

DEVELOPING ATTACK POINT IN VOLLEYBALL GAME USING PLYOMETRIC EXERCISES AT 13-14 YEARS OLD VOLLEYBALL PLAYERS

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Abstract: *The research started from the need to develop physical strength and speed and also to improve the jumping abilities of a women volleyball team. The research had as experiment group a team of 15 girls with age between 13-14 years old (13 ± 1.20 years old) and a volleyball experience between 5 and 6 years old (5 ± 1.50 years of experience). The experiment started in January 2018 and ended in October 2018 with five stages: documenting, initial testing, plyometric training, and final testing and statistical analyze. Research methods included five physical tests: standing long jump, triple broad jump, standing vertical jump, spiking point, and block point. The experiment group followed a four months plyometric program for improving jumping abilities and the results were analyzed statistically for significance.*

The conclusions of our research showed that the plyometric program included in the experiment had good results in both five tests but statistically significant results were found in standing long jump test, triple broad jump test and in block point.

Key words: *volleyball, attack point, plyometric exercises, jumping skill.*

1. Introduction

Nowadays volleyball game has developed in speed and strength characteristics being more and more physical.

Volleyball game is an acyclic team game, where muscular work is of a speed-power, accuracy-coordinating character [7].

A volleyball player's use of explosive power in vertical, horizontal and side movements is critical. The relationship between explosive power and the technical and tactical level of the player is especially evident when observing the player's activities at the net, attack from the field and spike serve [10].

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The spike and block actions are dominated by the corresponding explosive type of strength which is referred to as a player's vertical jump which is usually the key to winning point. Volleyball is a dynamic, fast-paced game. The purpose of strength training for volleyball is not to build big muscles, but to develop the physical attributes necessary to improve a player's performance. So strength training is very important to volleyball and should not be developed independently of other abilities such as agility, quickness and endurance [17].

Moving actions of volleyball players include instant starts and accelerations, jumps, a large number of explosive percussion movements with a long and almost continuous response to a situation that is constantly changing [15] [20] [19] [21] [24] [25]. Physical fitness of volleyball players coordination abilities among other physical qualities of volleyball players occupy a special place.

High intensity active stages of the game such as serving, service receive, setting, spiking, blocking and defending that last a few seconds, require improved anaerobic metabolism to produce energy [22] [4]. Vertical jumping is a valid and reliable tool to estimate anaerobic power of players and because of high reproducibility and repeated measures of vertical jump measures power development [11] [16]

Plyometric exercises have been shown to improve jump performance in many sports. These exercises combine strength with speed of movement to produce power [23] and is often applied in team sports to master explosive power of lower extremities. Plyometric training mainly consists in application of special drills which contribute to muscle power increase [23].

According to some specialists important part in training is its periodization which modulates implementation legitimacy and schedule load norms in adequate time periods and contains three phases: first phase is described as being the plyometric stabilization, the second phase is the plyometric muscle strength and the third phase is the plyometric power [2].

As plyometric training may result in conspicuous jumping abilities increment it also carries the risk of injury thus coaches role is very important as they are the only to monitor and adjust loads [5]. Additionally, the most sensitive group of athletes are children and adolescents whose biological development attendant should take care of. Light intensity plyometric exercises may be performed during the first years of the individual's healthy training process. However, after this process, they must continue to work with the jump in challenging levels. Teaching of plyometric studies is of increasing importance [1].

Plyometric exercises are one of the most commonly used training models for supporting strength development and shortening the strength level. Plyometric training also contributes to the development of physical performance [13].

The plyometric method also decreases muscle reflex inhibition, increases the sensitivity of the Golgi tendon organs, improves the sensitivity of the muscle spindles, increases muscle tension and at the same time can decrease the risk of injuries [1], [3], [14], [26].

2. Objectives and Hypothesis of the Research

The experiment started from our need to develop jumping skill of the volleyball

players. The hypothesis of our research was using the plyometric program and a proper set of evaluation tests, we can develop and analyse the evolution of jumping skill.

