






Physical fitness, developmental age and somatic development of youth Greco-Roman wrestlers and school youth aged 13-14 years

Authors' Contribution:

-  **A** Study Design
-  **B** Data Collection
-  **C** Statistical Analysis
-  **D** Manuscript Preparation
-  **E** Funds Collection

Kazimierz Witkowski, Paweł Piepiora, Julian Migasiewicz, Jarosław Maśliński, Adam Salachna

Faculty of Sports Sciences, University School of Physical Education in Wrocław, Wrocław, Poland

Received: 19 February 2018; **Accepted:** 13 April 2018; **Published online:** 12 June 2018

AoBID: 12489

Abstract

Background & Study Aim:

Many research reports confirm that regular sports training stimulates the development of physical fitness of children and adolescents. The aim of the study was knowledge about physical fitness, developmental age and somatic development of fifteen-year-old students whom some of them systematically trained wrestling and the physical development of others was stimulated only by PE school exercises.

Material & Methods:

The research was carried out on a group of 50 people (32 non-training sports, 18 practising Greco-Roman wrestling) at the age of 13-14. Eight attempts from the International Physical Fitness Test were used in the measurements. The developmental age was also defined, and the height and weight were assumed as indicators of somatic development. Statistical calculations were made with the t-student test.

Results:

There are significant differences in the level of physical fitness between the wrestling group (positive results) and the school youth group. In the studied groups, weak correlations between individual test samples were observed. Strong correlations were demonstrated among somatic features.

Conclusions:

The results of our research, combined with the reports of other authors, authorize the recommendation that wrestling belongs to the optimal means of stimulating the physical and somatic development of school-age youth.

Key words:

body height age • International Physical Fitness Test • PE • sport which training

Copyright:

© 2018 the Authors. Published by Archives of Budo Science of Martial Arts and Extreme Sports

Conflict of interest:

Authors have declared that no competing interest exists

Ethical approval:

The research was approved by the local Ethics Committee

Provenance & peer review:

Not commissioned; externally peer reviewed

Source of support:

Departmental sources

Author's address:

Paweł Piepiora, Combat Sports Team, Department of Sport Didactics, Faculty of Sports Sciences, University School of Physical Education in Wrocław, Paderewskiego 35 str., Multifunctional Sports Hall room 73, 51-612 Wrocław, Poland; e-mail: pawel.piepiora@awf.wroc.pl

INTRODUCTION

Body height age – Pilicz et al. [19], they proposed that boys and girls who are distinctly taller or shorter than their peers have their physical fitness evaluated according to the point values presented in special tables (developed by them). Beforehand, however, it's necessary to calculate the extent to which the child's age is to be adjusted. This calculation is made by comparing the measured height of the child's body, or "real height", with the child's "proper height" for his/her age as expressed in completed years and months of life. The "proper height" is the arithmetic average of the body heights of Polish children at the end of the Twentieth Century in successive monthly chronological age brackets [19, pp. 70-125].

Developmental age – is a broader concept than **body height age**. In simplified terms, it can be assumed that body height age is an proper indicator of developmental age.

Performance – *noun* the level at which a player or athlete is carrying out their activity, either in relation to others or in relation to personal goals or standards [64].

PE – *abbreviation* physical education [64].

Physical activity – *noun* exercise and general movement that a person carries out as part of their day [64].

Psychomotor – *adjective* relating to bodily movement triggered by mental activity, especially voluntary muscle action [64].

Wrestling – *noun* a sport in which two contestants fight by gripping each other using special holds, each trying to force the other's shoulders onto a mat [64].

Endurance – *noun* the ability or power to bear prolonged exertion, pain or hardship endurance athlete [64].

Flexibility *noun* **1.** the amount or extent to which something can be bent **2.** the extent to which something can change or respond to a variety of conditions or situations [64].

Agility *noun* a combination of physical speed, suppleness and sill [64].

A child's physical fitness increases with his or her age. This obvious relationship is not, however, direct. With increasing age, the dimensions of the body grow, the functions of the internal systems improve and the process of maturation of the organism progresses. These biological processes are manifested in an improvement of physical fitness [1-3]. Therefore, children of the same age differ in size, biological maturity and physical fitness.

It is emphasised in the literature on the subject [4-12] that physical fitness determines the outcome of a competition as well as sport performance. Research on physical fitness demonstrates that it is a comprehensive issue. Any one-sided considerations are incomplete, easily leading to incorrect results. On the other hand, a person's physical fitness cannot be viewed as an external manifestation. The phenomenon of movement – and its essence – leads to the discovery of various conditions, causes and regularities experienced by us and perceived by our senses. It is not an external manifestation, as sensory cognition occurs, which should act in unity with rational cognition. The basic forms of physical fitness have developed from original production movements and their practical development and the formation of theoretical foundations were preceded by a long 'pre-scientific' period in which people came up with solutions to problems associated with sport movements.

The issue of physical fitness is extremely complex, as it relates to a living human being. Physical fitness is a concept that encompasses the whole of a person's movement activities – everything that concerns human movement in space due to changes in the position of the whole body or its individual parts in relation to one another [2, 13]. The puberty period is a period of serious changes occurring in the body. It begins, at the age of 10-12 in girls and 12-14 in boys, with an increase in the secretion of sex hormones and the growth hormone, which manifests itself in the so-called pubertal spurt. This is a significant acceleration of growth, especially of long bones, which results in not only a significantly faster rate of body height development, but – through faster increases in, primarily, limb lengths – changes in body proportions (a more slender figure, the centre of mass of the body moving in the upward direction, etc.). The maturation process lasts several years. After approximately 2 years from the peak

of the pubertal spurt of body height, the basic symptoms of sexual maturity appear, after which the period of 'achieving fullness' begins, which is characterised by a faster increase in width indicators – mainly in girls – including, in particular, body mass and fat mass. A more detailed description of physiological and somatic changes in that period depends on the sport discipline practiced [14].

