BIOMECHANICAL ASSESSMENT OF STRENGTH AND JUMPING ABILITY IN MALE VOLLEYBALL PLAYERS DURING THE ANNUAL TRAINING MACROCYCLE

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Abstract

Introduction. The aim of the study was to determine the changes in the peak torque of the knee extensors and flexors of the dominant lower limb, the shoulder internal and external rotators of the dominant upper limb, and the shoulder extensors and flexors of the dominant upper limb as well as the changes in jump height in volleyball players during the annual training macrocycle. Material and methods. The study involved 13 volleyball players from a Polish second-league team. The measurements were performed five times: before the preparation period (T1), at the beginning of the competitive season (T2), in the middle (T3) and at the end of the first competition period (T4), and after the competitive season (T5). The torque of the knee muscles and shoulder rotators was measured in isokinetic conditions, and the torque of the shoulder extensors and flexors was assessed in isometric conditions. Jumping ability was tested using a piezoelectric platform. Results. We observed statistically significant differences (p < 0.05) in jump height and relative peak torque between the measurements, except for the torque of the shoulder external rotators and flexors. The results of multiple factor analysis based on 5 sets composed of 5 strength variables revealed differences between subjects and measurement sessions. Conclusions. The results obtained indicate that strength and jumping ability should be assessed regularly during the competitive season. The findings of the study suggest that it is necessary to modify the training methods used during the preparation period and individualize the training in the final phase of the competition period.

Key words: volleyball, muscle torque, jump height, annual macrocycle

Introduction

Volleyball was introduced to the Olympic Games in Tokyo in 1964. For several years, it has been one of the most popular team sports [1, 2]. It is characterized by the changing dynamics of the movements of the players, who are required both to receive the ball accurately and perform explosive movement when spiking. Due to the status, popularity, and dynamic nature of volleyball, players are systematically assessed. One of the characteristic aspects of such assessments is the evaluation of the players’ motor capacities by means of measuring their strength and jumping ability [3, 4, 5].

The biomechanical assessment of the strength of volleyball players can be performed in isokinetic and isometric conditions. In the first case, isokinetic dynamometers are typically used to measure the net torque of the knee extensors and flexors [6, 7, 8, 9] and the shoulder internal and external rotators [3, 10, 11, 12, 13, 14]. Isometric measurements, on the other hand, are not frequently applied in volleyball, despite their long tradition [15]. This stems both from a lack of standard measuring equipment and from inconsistencies in the results of such assessments. There is no evidence of strong correlations between isometric strength and the prediction of movement performance [16] or correlations between maximal voluntary isometric knee extension torque development and jump performance [17].

Due to the specificity of volleyball, jumping is regarded as a basic motor ability in this discipline. That is because this variable reflects the players’ ability to perform spikes, jump serves, and blocks. A basic measurable variable which is used to assess jumping ability is jump height. The most commonly applied methods of measuring this variable include different types of vertical jumps [3, 18, 19, 20, 21, 22].

Contemporary training programmes in team sports are oriented towards ensuring that players maintain a particular level of strength and jumping ability during the entire season [23, 24]. In the first of the two studies cited above, the players were tested during the season before and after undergoing 12 weeks of resistance training, and in the second one (involving female players), the assessments were performed at the start of the season, mid-season (7th week), and at the end of the season (11th week). Other authors [22] have also studied long-term training adaptations of volleyball players at the beginning and end of the macrocycle. However, verifying the effect of training programmes requires assessing the players’ physical capacities...