research Scholar, Kongu Nadu Arts and Science College, Coimbatore, Tamil Nadu
[2]Research Supervisor, Kongu Nadu Arts and Science College, Coimbatore, Tamil Nadu
[3]Principal, Adithya College of Physical Education Rajamundry, Andhra Pradesh
[4]Head Dept of Physical Education Sri Ramakrishna Mission Vidyalaya College of Arts and Science, Coimbatore, Tamil Nadu, India

DOI: https://doi.org/10.36348/jaspe.2025.v08i08.004 | **Received:** 22.07.2025 | **Accepted:** 19.09.2025 | **Published:** 22.09.2025

***Corresponding author:** P. Gopalakrishna
PhD Research Scholar, Kongu Nadu Arts and Science College, Coimbatore, Tamil Nadu

Abstract

Circuit training involves transitioning quickly between various exercise stations, completing a set number of repetitions or working for a specific duration at each station. It is a type of high-intensity training that combines elements of resistance and aerobic exercises, primarily aimed at enhancing both strength and muscular endurance. A full round of the exercises in a session is referred to as an "exercise circuit. "This training method was introduced in 1953 by R.E. Morgan and G.T. Anderson at the University of Leeds, England. It is widely regarded as an effective way to improve multiple components of physical fitness, including muscular strength, muscular endurance, explosive power, cardiovascular endurance, anaerobic capacity, agility, and flexibility. Morgan and Anderson's model typically include six to twelve different exercise stations, targeting overall body conditioning. A full workout usually comprises two to three rounds of the circuit, with rest periods between 15 to 30 seconds between stations or sets. Circuit training programs can be tailored to fit individual fitness goals by adjusting the duration, intensity, or number of exercises. In a study involving 45 district-level football players, participants were divided to undergo either traditional circuit training or cardio-based circuit training. A pretest was conducted to assess selected motor fitness components. After a 12-week training period, a post-test was administered to evaluate improvements. Statistical methods such as the paired 't' test and Analysis of Covariance (ANCOVA) were used to analyze the data. Where significant differences were found using the F-ratio, Scheffe's post hoc test was employed to determine specific group differences. All statistical analyses were performed using SPSS software. The results indicated that both forms of circuit training produced significant improvements in motor fitness variables, particularly in muscular strength and muscular endurance, among the football players.

Keywords: circuit training, cardio aerobic circuit training, muscular strength, muscular endurance, motor fitness, football players.

INTRODUCTION

Football is an intensive sport that demands a high level of physical conditioning, particularly in areas such as strength, speed, agility, and endurance. To meet these demands, athletes often engage in specialized training programs. Among the most commonly used methods are circuit training and cardio aerobic circuit training, both of which are designed to enhance overall athletic performance. Circuit training typically includes a sequence of exercises performed with minimal rest, targeting various muscle groups and energy systems simultaneously. In contrast, cardio aerobic circuit training emphasizes sustained movement to primarily improve cardiovascular endurance, while still incorporating elements of strength training.

For college-level football players, sustaining optimal motor fitness is crucial for maintaining high performance during competition. Circuit training tends to be more effective in boosting muscular strength and anaerobic capacity, while cardio aerobic circuits contribute more significantly to cardiovascular health and recovery. Understanding the specific impacts of each training approach can help in designing targeted fitness programs. This study aims to evaluate the effectiveness of both training methods on select motor fitness components, with the goal of offering guidance for

coaches and trainers in creating effective conditioning plans for football athletes.

METHODOLOGY

To conduct this study, a total of 45 male football players, aged between 18 and 25, who had been selected at the district level, were chosen at random. These participants were then evenly divided into three groups, each consisting of 15 individuals (n=15). Group I participated in a circuit training program, Group II engaged in cardio aerobic circuit training, and Group III served as the control group, continuing with their standard routine without any specialized intervention. Both experimental groups followed their respective training programs three times a week over a period of eight weeks. Group III did not receive any additional training beyond their usual activities.

Training Programme

All training sessions were conducted in the morning and supervised by the researcher, who ensured proper execution, provided motivation, and gave necessary instructions. Only the experimental groups participated in these scheduled sessions, which were specifically designed to meet the objectives of the study.