The most important of them occur in the mental sphere. A rich emotional life, a disturbed balance in the processes of stimulation and inhibition and a change in one's interests reduce a person's motivation and interest in movement activities – which immediately affects their level of physical fitness. The majority of studies show that, during and after the puberty period, girls perform worse than before in almost all physical fitness tests, but the same is not true for boys. The period in question is characterised by an increase in sexual dimorphism with regard to physical fitness. It is worth noting that the above-mentioned tendency consisting in the suspension or regression of the development of physical fitness is not observed in girls who practise sport. In that period it is particularly important for the family and the school to make an effort to ensure that girls' physical activity is maintained on the basis of the habits developed in the previous period [15].

As regards the quality of physical fitness, the puberty period is characterised – to a greater or lesser extent – by the so-called pubertal clumsiness. As a result of the changes, described above, in somatic and functional development, movements become clumsy, lacking harmony and exhibiting a lower level of accuracy and rhythm. The ability to learn new movements also decreases. Frequent symptoms are also sluggishness and movement apathy, caused by the already mentioned lack of balance between the processes of stimulation and inhibition. These disruptions are revealed in the following activities: 1) in difficult acyclic movements (e.g. gymnastic exercises on apparatus); 2) in combined movements; 3) when learning new movements; 4) in the body posture during the performance of movements and in twitches; 5) in movements requiring exceptional accuracy and precision [16-18].

The above-mentioned disorders are, however, temporary and should not be treated as

abnormal symptoms or a crisis in physical fitness. They are a natural consequence of developmental processes and disappear after the end of puberty. Besides, they are mostly qualitative in nature, as, in terms of quantity, further development of the level of coordination predispositions is observed.

The aim of the study was knowledge about physical fitness, developmental age and somatic development of fifteen-year-old students whom some of them systematically trained wrestling and the physical development of others was stimulated only by PE school exercises.

The following hypotheses were put to the verification: (H1) boys who practise wrestling exhibit a higher level of physical fitness; (H2) subjects with a worse Body Mass Index exhibit a lower level of physical fitness.

Table 1. Somatic characteristics in the wrestling group age 13-14 (n = 18) – ordinal variable is body height age (code person from W1 to W18).

Code person	Date of birth	Body height age (years + months)	Body height (cm)	Body mass (kg)	BMI	Rohrer
W1	23 May 1989	16+11	180.00	62.00	19.14	1.06
W2	3 May 1989	16+00	175.00	71.00	23.18	1.32
W3	8 Jan 1989	15+09	174.00	66.00	21.80	1.25
W4	31 Jan 1990	15+00	169.00	65.00	22.76	1.35
W5	13 May 1989	14+10	169.00	62.00	21.71	1.28
W6	9 Jun 1990	13+11	163.00	56.00	21.08	1.29
W7	15 May 1989	13+07	163.00	52.00	19.57	1.20
W8	10 Sep 1989	13+06	162.00	51.00	19.43	1.20
W9	27 Jun 1989	13+05	162.00	45.00	17.15	1.06
W10	6 Oct 1990	12+10	157.00	41.00	16.63	1.06
W11	6 Jun 1989	12+08	158.00	43.00	17.22	1.09
W12	6 Jun 1990	12+06	156.00	42.00	17.26	1.11
W13	9 Jun 1990	12+06	156.00	55.00	22.60	1.45
W14	23 Mar 1990	12+03	155.00	40.00	16.65	1.07
W15	2 Jun 1989	12+03	159.00	42.00	16.61	1.04
W16	21 Dec 1990	12+02	151.00	39.00	17.10	1.13
W17	26 Nov 1989	12+01	150.00	40.00	17.78	1.19
W18	21 Sep 1990	12+00	150.00	35.00	15.56	1.04
x		13+11	161.61	50.39	19.07	1.18
max		16+11	180.00	71.00	23.18	1.45
min		12+00	150.00	35.00	15.56	1.04
S		01+06	8.79	11.12	2.52	0.12

MATERIAL AND METHODS

Participants

The study sample consisted of 18 Greco-Roman wrestlers – sub-juniors, school youths aged 13-14 (Table 1). The reference sample consisted of 32 boys from the same age group who did not practise sport (Table 2). The age range of the subjects was chosen deliberately, as it is the puberty period in youths. The subjects were students of Primary School No. 113 in Wrocław. The measurements were carried out on 23-24 April 2003 in the wrestling group and on 26-27 April 2003 among the non-training boys.

Procedures

Body weight and height measurement

The body weight and height were measured using a digital scale. On that basis, the BMI indices were calculated. The following eight tests from the International Physical Fitness Test (IPFT)

Strength – *noun* the fact of being strong [64].

Sprint – *noun* **1.** a short race run or cycled at a very high speed **2.** a burst of fast running or cycling during the last part of a longer race **3.** a sudden burst of activity or speed ■ **verb** to run, swim or cycle as rapidly as possible [64].

Pull-up – *noun* **UK** a physical exercise in which the hands are placed on an overhead horizontal bar, and the body is lifted by pulling upwards with the arms. Also called **chin**, **chin-up** [64].

Long jump – *noun* an athletics event in which the contestants jump for distance, usually from a running start into a sand pit [64].

Sit-up – *noun* an exercise in which you lie flat on your back with your legs bent and then raise the upper part of your body to a sitting position without using your hands [64].

Table 2. Somatic characteristics in the non-training group boys 13-14 (n = 32) – ordinal variable is body height age (code person from B1 to B32).

