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EFFECT OF HIGH-INTENSITY INTERVAL TRAINING AND CONTINUOUS RUNNING TRAINING ON SELECTED PHYSICAL FITNESS AND PERFORMANCE VARIABLES AMONG COLLEGE MALE ATHLETES

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Abstract
The purpose of the study was to investigate the effect of high-intensity interval training and continuous running training on selected physical fitness variables and performance variables among college male athletes. To achieve the purpose of this study, Forty five Male Athletes (n=45) were randomly selected as subject from various colleges affiliated to Bharathidasan University Thiruchirappalli, Tamilnadu, India. Their age ranged between 18 to 23 years. The selected as subjects and they were divided into Three groups such as Group '1' underwent high-intensity interval training (n=15) and Group '2' acted as continuous running training (n=15). and Group '3' acted as control (n=15). Group '1' underwent high-intensity interval training for five days and one session lasted for 60 minutes for eight weeks period. Group '2' underwent continuous running training for five days and one session lasted for 60 minutes for eight weeks period. Group '3' was not exposed to any specific training but they were participated in regular activities. The data on physical fitness variables and performance variables were collected and administering by subjective rating tests. The pre and post test data were collected on selected criterion variable prior to and immediately after the training programme. The pre and post test scores were statistically examined by the ANCOVA test. Result showed significant improvement in both HIIT and CRT groups compared to control group.

Key words: High-intensity interval training, continuous running training, physical fitness, performance.

Introduction

HIIT involves alternating periods of high intensity aerobic exercise with light recovery exercise or no exercise, allowing for greater physiological stimulus and adaptation than moderate intensity continuous training (MICT) for cardio respiratory fitness and other cardio metabolic processes. However, there is no universal criteria or framework for the prescription and monitoring of HIIT in clinical populations, and safety concerns remain a common barrier for implementing HIIT as standard care. (Ross et al., 2016) in his article proposed high intensity interval training (HIIT) is now international clinical based exercise guidelines as an appropriate and beneficial adjunct to moderate intensity continuous training. Historically, exercise intensity has been prescribed using heart rate (HR) targets derived from either a predicted maximal HR (HR max) or from an attempt to objectively measure HR max. However, using this approach alone has a number of limitations. Here we provide guidelines to improve the delivery of HIIT in cardio metabolic populations using (Taylor et al., 2019). High-intensity interval training (HIIT) became popular for training athletes during the early 1950s when Emil Zátopek, an Olympic champion long-distance runner, won the 1952 Helsinki Olympic 10,000 meter race after utilizing HIIT.

Speed

(Putra et al., 2021) in his article defined speed is one of the bio motor components that an athlete must have in a sport that involves this element. Speed is defined as the amount of displacement made by an object in one unit of time. The running speed of an athlete is influenced by the leg

muscle power. This is because power and speed are interrelated bio motor components. Athletes who have strong leg muscle power are able to run more optimally. The importance of training the leg muscle power of athletes in their respective clubs.

Arm Strength

(Jamrern et al., 2019) in his thesis proposed we need to develop arm and hand strength in the population to improve their quality of life. Arm and hand strength may be improved by resistance training, such as weight-bearing training, elastic balls, medicine balls, etc. Moreover, coordination can be developed
by throwing and catching small objects. Programs are available to not only improve arm and hand strength but also to provide a variety training methods, depending on the purpose of the study.

Abdominal Strength

Abdominal strength is a critical component of core stability and overall athletic performance. It refers to the endurance and power of the abdominal muscles, which play a vital role in maintaining posture, balance, and efficient movement during physical activities (Jamrern et al., 2019). Strong abdominal muscles contribute to enhanced performance in sports by supporting dynamic movements, reducing the risk of injury, and improving energy transfer between the upper and lower body. Training programs often incorporate exercises like sit-ups, planks, and medicine ball rotations to develop abdominal endurance and strength, as these muscles are essential for both explosive actions and sustained efforts (Suma et al., 2022).

Leg Explosive Power

(Suma et al., 2022) in his paper proposed it is a combination of strength and speed abilities. It can be defined as the ability to overcome resistance with high speed. Depending on the nature of combination of speed the explosive strength can be further sub divided into start strength, Strength speed (power) and speed strength, start strength is the ability to develop maximal muscle force during the starting phase of the movement sprint, start, weight lifting etc. Strength speed is the ability to overcome heavy resistance with high speed e.g team games, compact sports (lower weight categories). The explosive strength is of different nature in cyclic and acyclic movements. Explosive strength always finds expression in motor movement. It is a form of dynamic strength explosive strength performance.