Table 1

Week	Group I: Circuit Training	Group II: Cardio Aerobic Circuit Training
1–2	Basic circuit (6 stations): push-ups, squats, jumping jacks, crunches, lunges, plank (30 sec/work; 30 sec rest). 2 rounds.	Low-intensity aerobic circuit (6 stations): high knees, step-ups, jumping jacks, arm circles, butt kicks, marching in place (45 sec each, 15 sec rest). 2 rounds.
3–4	Increase to 8 stations: add burpees and mountain climbers. Work: 40 sec, Rest: 20 sec. 2 rounds.	Increase time to 50 sec per station, reduce rest to 10 sec. Add light resistance exercises (e.g., resistance band rows). 2 rounds.
5–6	Increase to 3 rounds. Include light weights (dumbbells) in squats and lunges. Work: 45 sec, Rest: 15 sec.	Moderate-intensity: continuous movement for 30 mins including 8 aerobic/strength moves. Emphasis on coordination and endurance. 3 rounds.
7–8	Add agility ladder drills and jump squats. Focus on speed and form. Work: 45 sec, Rest: 15 sec. 3 rounds.	Include aerobic combos (e.g., step + knee lifts, dance moves). Emphasize rhythm and cardio. 3 rounds.
9–10	Increase difficulty: add plyometrics (e.g., tuck jumps). Reduce rest: 10 sec. Work: 50 sec. 3 rounds.	Higher intensity: longer circuits (10 exercises). Include bodyweight strength + aerobic intervals (e.g., 1 min jog, 1 min push-ups). 3 rounds.
11–12	Peak weeks: full-body power circuit. Work: 1 min, Rest: 15 sec. Emphasis on explosive power (e.g., jump lunges, med ball slams). 3 rounds.	High-intensity aerobic intervals: 10 exercises x 1 min, 10 sec rest. Include resistance bands or light weights. 3 rounds. End with dynamic stretching.

Statistical Technique

Data were collected from all participants before and after the 12-week training period, focusing on key motor fitness components such as muscular strength and muscular endurance. To analyze the impact of the training programs, a paired 't' test was used to compare pre- and post-test scores within groups. In addition, Analysis of Covariance (ANCOVA) was employed to assess differences between the groups. The level of significance for all statistical tests was set at 0.05.

Table 2: Significance Of Mean Gains /Losses Between Pre and Post Test of Circuit Training Group Cardio Aerobic Circuit Training Group and Control Group on Motor Fitness Variables of Volleyball Players

Circuit Training Group					
Variables	**Pre test mean ±SD**	**Post test mean ±SD**	**MD**	**SEM**	**t ratio**
Muscular Strength	29.26±1.32	34.10 ±1.42	4.84	0.46	10.46
Muscular Strength and Endurance	38.00±3.34	40.80±2.88	2.80	0.45	6.23
Cardio Aerobic Circuit Training Group					
Variables	**Pre test mean ±SD**	**Post test mean ±SD**	**MD**	**SEM**	**t ratio**
Muscular Strength	29.53±1.36	32.20±1.47	2.70	0.33	8.08
Muscular Strength and Endurance	37.87±3.44	42.73 ±3.41	4.86	0.38	12.93
Control Group					
Variables	**Pre test mean ±SD**	**Post test mean ±SD**	**MD**	**SEM**	**t ratio**
Muscular Strength	29.37 ±1.16	29.40 ±1.20	0.04	0.03	1.00
Muscular Strength and Endurance	38.20 ±2.54	38.60±2.61	0.40	0.13	2.05

The study analyzed the effects of circuit training and cardio aerobic circuit training on muscular strength and muscular strength & endurance among college-level male football players.

In the circuit training group, the mean muscular strength increased from 29.26 ± 1.32 kg in the pre-test to 34.10 ± 1.42 kg in the post-test, showing a mean difference (MD) of 4.84 kg with a t-ratio of 10.46, indicating significant improvement. Muscular strength and endurance also improved from 38.00 ± 3.34 reps to 40.80 ± 2.88 reps, with a MD of 2.80 and a t-ratio of 6.23.