Code person	Date of birth	Body height age (years + months)	Body height [cm]	Body mass [kg]	BMI	Rohrer
B1	25 Feb 1990	16+05	176.00	55.00	17.76	1.01
B2	8 Feb 1990	16+03	175.00	78.00	25.47	1.46
B3	3 Jan 1990	16+00	174.00	57.00	18.83	1.08
B4	2 Feb 1990	16+00	174.00	67.00	22.13	1.27
B5	3 Jul 1990	15+11	173.00	75.00	25.06	1.45
B6	28 Jun 1990	15+09	172.00	52.00	17.58	1.02
B7	6 Oct 1990	15+05	170.00	55.00	19.03	1.12
B8	3 Aug 1990	15+04	170.00	70.00	24.22	1.42
B9	6 Aug 1990	15+04	170.00	55.00	19.03	1.12
B10	22 Aug 1990	15+03	170.00	62.00	21.45	1.26
B11	1 Jan 1990	15+00	170.00	51.00	17.65	1.04
B12	28 Dec 1990	14+11	163.00	50.00	18.82	1.15
B13	14 Mar 1990	14+10	168.00	50.00	17.72	1.05
B14	16 Jan 1990	14+05	166.00	62.00	22.50	1.36
B15	23 Sep 1990	14+05	165.00	50.00	18.37	1.11
B16	10 Mar 1990	14+04	165.00	65.00	23.88	1.45
B17	8 Jul 1990	14+04	165.00	45.00	16.53	1.00
B18	26 Feb 1990	14+03	165.00	54.00	19.83	1.20
B19	11 Oct 1990	14+00	163.00	51.00	19.20	1.18
B20	1 Dec 1989	13+09	163.00	49.00	18.44	1.13
B21	30 Jul 1990	13+04	160.00	55.00	21.48	1.34
B22	17 Jan 1990	12+10	158.00	53.00	21.23	1.34
B23	14 Mar 1990	12+08	158.00	40.00	16.02	1.01
B24	13 Apr 1990	12+06	156.00	46.00	18.90	1.21
B25	7 Jun 1990	12+06	156.00	50.00	20.55	1.32
B26	20 Oct 1990	12+06	156.00	40.00	16.44	1.05
B27	1 Nov 1990	12+05	155.00	52.00	21.64	1.40
B28	22 Jan 1990	12+02	150.00	40.00	17.78	1.19
B29	26 Aug 1990	12+01	150.00	40.00	17.78	1.19
B30	20 Dec 1990	12+01	148.00	41.00	18.72	1.26
B31	17 Jul 1990	12+00	146.00	42.00	19.70	1.35
B32	29 Oct 1990	12+00	149.00	46.00	20.72	1.39
x		13+08	163.09	53.06	19.83	1.22
max		16+05	176.00	78.00	25.47	1.46
min		12+00	146.00	40.00	16.02	1.00
s		01+05	8.70	10.00	2.49	0.15

battery were used: 50-meter sprint – speed test; standing long jump – power test; 1000-meter run – endurance test; grip strength – static force test; pull-up on a bar – relative power test; 10-meter

x 4 shuttle run with a replacement of blocks – agility test; 30-second sit-ups – dynamic force test; standing trunk flexion – flexibility test [19].

International Physical Fitness Test (IPFT)

The IPFT was performed over a period of two days, separately for each group. According to recommendations of the test creators, tests 1-3 were carried on the first day and tests 4-8 – on the second day. On the basis of the results obtained, both groups were then compared in terms of their physical fitness. The evaluation of physical fitness results was made using the T scale. After the results were translated into points, an evaluation of the physical fitness of individual groups of persons was obtained. The scores obtained provided information about the position of individual results of each test in relation to the average result expressed in points, i.e. 50 points. Finally, the results of individual tests were summed up. That summary score was referred to the classification standards presented below and, on that basis, the physical fitness of the subjects was evaluated. The standards correspond to three levels of physical fitness regardless of age and sex. As separate score tables were prepared for each age and sex group, these are as follows: **HLF** high level of fitness 481 and more points; **MLF** medium level of fitness from 320 to 480 points; **LLF** low level of fitness 319 and less points [20].

Statistic analyses

The ordinal variable in tables presenting individual results is the value of the body height age

(from highest to lowest). Personal codes (for wrestlers preceded by the letter W, for boys from the control group with the letter B) are therefore rankings of this feature. Ranking of the level of physical fitness (sum of IPFT points) starts from the highest value. The Pearson correlation coefficient between both rankings was determined.

The arithmetic mean, standard deviation (SD), maximum and minimum values were calculated. In order to verify the hypotheses, the Student's t-test was used. In tables values that statistically significant at the level of $\alpha \leq 0.05$ are highlighted.

RESULTS

The characteristics of somatic development of juvenile wrestlers and non-practicing sports peers are similar (Tables 1 to 4). No statistically significant differences were found between the indicators compared (Table 5).

Juvenile wrestlers exceed the physical fitness of their peers who do not practice sports (Tables 6 to 10). Wrestlers dominate medium level of fitness (56%), including the 7 athletes' score measured by the sum of IPFT points from 400 to 480, and 3 from 320 to 399. The rest (44%) revealed high

Table 3. Data on the level of somatic development of the wrestling group (n = 18).

Variable	Arithmetic mean	SD	Max	Min	Sample range	SD of the mean	Coefficient	
							variation	interval
Developmental age	13+05	01+06	16+11	12+00	04+11	00+03	00+02	03+09
Body height (cm)	161.61	8.79	180.00	150.00	30.00	2.07	5.44	4.06
Body mass (kg)	50.39	11.12	71.00	35.00	36.00	2.62	22.07	5.14
BMI	19.07	2.52	23.18	15.56	7.63	0.59	13.21	1.16
Rohrer	1.18	0.12	1.45	1.04	0.41	0.03	10.49	0.06

Table 4. Data on the level of somatic development of the non-training boys (n = 32).

Variable	Arithmetic mean	SD	Max	Min	Sample range	SD of the mean	Coefficient	
							variation	interval
Developmental age	13+08	01+05	16+05	12+00	04+05	00+02	00+01	02+04
Body height (cm)	163.09	8.70	176.00	146.00	30.00	1.54	5.34	3.02
Body mass (kg)	53.06	10.00	78.00	40.00	38.00	1.77	18.84	3.46
BMI	19.83	2.49	25.47	16.02	9.45	0.44	12.58	0.86
Rohrer	1.22	0.15	1.46	1.00	0.45	0.03	12.10	0.05

Table 5. Comparative data on the level of somatic development of both groups.

