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Impact of circuit training on selected physical fitness components of basketball players from the Jammu region

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Abstract
This study investigates the impact of Circuit Training on key physical fitness components among basketball players in the Jammu Region. The research involves an experimental group of twenty college-level students, aged 18 to 25 years, who undergo a 12-week Circuit Training program. The selected variables for testing the hypothesis include Explosive Strength, Speed, Endurance, Flexibility, and Neuromuscular Coordination. A paired t-test is used for data analysis, with the level of significance set at 0.05. Measurements of these variables are taken before and after the training period to assess the effects of Circuit Training. The results reveal significant improvements in Explosive Strength, Speed, Endurance, Flexibility, and Neuromuscular Coordination among the basketball players.

Keywords: Circuit training, basketball, physical fitness

Introduction
Basketball, a dynamic and high-intensity sport, requires players to possess a diverse range of physical fitness components such as explosive strength, speed, endurance, flexibility, and neuromuscular coordination (Cao *et al*., 2024) [4]. These attributes are crucial for optimal performance, influencing both offensive and defensive maneuvers on the court. Given the demanding nature of the game, developing these physical fitness components through targeted training regimens is essential for athletes aiming to excel. Circuit training, characterized by its versatility and comprehensive approach, has emerged as a potent training method to enhance multiple fitness components simultaneously (Hu *et al*., 2024) [6]. By integrating a series of exercises performed in succession with minimal rest, circuit training effectively targets different muscle groups and energy systems. This holistic approach not only improves physical attributes but also contributes to overall athletic performance. Numerous studies have investigated the effectiveness of various training methods. Circuit training is a form of interval training that combines strength exercises with endurance and aerobic exercises, offering the benefits of both cardiovascular and strength workouts. In this context, "circuit" refers to a series of selected stations arranged around a facility, which participants visit in rapid succession. (Kundu, 2017) [7]. Sánchez (2021) [2] stated in his study that combined training may yield better jump performance outcomes than plyometric training alone, highlighting the importance of measuring biomechanical variables to interpret training effects accurately. Kumar, V. (2016) [11] reveled that circuit training program significantly improve motor abilities among university male. Through a rigorous experimental design of this study aims to offer evidence-based recommendations for coaches, trainers, and athletes. The findings will not only contribute to the existing body of knowledge on sports training but also provide practical insights for enhancing the physical fitness and overall performance of basketball players in the Jammu region.

Methods
Research Design
This study aims to investigate the impact of Circuit Training on physical fitness components among basketball players in the Jammu Region. A experimental design will be utilized, group consisting of twenty subjects.

Participants

The study will include sixty college-level students aged between 18 to 25 years. Participants will be randomly assigned, which will undergo 12-week Circuit Training program.

Table 1: Circuit Training Programme Design For 12- Week

Period (Week)	Warm-Up	Sit-ups	Pushups,	body weight squat	30 m sprint	Skipping rope	Burpee	Shuttle run	Plank
1st and 2nd	10.Min	30sec	30sec	30sec	30sec	30 sec	30 sec	30 sec	30 sec
3rd and 4th	10.Min	35sec	35 sec	35sec	35sec	35 sec	35 sec	35 sec	35 sec
5th and 6th	10.Min	40sec	40 sec	40sec	40sec	40 sec	40 sec.	40 sec.	40 sec.
7th and 8th	10.Min	45sec	45 sec	45sec	45sec	45 sec	45 sec.	45 sec.	45 sec.
9th and 10th	10.Min	50sec	50 sec	50sec	50sec	50 sec	50 sec.	50 sec.	50 sec.
11th and 12th	10.Min	55sec	55 sec	55sec	55sec	55sec	55 sec.	55 sec.	55 sec.

