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Identification of Explosive Force in 15-year Old Volleyball Players

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Abstract

Assessment of physical features, especially vertical jump performance in various GRFP is of particular importance in advancing and determining the physical abilities of young age groups in volleyball. The purpose of this study is to evaluate the performance of vertical jump in volleyball in Albania. Method; 181 volleyball players were tested, including 106 female (F) and 75 men (M) with an average age of 15-16 years, BH cm(F-177/M-191), BW kg(F-64.3/M-79.5), BMI kg/m² (F-20.39/M-21.88). Field tests Attack cm(F-285.3/M-323.7), Block cm(F-274.6/M-310.3.In three tests Bosco; Squat Jump (SJ), Countermovement Jump (CMJ), Repeat Jump (RJ 15sec) tests were conducted on the Ergo Jump System platform. The average values according to the calculations in the index of elasticity and elastic energy of the lower extremities of volleyball players as well as the index of explosive force are shown. Results: The fast power index is derived from the CMJ-SJ test difference and showed that (F-5.6/M-7). The coefficient of elasticity is expressed in% by the formula (CMJ-SJ) x100 / CMJ where it showed the values of (F-17.3% /M-16.2%), while in the RJ15sec test of anaerobic power showed the values where (F-0.8/M-0. 7).Conclusions: Tests conducted in these age groups of volleyball players in Albania clearly showed that they have unused reserves of elastic muscle energy. The capacity of the strength index in team sports in teams reaches values up to 0.90-0.95 but F&M volleyball players showed values of 0.7-0.8, is a low capacity of reactive force resistance, which results from the lack of plyometric training. The mechanical strength during the RJ15sec jump proved to be a very sensitive functional parameter that individualizes the features and characteristics of the anaerobic element of lactic acid related to training.

Keywords: volleyball; tests; squat jump; countermovement jump.

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1. Introduction

Age's volleyball in our country has a constant participation in national and international activities. The identification and development of sports performance of young people is of particular importance for their performance in sports. Volleyball is defined as an activity with aerobic-anaerobic engagement alternating with the entry into work of a large number of bodily muscles and high strength requirements in certain regions. Volleyball is a fast game and is characterized by a lot of body height, athleticism of the athlete, explosive force, lateral movements forward and backward but also other technical-tactical aspects of individual or collective training. Various physiological studies on this discipline have shown how a volleyball player should master and increase, through training the ability to develop explosive force and reuse elastic energy. The methods used until recently were mainly based on empirical bases and personal experiences that although caused by specific scientific knowledge did not guarantee absolute assurance of an appropriate training stimulus and the specific adaptation desired. Numerous scholars have found that high jumps can be improved through applications of plyometric exercises. The best perfection of a vertical jump is achieved with training with the specific purpose of increasing the height of the jump, the high degree of muscular activity that is achieved by increasing the loads in the phase of the extension of the vertical jump. The ability to develop the performance of vertical jump in volleyball is the key point for the success of a volleyball player, combined with other technical elements of the game. One of the training methods used by coaches during the training period of athletes is the "Plyometric" exercises. Plyometric exercises contain fast and continuous eccentric and concentric movements to increase muscle strength in effect to perform the performance of a jump as efficiently as possible [1].Vertical jump assessment has been widely used as an alternative to the maximum straightforward assessment of strength and power of the lower extremities [2].The rate of force development is the development of maximum force in minimum time and is commonly used as an index of explosive force [3]. Komi & Bosco compared the performance of vertical jumps in men and women in these three specific tests; SJ, CMJ and DJ where males performed higher than females but females had a good use of stored elastic energy [4].It has previously been reported [5] an average relationship between strength /measuring power in squat jump performance from place to place and CMJ counter-action jump (movement) in the elite volleyball team. Despite the number of some plyometric studies, few studies on applied exercise have directly compared the effectiveness of weightless plyometric exercises. Plyometric is a method of training athletes especially applied in volleyball. It is a method used to improve athletic performance, increasing the strength, speed or power of athletes during a vertical jump. This is a specific method of strength training in order to develop the explosive power of the muscles of the lower extremities and the capacity of the reactive neuromuscular system [6]. Plyometric is a form of resistance exercise that refers to the stretch-shortening cycle such as jumping or doing vertical or horizontal jumps [7]. A comprehensive review has reported [8] that plyometric training is effective in improving vertical jump performance. Given both research and experience shows how specific and necessary it is to know when is the most favorable period to develop capacity and improve vertical jump. According to[6] report that for men the period in which the ability to evolve is predicted one year after the peak of puberty, while for women after six months and therefore it is suggested to plan a program training at these ages. We thought to identify the physical performance of 15-year-old volleyball player.

2. Materials and Methods

2.1. Subjects

Table 1 presents the average data of anthropometric measurements of volleyball players. In total there are 181 young men volleyball players of Tirana in Albania respectively with 106 player's group Female (F) & Male (M) 75 players. The average age of players included in this study is 14-15years old. All 80 F&M volleyball players underwent anthropometric measurements; body height (BH cm), body weight (BW kg), BMI kg/m², attack and block. Volleyball players have developed in three protocol tests Bosco; Squat Jump (SJ), Countermovement Jump (CMJ), Repeat Jump (RJ 15sec) tests were conducted on the Ergo Jump System platform in the biomechanics laboratory at the University of Sports in Tirana. The test has been developed 3 times and we got the best measure of the contact time jump.