The objectives of the research were to develop and evaluate the jumping skill using a plyometric program specially designed for volleyball players, and also evaluate and observe the evolution of strength and speed.

3. Design of the Research

3.1. Subjects of the research

The subjects of our investigation were 15 female players from the Excellence Center of Volleyball from Baia Mare. The volleyball players had between 13 years old and 14 years old (13 ± 1.20 years old) all women gender, with a volleyball experience between 5 and 6 years (5 ± 1.50 years of experience).

3.2. Stages of the experiment

The experiment started in 1st of June 2018, with an initial test that evaluated the parameters of jump in all the five tests proposed by the research (standing long jump, triple broad jump, standing vertical jump, spike and blocking point) and continued with a four month of developing jump parameters using plyometric program, and ended in 10th of October 2018 with the final evaluation of jumping parameters.

The stages of the experiment were the following:

- stage 1: research for choosing the optim tests for a proper evaluation of jumping skill and plyometric program, started from 1st January and ended in

1st June.

- stage 2: instruction and practice for the initial test and initial evaluation of our experiment group in the 1st of June.
- stage 3: implementing the plyometric program with the purpose of developing the jumping skill, started from 2nd of June until 5th of October.
- stage 4: final evaluation of jumping skill using the five tests consider proper and concludent for volleyball game, 10th of October.
- stage 5: register all the final results and compare them with the initial tests results, discussions and conclusions.

4. Methods of Research

The research used five physical evaluation tests for jumping skill: standing long jump, triple broad jump, standing vertical jump, spike and blocking point. After registering the initial and final test results we used several statistical parameters to observe if the differences between the two tests were statistically significant. Bellow we described the tests used for assessing the jumping skill:

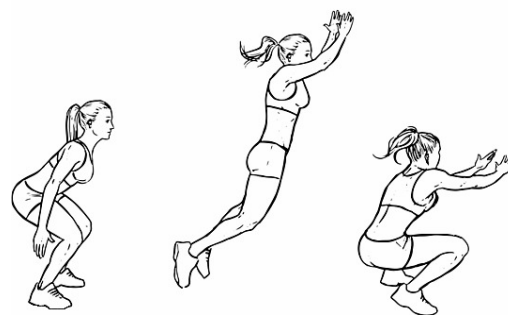


Fig. 1. Standing long jump



Fig. 2. *Triple broad jumps*

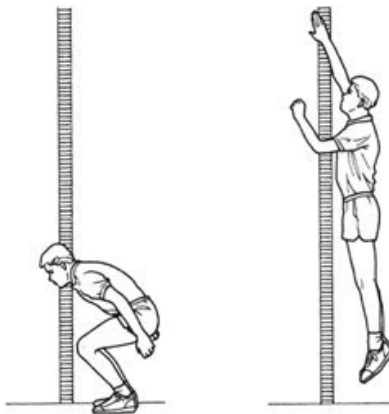


Fig. 3. *Standing vertical jump*



Fig. 4. *Measuring the spiking point*



Fig. 5. *Measuring the blocking point*

5. Results of the Research

Our experiment started with the initial test when we wanted to analyse the jumping potential of our research group. We selected five conclusive tests that are properly used in volleyball game measuring jumping skill both in length and height so we applied the following tests: for length jumping we used standing long jump and triple broad jump and for height we used standing vertical jump, spiking point and blocking point, all measurements are specific to volleyball game. We analysed the results using specific basic statistical parameters that can be seen in Table 1.

