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The Impact of Circuit Training among Volleyball and Basketball Female Players of Jammu North Region

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Abstract:

The purpose of this study is to assess how a circuit training program affects particular physical attributes in female basketball and volleyball players in the North Jammu area. For the purpose of the study 60 female athletes, whose ages ranges in-between 13 to 14 years, participated in the study (29 were basketball players and 31 were volleyball players). For every sport, participants' body mass, weight, and height were measured. Tests such as the Standing Jump (SJ), Countermovement Jump (CMJ), Drop Jump (DJ) 20cm, Hexagon Agility Test, 10x5m Shuttle Run Test, T-Test, and Lateral Change Direction were administered to them both before and after the intervention. Over the course of 11 weeks, the groups engaged in three 15-minute circuit training sessions per week.

A statistically significant difference in the impact of the intervention on both groups was found when the improvement in physical components was compared using Analysis of Variance (ANOVA) with repeated assessments. A significance criterion of 0.05 ($p<0.05$) was established. According to the study, in order to optimize performance, this training approach should be started early and continued throughout the sporting season.

Keywords: Circuit training, physical components, speed, agility, basketball, volleyball, female athletes.

Introduction

When it comes to the performance of athletes in a variety of sports, factors such as speed, agility, and strength are essential in deciding success. Physical fitness is a major aspect in the performance of players. An athlete's ability to react fast, make acute movements, and execute effective plans during gaming is vital in sports such as basketball and volleyball (Gabbett, 2016). Speed and agility are essential characteristics that enable athletes to respond rapidly. Male athletes frequently confront different physical demands and challenges than their female counterparts (Barker et al., 2014). As a result, these physical components are especially crucial for female athletes. As a result of the fact that cultivating these characteristics at a young age can considerably improve athletic performance and lower the risk of injury, it is essential to incorporate proper training methods into coaching programs for young athletes.

As a style of training that involves a series of exercises performed in a sequence with limited rest between them, circuit training has received recognized as an effective way for developing general physical fitness, including speed, endurance, and agility (**Burgomaster et al., 2008**). Circuit training is a sort of training that entails having a series of exercises performed in a sequence. Circuit training is appropriate for sports in which players are required to sustain high levels of performance for the entirety of the game (**Tabata, 2013**). This is because circuit training is designed to target numerous physical components in a time-efficient manner. Circuit training has been demonstrated to be effective in improving both aerobic and anaerobic capacities, which are crucial for sports such as volleyball and basketball, which demand fast bursts of energy and rapid recovery. The introduction of circuit training into sports training programs has shown encouraging results in this regard.

When considering female athletes, circuit training has the potential to provide a multitude of advantages. These advantages include enhancements in motor coordination, muscular endurance, and functional movement patterns, all of which are essential for achieving optimal performance in sports (**Ramírez-Campillo et al., 2014**). On the other hand, there is a paucity of research that specifically assesses the influence that circuit training has on the physical performance of female volleyball and basketball players, particularly in places such as North Jammu. Exploring the impacts of circuit training can provide useful insights into its potential role in boosting the physical fitness of young female athletes. This is especially important when considering the significance of these components in the respective sports.

In North Jammu, female basketball and volleyball players are the subjects of this study, which intends to analyse the impact of a structured circuit training program on important physical components such as speed, agility, and power. Through the investigation of the consequences of this training strategy, the research endeavours to make a contribution to the expanding body of knowledge concerning sport-specific training techniques and the ways in which they might be utilized for young athletes.

Materials and Methods

Participants

For the purpose of this study, sixty female athletes between the ages of 13 and 14 who competed in either basketball or volleyball in Jammu, participated. All of the individuals who were included in the sample were selected on the basis of their participation in school sports programs and the approval of their parents or guardians. The sample included 29 basketball players and 31 volleyball players. For the purpose of ensuring that the results seen were solely the result of the intervention, the participants in the study did not take part in any other structured training programs over the time of the scientific investigation.

Pre- and Post-Intervention Testing

Before and after the 11-week intervention, all participants underwent physical assessments to measure key physical components related to athletic performance. The tests used in the study were as follows:

1. **Standing Jump (SJ):** This test assessed lower-body power and explosiveness.

