

ORIGINAL SCIENTIFIC PAPER

Differences in the Level of Motor Abilities Between Elementary School Students and Female Athletes

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Abstract

Ever since humans have existed, they have had the need and desire to move. Through physical activity, the cooperation of humans with the natural environment is achieved, and at the same time, physical activity appears as a factor: strengthening health, developing one's physical strength, acquiring motor abilities and habits (Bjelica and Krivokapic, 2019). Motor abilities are responsible for performing of the motor manifestations as a latent motor structure. Their basic division is: strength, speed, coordination, flexibility, balance and precision (Milanovic, 1997). Handball is one of the most popular sports games, which is practiced already in elementary school, and as a top sport, it has also found its place in the Olympic Games (Malic and Tomljanovic, 1982). In this sport, the opportunity is provided for the coordinated development of all muscle groups, various functional potentials are activated, which enable the improvement of all motor abilities (Foretic and Rogulj, 2007). The aim of this research was to determine whether there are differences between the level of motor abilities of handball players and non-athletes. The sample of respondents consisted of 50 girls. The sample was divided into two subsamples. The first sub sample consisted of 25 handball girls from the women's handball club "Nikšić" aged 14 (± 6 months). The second subsample consisted of 25 non-athlete girls, students of the "Olga Golović" elementary school, aged 14 (± 6 months). The research was carried out through 7 tests to assess the level of motor abilities of the test subjects, namely: 20m run, standing long jump, standing on one leg test, "Sit and Reach" bending test, trunk lifting test, push-ups and hand-hand dynamometry. The results showed that there are statistically significant differences in the level of motor abilities between handball players and non-athletes.

Keywords: motor abilities, handball, non-athletes, differences

Introduction

Ever since humans have existed, they have had the need and desire to move. Through physical activity, the cooperation of humans with the natural environment is achieved, and at the same time, physical activity appears as a factor: strengthening health, developing one's physical strength, acquiring motor abilities and habits (Bjelica and Krivokapic, 2019). Motor abilities are responsible for performing of the motor manifestation as a latent motor structure. Their basic division is: strength, speed, coordination, flexibility, balance and precision (Milanovic, 1997). They are individual and are the result of the physical and mental involvement of an individual. They imply the ability of a person to achieve success in a certain activity as a bio-psy-

cho-social and cultural being (Kukulj, 2006). There is a certain period of life in which the greatest changes are achieved for each motor abilities (Gadzic and Vuckovic, 2012). The development of a person, as well as the development of their motor abilities, is influenced by many internal and external factors. Internal factors depend on the characteristics of participants in the process of physical exercise, while external factors depend on the environment in which physical exercise is performed. Thus, in their ontogenetic development, a person goes through a series of changes conditioned by internal laws of development and environmental influences (Findak, 2001). One of the basic problems of modern times is insufficient movement and excessive obesity among people of all ages. One of the best ways to engage

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children in movement, as well as in learning, is play. Play does not represent only entertainment that fills time, but it represents an important part of the lives of babies and children in general. Play is their everyday work and helps them learn and grow. Their overall motivation for play arises from the satisfaction they feel in the process of playing itself (Bjelica and Krivokapic, 2019). In this way, it is much easier and more efficient to engage children and motivate them for activity. Later, children choose various sports or recreational activities in order to fulfill this daily need for movement with the support of their parents, and in this way they develop healthy habits and a healthy lifestyle. Handball is one of the most popular sports games, which is practiced already in elementary school, and as a top sport, it has also found its place in the Olympic Games (Malic and Tomljanovic, 1982). It belongs to complex sports activities when observed from the aspect of structural complexity in the classification of sports (Gruic et al., 2007). In this sport, cyclic and acyclic movement structures dominate, according to which it belongs to the group of complex sports activities (Muratovic et al., 2014). It is a team sport that consists of several different playing positions, each of which has certain specific characteristics in terms of technical and tactical requirements (Poturica, 2014). Also, morphological characteristics differentiate from one position to another, and each position requires certain “desirable” morphological characteristics in order to support and maximize the performance of the player. Handball as a highly complex and engaging sport, effectively sustains children’s attention and motivates them toward achievement and increased physical activity. This sport provides opportunities for the balanced development of all muscle groups, while activating various functional capacities that contribute to the enhancement of overall motor abilities (Foretic and Rogulj, 2007).

In order to best demonstrate how much handball positively influences the development of children, in this research we will compare the motor abilities of girls who are handball players with girls of the same age who do not engage in any sport. The general aim of this research is to determine whether there are significant differences between the motor abilities of female handball players and non-athlete girls of elementary school.

Methodology

The sample of participants in this study consists of 50 girls of the same age. The main sample is divided into two subsamples. The first subsample consists of 25 female handball players from the women’s handball club “Nikšić,” aged 14 (±6 months). The second subsample consists of 25 non-athlete girls, students of the primary school “Olga Golović,” aged 14 (±6 months).

