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ORIGINAL ARTICLE

Differences in some morphological characteristics and repetitive strength in relation to age in handball players

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Abstract

Many different anthropological parameters contribute to achieving top success in handball. Morphological characteristics and repetitive strength have been shown through scientific and practical work to be one of the most important indicators of success. Therefore, the aim of this research is to determine the differences in some morphological characteristics and repetitive strength in relation to the age of handball players. This research includes subjects of three age categories, handball players born in 2009, 2010, and 2011. The sample of measuring instruments consisted of three independent variables - age category of handball players, three variables for the assessment of morphological characteristics (body height, body mass, body mass index) and three variables for the assessment of repetitive strength (sit ups until failure, push-ups until failure and chin ups until failure). All statistical analyzes were implemented within the statistical package IBM SPSS Statistics (Version 20). In all tests of morphological characteristics, significant differences were found (body height, body mass, body mass index) were at the level of $p<0.005$, while repetitive strength test differences were not found in the push-ups until failure test ($p>0.005$), but in the sit ups until failure and chin ups until failure tests, significance was determined ($p<0.005$).

Keywords: morphological characteristics · repetitive strength · difference · younger age · handball

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Introduction

The specificity of handball is based on natural forms of movement that constantly alternate such as running, sprinting, jumping, catching, passing, blocking, pushing, and shooting (Buchheit et al., 2009; Chelly et al., 2010). This contact sport belongs to a semi-structured sport that has unpredictable dynamics of cyclic and acyclic type activities (Bragazzi et al., 2020; Branković et al., 2012; Vuleta & Milanović, 2004). This highly intense and dynamic game is one of the most popular and widespread games among children and adults all over the world. Handball is a phenomenon that is gaining momentum and continues to develop based on numerous scientific findings (Simić et al., 2022). The success of handball players is determined by the level of development and the structure of relevant abilities, knowledge, skills, and traits that can be measured, analyzed, and improved during a sports career (Čavala, 2012; Rogulj, 2003). To determine the areas that achieve the greatest projections on success in handball, numerous studies were carried out that had as the subject of research the differences in morphological, motor, psychological, and sociological characteristics and abilities in relation to the chronological age of handball players (Matthys et al., 2011; Milanese et al., 2011; Póvoas et al., 2014). Previous research has established that certain morphological characteristics and motor skills have a significant impact on success in handball (Bojić et al., 2019; Katić et al., 1994; Massuça & Fragoso, 2011; Massuça & Fragoso, 2015; Oxyzoglou et al., 2006; Póvoas et al., 2014; Simić et al., 2022; Šibila M & Pori 2009). Morphological characteristics and motor abilities are closely related to each other and influence the realization of motor tasks in handball (Živković et al., 2010). Morphological characteristics of the anthropological status of a person usually mean a certain system of basic anthropometric latent dimensions (Čavala, 2012; Simić et al, 2022; Šeparović et al, 2015). Morphological characteristics are of particular importance for orientation and selection both in other sports and in handball (Bala & Popmihajlov, 1988; Hošek & Pavlin, 1983; Milanović, 1980). In addition to the morphological characteristics that affect success in handball, motor abilities are also highlighted, which to a certain extent are predictors of success in the game (Fernadez-Romero et al., 2016; Fieseler et al., 2017; Srhoj et al., 2002). One of the most important motor skills is repetitive strength (Rogulj et al., 2007). Repetitive strength can be defined as the ability of a muscle to exert force in a cyclic mode of work (Kukolj, 2006; Kurelić, 1975; Zatsiorsky & Kraemer, 2009; Željaskov, 2004). Namely, a competitive result in any sport, including handball, cannot be explained by individual abilities and characteristics that are responsible for that result, but by their relationships and differences (Čavala, 2012; Póvoas et al., 2014). For this reason, it is necessary to monitor the development of functions that describe the morphological characteristics and repetitive strength of handball players of a certain age (Zaparditis et al., 2011). Accordingly, the aim of this research is to determine the differences in some morphological characteristics and repetitive strength in relation to the age of handball players.