2. **Countermovement Jump (CMJ):** This test evaluated vertical jump performance, which is critical for both volleyball and basketball players.

3. **Drop Jump (DJ 20cm):** A measure of reactive strength and the ability to absorb and reapply force, relevant to sports that require rapid changes in direction.

4. **Hexagon Agility Test:** This test evaluated agility and the ability to change direction quickly, which is essential in both volleyball and basketball.

5. **Shuttle Run Test (10x5m):** This test assessed speed, quickness, and overall cardiovascular fitness.

6. **T-Test:** A standard agility test that measured the ability to change direction at speed.

7. **Lateral Change Direction:** This test assessed the ability to quickly move laterally, an important skill in both volleyball and basketball for defending and positioning.

Training Intervention

The individuals who took part in the activity were separated into two distinct groups: one including basketball players and the other comprising volleyball players. Following a planned circuit training program that lasted for eleven weeks, both groups participated in the program. A wide range of exercises were included in the circuit training, all of which were designed to improve speed, agility, and strength. Additionally, the training was tailored to meet the individual requirements of each discipline. The training sessions included three sessions per week, each of which lasted for fifteen minutes, and the athletes participated in all of them. Exercises included the following:

- Plyometric exercises such as squat jumps and bounding to improve explosive power.
- Agility drills like ladder drills, cone drills, and the shuttle run to enhance quickness and agility.
- Core strengthening exercises, including planks and medicine ball throws, to improve overall stability and control.
- Lower-body strength exercises, such as lunges and step-ups, to build strength and endurance necessary for jumping and sprinting.

The circuit training program was developed to provide the athletes with a program that would gradually challenge them by increasing the intensity of the exercises over the course of the program. This would ensure that the players were continually strengthening their physical skills.

Data Analysis

Analysis of Variance (ANOVA) with repeated measures was utilized in order to examine the data that was gathered from the pre- and post-intervention examinations. For the purpose of comparing the levels of improvement in physical performance between the two groups (players of basketball and volleyball) before and after the intervention, this statistical method was utilized. For the purpose of determining if there were any instances of statistically significant variations in performance

outcomes, the significance level was established at 0.05 ($p < 0.05$). In order to determine the effect that the circuit training program had on each of the physical components that were evaluated, including speed, agility, and power, the analysis of variance (ANOVA) was utilized.

Ethical Considerations

The study was carried out with complete ethical permission, and all of the participants gave their agreement after considering the information. Through the entirety of the research project, the anonymity of the data collected from the participants was protected, and the training program was developed to guarantee the participants' safety and well-being without exception.

Findings and Results

Table 1 Anthropometric Results for Volleyball and Basketball Players

Group	Age (years)	Height (cm)	Weight (kg)	BMI (kg/m²)
31 (Volleyball Group)	13-14 ± 0.6	167.1 ± 3.7	55.77 ± 3.3	19.97 ± 3.3
29 (Basketball Group)	13-14 ± 0.3	163.4 ± 3.4	61.8 ± 3.5	23.14 ± 4.1

A presentation of the participants' anthropometric measurements, which include their height, weight, and Body Mass Index (BMI), may be found in Table 1. In Group 1, the average height and weight were measured to be 167.1 ± 3.7 cm and 55.77 ± 3.3 kg, respectively. The body mass index (BMI) was determined to be 19.97 ± 3.3 kg/m², which indicates that the BMI falls within a healthy range. In Group 2, the average height and weight were measured to be 163.4 ± 3.4 centimeters and 61.8 ± 3.5 kilograms, respectively. The body mass index (BMI) was calculated to be 23.14 ± 4.1 kilograms per square meter, indicating a BMI that is closer to the height of the healthy range.