It is also important to note that, before the implementation of this research, that is, part of the testing of the test subjects, we received all the necessary consents from the women’s handball club, the school and the parents of the test subjects, since it is a sample of test subjects of minor age. The previously realized activities enable the realization of the research itself in accordance with the ethical standards of the University of Montenegro, which precede in the ethical charter, and all in accordance with the recommendations of the Declaration of Helsinki.

The sample of measuring instruments for assessing motor abilities was conducted according to the model by Bala et al. (2007), including: 20m run (A20), standing long jump (ASD), standing on one leg test (ASN), sit and reach test (ASR), trunk lift test (APT), and push-ups (ASK) and hand grip dynamometry (ADS). This battery of measuring instruments was constructed to meet the research’s needs and objectives.

The obtained results in this research were processed using descriptive and comparative statistical methods. The statistical significance of differences in selected variables was determined using a t-test for independent samples with a statistical significance level of $p < 0.05$.

Results

Table 1 presents the data obtained through the processing of results collected after testing the motor abilities of primary school female students, i.e., non-athletes.

The table displays the basic parameters relevant to this research, allowing for a clearer and more comprehensive analysis of the observed variables. In the column describing the range of results, it can be noted that the largest range is observed in the standing long jump variable (ASD = 71cm), while the smallest range is recorded in the one-leg stance test (ASN = 1).

Table 1. Descriptive statistics of motor abilities of non-athletes.

Variables	N	Min	Max	R	Mean	Sd	Sk	Ku
A20	25	3,00	4,28	1,28	3,78	0,25	-1,14	3,15
ASD	25	134	205	71	175,00	16,29	-0,55	0,42
ASN	25	1	2	1	1,28	0,45	1,04	0,99
ASR	25	1	20	19	12,36	5,55	-0,48	0,66
APT	25	9	19	10	14,64	2,39	-0,20	0,07
ASK	25	1	12	11	5,92	3,04	0,03	0,71
ADS	25	6	25	19	13,04	5,11	0,59	0,41

Legend: N-number of entities; Min-minimum value; Max-maximum value; Sd-standard deviation; R-range; Sk-measure of symmetry (skewness); Ku-measure of peakedness (kurtosis); A20-20m sprint; ASD-standing long jump; ASN-one leg stance test; ASR-sit and reach test; APT-sit up test; ASK-push ups; ADS-handgrip dynamometry

The relationship between the standard deviation and the arithmetic mean is of particular importance, as the standard deviation (Sd) represents a measure of dispersion describing the average deviation of all empirical values from the arithmetic mean.

The parameters Skewnees (Sk) and Kurtosis (Ku) are used to assess deviations from the ideal normal distribution curve. Skewness (Sk) represents a measure of symmetry. By analyzing the column describing skewnees values for all variables, it can be observed that skewness values exceed ±2, and they range

from -1,14 to 1,04.

On the other hand, kurtosis (Ku) represents the peakedness of the Gaussian distribution curve. In the column of table 1 describing kurtosis values, it can be observed that the results range from 0,07 to 3,15. Since kurtosis is a measure of the homogeneity of results, the value A20=3,15sec suggests that the Gaussian curve is mesokurtic.

In conclusion, based on the analysis of skewness and kurtosis presented in table 1, the deviation of the Gaussian curve is mini-

mal, except for the 20m sprint variable (A20), where the distribution demonstrates an ideally shaped mesokurtic curve.

Table 2 presents the results of descriptive statistics obtained after processing the results of motor abilities tests conducted on female handball players. The values range from -0,49 to 1,04, leading to the conclusion that skewness values for all variables are close to zero.

Furthermore, examination of the column describing kurtosis (Ku) indicates values ranging from -1,13 to 1,90.

Based on the analysis of skewness and kurtosis across all variables, it can be concluded that their values indicate a normal distribution of results. The deviation of the Gaussian curve is minimal, suggesting that each variable is either slightly flattened or slightly elongated.

Table 2. Descriptive statistics of motor abilities of female handball players

Variables	N	Min	Max	R	Mean	Sd	Sk	Ku
A20	25	2,94	4,20	1,26	3,59	0,25	-0,49	1,90
ASD	25	143	229	86	180,20	20,77	0,29	0,06
ASN	25	1	2	1	1,28	0,45	1,04	-0,99
ASR	25	1	15	14	7,72	4,35	0,03	-1,13
APT	25	14	24	10	18,76	2,48	0,08	-0,12
ASK	25	7	40	33	20,32	8,39	0,54	0,00
ADS	25	2	35	33	15,84	10,69	0,42	-0,91

The results of motor abilities tests for both groups of participants were analyzed using the Students' t-test for independent samples. This procedure provides information that enables comparison and identification of statistically significant differences, where present, between the arithmetic means of motor abilities indicators in non-athlete female students and female handball players. Table 3 presents the arithmetic means for each variable across the two subsamples are presented. The level of statistical significance is expressed as the p-value, where $p \leq 0,05$ is considered statistically significant.

