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# The impact of circuit training among volleyball and basketball players girls in Tirana of Albania

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**Abstract:** The study aims to evaluate the impact of a circuit training program on certain physical components in girls who play basketball and volleyball in Tirana of Albania. Speed and dexterity are considered essential components in sports games that should be practiced from an early age. Materials & Methods: The study involved 60 girls players (29 basketball players and 31 volleyball players) aged 13-14. The participants were assessed for body height, body weight, and body mass for each sport and underwent tests before and after the intervention including tests; SJ, CMJ, DJ 20cm, hexagon, shuttle run test 10x5m, T-Test and Lateral Change Direction. The groups followed circuit training for 15 minutes, three times a week for 11 weeks. Results: For the results of the study we used analysis of variance (ANOVA) with repeated measurements, was used to compare the improvement level of training circuit, which showed a statistically significant difference in the impact of the intervention on both groups. The significance level was taken as 0.05 in the comparisons ($p< 0.05$). Conclusions: The results of this paper were very encouraging and demonstrated the benefits on components of speed and agility for volleyball and basketball girl's players after the training circuit. This training method showed that it should be implemented from a young age and throughout the season in these sports.

***Keywords:*** *Agility, Basketball, Circuit, Speed, Training, Volleyball.*

## 1. Introduction

The Albanian sports landscape shows a positive trend in the mass popularity of volleyball and basketball, which are the second most popular sports in the country after football. Female players in team sports, especially those that are played with a ball, have become a subject for many researches [1, 2]. In terms of player development and quality, the sports sector in Albania is currently facing challenges. One of the key issues for coaches in Albania is the necessity to discover innovative and effective methods for enhancing the speed, agility and jumping abilities of volleyball and basketball teams. Show [3] the training process of children volleyball players in Albania is conditioned by the factor times available to develop training sessions with a specific training purpose. Speed, change of direction, dexterity, coordination, and vertical jump are fundamental components of performance in sports games, for training athletes from the early stages of their practice. Many studies indicate that power, agility, and speed are required by players who play basketball, volleyball, and handball [4, 5, 6, 7, 8 and 9]. In these types of sports, athletes must accelerate, decelerate, and change direction during the game in response to stimuli such as the movement of other players or the ball. These


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implementations must be repeatedly performed with maximal intensity for successful performance in volleyball, basketball and handball [10, 11].

Improving jumping ability and agility is a priority for volleyball team members, as it is considered a key component for success in the sport [12]. Volleyball, being a complex team sport, demands multifaceted sports skills and the ability to adapt to constantly changing positions [13]. Agility is recognized as a crucial determinant of performance in sports such as soccer, basketball, ice hockey, and handball [14]. The functional aspects of the training model used by sports trainers during talent scouting for sports teams primarily involves assessing their jumping abilities and agility, as these are considered essential components for evaluating a candidate's sports capabilities [15]. However, studies about the effects of skill-based trainings on power, agility and speed were limited. Very few studies showed that skill-based trainings had important effects on the progress of physical performance [16, 17] furthermore; determination of the progress on different sports and physical performance characteristics is an important research. Determination of the progress on different sports and physical performance characteristics is an important research topic. The primary objective of the study is to assess a training model focused on developing basic components such as vertical jump and improving agility, which are key elements in enhancing physical fitness and achieving success in sports competitions for female volleyball and basketball players aged 13-14 years, as well as to compare the effect of this training in these sports in Tirana of Albania.

## 2. Materials and Methods

*2.1. Participants*

The study included a total of 60 girl's participants playing volleyball (VB) n=31 and basketball (BB) n=29 who voluntarily participated in this study. All participants had a minimum of 2 years of experience in their respective sports and trained three times a week for 90 minutes in Tirana, Albania. The average age of the participants was 13-14 ± 1.3 years. The variation in the number of players in each sport was due to objective factors and the health status of the players. The anthropometry measure of the groups are listed in Table 1; Body Height (BH), Body Weight (BW), BMI%-kg/m2

*2.2. Procedure*

Prior to the study, all players were informed about the procedures, and their consent was obtained. The study was approved by the Ethics Council of the Sports University of Tirana, Albania. Written informed consent was obtained from all participants and their parents or coaches (for participants under 18 years old), in accordance with the ethical standards of the Declaration of Helsinki. Timeline: The study was conducted from September to Decembers 2023.