Methodology Research Design

The study employed a quasi-experimental design with pre-test and post-test measurements to evaluate the effects of two distinct training interventions—high-intensity interval training (HIIT) and continuous running training (CRT)—on selected physical fitness and performance variables. A control group was included to account for any extraneous variables that might influence the outcomes. The dependent variables were speed, arm strength, abdominal strength, and leg explosive power, while the independent variable was the type of training intervention.

Participants

Forty-five male athletes (N=45) aged between 18 and 23 years were randomly selected from various colleges affiliated with Bharathidasan University, Tiruchirappalli, Tamil Nadu, India. The participants were divided into three groups using a randomized controlled trial approach :

- Group 1 (Experimental Group 1) : High-Intensity Interval Training (HIIT), n = 15.

- Group 2 (Experimental Group 2) : Continuous Running Training (CRT), n = 15.
- Group 3 (Control Group) : No specific training intervention, n = 15.

All participants were informed about the purpose of the study, and written consent was obtained prior to participation. Ethical approval was granted by the Institutional Ethics Committee of Bharathidasan University. Participants were excluded if they had any pre-existing medical conditions or injuries that could interfere with the training protocols.

Selection of Variables
Four key physical fitness and performance variables were selected for the study:

1. Speed : Measured using the 50-meter dash test , which evaluates an athlete's ability to accelerate and maintain maximum velocity over a short distance.
2. Arm Strength : Assessed using the push-up test , which measures upper body muscular endurance and strength.
3. Abdominal Strength : Evaluated using the sit-up test , which assesses core muscle endurance.
4. Leg Explosive Power : Measured using the standing broad jump test , which evaluates lower body explosive strength and power.

Training Protocols
The training period lasted for eight weeks , with each group undergoing five sessions per week. Each session lasted 60 minutes , including warm-up and cool-down periods.

1. High-Intensity Interval Training (HIIT) :
- Warm-up : 10 minutes of dynamic stretching and light jogging.
- Main Session : Participants performed alternating intervals of high-intensity exercises (e.g., sprinting, burpees, squat jumps) and active recovery (e.g., walking or slow jogging). For example:
- Sprint at 90–95% of maximum effort for 30 seconds.
- Followed by 30 seconds of walking or slow jogging.
- This cycle was repeated for 30 minutes.
- Cool-down : 10 minutes of static stretching and breathing exercises.
- The intensity and duration of the intervals were progressively increased over the eight weeks to ensure adaptation and avoid plateauing.
2. Continuous Running Training (CRT) :
- Warm-up : 10 minutes of dynamic stretching and light jogging.
- Main Session : Participants engaged in steady-state running at 60–70% of their maximum heart rate for 40 minutes. Heart rate monitors were used to ensure adherence to the prescribed intensity.
- Cool-down : 10 minutes of static stretching and breathing exercises.
- The running distance and pace were gradually increased over the eight weeks to enhance aerobic capacity.
3. Control Group :
- Participants in the control group did not undergo any specific training intervention but continued their regular physical activities, such as recreational sports or casual exercise. They were instructed not to engage in any structured exercise programs during the study period.

Testing Procedures

Pre-test and post-test data were collected for all four variables under standardized conditions to ensure reliability and validity. The tests were administered by trained evaluators who were blinded to the group assignments to minimize bias.

1. 50-Meter Dash Test :
- Participants sprinted 50 meters on a flat track, and their time was recorded using a digital stopwatch.
- Three trials were conducted, and the fastest time was used for analysis.
2. Push-Up Test :
- Participants performed as many push-ups as possible in 60 seconds, maintaining proper form (body straight, full extension of arms).
- The total number of repetitions was recorded.
3. Sit-Up Test :
- Participants performed as many sit-ups as possible in 60 seconds, with knees bent and hands crossed over the chest.
- The total number of repetitions was recorded.
4. Standing Broad Jump Test :
- Participants stood behind a marked line and performed a maximal horizontal jump. The distance from the starting line to the heel of the landing foot was measured using a measuring tape.
- Three trials were conducted, and the longest jump was used for analysis.

Statistical Analysis

To determine the effectiveness of the training interventions, the pre-test and post-test scores were analyzed using Analysis of Covariance (ANCOVA) . Pre-test scores were used as covariates to control for initial differences among the groups. Post-hoc pairwise comparisons with Bonferroni correction were conducted to identify significant differences between the groups. The level of significance was set at $p < 0.05$. All statistical analyses were performed using SPSS version 26.0.

Results

The study aimed to examine the effects of high-intensity interval training (HIIT) and continuous running training (CRT) on selected physical fitness and performance variables among college male athletes. The pre- test and post-test data were collected for speed (50m Dash), arm strength (Push-ups), abdominal strength (Sit-ups), and leg explosive power (Standing Broad Jump). Statistical analysis was performed using ANCOVA, with pre-test scores as covariates to control for initial differences.

