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The anthropometric profile of junior handball players (Note II)

Profilul antropometric al jucătorilor de handbal juniori (Nota II)

Cristian Potoră [1], Nikolaos Mavritsakis [2,3], Simona Tache [1]
[1] Iuliu Haţieganu University of Medicine and Pharmacy, Cluj-Napoca, Department of Biosciences, Physiology
[2] 1 December 1918 University of Alba Iulia, Department of Physical Education and Sport
[3] The Geriatrics and Gerontology Centre, Alba Iulia

Abstract
Background. Specific hand anthropometric parameters might influence performance and could be useful for the selection and identification of talents among junior handball players.
Aims. We aimed to study the effect of maturation on specific anthropometric variables – hand span as a static parameter and hand grip strength as a dynamic parameter, in handball players and non-athletes.
Methods. The specific anthropometric variables determined by direct methods were the following: hand grip strength as a dynamic parameter; hand span as a static parameter.
Results. Specific hand anthropometric parameters increase significantly with age. Hand grip strength and hand span are significantly increased in athletes compared to non-athletes.
Conclusions. Specific anthropometric parameters measured in junior handball players can be used for the identification of talents in grip sports and for tertiary selection.
Key words: junior handball players, specific anthropometric variables, grip sports.

Rezumat
Premize. Indicatorii antropometrici specifici de la nivelul mâinii ar putea influenţa performanţele şi ar putea fi utile pentru selecţia şi identificarea talentelor la handbaliştii juniori.
Obiective. Ne-am propus să studiem şi efectul maturizării asupra indicatorilor antropometrici specifici - anvergura mâinii ca indicator static şi forţa de contracţie a flexorilor palmari ca indicator dinamic, la sportivii handbalişti şi nesportivi.
Metode. Indicatorii antropometrici specifici determinaţi prin metode directe au fost următorii: forţa de contracţie a muşchilor flexori palmari ca indicator dinamic; anvergura palmară ca indicator static
Rezultate. Indicatorii antropometrici specifici mâinii sunt diferiţi la jucătorii de handbal juniori faţă de nesportivi. Indicatorii antropometrici specifici mâinii cresc semnificativ cu vârsta. Forţa de contracţie a muşchilor flexori palmari şi anvergura mâinii sunt crescute semnificativ la sportivi faţă de nesportivi.
Concluzii. Indicatorii antropometrici specifici determinaţi la handbaliştii juniori pot fi utilizaţi pentru identificarea talentelor în sporturile grip şi pentru selecţia terţiară.
Cuvinte cheie: jucători de handbal juniori, indicatori antropometrici specifici, grip sports.

Introduction

Sports can be divided into two categories in terms of grasping with the hands: grip and non-grip sports (Fallahi & Jadidian, 2011). The hand, particularly the flexors, can be used to throw, to prehend (grab, grasp, seize), to hit in grip sports:

- ball sports (basketball, baseball, handball, volleyball, rugby);
- climbing sports (rock climbing);
- combat sports (boxing, wrestling, judo) – ground bearing sports (gymnastics);
- paddle sports (kayaking, canoeing) – equestrian sports (horseback riding);
- racket sports (tennis, table tennis, badminton) – weapon sports (fencing) – club sports (golf);
- snatch sports (weightlifting).

A number of studies have investigated, in addition to basic anthropometric parameters (height, weight, BMI, circumferences and diameters), specific anthropometric parameters (finger length, palm width, palm diameter, palmar surface, hand grip strength) in different grip sports.

In handball players, studies on specific anthropometric parameters have focused on:

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Address for correspondence: 400192 Cluj-Napoca, Ştefan cel Mare Square no. 4, tel. 40-(0)264-594672, fax. 40-(0)264-592832
E-mail: cristipotora@gmail.com
Corresponding author: Cristian Potoră, cristipotora@gmail.com

- hand size (Mc Laine, 2010; Fallahi & Jadidian, 2011; Zapartidis et al., 2009a; Zapartidis et al., 2009b; Zapartidis et al., 2011);
- intra- and interindividual population variability (Mc Laine, 2010; Barut et al., 2008);
- hand grip strength depending on the playing position in the team (Vila et al., 2012), the level of training (Hermassi et al., 2010; Hermassi et al., 2010) and sex (Barut et al., 2008);
- specific motor skills (Visnapuu & Jürimäe, 2009);
- various ball grip sports (Barut et al., 2008);
- role of the dominant hand (Fallahi & Jadidian, 2011);
- predictive role of anthropometric parameters (Debanne & Laffaye, 2011);
- influence of body composition on anthropometric parameters (Jürimäe et al., 2009).