In the cardio aerobic circuit training group, muscular strength rose from 29.53 ± 1.36 kg to 32.20 ± 1.47 kg, showing a MD of 2.70 kg and a t-ratio of 8.08. For muscular strength and endurance, the pre-test mean of 37.87 ± 3.44 reps increased to 42.73 ± 3.41 reps, with a MD of 4.86 and at-ratio of 12.93, indicating a significant improvement.

In the control group, changes were minimal. Muscular strength shifted slightly from 29.37 ± 1.16 kgto29.40 ± 1.20 kg, with a MD of 0.04 kg and t-ratio of 1.00, showing no significant difference. Similarly, muscular strength and endurance changed marginally from 38.20 ± 2.54 reps to 38.60 ± 2.61 reps, with a MD of 0.40 and t-ratio of 2.05, indicating negligible improvement. These results suggest that both circuit training methods led to notable gains, with cardio aerobic training having a greater impact on muscular strength and endurance.

Table 3: The Scheffe's Test for The Differences Between Adjusted Post Test Means on Muscular Strength

CTG	CACTG	CG	Mean Differences	Confidence Interval Value
34.17	32.13	-	2.04	1.27*
34.17	-	30.11	4.06	1.27*
-	32.13	30.11	2.02	1.27*

A comparative analysis was conducted to assess the effectiveness of different training methods on muscular strength among the three groups. The post-test mean score for muscular strength in the Circuit Training Group (CTG) was 34.17, while the Cardio Aerobic Circuit Training Group (CACTG) recorded a mean of 32.13. The Control Group (CG) had a lower mean of 30.11.

When comparing CTG and CACTG, the mean difference was 2.04, which exceeded the confidence interval value of 1.27, indicating a statistically significant difference in favor of CTG. Similarly, the comparison between CTG and CG showed a larger mean difference of 4.06, also surpassing the confidence interval, confirming a significant improvement due to circuit training.

The comparison between CACTG and CG revealed a mean difference of 2.02, which again exceeded the confidence interval value of 1.27, suggesting that cardio aerobic circuit training was also effective, though slightly less so than regular circuit training.

Overall, the results suggest that both training programs significantly improved muscular strength compared to the control group, with the Circuit Training Group showing the most pronounced improvement.

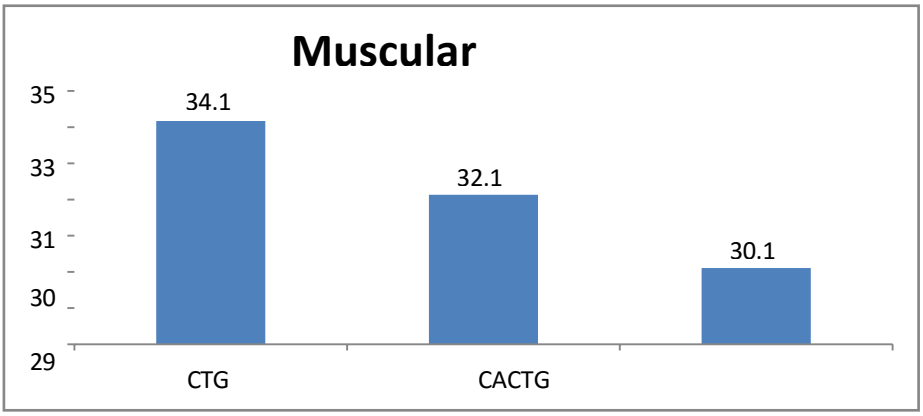

Figure 1: Bar Diagram Showing the Adjusted Mean Values on Muscular Strength of Circuit Training Group Cardio Aerobic Circuit Training Group and Control Group

Table 4: The Scheffe's Test for the Differences Between Adjusted Posttest Means on Muscular Strength and Endurance

CTG	CACTG	CG	Mean Differences	Confidence Interval Value
40.82	42.87	-	2.05	1.34*
40.82	-	38.45	2.37	1.34*
-	42.87	38.45	4.42	1.34*

The post-test results for muscular strength and endurance indicate clear differences in performance among the three groups. The Cardio Aerobic Circuit Training Group (CACTG) recorded the highest post-test mean of 42.87 repetitions, followed by the Circuit Training Group (CTG) with a mean of 40.82, while the Control Group (CG) had the lowest mean of 38.45. When comparing CTG and CACTG, the mean difference was 2.05, which is greater than the confidence interval value of 1.34, indicating a statistically significant difference in favor of CACTG. This suggests that cardio aerobic circuit training was more effective in enhancing muscular endurance than circuit training alone.

