



IMPACT OF HIGH-INTENSITY INTERVAL TRAINING (HIIT) ON CARDIOVASCULAR ENDURANCE IN COMPETITIVE BASKETBALL ATHLETES

Physical Education

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ABSTRACT

High-Intensity Interval Training (HIIT) has become an important method in sports conditioning because of its effectiveness in enhancing aerobic capacity and overall physical fitness. Competitive basketball requires repeated high-intensity actions, including sprinting, jumping, and rapid changes in direction, which place substantial demands on cardiovascular endurance. Conventional continuous training may not fully meet the intermittent physiological demands of basketball, thereby making HIIT an appropriate conditioning strategy. The purpose of this study was to investigate the effect of HIIT on cardiovascular endurance among competitive basketball athletes. Forty male basketball players aged 18–25 years were randomly allocated to an experimental group ($n = 20$) and a control group ($n = 20$). The experimental group participated in an eight-week HIIT program, three sessions per week, while the control group continued with regular basketball training. Cardiovascular endurance was measured using the Yo-Yo Intermittent Recovery Test Level 1 before and after the intervention period. The findings revealed a significant improvement in cardiovascular endurance in the experimental group compared with the control group, confirming that HIIT is an effective and practical conditioning method for basketball athletes.

KEYWORDS

High-Intensity Interval Training, Cardiovascular Endurance Basketball Players, Yo-Yo Intermittent Recovery Test.

INTRODUCTION

Cardiovascular endurance is a vital component of fitness for competitive basketball players, as the sport requires continuous alternation between high-intensity efforts and brief recovery periods. During match play, athletes repeatedly engage in sprinting, jumping, rapid accelerations, and frequent changes of direction over extended durations, making efficient cardiovascular function essential for sustaining performance and minimizing fatigue (Stojanović et al., 2020). Sufficient cardiovascular endurance also facilitates quicker recovery between successive high-intensity actions.

The physiological demands of basketball are largely intermittent, requiring the combined involvement of both aerobic and anaerobic energy systems. While anaerobic pathways primarily support explosive movements, aerobic capacity plays a crucial role in recovery and in maintaining repeated high-intensity performance throughout the game (Scanlan et al., 2021). As a result, training programs should be designed to address these specific physiological demands.

High-Intensity Interval Training (HIIT) consists of short periods of high-intensity exercise interspersed with recovery intervals and has been shown to significantly enhance cardiovascular endurance and maximal oxygen uptake in team-sport athletes (Buchheit & Laursen, 2020). HIIT is a useful and time-saving way to get in shape because it closely mimics the changes in intensity and movement patterns of basketball.

Despite extensive evidence supporting HIIT, research focusing specifically on competitive basketball players remains limited, particularly within structured training interventions in the Indian context. Therefore, the present study aims to investigate the effect of HIIT on cardiovascular endurance in competitive basketball athletes.

REVIEW OF LITERATURE

Bossmann, Woll, and Wagner (2022) examined three types of HIIT protocols (4×4 , 12×1 , and circuit training) in a sample of 121 students aged 11–15 years over a six-week period. The results indicated that all HIIT protocols produced significant improvements in aerobic fitness. However, circuit-based HIIT, in contrast to running-based HIIT, also resulted in significant enhancements across all measured strength parameters.

Avunoori Mallesh and Suresh T. N. (2018) carried out a quasi-experimental study involving 40 male basketball players aged 18–25 years to compare the effects of sports-specific circuit training and High-Intensity Interval Training (HIIT) on aerobic capacity (VO_{2max}). The findings revealed that HIIT produced a statistically significantly greater improvement in aerobic capacity compared to

circuit training.

Aschendorf et al. (2018) investigated the effects of a five-week basketball-specific high-intensity interval training program in youth female basketball players. The study reported significant improvements in aerobic performance, along with enhanced sprint and agility performance, without any negative impact on jump performance.

Hita and Pambayu (2024) conducted a review of the literature on high-intensity interval training in basketball and concluded that HIIT effectively enhances cardiorespiratory fitness, aerobic capacity, muscle strength, and training time efficiency. The authors also emphasized the importance of individualized program design and appropriate safety monitoring to optimize performance outcomes.

THE STUDY'S OBJECTIVES

- To determine how competitive basketball players' cardiovascular endurance is affected by high-intensity interval training.
- to evaluate cardiovascular endurance before and after an eight-week HIIT exercise.
- To evaluate how well HIIT works as a conditioning method for playing competitive basketball.

Research Hypotheses

Hypothesis Null (H_0):

The cardiovascular endurance ratings of competitive basketball players performing HIIT will not alter significantly between the pre-test and post-test results.

Research Hypothesis (H_1):

Competitive basketball players' cardiovascular endurance will improve statistically significantly as a result of high-intensity interval training.