Variable	Wrestlers (n = 18)		Non-training boys (n = 32)		t-test (df 48)
	arithmetic mean	SD	arithmetic mean	SD	
Developmental age	13+05	01+79	13+08	01+70	-0.06
Body height (cm)	161.61	8.79	163.09	8.70	-0.56
Body mass (kg)	50.39	11.12	53.06	10.00	-0.85
BMI	19.07	2.52	19.83	2.49	-1.01
Rohrer	1.18	0.12	1.22	0.15	-0.93

level of fitness (Table 6). Among the boys who do not train any sport, it dominates also medium level of fitness (66%), Only one (3%) reveals the high level (Table 7). The results of each of the eight IPFT wrestlers' trials are higher (Table 8) than the results of non-training peers (Table 9). The results of only three IPFT (50-meter sprint, grip strength, shuttle run) tests are not statistically significant (Table 10).

The research conducted revealed significant differences in the level of physical fitness between the wrestling group and the non-training boys. Weak correlations between individual tests were recorded in the groups studied, while strong correlations between the subjects were demonstrated with regard to somatic traits. There were, however, no significant correlations between physical fitness tests.

Table 6. Based on results International Physical Fitness Test the characteristics of wrestlers (n = 18) – ordinal variable is body height age (code person from W1 to W18; see Table 1).

Code person	Arithmetic mean (points)	SD	Max	Min	Sample range	SD of he mean	Coefficient		Physical fitness		
							variation	interval	total points	ranking position	level
W1	49.50	5.81	56	40	16	2.05	11.73	4.02	396	16	MLF
W2	55.63	7.80	65	44	21	2.76	14.02	5.40	445	14	MLF
W3	51.88	8.87	64	36	28	3.14	17.10	6.15	415	15	MLF
W4	44.63	12.00	56	18	38	4.24	26.89	8.31	357	18	MLF
W5	71.00	8.40	84	62	22	2.97	11.83	5.82	568	1	HLF
W6	67.00	10.58	79	46	33	3.74	15.80	7.33	536	3	HLF
W7	60.75	9.91	73	41	32	3.50	16.31	6.87	486	7	HLF
W8	59.13	9.52	68	39	29	3.37	16.11	6.60	473	9	MLF
W9	68.63	10.41	84	51	33	3.68	15.16	7.21	549	2	HLF
W10	58.88	5.49	67	50	17	1.94	9.32	3.80	471	10	MLF
W11	64.25	9.95	80	48	32	3.52	15.49	6.90	514	5	HLF
W12	60.50	6.76	70	53	17	2.39	11.18	4.69	484	8	HLF
W13	45.25	7.57	54	33	21	2.68	16.74	5.25	362	17	MLF
W14	65.38	8.55	75	51	24	3.02	13.08	5.93	523	4	HLF
W15	58.38	8.23	73	45	28	2.91	14.09	5.70	467	11	MLF
W16	56.88	12.70	69	34	35	4.49	22.33	8.80	455	13	MLF
W17	63.38	13.69	81	40	41	4.84	21.60	9.49	507	6	HLF
W18	57.88	18.41	75	22	53	6.51	31.81	12.76	463	12	MLF
Total	58.83	3.097	84	18	66	0.78673	5.264	2.146	470.6		HLF 56% MLF 44%

Table 7. Based on results International Physical Fitness Test the characteristics of non-training boys (n = 32) – ordinal variable is body height age (code person from B1 to B32; see Table 2).

Code person	Arithmetic mean	SD	Max	Mini	Sample range	SD of the mean	Coefficient		Physical fitness		
							variation	interval	total points	ranking position	level
B1	47.75	11.36	62	32	30	4.02	23.79	7.87	382	11	MLF
B2	44.25	20.73	66	0	66	7.33+	46.86	14.37	354	16	MLF
B3	54.88	8.97	71	44	27	3.17	16.34	6.21	439	4	MLF
B4	32.88	19.95	56	0	56	7.05	60.69	13.83	263	29	LLF
B5	33.63	17.78	56	0	56	6.29	52.89	12.32	269	27	LLF
B6	36.00	18.75	57	0	57	6.63	52.07	12.99	288	24	LLF
B7	41.63	18.63	62	0	62	6.59	44.76	12.91	333	18	MLF
B8	45.50	20.28	66	0	66	7.17	44.58	14.06	364	15	MLF
B9	34.88	17.77	55	0	55	6.28	50.96	12.32	279	26	LLF
B10	35.00	23.84	56	0	56	8.43	68.13	16.52	280	25	LLF
B11	30.25	17.78	51	0	51	6.29	58.78	12.32	242	30	LLF
B12	37.38	18.74	59	0	59	6.63	50.14	12.98	299	23	LLF
B13	56.50	9.32	66	46	20	3.30	16.50	6.46	452	2	MLF
B14	26.50	21.83	52	0	52	7.72	82.38	15.13	212	31	LLF
B15	47.25	7.32	58	34	24	2.59	15.50	5.08	378	12	MLF
B16	40.38	18.23	61	0	61	6.44	45.15	12.63	323	21	MLF
B17	50.88	9.86	62	37	25	3.49	19.39	6.83	407	8	MLF
B18	60.88	6.73	69	46	23	2.38	11.05	4.66	487	1	HLF
B19	46.88	7.61	59	36	23	2.69	16.22	5.27	375	13	MLF
B20	52.13	3.83	59	46	13	1.36	7.35	2.66	417	7	MLF
B21	42.63	19.46	63	0	63	6.88	45.66	13.49	341	17	MLF
B22	50.88	11.75	67	29	38	4.16	23.10	8.14	407	8	MLF
B23	41.50	19.41	57	0	57	6.86	46.78	13.45	332	19	MLF
B24	56.38	7.37	70	47	23	2.60	13.07	5.10	451	3	MLF
B25	40.88	25.85	63	0	63	9.14	63.25	17.92	327	20	MLF
B26	45.88	21.00	67	0	67	7.42	45.78	14.55	367	14	MLF
B27	53.88	7.28	66	44	22	2.57	13.51	5.04	431	5	MLF
B28	53.63	11.34	71	35	36	4.01	21.14	7.86	429	6	MLF
B29	38.75	25.23	65	0	65	8.92	65.11	17.48	310	22	MLF
B30	49.88	5.33	56	42	14	1.88	10.69	3.69	399	9	MLF
B31	33.25	23.19	56	0	56	8.20	69.75	16.07	266	28	MLF
B32	48.50	16.25	66	12	54	5.74	33.50	11.26	388	10	MLF
Total	44.11	6.47	71	0	71	2.04	14.66	2.15	352.8		HLF 3% MLF 66% LLF 31%

There is no statistically significant correlation between the ranking item „ranking position of physical fitness” and „code person”: for wrestlers $r = -0.170$; for non-training peers $r = -0.269$.