The comparison between CTG and CG showed a mean difference of 2.37, again exceeding the confidence interval, confirming that circuit training significantly improved muscular endurance compared to no training.

A larger difference was observed between CACTG and CG, with a mean difference of 4.42, which also surpassed the confidence interval. This indicates that cardio aerobic circuit training had the most substantial impact on muscular strength and endurance among all three groups.

In conclusion, while both experimental groups showed improvements, the Cardio Aerobic Circuit Training Group demonstrated the highest gains in muscular endurance, followed by the Circuit Training Group, with the Control Group showing minimal progress.

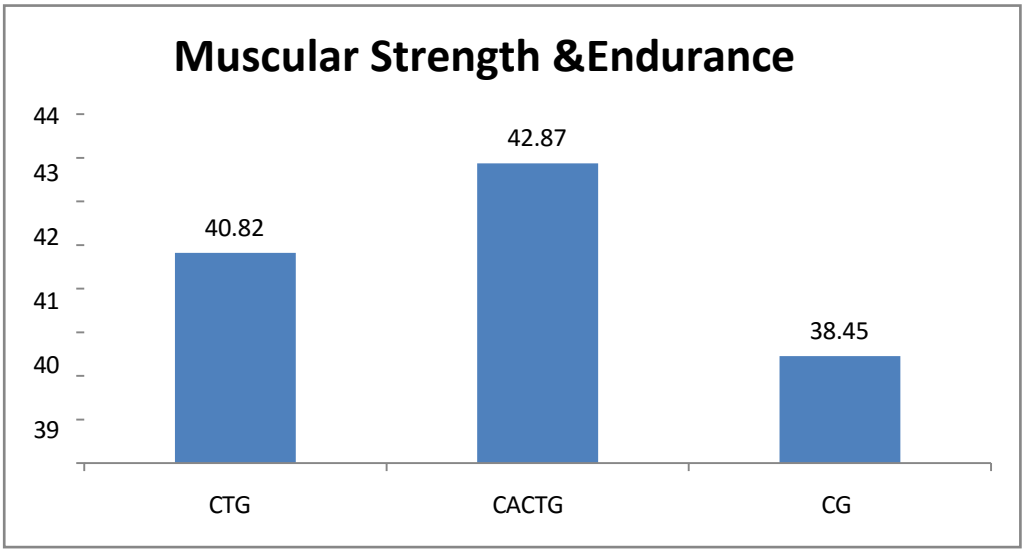

Figure 2: Bar Diagram Showing the Adjusted Mean Values on Muscular Strength Endurance of Circuit Training Group Cardio Aerobic Circuit Training Group and Control Group

DISCUSSION

The findings of this study reveal that both circuit training and cardio aerobic circuit training significantly improved muscular strength and muscular strength and endurance among college-level male football players compared to the control group. The Circuit Training Group (CTG) demonstrated notable gains in muscular strength, with a mean increase from 29.26 kg to 34.10 kg, supported by a significant t-ratio. This improvement suggests that the structured combination of resistance-based exercises in a circuit format effectively targets muscle development and power.

In contrast, the Cardio Aerobic Circuit Training Group (CACTG) showed superior improvement in muscular strength and endurance, with performance increasing from 37.87 to 42.73 repetitions. The continuous aerobic component integrated with strength exercises likely contributed to enhanced cardiovascular efficiency and muscular stamina.