RESEARCH METHOD

The research method used in this study was the pre-test post-test control experimental group design. This was used to determine the effect of High Intensity Interval Training on the cardiovascular endurance of competitive basketball players. The subjects were either placed in a group to receive the training or in a control group, and before and after the experiment, the subjects underwent tests to assess the effect of the training. Participants consisted of male competitive basketballers; these were recruited from local sports clubs and universities. Forty athletes randomly chosen were males whose ages fell between 18 and 25. Competitors were physically fit and they were also experienced in competitive games. The Forty subjects were divided at random into two groups of twenty subjects each. One group

served as a control group, the other as an experimental group. The factor being tested was interval training and the factor being measured was endurance. A HIIT program was followed by the test group over eight weeks. This consisted of three sessions each week. Exercisers performed intervals of vigorous exercise at 90 percent of their maximum heart rate. These sessions included active recovery periods. The work intervals were of 30-60 seconds duration. After this, there was a rest period of 30-90 seconds. The control team carried on with their normal basketball training without further HIIT training sessions.

RESEARCH TOOLS TEST AND MEASUREMENTS

Statistical tools Ms- Excel, SPSS - Paired sample T-Test and SPSS - Paired statistics.

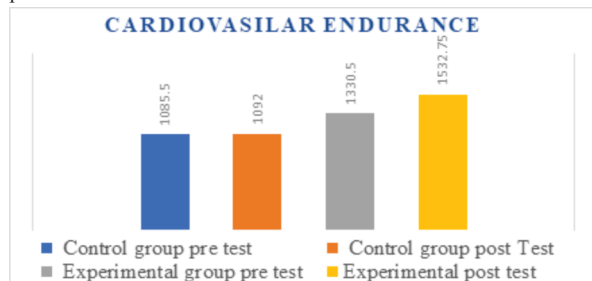
Statistical Analysis

Cardiovascular endurance - Paired Samples Statistics on Control and Experimental Group					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Control group pre test	1085.5000	20	51.65421	11.55023

Paired Samples Test

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Control group pretest - Control group post test	-6.50000	27.77257	6.21014	-19.49796	6.49796	-1.047	19	.308
Pair 2	Experimental pretest - Experimental post test	-202.25000	71.05363	15.88807	-235.50412	-168.99588	-12.730	19	.000

The control group's pre-test and post-test cardiovascular endurance ratings did not differ statistically significantly, according to the paired samples t-test ($t = -1.047$, $p > 0.05$). On the other hand, the experimental group showed a statistically significant improvement after the HIIT intervention ($t = -12.730$, $p < 0.001$), demonstrating the training program's efficacy. Overall, the paired samples t-test results indicate that the intervention produced a significant improvement in the selected outcome variable in the experimental group, whereas no significant change was observed in the control group. These findings provide strong empirical support for the efficacy of the applied training protocol.



Bar Diagram

DISCUSSION ON FINDINGS

The current study's results show a distinct difference between the experimental and control groups. Cardiovascular endurance improved statistically significantly in the experimental group following an eight-week HIIT intervention, while only minor changes were seen in the control group. These findings suggest that regular basketball exercise might not be enough to cause significant cardiovascular changes. On the other hand, HIIT's progressive and planned approach seems to improve recovery efficiency and aerobic capacity. Previous studies showing varying physiological reactions to high-intensity training stimuli are consistent with the observed inter-individual heterogeneity in post-test performance (Buchheit & Laursen, 2013).

Implications For Coaching And Training

The results of this study are really important for people who coach and train. To get the results coaches should use training plans that are well organized and tailored to each person. They need to pay attention to things, like how someone is working how much they are doing and how much time they have to rest. These things should be changed based on how each person's responding to the training. It is also very important to keep track of how people're doing all the time. Coaches should make sure people are getting ready to train doing the right

	Control group post Test	1092.0000	20	53.27189	11.91196
Pair 2	Experimental group pre test	1330.5000	20	58.41999	13.06311
	Experimental post test	1532.7500	20	90.92326	20.33106

The control group did well on the tests before and after. The scores for the control group were the same. The average score for the control group went up a bit from 1085.50 to 1092.00. This is not a deal because the control group did not get any special training. The control group scores did not get much better. The control group scores were steady because there was no help, for the control group.

Conversely, the experimental group exhibited a substantial enhancement in performance. The mean score increased from 1330.50 ($SD = 58.41$) in the pre-test to 1532.75 ($SD = 90.92$) in the post-test, reflecting a marked improvement following the training programme. These results suggest that the experimental intervention was effective in producing significant performance gains compared to the control condition.

exercises to get stronger and cooling down afterwards to make training better and prevent injuries. The training programs should be adjusted to fit each person and help them get better. Coaches can use the results to make their training plans more effective and help people perform at their best. Using high intensity training that's specific to a particular skill or adding weights can really make a big difference in how well the athletes do. This is what the experimental group showed they had results because of this type of training. The athletes in this group did a lot better when they used high intensity training that was specific, to their skill or when they used weights to make their training.

CONCLUSION

The results demonstrate that HIIT is a very successful conditioning method for enhancing cardiovascular endurance in basketball players who compete. To maximize physiological adaptations and improve competitive performance, coaches are urged to incorporate sport-specific HIIT protocols into training regimens.

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