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# EFFECT OF JUMP TRAINING EXERCISE ON THE PHYSICAL FITNESS OF FEMALE HANDBALL PLAYERS OF UNDERGRADUATES STUDENTS IN ANAMBRA STATE

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## ABSTRACT

*The study determined the effect of jump training exercise on the physical fitness of female handball players of undergraduate students in Anambra State, Awka. Two research questions guided the study and two hypotheses were tested at 0.05 level of significance. The study adopted the quasi-experimental research design. The population of the study was 72 female students in 100 and 400 levels from department of Human Kinetics in Nnamdi Azikiwe University Awka, Anambra State. A sample of 30 female students was taken from the population using randomly sampling technique. The instruments for data collection were a weighing scale of Goonja communications and Electronics scales Co. Made in Delhi India, and Balance beam of Shandong Taigang Metal Production Sales Co. Ltd China. Data were generated by obtaining the weight and balance of the female players which was done on pre-test and post-test experiment in order to get the accurate data needed for the research. The data obtained were analyzed using mean and standard deviation for the research questions while t-test was used to test the hypotheses. The findings of the study revealed jump training exercise significantly improved female handball players' balance and coordination. It was therefore, recommended that preliminary jump training exercise should be done before any game to improve the physical fitness of players and that students and players should adopt jump training exercise as a personal exercise for improving their physical fitness.*

**Keywords**: Jump training exercises, Physical fitness, and Handball players.

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## Introduction

Jump training exercise (JTE) is one of the most popular training approaches adopted by coaches and strength and conditioning professionals in both, team and individual sports (Blagrove 2017). The importance of jump training exercise has principally been gained from the increasing number of scientific studies demonstrating its effectiveness in improving a wide range of physical fitness components (e.g., muscle power, linear sprint, and change-of-direction speed), irrespective of age, sex, and training expertise. Generally, jump training exercise benefits from the mechanical properties of the stretch-shortening cycle (SSC) during jump drills (Taube 2012), jump drills can be classified as fast SSC exercises (Sands *et al.*, 2012; Faigenbaum and Chu, 2017). Jump training exercise has been shown to enhance neuromuscular (e.g., improved neural drive to agonist's muscles) and/or mechanical and structural properties (e.g., alterations to musculotendinous stiffness and architecture) (Markovic and Mikulic, 2010). These positive effects on neuromuscular and structural properties should have potential in sports such as handball, which involves extensive movements analogous to jump training exercise drills. Jump training exercise is broadly used to improve physical performance in many sports activities involving sprinting, jumping and change of direction ability. It usually involves exercises that use the stretch-shortening cycle (SSC), in which a lengthening movement (eccentric) is quickly followed by a shortening movement (concentric). The term Jump training exercise (plyometric) first appeared in the work of the Russian researcher Zaciorski in 1966. Zaciorski proposed the term plyometric, considering that in these types of exercises involving SSC, the tension expressed by a group of muscle measured externally (metron) is higher (plio) than the muscle tension expressed when using other procedures, e.g., isometric exercise. Different types of classifications for jump training exercise have been used in the last seven decades.

Physical fitness is of critical importance to several sports, particularly in individual sports. For individual sport athletes, adequate levels of explosive strength, maximal strength, sprinting, acceleration, deceleration, change of direction, and endurance, are key factors potentially affecting athlete's performance (Aughey, Garvican- Lewis, Roach, Sargent, Billaut, Varley, *et al* 2013). Several training methods are routinely used by players in order to boost physical fitness, such as jump training exercises (JTE) (Bazyler Abbott, Bellon, Taber, & Stone, M. H *et al.*, 2015). JTE is characterized by jumping drills with different ground contact times, usually involving a slow muscle-tendon stretch-shortening cycle (SSC) or a fast SSC (Ramirez-Campillo, Alvarez, Garcia-Hermoso, Keogh, García-Pinillos, & Pereira, L. A. (2020a). Jumping drills involving slow SSC are performed with ground contact times >250 ms, large lower-limb joint excursion, and low stiffness (e.g., counter drop jump). During both slow and