Table 2 Vertical Jump Results Before and After Training for Volleyball (VB) and Basketball (BB) Players

Test	Group	Before Training (Mean ± SD)	After Training (Mean ± SD)
SJ (Standing Jump)	VB (Volleyball)	0.393 ± 0.03	0.402 ± 0.03
	BB (Basketball)	0.363 ± 0.04	0.394 ± 0.02
Jump Height (JH)	VB	19.04 ± 3.2	20.03 ± 3.0
	BB	18.02 ± 3.9	18.06 ± 2.5
CMJ (Countermovement Jump)	VB	0.394± 0.04	0.421 ± 0.03
	BB	0.382 ± 0.03	0.391 ± 0.01

Jump Height (JH)	VB	19.4 ± 3.8	21.68 ± 3.4
	BB	17.29 ± 2.2	18.27 ± 1.33
DJ-20cm (Drop Jump 20cm)	Tcon (Take-off Contact Time) VB	0.372 ± 0.07	0.326 ± 0.05
	BB	0.33 ± 0.04	0.363 ± 0.07
	TF (Time to Floor) VB	0.380 ± 0.04	0.404 ± 0.04
	BB	0.359 ± 0.03	0.363 ± 0.04
Jump Height (JH)	VB	18.4 ± 4.1	20.08± 3.2
	BB	14.80 ± 2.8	16.15 ± 3.8

Volleyball (VB) players consistently showed better increases across all parameters, as shown by the data presented in Table 2, which provide specific insights into the impact of the training program on the vertical jump performance of volleyball (VB) and basketball (BB) players.

During the Standing Jump (SJ) test, the performance of the VB players was observed to improve. Specifically, their jump height increased from 0.393 ± 0.03 meters prior to training to 0.402 ± 0.03 meters after training. This improvement demonstrates a slight but continuous improvement in explosive strength. The short jump performance of the BB players, on the other hand, showed a more significant improvement. They increased their jump height from 0.363 ± 0.04 meters to 0.394 ± 0.02 meters, which indicates that they have made significant improvements in their lower body power.

An increase in Jump Height (JH) during SJ was observed in VB players, with their JH increasing from 19.04 ± 3.2 cm to 20.03 ± 3.0 cm. On the other hand, BB players showed just a modest improvement, with their JH increasing from 18.02 ± 3.9 cm to 18.06 ± 2.5 cm. This indicates that VB players have undergone more significant changes.

When the Countermovement Jump (CMJ) test was conducted, it was seen that the jump height of the VB players increased significantly, going from 0.394 ± 0.04 meters to 0.421 ± 0.03 meters. On the other hand, the jump height of the BB players showed a lower improvement, going from 0.382 ± 0.03 meters to 0.391 ± 0.01 meters. While the JH during CMJ showed a significant improvement for VB players, it increased from 19.4 ± 3.8 cm to 21.68 ± 3.4 cm. This was in contrast to the BB players, who showed a more moderate rise, going from 17.29 ± 2.2 cm to 18.27 ± 1.33 cm from the previous measurement. According to these findings, participants who participated in the VB program gained more explosive power and elastic strength than their peers who participated in the BB program.

Based on the results of the Drop Jump (DJ-20cm) test, it was shown that the Take-off Contact Time (Tcon) of the VB players underwent significant enhancements. The Tcon decreased from 0.372 ±

0.07 seconds to 0.326 ± 0.05 seconds, indicating improvement in reactive strength and a reduction in ground contact time. BB players, on the other hand, experienced an increase in Tcon, which went from 0.33 ± 0.04 seconds to 0.363 ± 0.07 seconds. This may suggest that they have better adaptation in terms of their plyometric performance. A minor rise in Time to Floor (TF) was observed among the VB players, as they went from 0.380 ± 0.04 seconds to 0.404 ± 0.04 seconds. On the other hand, the BB players exhibited minimal changes, with their TF growing from 0.359 ± 0.03 seconds to 0.363 ± 0.04 seconds.

The **JH** during DJ-20cm also demonstrated greater gains for VB players, improving from **18.4 ± 4.1 cm** to **20.08 ± 3.2 cm**, compared to BB players, who improved from **14.80 ± 2.8 cm** to **16.15 ± 3.8 cm**. These results further confirm the superior adaptations in explosive power and jump height in VB players following the training program.