Hypothesis

Given the importance of basic anthropometric parameters in determining the anthropometric profile of junior handball players (Note I, Potora et al., 2016), we aimed to study the effect of maturation on specific anthropometric parameters – hand span as a static parameter and hand grip strength as a dynamic parameter in handball players and non-athletes.

Material and methods

The research was carried out with the approval of the Cluj County School Inspectorate, with the subjects' informed consent, the consent obtained from the subjects' parents, and the approval of the sports medicine doctor at the *George Coşbuc* National College in Cluj-Napoca.

Research protocol

a) Period and place of the research

The specific anthropometric parameters of athletes in the experimental groups E1, E2, E3 and in the control groups C1, C2, C3 were determined for each group in October 2015.

Studies were carried out at the school medical office of the *George Coşbuc* National College in Cluj-Napoca and at the medical office of the Sports High School in Cluj.

b) Subjects and groups

The research was conducted in 6 groups of subjects, each consisting of 10 subjects.

The experimental groups (E) included professional athletes from the Sports High School Cluj and the Potaissa Handbal Club Association Turda, and the control groups (C) were formed by pupils from the *George Coşbuc* National College in Cluj-Napoca, as follows:

C1 – subjects born in 1997, aged 18.77 ± 0.26
C2 – subjects born in 1998, aged 17.57 ± 0.19
C3 – subjects born in 1999, aged 16.88 ± 0.25
E1 – subjects born in 1997, aged 18.72 ± 0.26
E2 – subjects born in 1998, aged 17.24 ± 0.38
E3 – subjects born in 1999, aged 16.47 ± 0.17

The weekly training program of groups C consisted of general physical training 1-2 hours/week, while the weekly training of groups E consisted of specific physical training 1.5-2 hours/day, 5 days/week.

c) Tests applied

The specific anthropometric variables determined by direct methods were the following (Cordun, 2009; Neagu, 2014):

- *hand grip strength as a dynamic parameter*, measured with a FA-100 mechanical dynamometer and expressed in kgf;
- *hand span as a static parameter*, measured with an anthropometric compass and expressed in cm.

d) Statistical processing

Statistical processing was performed with the Excel application (Microsoft Office 2010) and the StatsDirect v.2.7.2 software. The results were graphically represented using the Excel application (Microsoft Office 2010).

Results

a) Hand grip strength (Tables I and II)

The statistical analysis of *left hand grip strength*, *considering all six groups,* showed statistically significant differences between at least two of the groups ($p < 0.001$). The statistical analysis of the values of *left hand grip strength*, *considering all control groups,* evidenced no statistically significant differences between the groups ($p > 0.05$). The statistical analysis of the values of *left hand grip strength*, *considering all groups of athletes,* revealed no statistically significant differences between the groups ($p > 0.05$).

The statistical analysis of the values of *right hand grip strength*, *considering all six groups,* indicated statistically significant differences between at least two of the groups ($p < 0.001$). The statistical analysis of the values of *right hand grip strength*, *considering all control groups,* showed no statistically significant differences between the groups ($p > 0.05$). The statistical analysis of the values of *right hand grip strength*, *considering all groups of athletes,* indicated no statistically significant differences between the groups ($p > 0.05$).

Table I

Comparative analysis of left hand grip strength vs. right hand grip strength (kgf) in the studied groups and statistical significance.

Hand	Group	Mean	SE	Median	SD	Min	Max	Statistical significance (p)			
Left	C1	27.20	1.5261	27.00	4.8259	20	34	C+E	**< 0.0001**	E1-E2	0.8938
	C2	25.20	1.2000	26.00	3.7947	20	32	C1-C2-C3	0.0996	E1-E3	0.4385
	C3	23.00	1.0000	22.00	3.1623	20	30	E1-E2-E3	0.7263	E2-E3	0.5137
	E1	35.40	3.2393	32.00	10.2437	20	54	C1-C2	0.3173	C1-E1	**0.0394**
	E2	36.00	3.0258	36.00	9.5685	20	54	C1-C3	**0.0488**	C2-E2	**0.0061**
	E3	38.40	1.9276	37.00	6.0955	30	52	C2-C3	0.1792	C3-E3	**< 0.0001**
Right	C1	30.80	1.4667	32.00	4.6380	22	36	C+E	**< 0.0001**	E1-E2	0.8105
	C2	27.20	1.6384	25.00	5.1812	22	38	C1-C2-C3	0.0578	E1-E3	0.8486
	C3	25.60	1.2579	24.00	3.9777	22	34	E1-E2-E3	0.9644	E2-E3	0.9303
	E1	41.80	3.2448	41.00	10.2610	24	60	C1-C2	0.1190	C1-E1	**0.0086**
	E2	43.00	3.7148	42.00	11.7473	20	64	C1-C3	**0.0199**	C2-E2	**0.0021**
	E3	42.60	2.5482	42.00	8.0581	34	58	C2-C3	0.5069	C3-E3	**< 0.0001**