fast SCC, the accumulation of elastic energy facilitates greater mechanical work (i.e., explosive strength) production in subsequent actions (Radnor *et al*., 2017; Taube, Leukel and Gollhofer, 2012). Indeed, the SSC of the muscle-tendon complex optimize the rate of force development, the relative force per-motor unit recruited, and therefore, muscle power (Radnor *et al*., 2017). In this sense, JTE, through enhancement of the SSC and associated neuro-mechanical mechanisms (Markovic and Mikulic, 2010), may facilitate improvements in physical fitness. Handball is a very dynamic sports discipline, in which short actions lasting no longer than 10-20 seconds dominate. Over the course of the competition, repeated efforts at high intensity and varying duration occur, which results in the playing time to be approximately 30-35% in the anaerobic zone. The applied techniques (passes, throws, jumps, starts, changes of running direction), as well as proper technical and tactical behaviors (e.g., ball handling, individual defensive actions, direct contact with opponents, etc.) often require the player to develop high values of power in a very short time. This means that the effectiveness of a technique in sports competition is largely dependent on the level of competitor's anaerobic power. It seems that the best way to improve the strength of a handball player is to use jump training exercise.

Regular use of these exercises increases muscle tolerance to significant eccentric loads and allows for better use of the stretch shortening cycle (SSC). However, this type of training is considered controversial. Many studies confirm the effectiveness of jump training exercise exercises in increasing the strength and power of athletes. However, concern is raised by excessive overloading during such exercises, which may have adverse effects on the athlete's health, especially injuries to the joints, ligaments and muscles. In addition, studies on competitive athletes, which frequently perform jumps during training and competition (volleyball, handball, basketball, etc.) indicate that the use of jump training exercise does not significantly improve athletic performance. This may be due to the fact that for team players in volleyball, basketball or handball, performing jumps is a regular part of most training sessions, thus additional jump training exercises may be an insufficient stimulus for the neuro-muscular system (Trajkovic, Kristicevic, & Baic 2012). This raises the question about the legitimacy of using additional jump training exercises in such team sports training. It should also be noted that jump training exercise produces other effects than those resulting from explosive resistance training. Depending on the value of the applied load, strength training may vary in its influence on the course of the strength-speed curve. In handball, an athlete must generate significant power regarding both small (e.g., throws) and large (e.g. fighting for a position on the field, defense) external forces. Therefore, when designing a handball resistance training program, one

cannot focus solely on power, bypassing maximal strength training.

To optimize the effectiveness of resistance training, it must be harmoniously integrated into the overall training program developed for a particular sport discipline. Although muscle strength and power are extremely important in handball, they are not the only factors determining success in this sport. Basic handball training is directed at improving technical and tactical skills. The periodization of strength training in handball is an extremely important issue. Under the conditions of high motor demands placed on the athlete in competitive sports, it is necessary to carry out systematic strength training over the course of the entire annual training cycle. This is especially important in disciplines such as handball, where a classic division of the annual macro cycle takes place and the players participate in competitions all year round. During the competitive period, the task of the athlete is to maintain or even improve the level of muscular power and strength developed during the preparatory period. Developing a training program during this period is extremely difficult, as it must be sufficiently intense to stimulate improvements in motor abilities, while avoiding excess fatigue that could lead to overtraining.

**Statement of the Problem**

Jumping training exercise (Plyometric) is of huge importance, which aims to improve cardiovascular health, metabolism, bone density, strength, muscle size and muscle speed, alongside improving coordination. But there is a gross lack of knowledge of this all important exercise, this can lead to better athletic performance – from improved handball playing, jumping, sprinting, strength and even endurance. However, lack of jump training exercise remains a major challenge; the high risk of injury and repetitive jumping and bounding can cause stress on the joints. The knowledge gain in this study will help athletes practicing regular jumping training exercises to be physically fit, it will help the female handball players to gain the knowledge of how the blood pressure rate works before and after the training. Also, the knowledge gained will help the players to have faster and more powerful movements that require less muscular effort to perform. So if a handball player practices jumping training exercises, they will find it easier to reach their top speed and maintain it during competition and a healthy body. It is considered to be one of the most effective exercises for heart health.