Table 1: Anthropometric measurements

Measurements	Female	Male
Age	15	15
BH cm	177	191
BW kg	64.3	79.5
BMI kg/m²	20.39	21.88
Attack cm	285.3	323.7
Block cm	274.6	310.3

2.2. Calculations

(CMJ - SJ) - By processing the difference between these tests SJ and CMJ we can calculate the coefficient of elastic reuse of force which is the difference in percentage between them. (CMJ-SJ) x100 /CMJ) the capacity to reuse accumulated energy as a result of elastic traction that precedes muscle contraction (percentage of elasticity). Mes.RJ15sec - anaerobic power. The capacity of the muscles which express the values of force during the work of eccentricity and concentration. By seeing the values obtained we have the opportunity to direct the training towards strength or towards speed. RJ15sec /CMJ - Explosive force resistance coefficient, to see what level of physical quality of vertical jump they are.

3. Results

Table 2 presents the averages of the tests applied to male & female volleyball players aged 15 years of Tirana in Albania. The calculation of the coefficient of elasticity expressed as a percentage is also presented as an indicator of the capacity of the energy accumulated as a result of the elastic elongation of the muscle that precedes the muscle contraction, the capacity of the fast force is calculated in the RJ15sec test [9]. The reliability of tests is controlled by the "test-retest" method, as one of the most used ways in similar tests, as to minimize the effect of other factors that are not taken into account in the study.

Table 2: Descriptive statistics of the tests

SJ	CMJ	RJ15sec	(CMJ-SJ)x100/CMJ	RJ15/CMJ
Jump high	jump high	jump high	% elasticity	Explosive force coefficient
FEMALE 25.81	31.45	24.12	17.84	0.7
MALE 36.41	43.3	34.88	73.6	0.8

The data averages obtained from the measurements of F&M volleyball players on the Ergo Jump System platform in the biomechanics laboratory at the University of Sports in Tirana presented in tab.2 clearly show the level of vertical dance performance in these age groups. The SJ test which provides a measure of fast throwing ability to develop a rapid explosive force showed different values F25.81cm <M36.41cm. The CMJ test which provides the measure of fast jump strength showed these values where F31.45cm <M43.3cm. [10] showed that the difference of the CMJ-SJ test shows the assessment of the "elastic quality" of athletes in teams using the concept of “elasticity index” that comes from the difference of these two tests. Good capacity used by elastic energy corresponds to 8-10 cm [10] but our volleyball players showed low level in the fast power index where F5.6cm and M6.8cm.From the calculations we have derived the coefficient of elasticity by means of the formula (CMJ-SJ) x100 / CMJ expressed as a percentage and indicates unused reserves of elastic muscle energy by volleyball players where the values of F17.84% <M73.6 %. Whereas the anaerobic strength assessment data of volleyball players of these age groups where the RJ15sec test is a very necessary test which calculates the capacity of fast strength in these volleyball players and RJ15sec determines; mechanical strength (w / kg) and average height (cm) during jumps where F24.12 <M34.88.According to the reference table reported by [1]the values of the ratio between the average height of jumps during RJ15sec and CMJ (h15 / h CMJ) should be close to 1, in the case of sports with team commitment good values reach 0.90-0.95. Rapid force resistance capacity; h15sec / h CMJ will be given to our groups at these levels where F0.7 <M0.8 and are at their lowest level of fast force resistance capacity which comes as a result of their lack of training of non-plyometric and strength.

4. Discussion

Vertical jump performance tests have often been studied for their reliability and validity. The ability to jump vertically is the key element to success in volleyball for both men and female because they play a game that is oriented around a certain net height in volleyball. Vertical jump performance can be assessed using a variety of apparatus ranging from sophisticated electronic measuring instruments (e.g., force platforms). Special moving models related to vertical jump in volleyball are characteristic of squat jump, countermovement jump and drop jump. These types of jumps are absolutely important in volleyball assessment tests in volleyball players. Standard vertical jump test procedures have been widely validated for various purposes [12-13]. The SJ and CMJ tests reported very high reliability indices in adult testing [9-11] and showed the best reproducibility for

assessing muscle energy in physical activity. Others [14] have reported that the assessment of vertical jump is mainly determined by the peak rate of strength development, suggesting training methods in order to improve strength. Numerous scientific studies have used the evaluation of vertical jumps through the SJ and CMJ tests to investigate how different factors influence the development of maximum power and production power during vertical jump [15- 1]. Comparisons of CMJ and SJ tests have shown that training involving CMJ has a greater effect on the development of explosive power [6].According to [16-17]a reciprocal, although not significant, relationship has been reported between the dynamics of the degree of force development and the performance of the vertical jump (r = 0.65-0.74) .The lack of a significant correlation between them is more likely to be caused by the low statistical power of participation in the study. According to a study [18] it is stated that the combination of light loads with plyometric exercises is an effective training for the mechanism of explosive power. According to [19] have shown the differences between the age in maximum strength and the height of the center of mass of the body, measured in the jump against movement CMJ and jump from the SJ position, through the volleyball players of young male and female volleyball players, where the assessment was not statistically significant in relation to the height of SJ jumps, CMJ and maximum strength, but only resulted in the production of muscle elastic energy in SJ jumping.

5. Conclusion

From the results obtained from the tests of F&M volleyball players of the 15-year-old age group in Tirana, Albania, the low level of fast strength was clearly identified, which indicates a possible poor plyometric training of their age. The applied tests are necessary to be used by the coaches to compare the high and poor performances of the volleyball players, which help to program plyometric training for the development of jumping ability in the young volleyball players based on the conditions that exist. The results of this evidence support our objective that the ability to perform in vertical jump as high as possible volleyball players should produce a higher power / strength that is achieved with a training program defined by the coach.

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