Initial test evaluation of jump

Table 1

Crt. No.	Test used in experiment	Standing Long Jump	Triple Broad Jumps	Standing vertical jump	Spiking point	Blocking point
1	Average	167.00	423.21	228.79	231.86	226.57
2	Stand. dev.	8.85	17.12	6.96	6.52	5.45
3	Median	167.00	420.00	230.00	235.00	230.00
4	Module	165.00	410.00	220.00	235.00	230.00
5	Min	155.00	405.00	220.00	220.00	218.00
6	Max	188.00	460.00	241.00	244.00	235.00
7	Skewness	0.53	0.90	0.13	-0.14	-0.22
8	Kurtosis	0.16	-0.49	-1.32	-0.49	-1.30

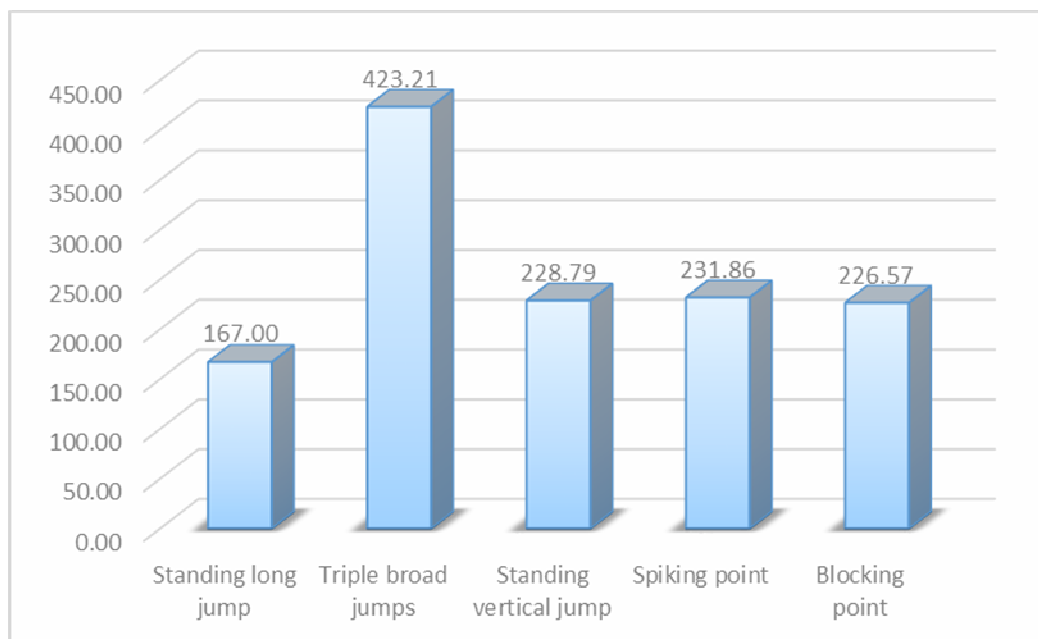


Fig. 6. The results of the initial test

In Figure 6 we used the graphical representation to express the results of the initial tests. As we can see at standing long jump the average of the experiment group was 167.00cm, in the triple broad jump test we had the average of average

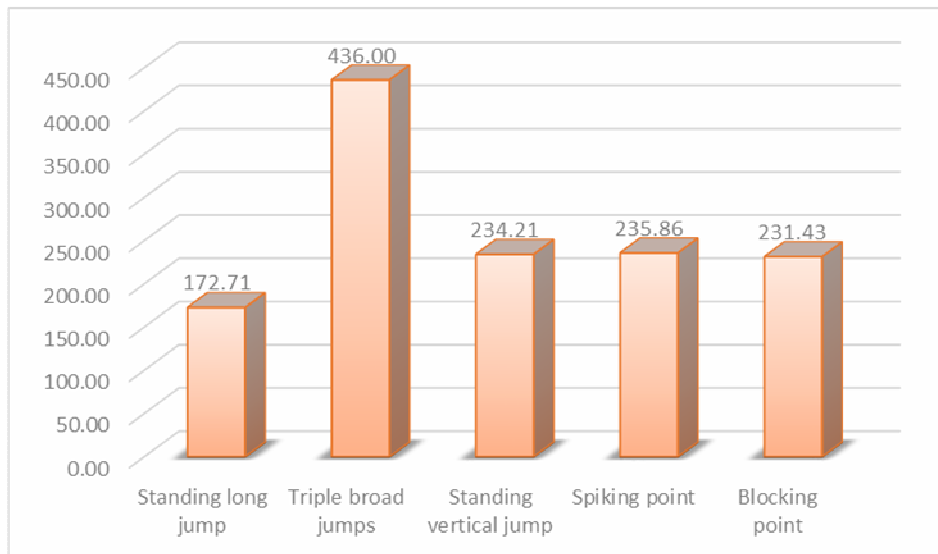
registered was 228.79, at the spiking point the group registered an average of 231.86cm as reached point and at the last point the blocking point the average was 226.57cm.