**Research Questions**

The study was guided by the following research questions:

1. What is the effect of jump training exercise in improving the balance of the female handball players?
2. What is the effect of jump training exercise in improving the coordination of the female handball players?

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**Hypotheses**

The following hypotheses were tested at 0.05 level of significance.

1. There is no significant effect of jump training exercise on the balance of the female handball players.
2. There is no significant effect of jump training exercise on coordination of female handball players.

**Research Method**

The population of this study consists of seventy-nine undergraduate (female) of department of, human kinetics, Nnamdi Azikiwe University Awka, 100 and 400 level students precisely. A sample of 30 female students (representing 29% of the population) was chosen from the population using randomly sampling technique. With simple random sampling 15 female students were selected from the 400 level students and another 15 female students from the 100 level students.

The study employed a pre-test post-test quasi-experimental design, comprising of one experimental group and one control group to determine the effect of jump training exercise on the physical fitness of female handball players of undergraduate students in Anambra State, Awka. The instrument for data collection were a weighing scale of Goonja communications and Electronics scales Co. Made in Delhi India, sphygmomanometer and stethoscope of Ningbo Henyo Tecare Medical Technology Co. Ltd made in Ningbo, Zhejiang, China and Balance beam of Shandong Taigang Metal Production Sales Co. Ltd China. The instruments were used to carry examine the weight, the blood pressure rate (heart rate), balance and coordination of the 30 female players.

The instrument were used to obtain the weight and the blood pressure rate of the female players which was done on pre-test and post-test experiment in order to get the accurate data needed for the research. The experiment was conducted for a period of 8weeks and every data during that period was taken with the aid of two research assistants who were the researcher's fellow course mates. A jump training exercise was administered to the players after taking their blood pressure rate and weight by the researcher with the help of the two research assistants. The researcher and his research assistants guided the players in taking their weight and blood pressure rate with the instrument listed above. Then after the handball game, the post-test was conducted also taking the current weight and blood pressure rate of the players in order to ascertain if jump training exercise has any effect on the physical fitness of the female handball players.

Data relating to the research questions were analyzed using mean and standard deviation. The hypotheses were tested at 0.05 level of significance using t-test. The decision rule for accepting or rejecting the null hypotheses was that where the P-value (probability value) was less than or equal to 0.05, the null hypothesis was rejected and

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where it was greater than 0.05, the null hypothesis was not rejected.

**Presentation of Results**

**Research Question 1:** What is the effect of jump training exercise in improving the balance of the female handball players?

**Table 1: Effect of Jump Training Exercise on Balance of Female Handball Players**

| Source of Variation | N | $\bar{x}$ | SD | Mean Difference |
|---|---|---|---|---|
| Pre-test | 30 | 13.80 | 2.93 | 2.70 |
| Post-test | 30 | 16.50 | 1.91 | |

Table 1 shows that female handball players had a pretest mean balance of 13.80 before jump exercise and posttest of 16.50 after jump training exercise. The mean difference of 2.70 shows that the female handball players' balance was slightly improved through the jump training exercise. To show whether the observed difference of 2.70 is a chance factor or significant, hypothesis on question one was tested.

**Research Question 2:** What is the effect of jump training exercise in improving the coordination of the female handball players?

**Table 2: Effect of Jump Training Exercise on Coordination of Female Handball Players**

| Source of Variation | N | $\bar{x}$ | SD | Mean Difference |
|---|---|---|---|---|
| Pre-test | 30 | 7.80 | 2.99 | 5.27 |
| Post-test | 30 | 13.07 | 2.57 | |

Table 2 shows that female handball players had a pretest mean coordination of 7.80 before jump exercise and posttest mean of 13.07 after jump training exercise. The mean difference of 5.27 shows that the female handball players' coordination was slightly improved through the jump training exercise. To show whether the observed difference of 5.27 is a chance factor or significant, hypothesis on question two was tested.

**Hypothesis 1:** There is no significant effect of jump training exercise on the balance of the female handball players.