DISCUSSION

On the basis of the research conducted it is possible to state, that the physical fitness of boys at Primary School No. 113 in Wrocław, is

Table 8. International Physical Fitness Test results juvenile wrestlers (n = 18).

IPFT indicator	Unit	Arithmetic mean	SD	Max	Min	Sample range	SD of the mean	Coefficient	
								variation	interval
50-meter sprint	s	8.66	0.69	10.10	7.23	2.87	0.16	7.99	0.32
	pts	49.33	6.98	62.00	39.00	23.00	1.64	14.15	3.22
Standing long jump	cm	207.06	23.94	260.00	147.00	113.00	5.64	11.56	11.06
	pts	63.61	11.96	84.00	43.00	41.00	2.82	18.80	5.52
1000-meter run	s	236.59	35.40	340.00	200.23	139.77	8.34	14.96	16.35
	pts	52.33	13.16	67.00	22.00	45.00	3.10	25.15	6.08
Grip strength	kg	32.61	8.37	54.00	20.00	34.00	1.97	25.66	3.87
	pts	58.67	12.39	78.00	36.00	42.00	2.92	21.11	5.72
Pull-up	qty	10.44	5.07	19.00	0.00	19.00	1.19	48.51	2.34
	pts	58.61	18.88	84.00	0.00	84.00	4.45	32.22	8.72
Shuttle run	s	10.59	0.65	11.90	9.34	2.56	0.15	6.17	0.30
	pts	62.56	6.54	75.00	52.00	23.00	1.54	10.45	3.02
Sit-ups	qty	31.94	3.61	40.00	24.00	16.00	0.85	11.29	1.67
	pts	66.11	7.78	82.00	51.00	31.00	1.83	11.76	3.59
Trunk flexion	cm]	6.78	8.55	20.00	-15.00	35.00	2.02	126.17	3.95
	pts	56.00	14.02	81.00	18.00	63.00	3.30	25.04	6.48

unsatisfactory. This school has three gymnasia, a swimming pool, a full-size handball court, two basketball courts, a 100-meter running track, a long jump pitch and a shot put circle. It is therefore necessary to exclude the infrastructure factor as the reason for this state of affairs. this diagnosis confirms many previous observations [21].

One of the reasons also observed in social media for neglecting daily physical activity by children and schoolchildren are modern technological attractions. A computer or a smartphone is a very helpful device in the process of effective learning, but it will not replace outdoor physical activity. In the long term that situation may even lead to health issues, such as deteriorated eyesight, curvature of the spine, obesity or malnutrition [22-25].

Another reason for shortage of physical activity (as a consequence the deteriorating physical fitness of Polish youths) is the not attractive physical education (PE) school curriculum. The authors are also of the opinion that the physical education classes provided for in the curriculum should be scheduled in such a way as to include two consecutive class units, as it is impossible to maintain an increase in training intensity for more than 15-20 minutes during within a 45-minute class [26-36].

To what extent is a high level of physical fitness due to regular physical activity? This is illustrated by the results obtained in the wrestling group. These results may be regarded as very good, even outstanding in comparison to those of their peers. As many as eight athletes received a high score, while the others – a medium one. It should also be noted that, in the wrestling section, integration activities with a group of senior athletes are also pursued. The youths identify with the wrestling community, feeling a kind of bond with it. Many of those senior athletes are leaders in their discipline at the Polish and European level [37]. The wrestling section could serve as an excellent example of working with youths and children, fostering a healthy spirit of rivalry, which contributes to an improvement of their skills and increasingly better sport performance.

The main advantage of our research is the use of a set of IPFT test samples. In this way, it is possible to compare with the results of tests in which the authors used only selected samples. Furthermore, IPFT has been used in many studies of the Polish youth population practicing combat sports, especially judo – in one study, the authors used a set of eight test samples [38-40], in others selected in relation to the judo's motor characteristics [41-44].

Table 9. International Physical Fitness Test results of non-training boys (n = 32).

IPFT indicator	Unit	Arithmetic mean	SD	Max	Min	Sample range	SD of the mean	Coefficient	
								variation	interval
50-meter sprint	s	9.09	1.08	12.28	7.39	4.90	0.19	11.89	0.37
	pts	42.41	12.03	60.00	13.00	47.00	2.13	28.37	4.17
Standing long jump	cm	190.13	22.64	230.00	141.00	89.00	4.00	11.91	7.84
	pts	53.78	8.72	66.00	31.00	35.00	1.54	16.22	3.02
1000-meter run	s	316.06	77.43	521.00	208.00	313.00	13.69	24.50	26.83
	pts	33.13	19.72	63.00	0.00	63.00	3.49	59.53	6.83
Grip strength	kg	28.41	8.87	52.00	19.00	33.00	1.57	31.22	3.07
	pts	48.09	8.23	62.00	32.00	30.00	1.46	17.12	2.85
Pull-up	qty	1.66	2.42	10.00	0.00	10.00	0.43	145.98	0.84
	pts	22.19	25.72	62.00	0.00	62.00	4.55	115.93	8.91
Shuttle run	s	10.99	0.97	12.87	9.60	3.27	0.17	8.79	0.33
	pts	58.28	8.26	71.00	41.00	30.00	1.46	14.18	2.86
Sit-ups	qty	25.50	5.04	35.00	16.00	19.00	0.89	19.75	1.74
	pts	51.47	11.18	71.00	29.00	42.00	1.98	21.71	3.87
Trunk flexion	cm]	-1.72	6.81	7.00	-34.00	41.00	1.20	396.05	2.36
	pts	43.50	8.75	56.00	4.00	52.00	1.55	20.13	3.03