The Control Group showed negligible improvements in both variables, confirming that the observed gains in the experimental groups were due to the intervention programs rather than natural progression or external factors. Comparative post-test analysis further supports these findings. In terms of muscular strength, CTG outperformed CACTG and CG, while for muscular endurance, CACTG showed the greatest improvement. The significant mean differences between groups, all exceeding the confidence interval values, affirm the effectiveness of the training methods.

CONCLUSION

Based on the results, it can be concluded that:

- Both circuit training and cardio aerobic circuit training are effective in enhancing muscular strength and muscular strength and endurance in college-level male football players.
- Circuit training is more effective for developing muscular strength, while cardio aerobic circuit

training produces greater improvements in muscular endurance.

- The lack of significant improvement in the control group emphasizes the importance of a structured training program for athletic development.

Recommendations

1. Coaches and trainers should incorporate circuit-based training into football conditioning programs to enhance key components of motor fitness.
2. For improving overall muscular endurance, cardio aerobic circuit training should be prioritized, especially during pre-season or endurance-building phases.
3. Circuit training should be emphasized when the training goal is to build muscular strength and explosive power.
4. Training programs should be periodized and tailored based on the athlete's specific needs, performance level, and playing position.
5. Future research may explore longer intervention periods, different age groups, or the combined effects of both training types to maximize overall athletic performance.

REFERENCE

- American College of Sports Medicine. (2018). *ACSM's Guidelines for Exercise Testing and Prescription* (10th ed.). Wolters Kluwer.
- Baechle, T. R., & Earle, R. W. (2008). *Essentials of Strength Training and Conditioning* (3rd ed.). Human Kinetics.
- Bompa, T., & Carrera, M. (2005). *Periodization Training for Sports* (2nd ed.). Human Kinetics.
- Bouchard, C., & Shepard, R. J. (1994). *Physical activity, fitness, and health: The model and key concepts*. In C. Bouchard, R. J. Shepard, & T. Stephens (Eds.), Physical Activity, Fitness, and Health (pp. 77–88). Human Kinetics.
- Getchell, B. (2009). *The effects of a 10-week circuit training program on agility and anaerobic endurance of college students*. Journal of Strength and Conditioning Research, 23(4), 1223–1229.
- Gharakhanlou, R., Kazemi, A., &Ghahramani, M. (2011). *Effect of 8 weeks of circuit resistance training on VO_2 max and muscular endurance in male students*. Iranian Journal of Health and Physical Activity, 2(1), 27–34.
- Jesuudoss, A. (2019). *Effect of circuit resistance training on selected motor fitness components among college level men football players*. International Journal of Physical Education, Sports and Health, 6(1), 294–296.
- Klika, B., & Jordan, C. (2013). *High-intensity circuit training using body weight: Maximum results with minimal investment*. ACSM's Health & Fitness Journal, 17(3), 8–13.
- Phulkar, M. (2017). *Effect of circuit resistance training and aerobic circuit resistance training on leg explosive power among college men football players*. International Journal of Physical Education, Sports and Health, 4(2), 235–237.
- Reilly, T., Bangsbo, J., & Franks, A. (2000). *Anthropometric and physiological predispositions for elite soccer*. Journal of Sports Sciences, 18(9), 669–683.
- Saeed, A. A., & Ismail, A. (2020). *Effect of aerobic and circuit training on cardiovascular endurance of university football players*. European Journal of Physical Education and Sport Science, 6(11), 15–26.
- Singh, G., &Patir, H. (2021). *Effect of circuit training on selected motor abilities of the football players*. Journal of Physical Education Research, 8(1), 32–36.
- Thomas, T. R., Etheridge, G. L., & Whaley, M. H. (1986). *Training responses to circuit weight training and jogging in sedentary adult males*. Medicine and Science in Sports and Exercise, 18(5), 561–565.
- Wilmore, *et al.,* (1978). *Physiological alterations consequent to circuit weight training*. Medicine and Science in Sports, 10(2), 79–84.
- Yadav, S., &Sardar, D. (2017). *Effect of circuit weight training on physical fitness variables of Gorakhpur University football players*. International Journal of Yogic, Human Movement and Sports Sciences, 2(2), 181–183.