Measurements

Table 2: Various physical fitness components and their test

S.No	Component	Test	Description
1.	Explosive Strength	Vertical Jump Test	Measures explosive leg power by the height of a vertical jump.
2.	Speed	50m Dash Test	Measures the time taken to sprint 50 m
3.	Endurance	12-minute Run-Walk Test	Measures the distance covered in 12 minutes.
4.	Flexibility	Sit and Reach Test	Measures the flexibility of the lower back and hamstring muscles.
5.	Neuromuscular Coordination	Ball Transfer Test	Measures coordination through tasks

These variables will be measured and compared between the experimental and control groups before and after the 12-week training period.

Data Collection

Pre- and post-test data will be collected for all selected variables. The tests will be administered under standardized conditions to ensure consistency and reliability.

Statistical Analysis

Mean, Standard Deviation (SD), Mean Difference, and Standard Error will be computed for each variable. Paired 't' Test: To compare the differences among the selected variables between the Pretest and Post test data. The level of significance will be set at 0.05.

Hypothesis Testing

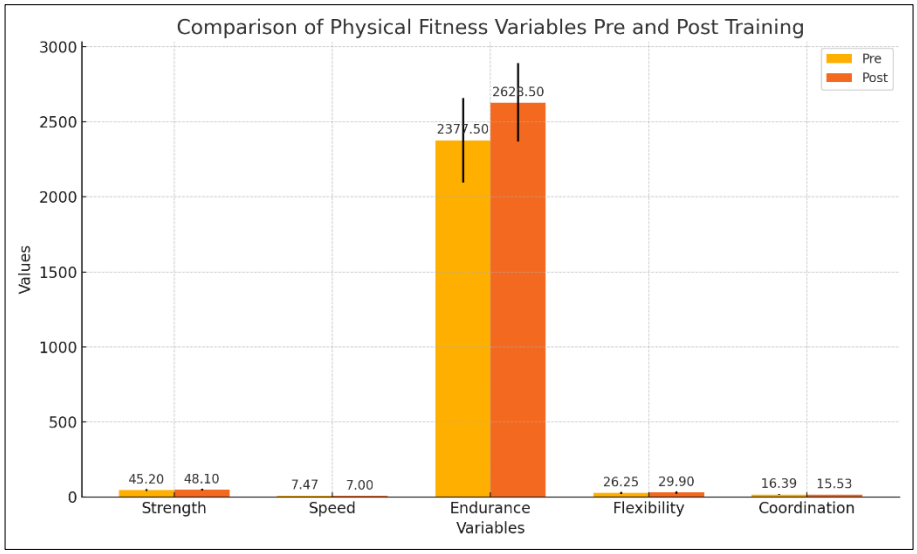
The hypotheses will be tested to determine the effectiveness of Circuit Training on the physical fitness components of basketball players. The analysis will include a comparison of pre- and post-training measurements to assess the impact of the training program. By employing this methodology, the study aims to provide comprehensive insights into the effects of Circuit Training on various physical fitness components among basketball players in the Jammu Region.

Results

Mean values, standard deviations, std error of mean and t-value of the circuit training group pre-test and post-test are presented in Table-1.

Table 3: Statistical Analysis of Strength Measurements Before and After Circuit Training Group.

Variable (cm)	Category	N	Mean	Std. Deviation	Std. Error of Mean	t-Value	Sig. (2-tailed)
Strength	Pretest Group	20	45.20	6.00	1.34	-10.72	.000
	Posttest Group	20	48.10	5.60	1.25		
Speed	Pretest	20	7.47	.44	.098	11.97	.000
	Posttest Group	20	6.99	.33	.074		
Endurance	Pretest Group	20	2377.50	280.86	62.80	-8.39	.000
	Posttest Group	20	2628.50	261.72	58.52		
Flexibility	Pretest Group	20	26.25	6.29	1.40	-2.70	.014
	Posttest Group	20	29.90	8.08	1.80		
Coordination	Pretest Group	20	16.38	1.28	.28	14.92	.000
	Posttest Group	20	15.52	1.23	.27		



Graph 1: graph comparing the pre and post-training values of various physical fitness variables. The mean values are shown along with the standard deviations for each variable, highlighting the improvements achieved through the training program.