*2.3. Test protocol*

To collect data for our study, we used a set of protocol tests designed to evaluate specific aspects related to our research objectives. The tests were conducted before and after 11 weeks of the circuit training program implemented in VB and BB players. The tests included measurements of;

*Squat Jump (SJ):* Is the jump starting from the player's position with the legs bent at a 90º angle, hands resting on the hips (waist). This protocol targets explosive strength without the reuse of elastic energy. The test provides the ability to develop rapid strength in a very short time (explosive) of the lower extremities.

*Countermovement Jump (CMJ):* The players begins the test from an upright position and gains momentum by flexing the lower limbs to 90º degrees with the hands placed on the hips (waist). This test evaluates explosive strength with the reuse of elastic energy.

*Drop Jump 20 cm (DJ20):* The DJ offers a progressive increase in drop cube height. This test evaluates the explosive strength of the lower limbs. Players take turns standing on the 20 cm high cube with their hands on their hips. Through a free fall from the height of the cube they fall onto the platform and react quickly after contacting the platform by jumping as high as possible.

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*Lateral Change of Direction (LCD):* This test monitors the development of speed with the athlete's change of direction. To perform this test, a flat non-slip surface, 3 (three) cones, and a stopwatch are needed. 3 cones are placed, 5 meters apart in a straight line. The athlete stands next to the middle cone (B), and on giving the command "start" indicates the start direction, right or left, and the stopwatch is pressed.

*T-Test (T-T):* Monitors the development of the player's speed with the change of direction. The T-Test is a simple running test of agility, including forward, lateral and backward running, suitable for a wide range of sports. This test requires the athlete to touch a series of cones arranged in a "T" shape while running as fast as possible.

*Shuttle Run Test 10 x 5 m (SHRT):* This test aims to evaluate the speed and agility of the players. We mark a straight section on the parquet with cones or lines at a distance of 5 m. The athlete sprints as fast as possible from one line to another for 10 times.

*Hexagonal Test (H-T):* Monitors the player's agility, the test is coordination test for the lower extremities. To perform this test you need a 66 cm sided hexagon marked on the floor, a timer. The player to perform a series of jumps with two feet outside - inside over the sides of a hexagon.

*2.4. Instruments*

OPTO Jump apparatus is an optical measuring system comprising a transmitter and receiver tape. This apparatus used for the evaluation of standardized test protocols. This apparatus enabled precise measurement of flight time and contact time during a series of jumps with an accuracy of 1/1000 of a second. The data collected from these tests were processed using dedicated software, which provided a comprehensive set of parameters related to the athletes' performance with maximum accuracy and in real-time. The tests were conducted in the "Laboratory of Biomechanics" and the "Fitness Gym" at the Sports University of Tirana. Before and after the tests, subjects underwent a 10-minute warm-up session. The best value obtained from three repeated tests was considered as the final result for analysis.

*2.5. Intervention*

The training circuit program that we have built for volleyball and basketball players is for 11 weeks, with 3 sessions per week, lasting about 15 minutes before they start practicing with the ball. The players perform a 10-minute general systemic warm up followed by a dynamic range of motion exercises. The program is built in the form of a circuit, which increases progressively, a suitable method for U12 – U15 [18]. The circuit contains 7 stations/exercises that correspond to the tests; 1) squat, 2) skip in hexagon in 4 directions, 3) 20cm hurdle jump and 1 foot lateral shift to the left and right, 4) side skips left and right on the stairs, 5) change of direction run (COD) with lateral running and the following 4 distances, straight running with a change of direction, 6) horizontal left-right plyometric step, 7) exit the circuit by running straight ahead 4-5m. The distance from one station to another will be 2-3 m and the ratio of working time to rest time will be 1:2. We have given special importance to the phase of getting to know and learning the technique of executing the exercises, planning that this phase should extend to the first 2 weeks. In this phase, the load is standard in all sessions, 2 repetitions per session. The next 9 weeks are divided into 3 mezzo cycles where each of them is divided into 3 micro cycles.

