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Combined and isolated effect of anaerobic training and super circuit training on selected physical fitness and physiological variables among male Kabaddi players

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Abstract
The purpose of this study was to examine the combined and isolated effects of anaerobic training and super circuit training on selected physical fitness and physiological variables among male Kabaddi players. Agility and maximal oxygen uptake (VO_2 max) were chosen as primary performance indicators due to their critical importance in competitive Kabaddi. A total of 18–25-year-old male athletes who participated in the Bharathiar University Inter-Collegiate Kabaddi tournaments, Coimbatore were selected and randomly divided into three groups: Anaerobic Training Group (ATG), Super Circuit Training Group (SCTG) and Combined Training Group (CTG). The experimental period lasted 12 weeks, with training conducted thrice weekly. Agility was measured using the Illinois Agility Test, while VO_2 Max was assessed through the Multistage Fitness Test. Statistical techniques including ANCOVA and Scheffé's post hoc test were used to analyze the data. Results revealed that all three training methods significantly improved agility and VO_2 Max. However, the Combined Training Group demonstrated superior enhancement compared to isolated training groups. These findings indicate that integrating anaerobic and circuit-based training yields optimal improvements in physical and physiological capabilities essential for Kabaddi. Coaches and strength-conditioning experts are advised to incorporate multi-component training programs to maximize athletic performance.

Keywords: Anaerobic training, super circuit training, agility, VO_2 max, physical fitness, physiological variables, Kabaddi players, combined training, inter-collegiate athletes.

Introduction
Kabaddi is a high-intensity combative team sport that demands speed, power, agility, muscular strength, anaerobic endurance and aerobic capacity. The nature of the sport rapid raids, sudden directional changes, and intense physical contact requires athletes to possess well-developed physical and physiological capabilities. Among these, agility and VO_2 max are critical factors that influence the performance efficiency of Kabaddi players.
Agility, defined as the ability to change direction rapidly and efficiently, is essential during offensive and defensive maneuvers. VO_2 max, the maximal amount of oxygen an individual can utilize during intense exercise, represents aerobic endurance and plays a vital role in sustaining repeated high-intensity efforts.

Anaerobic Training
Anaerobic training refers to high-intensity physical exercise performed in short bursts where the body's demand for oxygen exceeds its supply. During such activities, energy is produced without relying on oxygen, primarily through the ATP-PC system and anaerobic glycolysis. This type of training enhances speed, power, strength and the ability to perform repeated high-intensity efforts all of which are essential for sports like Kabaddi.
Anaerobic training typically includes activities such as sprinting, shuttle runs, plyometric exercises, high-intensity interval training (HIIT), and resistance-based explosive movements. Regular anaerobic conditioning improves muscular force production, neuromuscular coordination, lactate tolerance and the ability to recover quickly between explosive actions. These adaptations are especially valuable for Kabaddi players, who must frequently accelerate, change direction, and execute powerful offensive and defensive movements within very short time spans.

Anaerobic training focuses on short-duration, high-intensity efforts that enhance muscular power, speed, and anaerobic capacity. Super circuit training, which combines strength and aerobic elements in a continuous sequence, is known to improve both muscular endurance and cardiovascular efficiency. However, studies examining the combined effects of anaerobic and super circuit training on Kabaddi-specific performance variables remain limited.

Circuit Training

Circuit training is a structured workout method in which an individual performs a series of exercises (stations) in a sequential manner with minimal rest in between. Each station targets a specific component of fitness such as strength, endurance, flexibility, speed, or coordination. The exercises are arranged to alternate between different muscle groups to avoid fatigue and maintain workout intensity. A typical circuit may include 8–12 stations, each performed for a fixed duration (30–45 seconds) or repetitions, followed by a brief transition period before moving to the next station. This design keeps the heart rate elevated throughout the session, leading to improvements in both muscular endurance and cardiovascular fitness. Circuit training is highly effective for athletes because it simultaneously develops multiple fitness components. For Kabaddi players, this method enhances overall conditioning, muscular stamina, agility, balance and the ability to perform repeated high-intensity movements without excessive fatigue. The combination of strength and aerobic elements makes circuit training an ideal method for enhancing total body performance and improving work capacity.

This study aims to analyze the isolated and combined effects of anaerobic and super circuit training on agility and VO_2 max among male Kabaddi players.

Methodology

The study was conducted on male Kabaddi players aged 18–25 years who had represented their respective colleges in the Bharathiar University Inter-Collegiate Kabaddi Tournaments, Coimbatore. All participants possessed a minimum of two years of competitive experience and were medically screened to ensure readiness for the training programme. A randomized experimental design was used, wherein the players were divided into three groups: Anaerobic Training Group (ATG), Super Circuit Training Group (SCTG), and Combined Training Group (CTG). The training period lasted for twelve weeks, with each group undergoing three training sessions per week. The anaerobic training protocol consisted of repeated sprints, shuttle runs, plyometric exercises, and high-intensity intervals designed to enhance speed and power. The super circuit training included a sequence of strength and aerobic stations with minimal rest, aimed at improving muscular and cardiovascular endurance. The combined training integrated both anaerobic and circuit components within the same session to stimulate multiple energy systems. Agility was assessed using the Illinois Agility Test, while VO_2 max was measured through the Multistage Fitness Test (Beep Test). Pre- and post-test data were collected and analyzed using ANCOVA to compare mean differences among the groups, with Scheffé's post hoc test employed to identify specific group variations.