**Table 3: T-test of Significance of Effect of Jump Training Exercise on Balance of Female Handball Players**

| Source of Variation | N | $\bar{x}$ | SD | Df | t-calculated | P-value | Decision |
|---|---|---|---|---|---|---|---|
| Pre-test | 30 | 13.80 | 2.93 | 58 | 4.243 | 000 | Significant |
| post-test | 30 | 16.50 | 1.91 | | | | |

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Table 3 shows that a 0.05 level of significance and degree of freedom 58, the t-calculated value was 4.243 with a P-value of 0.000 which is less than 0.05. The null hypothesis was rejected showing that there is a significant difference between the pretest and posttest mean balance ability of female handball players before and after jump training exercise in favor of post-training jump exercise.

**Hypothesis 2:** There is no significant effect of jump training exercise on coordination of female handball players.

**Table 4: T-test of Significance of Effect of Jump Training Exercise on Coordination of Female Handball Players**

| Source of Variation | N | $\bar{x}$ | SD | Df | t-calculated | P-value | Decision |
|---|---|---|---|---|---|---|---|
| Pre-test | 30 | 7.80 | 2.99 | 58 | 7.182 | 000 | Significant |
| post-test | 30 | 13.07 | 2.57 | | | | |

Table 4 shows that a 0.05 level of significance and degree of freedom 58, the t-calculated value was 7.182 with a P-value of 0.000 which is less than 0.05. The null hypothesis was rejected showing that there is a significant difference between the pretest and posttest mean coordination ability of female handball players before and after jump training exercise in favour of post-training jump exercise.

## Discussion

The findings in table 1 reveal that the engagement improved the balance of female handball players. The observed result can be explained from the fact that by building strength in your legs, shoulders and back, jump training exercise builds a stronger base to control the body and improve awareness and general physical fitness. Through jump training which involves doing exercises that strengthen the muscles, female handball players developed greater ability help keep you upright, with legs and core. These kinds of exercises can improve stability and help prevent falls thereby improving balance. Jump training exercise by strengthening the core, it can further strengthen the balance by improving the trunk muscles to hold up the upper half of the body more effectively. The findings of the study is in line with the findings of Athos, Luca, Riccardo and Giampietro (2015) that jump training practice within regular soccer training enhanced general motor coordination and balance in preadolescent soccer players. The findings of the study also supports that findings of Akhilesh, Utkarsh, Rodrigo, Filipe, Afonso and Urs (2021) that jump training appears to be an adequate training regime to improve balance in both, athletic and recreational settings.

The finding in table 2 showed that there is significant improvement in coordination of female handball players. Adding rope jump to training programs improves joint repositioning and coordination. Weighted Rope Training

group got greater gains for coordination and eccentric endurance parameters for lower extremities in a closed kinetic chain. Jumping rope for instance is a cyclic activity, which means you perform it for a steady, regular cadence. The steady cadence and rhythm of jumping rope can help improve the coordination between your eyes, feet and hands. Jumping rope is a great tool for improving your strength & agility because it incorporates so many training elements: conditioning, timing, hand-eye-foot coordination, and the mental focus to access these elements at the same time. Other than the multiple muscles in your body, doing jumping jacks benefits your brain too. This exercise requires the coordination of different muscles of your body hence improving coordination, balance and rhythm.

The findings of the study supports that findings of Zuozheng, Shu, Yue, Xinru, Long, Binglong, & Bing, (2023) that jumping exercise significantly increased coordination level of athletes. The findings of the study are not at contrast to the findings of Athos, Luca, Riccardo and Giampietro (2015) that that jumping exercise practice within regular soccer training enhanced general motor coordination and balance in preadolescent soccer players.

## Conclusion

Jump training exercise significantly improved physical fitness of female handball players in terms of their balance, coordination as well as their blood pressure. The conclusion drawn from the study is that jump training exercise is a potent exercise for improving the physical fitness of handball players.

## Recommendation

Preliminary jump training exercise should be done before any game to improve the physical of players, students and players should adopt jump training exercise as a personal exercise for improving their physical fitness and regular jump training exercise should be done to continually improve the balance and coordination of players and make them more physically fit for games.

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