*2.6. Statistical Analysis*

In this paper, the SSPS 17.0 package program was used for data analysis. All the data was tested for normality and the test of homogenous was done by the analyses of variances and Shapiro- Wilkes test for further analyses. The statistical techniques of "arithmetic mean (M)" and "standard deviation (SD)" were used. Also, a paired sample t-test was used in comparison for pre-test and post-test. Likewise, a one-way analysis of variance (ANOVA) was used to compare the improvement level of method training circuit. The significance level was taken as 0.05 in the comparisons ($p < 0.05$).

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## 3. Results

Based on measurements of anthropometry conducted prior to the training/intervention, descriptive statistical results are presented in Table 1. Our study started with an initial anthropometric measurement, in January 2024. Both sports had an average age of VB 13-14 ±0.6 and BB 13-14 ±0.3. In Body Height VB 167.1 ± 3.8 cm while BB 162.4 ± 3.3 cm. Body Weight of VB 54.74 ±4.3 kg and BB 60.7 ±3.6 kg, while BMI % kg/m for VB 19.69 ±3.3% and BB 23.16 ±4.1%.

**Table 1.**
The results of anthropometric on volleyball & basketball players.

| Group's | Age | BH | BW | BMI % |
|---|---|---|---|---|
| | (year) | cm | kg | kg/m² |
| 31-VB | 13-14 ± 0.6 | 167.1 ± 3.8 | 54.74 ± 4.3 | 19.69 ± 3.3 |
| 29-BB | 13-14 ± 0.3 | 162.4 ± 3.3 | 60.7 ± 3.6 | 23.16 ± 4.1 |

According to Table 2, the pre-test and post-test show results of vertical jump for groups. Based on the obtained results, there was a difference in the levels of variables between the groups after circuit training in volleyball and basketball sports, but in low values between them. There were no significant differences among the girls' basketball and volleyball players' vertical jump performance variables, but volleyball players showed slightly higher values after training compared to basketball players; SJ (VB-0.9, BB-0.06), CMJ (VB-2.38,BB-0.98) and in DJ 20 cm (VB-2.37, BB-0.45). The linear effect of the intervention on speed and agility is statistically significant ($P < 0.001$), indicating that there is a significant difference across intervention levels in both sports Table 3. At the agility tests measurements we also compared the results of the two tests (initial and final ones) using the statistical significance t-test. The results showed us that the value of p was with a difference between the results of the two tests being considered to be statistically significant. Repeated-measures analysis of variance (ANOVA) is a suitable method for evaluating the effectiveness of an intervention on a time-dependent (post-intervention) variable with 2 groups, as it provides control for individual differences and the ability to examine changes in time within and between groups.

**Table 2.**
The results of the vertical jump, before & after training of the VB and BB.

| | | Before | | | | After | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Tests** | | **VB** | | **BB** | | **VB** | | **BB** | |
| | | **Mean** | ***SD*** | **Mean** | ***SD*** | **Mean** | ***SD*** | **Mean** | ***SD*** |
| SJ | Tf | 0.392 | *0.03* | 0.361 | *0.04* | 0.401 | *0.03* | 0.391 | *0.02* |
| | JH | 19.03 | *3.2* | 18.01 | *3.9* | 20.01 | *3* | 18.07 | *2.5* |
| CMJ | Tf | 0.394 | *0.04* | 0.382 | *0.03* | 0.419 | *0.03* | 0.384 | *0.01* |
| | JH | 19.3 | *3.8* | 17.27 | *2.2* | 21.68 | *3.4* | 18.25 | *1.33* |
| DJ-20cm | Tcon | 0.371 | *0.07* | 0.31 | *0.04* | 0.325 | *0.05* | 0.362 | *0.07* |
| | TF | 0.378 | *0.04* | 0.352 | *0.03* | 0.403 | *0.04* | 0.361 | *0.04* |
| | JH | 17.7 | *4.1* | 15.66 | *2.8* | 20.07 | *3.2* | 16.11 | *3.8* |

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**Table 3.**
The results of the speed and agility test before & after training of the two groups.