Method

The sample of participants

The research was conducted on three age categories of handball players of the "Trepča" handball club from Kosovska Mitrovica. The age of the respondents is defined based on chronological age, so the research includes respondents of three age categories, handball players born in 2009, 2010, and 2011. All respondents are male, the sample was selected motorically, cognitively, and conatively.

The sample of measuring instruments

The independent variable represents the manipulation of age categories of handball players, and based on that, young handball players are divided into three age categories: the age category of handball players born in 2009; the age category of handball players born in 2010, and age category of handball players born in 2011. The repetitive strength of the handball players in this study was tested with the following battery of tests: sit-ups until failure; push-ups until failure and chin-ups until failure. The following variables were used to measure morphological characteristics: body height; body mass and body mass index.

Procedures

Measurement and testing of repetitive strength and morphological characteristics was carried out in the morning hours in the sports hall where the players of the handball club "Trepča" from Kosovska Mitrovica train. Before testing and measuring, molding exercises and directed-intensity aerobic exercises were conducted to warm up.

Data analysis

The data obtained in the realized research work were processed by descriptive analysis, one-way analysis of variance (ANOVA), and after the obtained effects through ANOVA, a Tukey post hoc analysis

was used to determine the exact detailed differences between the analyzed age categories. All statistical analyses were implemented within the statistical package IBM SPSS Statistics (Version 20).

Ethics statement

This study was approved in advance by the handball club "Trepča" Each participant voluntarily provided written informed consent before participating.

Results

The results of the descriptive statistical analysis of the observed areas of morphological characteristics and repetitive strength of handball players of different chronological ages are presented in Table. For the results to be accepted as adequate and representative, before all statistical procedures, data normalization was applied, and some extreme values of the test results were eliminated.

Table 1. Results of statistical differences of morphological characteristics and repetitive strength in relation to the age category of handball players

Variable	2009[A]	2010[B]	2011[C]		
	Mean±SD	Mean±SD	Mean±SD	F	p
Body height (m)	1.62±0.05[B,C]	1.57±0.05[A,C]	1.48±0.04[A,B]	25.60	0.00
Body mass (kg)	61.45±4.46[C]	57.09±4.42[C]	46.18±4.83[A,B]	32.56	0.00
Body mass index (kg/m²)	23.19±0.81[C]	23.16±0.83[C]	20.99±1.43[A,B]	15.59	0.00
Sit-ups until failure (freq.)	20.73±2.01[B,C]	17.64±2.11[A,C]	14.45±2.42[A,B]	22.63	0.00
Push-ups until failure (freq.)	10.82±2.52	8.82±2.48	9.91±3.18	1.46	0.25
Chin-ups until failure (freq.)	8.00±1.73[C]	6.73±1.10[C]	3.64±1.12[A,B]	30.37	0.00

Also, in Table shows the values of the statistical test of one-way ANOVA (F and p), the difference between age categories (2009, 2010, 2011 years) was determined for the variables of morphological characteristics (body height, body mass, body mass index) and the variables of selected motor abilities - repetitive strength (sit ups until failure, push-ups until failure, chin-ups until failure).

In all tests of morphological characteristics, significant differences were found (body height, body mass, and body mass index were at the level of ($p<0.005$), while repetitive strength test differences were not found in the push-ups until failure test ($p>0.005$), while in the sit-ups until failure and chin ups until failure tests significance was determined ($p<0.005$).