The statistical analysis of the values of *hand grip strength for unpaired samples* demonstrated:

- *in the left hand*: statistically significant differences between groups C1-C3 ($p < 0.05$); statistically significant differences between groups C3-E3 ($p < 0.001$), statistically significant differences between groups C2-E2 ($p < 0.01$) and statistically significant differences between groups C1-E1 ($p < 0.05$);

- *in the right hand*: statistically significant differences between groups C1-C3 ($p < 0.05$); statistically significant differences between groups C3-E3 ($p < 0.001$) and statistically significant differences between groups C1-E1 and C2-E2 ($p < 0.01$).

The statistical analysis of the values of *left hand grip strength* compared to those of *right hand grip strength* showed no statistically significant differences for any of the groups ($p > 0.05$).

Table II

Left hand grip strength vs. right hand grip strength in the studied groups – statistical significance.

Time	Statistical significance (p)					
Group	C1	C2	C3	E1	E2	E3
p	0.1062	0.3394	0.1024	0.1797	0.1622	0.2061

b) Hand span (Table III)

The statistical analysis of the values of *left hand span*, *considering all six groups,* evidenced statistically significant differences between at least two of the groups ($p < 0.001$). The statistical analysis of the values of *left hand span*, *considering all control groups,* showed statistically significant differences between at least two of the groups ($p < 0.01$). The statistical analysis of the values of *left hand span*, *considering all groups of athletes,* indicated statistically significant differences between at least two of the groups ($p < 0.01$).

The statistical analysis of the values of *right hand span*, *considering all six groups,* showed statistically significant differences between at least two of the groups ($p < 0.001$). The statistical analysis of the values of *right hand span*, *considering all control groups,* demonstrated statistically significant differences between at least two of the groups ($p < 0.01$). The statistical analysis of the values of *right hand span*, *considering all groups of athletes,* revealed statistically significant differences between at least two of the groups ($p < 0.01$).

The statistical analysis of the values of *hand span for unpaired samples* revealed the following:

- *in the left hand*: statistically significant differences between groups E1-E3, C1-E1, C2-E2, C3-E3 ($p < 0.001$); statistically significant differences between groups C1-C3 ($p < 0.01$); statistically significant differences between groups C1-C2, E2-E3 ($p < 0.05$);

- *in the right hand*: statistically significant differences between groups E1-E3, C1-E1, C2-E2, C3-E3 ($p < 0.001$); statistically significant differences between groups C1-C3 ($p < 0.01$); statistically significant differences between groups C1-C2, E1-E2, E2-E3 ($p < 0.05$);

- *in the left hand vs. the right hand* – no statistically significant differences in any of the groups ($p > 0.05$).

c) Correlations between the studied parameters (Table IV)

For group C1, very good positive correlations between LHGS – RHGS, LHS – RHS

For groups C2 and C3, very good positive correlations between LHGS – RHGS, LHS – RHS; acceptable positive correlations between LHGS – LHS, RHGS – RHS

For group E1, very good positive correlations between LHGS – RHGS; good positive correlations between LHS – RHS

For group E2, very good positive correlations between LHS – RHS; good positive correlations between LHGS – RHGS; good negative correlations between LHGS – LHS, RHGS – RHS

For groups E3, very good positive correlations between LHGS – RHGS, LHS – RHS; good negative correlations between LHGS – LHS, RHGS – RHS.

Table III

Left hand span vs. right hand span in the studied groups and statistical significance.