Table 1: Pre-test and Post-test Mean Scores for Physical Fitness and Performance Variables

Variable	Group	Pre-test Mean	Post-test Mean	Significance Level (p-value)
Speed (50m Dash)	HIIT Group	7.25 seconds	6.80 seconds	$p < 0.03$
	CRT Group	7.30 seconds	7.05 seconds	$p < 0.02$
	Control Group	7.28 seconds	7.27 seconds	$p > 0.07$
Arm Strength (Push-ups)	HIIT Group	32 repetitions	45 repetitions	$p < 0.02$
	CRT Group	31 repetitions	38 repetitions	$p < 0.04$

	Control Group	30 repetitions	31 repetitions	$p > 0.06$
Abdominal Strength (Sit-ups)	HIIT Group	40 repetitions	55 repetitions	$p < 0.02$
	CRT Group	39 repetitions	48 repetitions	$p < 0.03$
	Control Group	38 repetitions	39 repetitions	$p > 0.09$
Leg Explosive Power (Standing Broad Jump)	HIIT Group	2.20 meters	2.50 meters	$p < 0.04$
	CRT Group	2.18 meters	2.35 meters	$p < 0.02$
	Control Group	2.15 meters	2.16 meters	$p > 0.07$

Speed (50m Dash)

- Pre-test Mean Scores :
- HIIT Group: 7.25 seconds
- CRT Group: 7.30 seconds
- Control Group: 7.28 seconds
- Post-test Mean Scores :
- HIIT Group: 6.80 seconds ($p < 0.03$)
- CRT Group: 7.05 seconds ($p < 0.02$)
- Control Group: 7.27 seconds ($p > 0.07$)

The results showed a significant improvement in speed for both the HIIT and CRT groups compared to the control group. However, the HIIT group demonstrated a greater reduction in time, indicating superior enhancement in speed.

Arm Strength (Push-ups)

- Pre-test Mean Scores :
- HIIT Group: 32 repetitions
- CRT Group: 31 repetitions
- Control Group: 30 repetitions
- Post-test Mean Scores :
- HIIT Group: 45 repetitions ($p < 0.02$)
- CRT Group: 38 repetitions ($p < 0.04$)
- Control Group: 31 repetitions ($p > 0.06$)

Both experimental groups showed significant improvements in arm strength, but the HIIT group exhibited a more pronounced increase in push-up repetitions compared to the CRT group.

Abdominal Strength (Sit-ups)

- Pre-test Mean Scores :
- HIIT Group: 40 repetitions
- CRT Group: 39 repetitions
- Control Group: 38 repetitions
- Post-test Mean Scores :
- HIIT Group: 55 repetitions ($p < 0.02$)
- CRT Group: 48 repetitions ($p < 0.03$)
- Control Group: 39 repetitions ($p > 0.09$)

Similar to the other variables, both HIIT and CRT groups improved significantly in abdominal

strength. However, the HIIT group outperformed the CRT group in terms of the number of sit-ups completed.

Leg Explosive Power (Standing Broad Jump)

- Pre-test Mean Scores :
- HIIT Group: 2.20 meters
- CRT Group: 2.18 meters
- Control Group: 2.15 meters
- Post-test Mean Scores :
- HIIT Group: 2.50 meters ($p < 0.04$)
- CRT Group: 2.35 meters ($p < 0.02$)
- Control Group: 2.16 meters ($p > 0.07$)

The HIIT group demonstrated a greater improvement in leg explosive power compared to the CRT group, as evidenced by the increased jump distance.

Discussion

The findings of this study support the hypothesis that both high-intensity interval training (HIIT) and continuous running training (CRT) positively impact physical fitness and performance variables among college male athletes. However, HIIT consistently produced superior results across all variables compared to CRT. This aligns with previous research suggesting that HIIT provides a greater physiological stimulus and adaptation due to its alternating intensity levels (Ross et al., 2016).

The significant improvements in speed, arm strength, abdominal strength, and leg explosive power observed in the HIIT group can be attributed to the anaerobic and aerobic adaptations induced by the training protocol. The CRT group also showed notable improvements, particularly in endurance-related variables, which is consistent with the benefits of sustained aerobic exercise (Taylor et al., 2019). The control group, which did not participate in any specific training program, showed no significant changes in any of the variables, highlighting the importance of structured training interventions for athletic development.

Conclusion

This study demonstrates that both high-intensity interval training (HIIT) and continuous running training (CRT) are effective in enhancing physical fitness and performance variables among college male athletes. However, HIIT appears to offer greater benefits in terms of speed, strength, and explosive power. These findings suggest that incorporating HIIT into training programs may optimize athletic performance. Future research should explore the long-term effects of HIIT and CRT on injury prevention and sport-specific performance.

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