Final test evaluation of jump

Table 2

Crt. No.	Test used in experiment	Standing Long Jump	Triple Broad Jumps	Standing vertical jump	Spiking point	Blocking point
1	Average	172.71	436.00	234.21	235.86	231.43
2	Stand. dev.	9.09	17.82	6.84	6.54	5.88
3	Median	175.00	435.00	235.00	238.00	234.00
4	Module	175.00	422.00	240.00	230.00	225.00
5	Min	160.00	415.00	226.00	224.00	220.00
6	Max	193.00	472.00	245.00	247.00	240.00
7	Skewness	0.46	0.70	-0.01	-0.14	-0.42
8	Kurtosis	0.23	-0.73	-1.78	-0.92	-0.73

The next phase of our experiment was implementing the plyometric program for developing jumping skill and also strength and speed of the lower members of body. After the four months of training we decided to investigate the progress made by our experiment group so we took a final test. The results can be analysed in Table 2 and also graphical representation can be analysed in Figure 7.

Fig. 7. *The results of the final test*

After registering the initial and final tests results we decided to compare the results and analyse the progress of our experiment group regarding the jumping skill. The comparison between the initial and final test can be observed in Figure 8.

Regarding the first test, **the standing long jump test**, we registered an average

progress of 5.71 cm from the initial test, where we registered a value of 167 cm, compared with the final test, where we obtained a 172.71 cm value, using the t-test we analyse the results and **found no statistical significant difference at $p < 0.05$** , having a t-value of -1.67117 and a p-value of 0.052915.

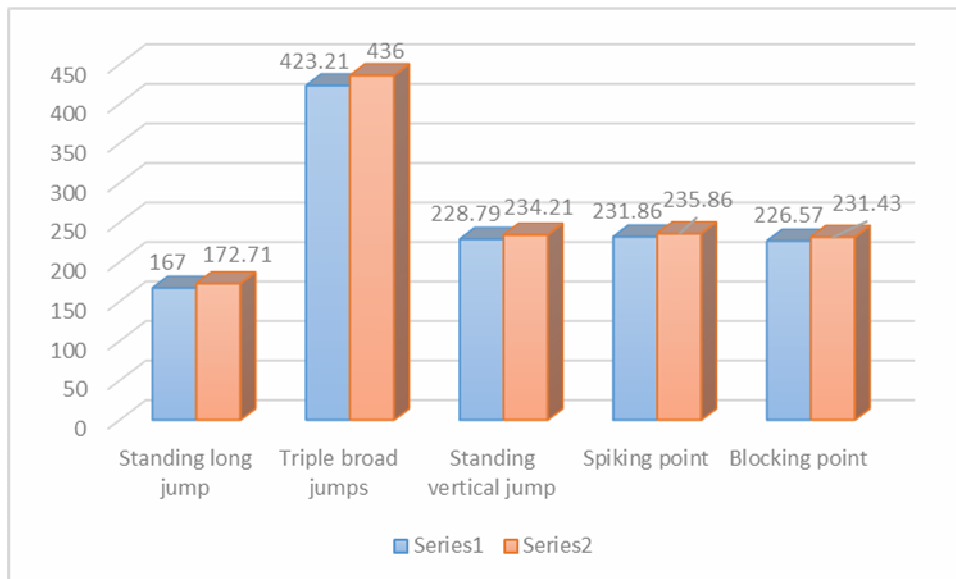


Fig. 8. Comparison between the initial and final evaluation

At the second test, **the triple broad jumps test**, we registered an average progress of 12.79 cm from the initial test, where we obtained a value of 423.21 cm compare with the final test, where we registered a value of 436 cm, using the t-test we analyse the results and **found a statistical significant difference at $p < 0.05$** , having a t-value of -1.9281 and a p-value of 0.3202.