| Tests | Before | | | | After | | | |
|---|---|---|---|---|---|---|---|---|
| | VB | | BB | | VB | | BB | |
| | Mean | *SD* | Mean | *SD* | Mean | *SD* | Mean | *SD* |
| Hexagon s | 17.18 | *1.6* | 17.7 | *2.1* | 13.37 | *0.7* | 14.7 | *1.9* |
| SHR10x5 s | *21.33* | *2.2* | 18.6 | *3.2* | 17.76 | *0.8* | 16.2 | *1.4* |
| *T-Test s* | *14.61* | *1.6* | *15.3* | *2.3* | *13.07* | *0.8* | *12.7* | *1.8* |
| LCD s | 7.42 | *0.6* | 8.5 | *0.8* | 6.9 | *0.3* | 6.2 | *0.7* |

## 4. Discussion

The primary objective of the study was to assess a training circuit model focused on developing basic components such as vertical jump, speed and improving agility, which are key elements in enhancing physical fitness and achieving success in sports competitions for female volleyball and basketball players aged 13-14 years, as well as to compare the effect of this training in these sports in Tirana of Albania. Indicated [19] out that the workload of a skill-based training program should be appropriate to improve the players' adaptability and achieve enhanced sports performance. However, the mean speed time of pre-test in the basketball group was significantly better than that of the volleyball groups. The diversity of movement differs from the kinds of sport. For example, sprint speed is an important constituent of physical performance especially during fast-break actions in basketball. On the other hand, vertical jump height and explosive power (for example, in jumping and spiking) are important factors in volleyball [20].

Stated [21] that through volleyball specific plyometric training it has been displayed significant improvement in speed, power and agility of male volleyball players. The most important result of this research was the determination of the differences between pre-test and post-test in basketball and volleyball players for all tested variables. The results indicated that this basketball training circuit and volleyball players was effective on speed and agility variables than in vertical jump. Training was especially more effective on agility and speed in volleyball players girls'. In addition, agility was affected more than speed in basketball than vertical jump.

The results were compared between groups VB & BB the initial and final tests and were as follows: In the Lateral Change of Direction (LCD) test, we can observe a time reduction of 0.5 sec. between the initial test (7.4 sec) and the final test (6.9 sec) in the VB group, compared to the BB group in 2.2 sec. But still players remain in poor values from the normative reference date. Regarding the T-Test, we can see a time reduction of 1.5 sec for VB, among the BB group in 2.6 sec had an improvement in time, but compared to the values of the [22] study, volleyball girls are faster in the T -Test (11.96 sec). The Shuttle Run Test 10 x 5m was intended to measure the speed and coordination skills of the players. According to the results of the test, it was found that the speed and agility values of the VB girls improved by 3.57 sec compared to the beginning of the training program, while the BB girls improved by 2.4 sec. Reported from [23] the 6-week agility ladder training provides 2.54% enhancement on 10 m sprinting. The hexagon test is a reliable measure of agility, with a high test-retest reliability rate (ICC = 0.93, $p < 0.001$). After the results in the Hexagon test, we can see a time reduction after training of 3.81 sec for VB and 3 sec for BB girls. Agility, as a main component is heralded as an important quality required by team sports athletes [24, 25].

The result of this study indicates that the ability of basketball and volleyball players to change direction quickly was found to be different between the groups during post-test. Basketball players had more speed and agility than volleyball players in the start of the training program. In a paper investigated the effects of a 6-week plyometric training program on agility and the results of their paper show that plyometric training was an effective training technique to improve an athlete's agility [26]. Those findings are also supported by another opinion that decision-making process in sport games is extremely important and they determine on the speed of realization of the motor task to a great measure

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[27]. A big role in the process of developing speed and agility is a good training timeline and efficient program of exercises. Concretely, the coach, by virtue of his role as manager and specialist, and his skill and experience, has the role of adapting the working methods and the intensity of the training according to the athletes' reaction to the planned effort, without departing from the proposed goals [28].

## 5. Conclusion

In conclusion, the 15 minute circuit training program utilized in this study was tailored to the specific movement techniques on the field, specifically tailored to the demands of gameplay for volleyball and basketball players aged 13-14 years. The results of this paper were very encouraging and demonstrated the benefits on components of speed and agility for volleyball and basketball girl's players after the circuit training. This training method showed that it should be implemented from a young age and throughout the season in these sports. We suggest that this study model be practiced by the coaches who train these age groups.

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