Discussion

The attempt to predict success, as well as the detection of necessary parameters, which would result from reaching exceptional achievements, has always been the primary goal of research conducted in the field of handball (Šibila & Pori, 2009; Zapartidis et al., 2011). Numerous studies have dealt with the influence of anthropological indicators on success in handball, as well as differences in anthropological indicators in relation to the age of handball players (Fernández-Romero et al., 2016; Šeparović et al., 2015; Vuleta et al., 2012). This research is focused on differences in some morphological characteristics and repetitive strength in relation to growth in handball players. The results obtained in this research show that there are statistically significant differences in the applied measurements of morphological characteristics and testing of repetitive strength in relation to the age of handball players. In all applied tests of morphological characteristics (body height, body mass, and body mass index), there are statistically significant differences in relation to the analyzed age categories (handball players born in 2009, 2010, and 2011), as well as in the research conducted by Bojić et al. (2019). Also, the highest mean value of longitudinal dimensionality is among handball players of the age category born in 2009, which can be attributed to biological and chronological maturation. Among handball players born in 2011, the body height variable has a minimal deviation from the mean value of other age categories, and this can be explained by their biological maturation because these are the years when this age category begins the phase of entering puberty, while the other two have already entered puberty. Specifically, in the body height variable, statistically significant differences were found with increasing age, this was expected considering that the height of young handball players changes significantly with increasing age (Beunen et al., 2006). Compared to other research, the body mass of handball players of all three age categories is within normal values, taking into account their age, development, and training status. Based on previous research, it was

expected that statistically significant differences in body mass would be found in relation to the age category of handball players (Hermassi et al., 2021; Živković et al., 2010). The derived morphological characteristic, the body mass index of the first and second age categories is at an approximate level, while the third age category of handball players deviates significantly from the other two. The third age category is at the limit of normal values, but it is important to note that they are at the beginning of puberty, where accelerated growth occurs, and body mass cannot keep up with growth. Both in this research and in the research conducted by Hermassi et al. (2021), statistically significant differences in the body mass index in relation to the age of young handball players were determined. Repetitive strength results are at a satisfactory level considering their chronological age, gender, training status, and competition rank. In almost all tests of repetitive strength of different age categories (handball players born in 2009, 2010, and 2011), it was determined that handball players of the first age category achieved significantly better results than other age categories, except for the push-ups until failure test. In the push-ups until failure test, the second age category achieved worse results compared to the third age category. It was expected that the second age category would be able to do more push-ups compared to the third age category. Such results can only be explained by the mismatch between the levels of biological and chronological maturity. On the other hand, in the repetitive strength tests, statistically, significant differences were established in the sit-ups until failure and chin-ups until failure tests in relation to the related categories. The analysis of the sit-ups until the failure test showed a significantly better result with increasing age category, as well as in the research conducted by Ghobadi et al. (2013). Also, in the research conducted by Lubans et al. (2010), handball players could achieve a better result in trunk repetitive strength with increasing age. Given that the results of this research showed that older handball players (born in 2009) have better results in a larger number of variables compared to younger age categories (handball players born in 2010 and 2011), this research corresponds to previous research that aimed to analyze differences in the anthropological status of handball players of different chronological ages (Vuleta et al., 2004; Vuleta et al., 2012).

Conclusion

Morphological characteristics and motor skills are recognized in theory and practice as very important factors in the final success both in handball and in other sports. It is an area that is constantly examined to determine most adequately the changes in trends imposed by modern handball. This research aimed to determine the differences in some morphological characteristics and repetitive strength in relation to the age of handball players. Based on the obtained results, it can be concluded that significant differences were found in all tests of morphological abilities, while repetitive strength test differences were not found in the push-ups until the failure test, while in the sit-ups until failure and chin-ups until failure tests significance was determined. The development of morphological characteristics of handball players, as well as other athletes, is age-dependent, where with age comes the development of more pronounced morphological characteristics. As with morphological characteristics, the development of repetitive strength is also age-related. In addition to age, it is conditioned by training status, since repetitive strength is an ability that is not genetically determined and can be influenced by training. For further research, it is necessary to expand the number of respondents, the number of variables, the anthropological space, and more age categories.

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