Hand	Group	Mean	SE	Median	SD	Min	Max	Statistical significance (p)				
Left	C1	23.75	0.2272	23.90	0.7184	22.7	24.8	C+E	**< 0.0001**	E1-E2	0.0590	C1 (LH-RH)
	C2	22.99	0.2312	23.10	0.7310	22	24.2	C1-C2-C3	**0.0017**	E1-E3	**0.0001**	0.5904
	C3	22.23	0.3297	22.05	1.0425	20.8	24	E1-E2-E3	**0.0014**	E2-E3	**0.0271**	C2 (LH-RH)
	E1	28.15	0.4083	28.00	1.2912	26.2	29.7	C1-C2	**0.0307**	C1-E1	**1.96×10^{-7}**	0.7015
	E2	26.72	0.4173	27.20	1.3198	24.5	28	C1-C3	**0.0016**	C2-E2	**< 0.0001**	C3 (LH-RH)
	E3	25.21	0.4347	25.00	1.3747	23.6	27	C2-C3	0.0774	C3-E3	**4.22×10^{-5}**	0.7681
Right	C1	23.94	0.2029	24.10	0.6415	22.4	24.6	C+E	**< 0.0001**	E1-E2	**0.0335**	E1 (LH-RH)
	C2	23.12	0.2407	23.10	0.7613	21.9	24.3	C1-C2-C3	**0.0032**	E1-E3	**0.0004**	0.6162
	C3	22.37	0.3317	22.15	1.0489	21	24.2	E1-E2-E3	**0.0012**	E2-E3	**0.0242**	E2 (LH-RH)
	E1	28.41	0.4496	29.00	1.4216	26.4	29.8	C1-C2	**0.0133**	C1-E1	**< 0.0001**	0.6691
	E2	26.79	0.4403	27.35	1.3924	24.7	28.2	C1-C3	**0.0028**	C2-E2	**< 0.0001**	E3 (LH-RH)
	E3	25.28	0.4192	25.15	1.3256	23.8	27	C2-C3	0.0859	C3-E3	**0.0004**	0.8676

Table IV

Statistical correlation analysis between grip strength and hand span values in the studied groups.

Indicators \ Group		C1		C2		C3		E1		E2		E3	
LHGS	RHGS	0.8459	****	0.8680	****	0.9968	****	0.7894	****	0.7078	***	0.8451	****
GS - HS	LH	-0.2051	*	0.3493	**	0.2907	**	0.1201	*	-0.5821	***	-0.5203	***
	RH	0.1988	*	0.2580	**	0.3044	**	0.1651	*	-0.5474	***	-0.5321	***
LHS	RHS	0.7693	****	0.9808	****	0.9978	****	0.7239	***	0.9969	****	0.9605	****

Legend: *LHGS = left hand grip strength; RHGS = right hand grip strength; LHS = left hand span; RHS = right hand span*

Discussions

Our results show that grip strength in both hands is significantly increased in 16-17 and 18-year-old handball players compared to non-athletes. For the non-athlete groups, significant increases in 18-year-old compared to 16-year-old subjects were observed regarding grip strength in both hands. The highest values of grip strength were found in the right hand in both handball players and non-athletes, which could be due to the fact that this is the dominant hand. The high values of grip strength at the age of 18 compared to age 16 can be attributed to biological maturation.

Hand span, which was not studied by other authors, was significantly increased in both hands in 16-17 and 18-year-old handball players compared to non-athletes, with the highest values at the age of 18.

The correlation analysis between grip strength in both hands shows good and very good positive correlations in both groups C and groups E. The correlation analysis between grip strength and hand span values evidences good and very good positive correlations for all groups C, and good negative correlations for the 16 and 17-year-old groups. The correlation values of the right hand and left hand span were very good and positive both in junior handball players and in control groups aged 16, 17 and 18 years old.

Our results regarding the increase of specific anthropometric parameters in 16-18-year-old junior handball players are in agreement with the observations of Fallahi & Jadidian (2011) regarding the importance of hand grip strength in athletes, handball players, compared to non-athletes, which is correlated with hand span and finger length.

Regarding the role of anthropometric parameters and motor skills, some authors support that these are relatively stable predictors (Visnapuu & Jürimäe, 2009). In contrast, other authors support the importance of anthropometric measurements in the test battery for junior handball players (Zapartidis et al., 2009a; Zapartidis et al., 2009b; Zapartidis et al., 2011; Barut et al., 2008) and the better predictive role of basic anthropometric parameters compared to specific anthropometric parameters (Debanne & Laffaye, 2011).

The determination of specific hand anthropometric parameters can be useful in grip sports and for the identification of talents (Clerke et al., 2005), as well as for hand treatment and rehabilitation strategies (Ghandhi & Singh, 2010, cited by Fallahi & Jadidian, 2011), in neuromuscular disorders - arteritis (Wiles et al., 1990), for the assessment of nutrition status (Fallahi & Jadidian, 2011), post-surgery complications (Wang et al., 2010).

Conclusions

1. Specific hand anthropometric parameters are different in junior handball players compared to non-athletes: grip strength and hand span are significantly increased in athletes compared to non-athletes.

2. Specific hand anthropometric parameters significantly increase with age in junior handball players.

3. Right hand and left hand grip strength is correlated with hand span values both in junior handball players and non-athletes.

4. The values of specific anthropometric parameters measured in junior handball players can be used for the identification of talents in grip sports and for tertiary selection.

Conflicts of interests

There are no conflicts of interest.

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