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The effect of muscle strength on the capacity of coordination in handball

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Abstract

The relationship between muscle strength and coordination capacity was examined at 17 handball players aged between 16-18 years old ($M = 17.06$, $SD = 0.827$). Strength indices were calculated by reporting the measured values to body weight. “The muscle strain differentiation test of hands” was used for the neuromuscular coordination capacity and the “Pendulum-throw-target” test for the throwing accuracy. The paper notes that muscle strength, being below the optimal values, does not significantly influence the coordination capacity ($CI = 95\%$). During this period, it is important to intensify the intramuscular coordination training, due to the qualitative aging of the SNC.

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1. Introduction

Researches on efficiently training the athletes by improving the capacity of coordination within the individual training are of great interest. The individualization of training for handball players is necessary due to the existent differences between tactical and technical content specific to the different game positions, but also to the high degree of difficulty of the technical execution (Baştiurea, 2005; Rizescu, Ghervan, Baştiurea, & Georgescu, 2011). In modern handball, athletes can play almost on any game position and so, they need more coordination to handle the technical and tactical actions specific to the game position that they play in, at a given time. Adapting to the

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change of a game position should be fast and done by selecting and executing a quick and appropriate response to a stimulus via an efferent way, from the nerve centers to certain effectors (Mihăilă, 2011; Cicma & Mereuță, 2012).

Reijo, Caroline, Pavoo, & Vesa (2009) demonstrated that the complex process of fast adaptation of the entire body to the requirements of the game has on its basis a constant feedback between motor skills, control and level of fatigue. Bompá (2001) presents coordination as a complex capacity correlated with speed, strength, endurance and mobility. From a physiological point of view, in the case of human beings, coordination is determined by the quality of nerve processes, by genetic and environmental factors. Baştüre (2007) shows that the level of coordination represents the ability to execute movements having different degrees of difficulty, quickness, with great accuracy and high efficiency in accordance with the specific objectives of the training. Of all the motor skills, muscle strength affects execution speed, endurance and coordinative abilities (Peper, Bettenc, Harjo, & Peter, 2008). Force development in parallel with the repeated practice of one skill or of one technical element lead to the adjustment of the fundamental nervous processes of excitation and inhibition, the result being a series of fine motor skills, reliable, efficient and well coordinated (Bompá, 2001). In fact, the adjustment of these processes results into an efficient “agonistic-antagonistic” co-activation (Cholewicki, Panjabi, & Khachatryan, 1997). The control capacity of time, space and strength parameters of movement increases actively from 6-7 years to 10-12 years. These skills decrease over time, both with adolescent girls and boys. At the end of puberty this capacity increases again until 17-18 years old and it further stabilizes. A similar dynamic age is characteristic for the natural development of voluntary loosening (free) capacity of the muscles (Chicu, 2006; Moises, 2011). The loosening capacity and the voluntary muscle contraction capacity have on their basis a neuromuscular control (Madeleine, Mathiassen, & Arendt-Nielsen, 2008). Latash, Scholz, & Schöner (2002) demonstrate the importance of sensory information in the adaptation of the workforce. The idea is supported by Slifkin, Vaillancourt, & Newell (2000) who show that visual feedback adjusts the power output. Other authors have carried out a growth chart for children, based on a model of the fingers strength (Visnapuu & Jurimae, 2007) and Maslovat, Lam, Brunke, Chua, & Franks (2008) demonstrated the effect of the muscle strength on the cyclic motion of the arms. In sports games, correlations between anthropometric indices and palmar force in handball and basketball players were studied (Molenar, Ruud, Sten, Steven, & Henk, 2011), and the conclusion was that those with higher weight and larger finger length have a superior force. Significant correlations between anthropometric and force parameters were also found by other authors (Hager-Ross & Rosblad, 2002; Sartorio, La Fortuna, Trecate, 2002; Stan, 2009). The subjects studied in this paper were aged between 16 and 18 years old, so, according to the authors quoted above, the subjects are in the second period of increasing their capacity of coordination and during the muscle strength growth. The purpose of this study is to find out how athletes manage to combine the two qualities, both being during their optimal development period. Another purpose is to find out, based on the conclusions drawn, whether some recommendations useful for the future sport activity can be provided. We have hypothesized that coordination test results are influenced by the values of muscle strength indices. However, we have noticed that the level of strength indices calculated for this team's athletes falls within the normal values.

2. Methods

2.1 Subjects

To study the relationship between muscle strength and the capacity of coordination in the handball game, a young team of handball players aged between 16 and 18 years old was examined ($M = 17.06$, $SD = 0.827$). It is important to mention that all athletes were in a good state of health so as to perform the tests correctly and with maximum efficiency. The study was conducted over a two-day period. On the first day, coordination tests were carried out and on the second day, the force measurement tests were performed.

2.2. Testing procedure

In Table 1, abbreviations for the variables used in the paper will be presented.

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