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Training strategy of explosive strength in young female volleyball players

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ABSTRACT

Objective: The aim of this study was to examine the effect of an 8-week combined jump and ball throwing training program in the performance of upper and lower extremities among young female volleyball players of the high school.

Materials and methods: A total of 20 young female volleyball players playing at Scholar Sport in High School at the district level were divided in two groups: the experimental group ($n = 10$; 14.0 ± 0.0 years; 1.6 ± 0.1 m; 52.0 ± 7.0 kg and $20.7 \pm 2.4\%$ body mass) and the control group ($n = 10$; 13.8 ± 0.4 years, 1.6 ± 0.1 m; 53.5 ± 4.7 kg and $20.3 \pm 1.7\%$ body mass). The experimental group received additional plyometric and ball throwing exercises besides their normal volleyball practice. The control group underwent only their regular session of training.

Results: Strength performance in the experimental group significantly improved (medicine ball and volleyball ball throwing: $P = 0.00$; and counter movement jump: $P = 0.05$), with the improvement ranging from 5.3% to 20.1%. No significant changes in strength performance were observed in the control group ($P > 0.05$).

Conclusions: The 8-week combined jump and ball throwing training can significantly improve muscular performance in young female volleyball players. These findings may be useful for all physical education teachers and volleyball coaches.

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1. Introduction

Volleyball is one of the world's most popular sports and because of its enormous popularity many studies have been conducted in an attempt to understand the better program training required to develop total body performance by a volleyball player [1,2]. Unfortunately, the scientific understanding of this issue remains unclear, with most young participants acquiring muscular performance through individual experience rather than research-based instructions [3,4]. Indeed, volleyball is a sport that requires strength in upper and lower limbs [5–7]. The development of muscle strength and specific technical skills are particularly important for young players and especially to female athletes [6], as priority factors to achieve success [8–10].

Both ball throwing and jumping performance are important factors for successful volleyball performance [1]. The distance in ball throwing is an important component and previously studies [1,11] concluded that strength training based on explosive movements during the competitive season can improve performance in upper extremity [5]. The literature seems to suggest that this may be the transfer to specific tasks in volleyball in terms of ball speed, since the athlete's training period allow these adaptations happen. Additionally, muscle strength in the lower limbs is also crucial in volleyball – the performance in the vertical jump is directly related to the performance of the players since the jump is one of the components of service and defense movement of volleyball [12], being used in case of interception and shot blocking [13].

There is a greater risk of injury during the execution of multiple jumps and further develops jumps without power. Also due to the impact of hundreds of jumps, the ligaments may be affected, as well as the joints and knees. In this way, strength training appears to have a decisive influence on motor performance of young players of this sport. Although some authors could identify significant relationships between the strength of the upper and lower limbs amongst volleyball players [4] but there is a lack of information concerning the effects of a plyometrics training program especially in young and trained female volleyball players. Several authors [4,6,14] stated that the discrepancy in the results of previous experiments studies may be caused by different research protocols such as different durations of training methods, different status of the subjects, or different training loads.

Nevertheless, in young female players that have a lower level of physical activity and for that reason also a muscular weakness, the implement of a program training based on strength performance has greater importance in the quality of specific skills of the game [9]. Motor development, is one of the basis of a total physical fitness that will ensure the health and well-being levels necessary for quality of life. Volleyball associated with the development of strength performance seems to be crucial and it is definitely a topic that deserves great attention within the framework of physical education classes [15].

To the best of our knowledge, no study investigated simultaneously jumping and ball throwing performances after a plyometrics training regimen of young female competitive volleyball players attending the high school. Therefore, the aim of this study was to examine the effect of 8-week combined plyometrics and ball throwing program on upper and lower body performance among young volleyball players. It was hypothesized that the training group would enhance jumping and ball throwing ability since they would train this.

2. Materials and methods

2.1. Experimental approach to the problem

Two groups (training group and a control group) of subjects were recruited to determine the effectiveness of plyometric and ball throwing training program on the upper and lower body performance in young volleyball players during an 8-week training program. A randomized controlled study was conducted with one team of young female volleyball players at the beginning of the competitive season. The players were equally divided at the pretest. Half of each team received the plyometrics and ball throwing program besides their normal volleyball practice and the other half just continued with their usual training. The evaluation process requires reliability, specificity and facility of application, especially when participants are inexperienced. We thus selected protocols that were time-saving and that had been previously used in several studies with these characteristics [6].

2.2. Subjects

A total of 20 competitive female volleyball players were divided into two groups: the experimental ($n = 10$; 14.0 ± 0.0 years; 1.6 ± 0.1 m; 52.0 ± 7.0 kg and $20.7\% \pm 2.4\%$ body mass) and the control ($n = 10$; 13.8 ± 0.4 years, 1.6 ± 0.1 m; 53.5 ± 4.7 kg and $20.3\% \pm 1.7\%$ body mass). Efforts were made to recruit subjects so as to form comparable groups. Apart from routine daily tasks, the experimental group underwent a plyometric training program of two training sessions per week for 8 weeks. The control group just executed the usual volleyball session and did not undergo any specifically orientated program training. The participants were from the team playing at the district level in their age class. None of the participants had a history of strength training. Written informed consent was obtained from each parent of the participant and they were fully informed about the protocol before participating in this study. Further, the Direction of the High School was informed about the main goal of the study. This study was approved by the local health services research ethics committee and was carried out according to the Declaration of Helsinki (Table 1).

2.3. Procedures

Before the pretest the participants were familiarized with the different tests in a practice session to avoid a learning effect. Pre- and posttests (T1 and T2, respectively) were performed on maximal countermovement jump and throwing a medicine and volleyball ball. All tests were conducted in an indoor facility to avoid weather changes during the pre- and posttest.