Analysing the results at the third test, **the standing vertical jump test**, we observe an average progress of 5.42 cm from the initial test, with a value of 228.79 cm, and the final test, with a value of 234.21 cm, using the t-test we analyse the results and **found a significant difference at $p < 0.05$** , having a t-value of -2.04629 and a p-value of 0.025111.

The results of **the spiking point test** showed a progress of 4 cm from the initial test, with a value of 231.86, compared with the final test results, with a value of 235.86, using the t-test we analyse the results and found **no statistical significant difference at $p < 0.05$** , having a t-value of -

1.59385 and a p-value of 0.061099.

Regarding the last test, **the blocking point test**, we registered a 4.86 cm progress from the initial test, with a value of 226.57, compared with the final test, with a value of 231.43 cm, using the using the t-test we analyse the results and **found a statistical significant difference at $p < 0.05$** , having a t-value of -2.27176 and a p-value of 0.01549.

6. Discussions

One of the most important elements for the development of general athletic skills is the ability of the nervous system to activate more motor cells and coordinate the work of motor cells among themselves [6] [7]. This provides more productive work of the muscles. Thus, higher speed and strength is achieved, which helps to improve proprioceptor (sensation of the relative position of body parts and their movements in a person, that is, the sense of one's body) [7].

Some experimental research with similar objectives for measuring the development of explosive power at children found similar results in long jump test with average length of 168.95 cm in girls [9].

In high-performance sports, there is a broad range of instruments and means from mathematics and informatics domain, different in form and complexity, which have improved over the last few years regarding the versatility and technical possibilities, the extent of their applicability and the facile way with which they used at present [18].

Scientific papers that analysed the physical development of volleyball players using plyometric training concluded that there is a positive development in balance characteristics of hearing-impaired volleyball players with regular plyometric training, it can be said that the application of plyometric training in addition to the volleyball training is beneficial in terms of sporting performance [12].

Also other scientific plyometric research prove experimentally that an six-week training model using the plyometric method can have an effect on the statistically relevant increase in the explosive type strength of the leg muscles, which in turn leads to an increase in the block jump and spike jump, due to this, the individual use of the plyometric method is recommended as more effective in the development of the vertical jump [17].

In another study authors found that the dynamics of changes in the monitored motor predispositions in female volleyball players showed a positive trend with differences between explosive power and speed values during the training program, and also found logically and statistically

significant improvements of explosive power tested by tests of the standing vertical jump and the vertical jump with an approach after eight week training period, that supported the opinion that plyometric exercises can be an effective tool for the improvement of the explosive power and speed predispositions of youth athletes [10].

Other research concluded that a 12-week lower extremity plyometric training combined with jump rope exercises improves jumping height, anaerobic capacity, sprint performance and dynamic balance of the young female volleyball players [4].

7. Conclusions

The conclusions of our experiment showed that the hypothesis was confirmed so we can affirm that using the right plyometric program we can improve lower members' strength and speed and also the jumping skill of female volleyball players.

The experiment proved to be efficient in developing jumping skill proven by the results presented at the five tests, the improvements were important and also at some of them even statistically significant (the triple broad jump, the standing vertical jump, the blocking point).

We can conclude that using the proper instruments in developing youth motor abilities we can obtain the expected results, using the proper plyometric exercise we can obtain better jumping abilities and improve women volleyball performances.

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