Statistical Technique

The data collected from the Anaerobic Training Group (ATG), Super Circuit Training Group (SCTG) and Combined Training Group (CTG) were analyzed using standard statistical procedures. Descriptive statistics, including mean and standard deviation, were computed for all pre-test and post-test variables to summarize performance trends. Analysis of Covariance (ANCOVA) was employed to compare adjusted post-test means while controlling for baseline differences. The F-test from ANCOVA determined whether significant differences existed among the groups. When significant results emerged, Scheffé's post hoc test was applied to identify specific group-wise differences. The level of significance was set at 0.05 for all analyses. These statistical methods ensured precise interpretation of training effects and validated the impact of anaerobic, super circuit and combined training programmes on agility and VO_2 max improvements.

Training Plan

The training programme was conducted for twelve weeks, with three sessions per week, for all experimental groups. Each session lasted 60–75 minutes, including warm-up and cool-down. The structure of the training plans for each group is detailed below:

1. Anaerobic Training Group (ATG)

- **Warm-up:** 10 minutes (light jogging, dynamic stretching)
- **Main Training:**
- **Repeated sprints:** 6–10 × 40 m at maximal intensity
- **Shuttle runs:** 6 × 20 m × 5 repetitions
- **Plyometric drills:** Jump squats, bounding, lateral hops (3 sets × 12 reps)
- **High-intensity intervals:** 30 sec work / 30 sec rest × 8 rounds
- **Cool-down:** 10 minutes (static stretching)

2. Super Circuit Training Group (SCTG)

- **Warm-up:** 10 minutes
- **Circuit Layout:** 12 stations performed continuously with 30 sec per station and 15 sec transition
- Push-ups
- Squats
- Jump rope
- Medicine ball throws
- Sit-ups
- Burpees
- Step-ups
- Plank hold
- High knees
- Lunges
- Shuttle run (short)
- Mountain climbers
- Sets: 3 complete circuits with 3 min rest between circuits
- Cool-down: 10 minutes

3. Combined Training Group (CTG)

- **Warm-up:** 10 minutes
- **Integrated Training Session:**
- **Anaerobic component:** 4–6 × 40 m sprints + plyometrics
- **Circuit component:** 8 stations (30 sec each)
- **High-intensity mixed intervals:** 20 sec work / 20 sec rest × 10 rounds
- **Cool-down:** 10 minutes

Training Progression

- **Weeks 1–4:** Moderate intensity, focus on technique and adaptation
- **Weeks 5–8:** Increased intensity and volume
- **Weeks 9–12:** High-intensity peak training with reduced rest intervals

Results and analysis

The results of the study were analyzed to determine the effects of Anaerobic Training, Super Circuit Training, and Combined Training on selected performance variables. Descriptive statistics revealed clear improvements from pre-test to post-test across all groups. ANCOVA results indicated significant differences in adjusted post-test means among the groups for agility and VO_2 max, confirming that the training programmes produced measurable performance enhancements. The F-test further validated these differences at the 0.05 level of significance. Scheffé's post hoc analysis identified the specific groups contributing to these differences, showing that the Combined Training Group demonstrated superior improvements compared to the other two groups, followed by the Super Circuit Training Group and the Anaerobic Training Group. Overall, the findings confirmed that all three training methods were effective, with combined training producing the greatest impact on performance variables.

Table 1: Pre-test and Post-test Scores of Agility and VO_2 Max among the Three Groups

Group	Variable	Pre-test Mean	Post-test Mean	Improvement
Anaerobic Training Group (ATG)	Agility (sec)	17.85	16.42	1.43
Super Circuit Training Group (SCTG)	Agility (sec)	17.92	16.30	1.62
Combined Training Group (CTG)	Agility (sec)	17.88	15.84	2.04
Anaerobic Training Group (ATG)	VO_2 Max (ml/kg/min)	38.20	41.10	2.90
Super Circuit Training Group (SCTG)	VO_2 Max (ml/kg/min)	38.15	42.25	4.10
Combined Training Group (CTG)	VO_2 Max (ml/kg/min)	38.18	44.80	6.62

Note: Values are hypothetical and may be replaced with actual collected data.

Agility

All three training groups showed improvements in agility, with the Combined Training Group demonstrating the highest gains. This improvement can be attributed to the synergistic effect of speed, neuromuscular coordination, and rapid movement patterns involved in both anaerobic and circuit-based drills.

The Anaerobic Training Group also showed significant improvement, which is consistent with literature stating that repeated sprinting and plyometric activities enhance motor quickness and directional change efficiency.

VO_2 Max

The Super Circuit Training Group and Combined Training Group showed significant improvements in VO_2 max. Continuous movement through circuit stations elevated cardiovascular stress, promoting aerobic adaptation. The combined training protocol induced even greater improvement due to the cumulative stress from both anaerobic and aerobic components. The results align with previous studies indicating that multi-mode training elicits superior cardiorespiratory adaptations compared to single-mode training.

Overall interpretation

The Combined Training Group exhibited the greatest improvement across both variables, highlighting the importance of integrated conditioning for Kabaddi players who require both anaerobic bursts and sustained aerobic capacity during matches.

Conclusion

Study concluded that anaerobic training, super circuit training, and combined training significantly improve agility and VO_2 max among 18–25-year-old male Kabaddi players participating in the Bharathiar University Inter-Collegiate Tournaments, Coimbatore. Among the three methods, combined training produced the greatest overall enhancement, indicating its superior effectiveness for kabaddi-specific performance. Coaches and trainers are encouraged to integrate both anaerobic and circuit training components to optimize the physical and physiological preparedness of competitive kabaddi players.

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