Table-3 and graph-1 outlines the impact of circuit training on the strength of basketball players. graph-1 visually represents the variations in strength measurements before and after training. The average strength values were 45.20 before training and 48.10 after training. Notably, a significant difference was observed between the pre-training and post-training strength levels of basketball players ($t = -10.72$, $p \leq 0.05$). The average speed values were 7.47 before training and 6.99 after training. Notably, a significant difference was observed between the pre-training and post-training speed levels of basketball players ($t = 11.97$, $p \leq 0.05$). The average endurance values were 2377.50 before training and 2628.50 after training. Notably, a significant difference was observed between the pre-training and post-training endurance levels of basketball players ($t = -8.39$, $p \leq 0.05$). The average flexibility values were 26.25 before training and 29.90 after training. Notably, a significant difference was observed between the pre-training and post-training flexibility levels of basketball players ($t = -2.70$, $p \leq 0.05$). The average neuro- muscular coordination values were 16.386 before training and 15.52 after training. Notably, a significant difference was observed between the pre-training and post-training neuro- muscular coordination levels of basketball players ($t = 14.92$, $p \leq 0.05$).

Discussion

The findings from this study provide robust evidence supporting the effectiveness of Circuit Training in enhancing key physical fitness components among basketball players in the Jammu Region. The experimental group of twenty college-level students, aged 18 to 25 years, who underwent a 12-week Circuit Training program, exhibited significant improvements across all tested variables: Explosive Strength, Speed, Endurance, Flexibility, and Neuromuscular Coordination. The study found an increase in strength from 45.20 to 48.10, supporting findings by Gettman *et al.* (1981) [5] that circuit weight training significantly enhances muscular strength, crucial for powerful basketball actions. An improvement in speed from 7.471 to 6.995 aligns with Alcaraz *et al.* (2008) [2], who demonstrated that circuit training effectively increases sprinting speed, essential for quick transitions and fast breaks in basketball. Enhanced endurance levels from 2377.50 to 2628.50 reflect findings by Wilmore and Costill (1994) [12] that circuit training improves cardiovascular endurance, helping athletes maintain high performance throughout the game and reducing fatigue. Flexibility improvements from 26.25 to 29.90 are consistent with Arazi and Asadi (2011) [3], who noted increased flexibility following a circuit training regimen, reducing injury risk and enhancing the range of motion for basketball techniques. Better neuromuscular coordination from 16.38 to 15.52 corroborates Gettman *et al.* (1981) [5], who found improvements in neuromuscular coordination with circuit training, vital for executing complex movements like dribbling and shooting. There are numerous studies revealed that circuit training is effective method to improve physical fitness components (Aboshkair, K. A. (2023), Molla, G. G., & Abebe, B. G. (2021), Sefri (2020)) [1, 8, 8, 10]

These significant pre- and post-training differences highlight the comprehensive benefits of Circuit Training, indicating that it not only enhances individual fitness components but also contributes to overall basketball performance. This study's findings align with previous research, reinforcing the importance of a well-rounded training regimen that addresses multiple fitness components to achieve comprehensive athletic development.

Conclusion

This study concludes that Circuit Training is a highly effective intervention for improving Explosive Strength, Speed, Endurance, Flexibility, and Neuromuscular Coordination among basketball players in the Jammu Region. The significant improvements observed in these key physical fitness components indicate that incorporating Circuit Training into regular training routines can substantially enhance basketball performance. Given these positive outcomes, it is recommended that coaches and trainers integrate Circuit Training programs to optimize the physical fitness and overall performance of basketball players. The results highlight the importance of a well-rounded training regimen that addresses multiple fitness components to achieve comprehensive athletic development. Future research could expand on these findings by exploring

the long-term effects of Circuit Training and its impact on different age groups and skill levels, as well as comparing its effectiveness with other training modalities.

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