Admittedly, physical fitness score tables are developed for girls and boys separately in the 7 to 19 year olds, but comparisons are possible on the basis of raw results [19]. For example, Pietraszewska et al [45] in the 19-26 year-old judo and ju-jitsu athletes studied, the average standing long jump 232 cm (in a separate set of 51 athletes with significantly lower level of motoric performance) and 224.8 cm in the 23 athletes collection – characterized by the type of higher motor performance. In our research, the result of this test in juvenile wrestlers amounted to 207.06 cm, while in peers, non-practicing sports 190.13 cm. The difference between combat sports athletes was 7.2 cm, while between the athletes we studied and those who did not train their peers as much as 16.93 cm. Results of 17 senior female judo competitors – members of the Olympic and National Teams in judo participated in the study conducted at the end of the preparatory period of 2007 (average age was 25.2 ± 3.7 years, and athletic experience 14.2 ± 4.0 years) – was 212 cm [39].

This simple example is empirical evidence of the importance of stimulating the development of biological (older maintaining optimal physical fitness) has a regular sports training. While there is

a difference in motor potential in favour of men training combat sports, however, another methodological aspect is important. The scoring standards for test results are adapted to gender and age [19]. Comparing results in points under certain circumstances does not make sense: e.g. when we analyze the motor potential in the aspect of self-defence of a child [46, 47], woman [48, 49], people with physical disability [50] and in universal sense [51, 52] against the physical aggression of a man; when we make selections for the police and other defence groups available to men, but also for women [53-59]. In the circumstances mentioned, an analysis based on raw test results is adequate.

When comparing the results expressed in points (T-scale), one should take far-reaching consideration. In our studies, the mean score of the sum of the points of all eight IPFT trials was in 13-14-year-old wrestlers 470.6 and in non-training peers 352.8 points. The difference between groups is 117.8 points. Physical fitness 11-12 years boys who train judo measured by this indicator is 517.45 points, while non-training sports 452.91 points [40]. The difference is almost twice smaller, 64.54 points. Results senior female judo athletes, members of the Olympic and National Teams in judo, was 534.4

Table 10. Comparison of International Physical Fitness Test results both groups.

IPFT indicator	Unit	Wrestlers (n = 18)		Non-training boys (n = 32)		t-test (df 48)
		arithmetic mean	SD	arithmetic mean	SD	
50-meter sprint	s	8.66	0.69	9.09	1.08	-1.50
	pts	49.33	6.98	42.41	12.03	2.20*
Standing long jump	cm	207.06	23.94	190.13	22.64	2.44**
	pts	63.61	11.96	53.78	8.72	3.27**
1000-meter run	s	236.59	35.40	316.06	77.43	-4.04**
	pts	52.33	13.16	33.13	19.72	3.62**
Grip strength	kg	32.61	8.37	28.41	8.87	1.61
	pts	58.67	12.39	48.09	8.23	3.54**
Pull-up	qty	10.44	5.07	1.66	2.42	8.11**
	pts	58.61	18.88	22.19	25.72	5.16**
Shuttle run	s	10.59	0.65	10.99	0.97	-1.53
	pts	62.56	6.54	58.28	8.26	1.85
Sit-ups	qty	31.94	3.61	25.50	5.04	4.69**
	pts	66.11	7.78	51.47	11.18	4.83**
Trunk flexion	cm	6.78	8.55	-1.72	6.81	3.78**
	pts	56.00	14.02	43.50	8.75	3.80**

*p<0.05 **p<0.01

points [39]. This indicator 16-18 years old-group judo female athletes group was 490.6 points, and 13-15 years old 513-points [60].

We share the view of Kalina [61] that the measurement and analysis of general physical fitness in the future is first and foremost meaningful in relation to the strengthening of all dimensions of health and survival ability. That is why works inspired by the authors strive to break the paradigm [6, 34, 36, 44, 46-50, 52-55, 57-59, 62, 63] of a group of sport science experts oriented on the selection of suitable candidates for achieving results at the highest level of sports competition (Olympic level, world championships and continental championships). The utilitarian dimension of combat sports and martial arts is one of those

forms of psychophysical activity that best fulfill the mission of strengthening all dimensions of health and survival.

CONCLUSIONS

The results of our research, combined with the reports of other authors, authorize the recommendation that wrestling belongs to the optimal means of stimulating the physical and somatic development of school-age youth.

Regular practice of wrestling positively affects the physical fitness of training persons. The non-training boys had worse BMI markers and exhibit a weaker level of physical fitness.

REFERENCES

- Osiński W. Zagadnienia motoryczności człowieka. Poznań: AWF; 1991 [in Polish]
- Szopa J, Mleczek E, Żak S. Podstawy antropomotoryki. Warszawa: PWN; 2000 [in Polish]
- Thomas JR, Nelson JK, Silverman SJ. Research Methods in Physical Activity. 5th ed. Champaign: Human Kinetics; 2005
- Fletcher GF, Balady G, Blair SN, et al. Statement on exercise: benefits and recommendations for physical activity programs for all Americans. A statement for health professional by the Committee on Exercise and Cardiac Rehabilitation of the Council on Clinical Cardiology, American Heart Association. Circulation 1996; 94(4): 857-862
- Wołkow LW. Sportownaja podgotowka dietiej i podrostkow. Kiev: Wieża; 1998 [in Russian]