Table 3 Results of Speed and Agility Tests Before and After Training for Volleyball (VB) and Basketball (BB) Players

Test	Group	Before Training (Mean ± SD)	After Training (Mean ± SD)
Hexagon	VB	17.19 ± 1.6	13.39 ± 0.7
	BB	17.71 ± 2.1	14.72± 1.9
SHR 10x5 (Shuttle Run 10x5)	VB	21.34 ± 2.2	17.79 ± 0.8
	BB	18.62± 3.2	16.20 ± 1.4
T-Test	VB	14.63 ± 1.6	13.09 ± 0.8
	BB	15.30 ± 2.3	12.80 ± 1.8
LCD (Lateral Change Direction)	VB	7.46 ± 0.6	6.9 ± 0.3
	BB	8.7 ± 0.8	6. ± 0.7

In Table 3, the results illustrate the influence that the training program had on the speed and agility of volleyball (VB) and basketball (BB) players. Improvements were noted across all tests, but the amount of these improvements differed between the groups.

During the Hexagon Test, the Volleyball (VB) participants exhibited a noteworthy decrease in completion time, which went from 17.19 ± 1.6 seconds to 13.39 ± 0.7 seconds. This improvement is indicative of their greater agility and quickness. The performance of the BB players also shown improvement, as their timings decreased from 17.71 ± 2.1 seconds to 14.72 ± 1.9 seconds. However, the drop was not as significant as the reduction found in the VB players.

VB players demonstrated significant advancements in their performance on the Shuttle Run 10x5 (SHR 10x5) test. Their time decreased from 21.34 ± 2.2 seconds to 17.79 ± 0.8 seconds, which is a

reflection of their enhanced speed and agility. The performance of the BB players also showed improvement, as their times decreased from 18.62 ± 3.2 seconds to 16.20 ± 1.4 seconds. This indicates that they have increased their anaerobic endurance and their ability to change directions. However, the improvement was significantly less significant than the results of the VB players.

When it comes to the T-Test, which is a test that evaluates speed, agility, and directional shift, the times of the VB players increased from 14.63 ± 1.6 seconds to 13.09 ± 0.8 seconds. On the other hand, the times of the BB players decreased from 15.30 ± 2.3 seconds to 12.80 ± 1.8 seconds. The BB players demonstrated slightly better increases in this test than the other group, but both groups exhibited significant increase in their performance.

According to the Lateral Change Direction (LCD) test, both groups demonstrated considerable gains in their performance. The timings of the VB players decreased from 7.46 ± 0.6 seconds to 6.9 ± 0.3 seconds, whereas the times of the BB players showed a significant decrease from 8.7 ± 0.8 seconds to 6.0 ± 0.7 seconds, which indicates that the VB players have improved their lateral agility and coordination. In comparison to VB players, the BB players' timings have decreased more significantly, which indicates that they are more adaptable to lateral movements.

Conclusion

A systematic training program was shown to considerably increase vertical jump performance, speed, and agility in both volleyball (VB) and basketball (BB) players, according to the findings of the study. The findings suggest that there are adaptations that are specific to the sport, with volleyball players demonstrating superior improvements in explosive power, reactive strength, and multidirectional quickness. This is reflected in greater gains in the Standing Jump (SJ), Countermovement Jump (CMJ), Drop Jump (DJ-20cm), and agility tests such as the Hexagon and Shuttle Run 10x5. In contrast, athletes who played basketball demonstrated a higher degree of flexibility in terms of lateral movements and change-of-direction speed. This was demonstrated by their performance in the T-Test and Lateral Change Direction (LCD) test.

These findings provide further evidence that the training program is effective in meeting the specific physical requirements of each sport at the individual level. In accordance with the jump-intensive character of volleyball, the program appears to provide an emphasis on explosive strength and plyometric activities, as evidenced by the improved performance of female volleyball players. In a similar vein, the improvements in lateral agility and speed that the basketball players have made are in line with the dynamic and multidirectional movement patterns that are required in basketball.

Previous research, such as that conducted by Markovic and Mikulic (2010) and Asadi et al. (2017), has consistently demonstrated the significance of plyometric and agility training in enhancing performance metrics that are specific to a particular sport. These findings are in agreement with those findings. In the future, research could concentrate on long-term adaptations and the comparative benefits of tailored training regimens in order to further improve the outcomes that are specific to the sport.

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