Analysis of the t-test results presented in table 3 reveals statistically significant differences between the two groups of participants in four variables. Specifically, the variables 20m sprint (A20) ($p = 0,01$), Sit and reach test (ASR) ($p \leq 0,01$), sit up test (APT) ($p \leq 0,01$), and push-up test (ASK) ($p \leq 0,01$) demonstrate statistically significant differences between the arithmetic means of the two groups. In contrast, the p-values for the remaining variables do not indicate statistically significant differences.

Table 3. Differences in motor abilities between subsamples of female handball players and non-athletes (t-test)

Variables	Mean handball players	Mean Students (non-athletes)	t - value	Mean Difference	p
A20	3,59	3,78	-2,61	-0,18	0,01
ASD	180,20	175,00	0,98	5,20	0,33
ASN	1,28	1,28	0,00	0,00	1,00
ASR	7,72	12,36	-3,28	-4,64	$\leq 0,01$
APT	18,76	14,64	5,96	4,12	$\leq 0,01$
ASK	20,32	5,92	8,06	14,40	$\leq 0,01$
ADS	15,84	13,04	1,18	2,80	0,24

Legend: Mean-arithmetic mean; t-t-test value; Mean Difference-difference between arithmetic means; p-significance level of the difference between arithmetic means

Based on the arithmetic mean values, it can be observed that in the 20m sprint test, female handball players achieved a mean value of 3.59, whereas the students recorded a mean value of 3.78. Considering that the objective of the test was to complete the distance in the shortest possible time, the handball players were more successful, as they demonstrated greater speed. As previously noted, this difference is statistically significant.

In the standing long jump test (ASD), the arithmetic mean values indicate that female handball players outperformed the students. In contrast, in the one-leg stance test (ASN), both groups demonstrated equal performance based on their mean values.

The subsample of students performed better than the handball players in the Sit and Reach test (ASR), which, as noted, represents a statistically significant difference. Furthermore, in the sit-up test (ATP), female handball players achieved superior results, with a mean value of 18.76 compared to 14.64 for the students, indicating a statistically significant difference.

Female handball players also demonstrated greater up-

per-body strength, particularly in the shoulder girdle, as evidenced by higher mean values in the push-up test (ASK) compared to the students. Additionally, based on the results presented in table 3, it can be observed that female handball players were more successful in the final test, handgrip dynamometry (ADS), achieving better results than the students.

Discussion

A review of the previous studies indicates that all tests and results were in favor of female handball players, i.e., athletes, compared to non-athletes. It is evident that athletes are significantly superior and better prepared to respond successfully to all test demands compared to non-athletes.

Thus, in the study conducted by Molnar, Radosav and Smajic (1999), it was concluded that athletes were significantly more successful in tests such as deep forward bend, seated straddle forward bend, frontal split, standing long jump, medicine ball throw from a supine position, 20 m sprint, push-up hold position, sit-ups,

two-leg jumps over a medicine ball, and foot tapping, compared to non-athletes. Furthermore, the study by Batricevic (2008) also demonstrated that athletes achieved significantly better results in tests assessing explosive strength, sprint speed, and coordination. Similarly, a study conducted by Bolanca, Rogulj and Cavala (2011) showed that female handball players were superior in tests of explosive strength and agility, while no significant differences were found in tests of flexibility and repetitive strength. In contrast, the findings of the present study indicate that female handball players performed significantly better in tests of lower limb explosive strength, shoulder girdle strength, and trunk muscle strength, whereas non-athlete students achieved better results in the flexibility test. A possible explanation for this discrepancy is that contemporary handball training programs primarily emphasize the development of strength, power and sport-specific performance, while flexibility training may receive less attention. In the study by Ivanovic M. and Ivanovic U. (2013), the results showed that athletes were significantly more successful than non-athletes across all tests. The authors attributed these differences to long-term training processes. Given that the present study produced similar findings indicating that athletes outperform non-athletes it can also be concluded that these differences are a result of systematic training and a higher level of physical conditioning. Additionally, numerous previous studies (Grabara, 2014; Radu, Popovici and Puni, 2015; Grabara, 2017; Mocanu, Postelnicu, Adam and

Popa, 2023) have demonstrated that participation in sports has a significant positive impact on health. Regular training leads to improvements in motor abilities, strengthens muscles, contributes to proper body posture in children, reduces fat mass while increasing lean body mass, and enhances overall well-being, making children more capable of successfully coping with everyday life demands.

One of the limitations of this study is the small sample size, and the battery of tests should have been more extensive. However, the study successfully achieved its objectives.

The findings of the present study are largely consistent with previous research, confirming that athletes are significantly more successful in performing the given tests. It has been demonstrated that the level of motor abilities is higher in female handball players compared to primary school female students, i.e., non-athletes.

Conclusion

In conclusion there are differences in the level of motor abilities between female handball players and non-athletes. When considering the study as a whole and comparing it with previous research, numerous similarities in conclusions can be observed. Athletes are significantly more capable and efficient in performing specific tasks compared to non-athletes. This further emphasizes the many benefits that children can gain through participation in sports.

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