6. Hagg H, Haag G in cooperation with B. Kaulitz: From physical fitness to motor competence. Aims – content – methods – evaluation. Frankfurt/M-Berlin-Berno-Bruksela-New York-Wien: Sports Sciences International; 2000
7. Kuński H. Trening zdrowotny osób dorosłych. Poradnik lekarza i trenera. Warszawa: Agencja Wydawnicza Medsportpress; 2002 [in Polish]
8. Przewęda R, Dobosz J. Kondycja fizyczna polskiej młodzieży. Studia i Monografie 98. Warszawa: Akademia Wychowania Fizycznego; 2003 [in Polish]
9. Jaskólski E, Wołkow L, Jagiełło W. Biologiczne i pedagogiczne podstawy systemu szkolenia sportowego. Warszawa: Centralny Ośrodek Sportu; 2005 [in Polish]
10. Drabik J. Pedagogiczna kontrola pozytywnych mierników zdrowia fizycznego. Gdańsk: Akademia Wychowania Fizycznego i Sportu; 2006 [in Polish]
11. Heyward VH. Advanced fitness assessment and exercise prescription. 5th ed. Champaign: Human Kinetics; 2006
12. Schmidt RA, Wrisberg CA. Motor Learning and Performance. A Situation-Based Learning Approach. 4th ed. Champaign: Human Kinetics; 2008
13. Osiński W. Antropomotoryka. Poznań: AWF; 2000 [in Polish]
14. Górski J. Fizjologiczne podstawy wysiłku fizycznego. Warszawa: PZW; 2008 [in Polish]
15. Raczek J, Mynarski W, Ljach W. Kształtowanie i diagnozowanie koordynacyjnych zdolności motorycznych. Podręcznik dla nauczycieli, trenerów i studentów. Katowice: Akademia Wychowania Fizycznego; 2002 [in Polish]
16. Płatonow WN. Obszczaa tieorija podgotowki sportsmienow w olimpijskom sportie. Kiev: Olimpijska Literatura; 1997 [in Russian]
17. Zaporozhanov W, Sozański H. Dobór i kwalifikacja do sportu. Warszawa: Biblioteka Trenera; 1997 [in Polish]
18. Sozański H. Podstawy teorii treningu sportowego. Warszawa: Centralny Ośrodek Sportu; 1999 [in Polish]
19. Pilicz S, Przewęda R, Dobosz J et al. Physical Fitness Score Tables of Polish Youth. Criteria for Measuring Aerobic Capacity by the Cooper Test. Warszawa: Studia i Monografie AWF; 2002
20. Talaga J. Sprawność fizyczna ogólna: testy. Poznań: AWF; 2008
21. Piepiora P, Superson M, Witkowski K. Personality and the body composition of athletes using the example of the Polish national youth female wrestling team. J Combat Sports Martial Arts 2017; 8(2): 107-109
22. Sallis J, Prochaska J, Taylor W. A review of correlates of physical activity of children and adolescents. Med Sci Sport Exer 2000; 32: 963-975
23. Morgan CF, McKenzie TL, Sallis JF et al. Personal, social, and environmental correlates of physical activity in a biethnic sample of adolescents. Pediatr Exerc Sci 2003; 15: 288-301
24. Subramanian PR, Silverman S. Middle school students' attitudes towards physical education. Teach Teach Educ 2007; 23: 602-611
25. Verkooijen KT, Nielsen GA, Kremers SPJ. Leisure time physical activity motives and smoking in adolescence. Psychol Sport Exerc 2009; 10: 559-564
26. Mazur J, Tabak I, Gajewski J et al. Nadwaga i otyłość wśród uczniów gimnazjum w zależności od wybranych czynników behawioralnych. Zmiany w latach 2006–2010. Prz Epidemiol 2012; 66(3): 503-508 [in Polish]
27. Woynarowska B, Mazur J. Tendencje zmian zachowań zdrowotnych i wybranych wskaźników zdrowia młodzieży szkolnej w latach 1990–2010. Warszawa: Instytut Matki i Dziecka; 2012 [in Polish]
28. Labbrozzi D, Robazza C, Bertollo M et al. Pubertal development, physical self-perception, and motivation toward physical activity in girls. J Adolescence 2013; 36(4): 759-765
29. Abu-Omar K, Rütten A, Robine J-M. Self-rated health and physical activity in the European Union. Int J Public Health 2004; 49(4): 235-242
30. Flensburg-Madsen T, Ventegodt S, Merrick J. Why is Antonovsky's Sense of Coherence not correlated to physical health? Analysing Antonovsky's 29-item Sense Of Coherence Scale (SOC-29). Sci World J 2005; 5: 767-776
31. Eriksson M, Lindstrom B. Antonovsky's sense of coherence scale and the relation with health: a systematic review. J Epidemiol Community Health 2006; 60: 376-381
32. Biddle SJH, Mutrie N. Physical activity: A feel-good effect? In: Biddle SJH, Mutrie N, editors. Psychology of Physical Activity. Determinants, Well-Being & Interventions. 2nd ed. Abingdon: Routledge; 2008: 163-242
33. Kalina RM, Barczyński B. Progresywny model wychowania fizycznego jako konieczny element promocji zdrowia. In: Mucha D, Zięba HR, editors. Przeciwdziałanie czynnikom ryzyka chorób cywilizacyjnych. Nowy Targ: PPWSZ; 2009: 97-108 [in Polish]
34. Kalina RM, Graczyński MR, Barczyński BJ. Budo – a unique keyword of life sciences. Arch Budo 2009; 5(5): 117-119
35. Moksness UK, Espness GA, Lillefiel M. Sense of coherence and emotional health in adolescents. J Adolescence 2012; 35: 433-441
36. Barczyński BJ, Kalina RM. Science of martial arts – Example of the dilemma in classifying new interdisciplinary sciences in the global systems of the science evaluation and the social consequences of courageous decisions. Proceedings of the Conference: 6th International Conference on Applied Human Factors and Ergonomics; 2015 Jul 26-30; Las Vegas, USA. Procedia Manufacturing 2015; 3: 1203-1210
37. Starosta W, Baić M. Battery of tests for evaluation level of motor abilities in high advanced wrestlers from perspective of 32 years of using in practice. Arch Budo Sci Martial Art Extreme Sport 2015; 11: 213-220
38. Jagiełło W. Teoretiko-metodiczeskije osnovy sistemy mnogoletniej fiziczeskoj podgotowki junych dzjudistow. Warszawa: Studia i Monografie AWF; 2002 [in Russian]
39. Smulski W, Wolska B, Jagiełło W et al. The correlation of general and sport-specific preparation indices of elite female judo competitors with their age-somatic characteristics. Arch Budo 2011; 7(4): 239-245
40. Maśliński J, Witkowski K, Jatowtt A et al. Physical fitness 11-12 years boys who train judo and those who do not practise sport. Arch Budo Sci Martial Art Extreme Sport 2015; 11: 41-46
41. Jagiełło W, Kalina RM, Tkaczuk W. Age peculiarities of speed and endurance development in young judo athletes. Biol Sport 2001; 18(4): 281-295
42. Jagiełło W, Kalina RM, Tkaczuk W. Development of strength abilities in children and youth Biology of Sport 2004; 21(4): 351-368
43. Jagiełło W, Kalina RM. Properties of Motor Development in Young Judokas. J Hum Kinet 2007; 17: 113-120
44. Niedomagała W. The result of "testing fights in a relaxed posture" as a selection criterion for professional training of judo sport – prognostic value TFVP. Arch Budo Sci Martial Art Extreme Sport 2016; 12: 181-190
45. Pietraszewska J, Burdukiewicz A, Stachoń A et al. Is the level of static strength and strength endurance a reflection of morphological differentiation among judo and ju-jitsu athletes? Arch Budo Sci Martial Art Extreme Sport 2014; 10: 67-73
46. Kalina RM, Chodała A, Dadeło S et al. Empirical basis for predicting success in combat sports and self-defence. Kinesiology 2005; 37(1): 64-73
47. Vit M, Reguli Z, Sebera M et al. Predictors of children's successful defence against adult attacker. Arch Budo 2016; 12: 141-150
48. Syska J. Psychomotoryczne efekty uprawiania przez kobiety nowoczesnych form gimnastyczno-tanecznych z elementami samobrony. [PhD thesis]. Warszawa: Akademia Wychowania Fizycznego; 2005 [in Polish]
49. Shishida F. Why can a little lady throw down a strong man using only a finger? The mechanism of soft *atemi-waza*. In: Kalina RM, editor. Proceedings of the 1st World Congress on Health and Martial Arts in Interdisciplinary Approach; 2015 Sep 17-19; Czeszochowa, Poland. Warsaw: Archives of Budo; 2015: 49-58
50. Čihounková J, Skotáková A, Bugala M et al. Different approach analysis of self-defence for people with physical disability. In: Kalina RM, editor. Proceedings of the 1st World Congress

- on Health and Martial Arts in Interdisciplinary Approach; 2015 Sep 17-19; Czestochowa, Poland. Warsaw: Archives of Budo; 2015: 40-43
51. Sterkowicz S, Chwała W, Ambroży T. Zdolności motoryczne warunkujące rezultat w teście podstawowej umiejętności samoobrony. In: Korzeniowski L, editor. Kształcenie pracowników ochrony. Kraków: Liport LFK; 2001; 154-169 [in Polish]
52. Harasymowicz J, Kalina RM: Honourable self-defence – the theoretical and methodological basis of training. Płock: Wydawnictwo Novum; 2006
53. Chodała A. Porównanie efektywności dwóch metod treningu fizycznego żołnierzy przygotowujących do misji „operacje inne niż wojna”. [PhD Thesis]. Warszawa: Akademia Wychowania Fizycznego Józefa Piłsudskiego; 2003 [in Polish]
54. Bukowiecka D. System diagnozowania sprawności fizycznej funkcjonariuszy policji. PhD thesis. Warszawa: Akademia Wychowania Fizycznego; 2005 [in Polish]
55. Dadeło S. Czynniki determinujące kompetencje pracowników ochrony na Litwie. Studia i Monografie. Warszawa: Akademia Wychowania Fizycznego J. Piłsudskiego; 2005 [in Polish]
56. Kalina RM, Jagiełło W, Wiktorek P. Motor competence in self-defence of students of a detectives' school during their course of studies. Arch Budo 2007; 3(3): 1-6
57. Bugala M, Reguli Z, Čihounková J. Educational Background of Security Bodies Identification in Self-defence: Study Programme Special Education of Security Bodies. In: Kalina RM, editor. Proceedings of the 1st World Congress on Health and Martial Arts in Interdisciplinary Approach; 2015 Sep 17-19; Czestochowa, Poland. Warsaw: Archives of Budo; 2015: 79-84
58. Kalina RM, Jagiełło W, Chodała A. The result of “testing fights in a vertical posture” as a criterion of talent for combat sports and self-defence – secondary validation (part I: the reliability). Arch Budo Sci Martial Art Extreme Sport 2015; 11: 229-238
59. Kalina RM, Jagiełło W, Chodała A. The result of “testing fights in a vertical posture” as a criterion of talent for combat sports and self-defence – secondary validation (part II: the accuracy). Arch Budo Sci Martial Art Extreme Sport 2016; 12: 163-180
60. Jagiełło W, Wolska B, Smulski W. Physical preparation of female judo competitors at selected stages of long-standing sports training. Arch Budo 2009; 5: 47-53
61. Kalina RM. Innovative agonology as a synonym for prophylactic and therapeutic agonology – the final impulse. Arch Budo 2016; 12: 329-344
62. Kalina RM, Barczyński BJ: From “physical fitness” through “motor competence” to the “possibility of action” Arch Budo 2008; 4(4): 106-109
63. Budō: The Martial Ways of Japan. Tokyo: Nippon Budokan Foundation; 2009
64. Dictionary of Sport and Exercise Science. Over 5,000 Terms Clearly Defined. London: A & B Black; 2006

Cite this article as: Witkowski K, Piepiora P, Migasiewicz J et al. Physical fitness, developmental age and somatic development of youth Greco-Roman wrestlers and school youth aged 13-14 years. Arch Budo Sci Martial Art Extreme Sport 2018; 14: 63-74