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Correlations between the somatic parameters and motor skills of 17-19-year-old boys from the Kujawsko-Pomorskie voivodeship

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Abstract

Introduction and purpose of the study: Physical activity is the key element of a healthy lifestyle. It is hard to associate it only with meeting the biological needs (Osiński, 1996). As hypokinesis is growing with age, it is becoming the cause of regress observed in physical fitness and efficiency of young generations (Woynarowska, 2008). The purpose of the study was to illustrate the condition of somatic development and motor skills in 17-19-year-old boys from the rural and urban areas of the Kujawsko-Pomorskie voivodeship. The correlations between the studied somatic characteristics and motor skills considering the age of respondents were identified using the Pearson correlation coefficient.

Material and methods*:* The study involved 1,147 boys aged 17-19 years from the areas of the Kujawsko-Pomorskie voivodeship in 2015. The research was diagnostic and cross-sectional (transversal) in nature. The somatic parameters (body height and weight) were calculated in accordance with the guidelines adopted in anthropology whereas motor skills by means of MTSF. The correlations between the studied measurable parameters were identified by estimating the Pearson linear correlation coefficient. The study results were shown in the tabular and descriptive form.

Results: The study revealed linear correlations between the somatic parameters and some motor skills in all age groups of boys (17-19 years).

Conclusions: In order to establish the strategic directions for the changes concerning the condition of physical fitness, a detailed diagnosis of the current state is required that will help the school work of physical education teachers who can control different elements of biological development of their students in a better and more efficient way.

Key words: motor skills, hypokinesia, physical fitness

Correlations between the somatic parameters and motor skills of 17-19-year-old boys from the Kujawsko-Pomorskie voivodeship

Introduction

Physical activity is the key element of a healthy lifestyle. It is hard to associate it only with meeting the biological needs (Osiński, 1996). As hypokinesis is growing with age, it is becoming the cause of regress observed in physical fitness and efficiency of young generations (Woynarowska, 2008). This is confirmed by the results of the research conducted by R. Przewęda (2003) in the years 1979-1997. The results of the current regional studies (the Bydgoszcz region) concerning health especially of young people indicate that urgent efforts are needed in connection with this adverse situation.

To ensure that proper directions are established for the changes regarding the state of physical fitness, a detailed diagnosis of the current condition is required. Hominization entails negative results like the ones relating to an individual's spontaneous activity. The statement that health comprises an indispensable condition of good achievements at school and the quality of work and economic results in adult life is truism. Health education and efforts aimed at improving physical fitness of children and teenagers have to be an ongoing process involving all levels of upbringing (Napierała, 2008).

The findings may indicate the proper direction for further actions and prove to be useful in terms of the school work of physical education teachers who can control different elements of biological development of their students in a better and more efficient way.

Purpose and thematic range of the study

Purpose:
– showing the condition of somatic development and motor skills of the boys involved in the study,
– identifying the correlations between the studied somatic parameters and motor skills considering the age of the research subjects using the Pearson correlation coefficient. The research was diagnostic and cross-sectional (transversal) in nature. The studies were conducted only once and concerned boys at different ages (ranging from 17 to 19 years) from the areas of the Kujawsko-Pomorskie voivodeship. The research concentrated on solving the above-mentioned issues as illustrated by the case of a particular area (rural and urban areas of the Kujawsko-Pomorskie voivodeship) and time horizon (the year 2015), therefore, the study did not go beyond the factual material included in the research conducted so far.

Material and methods

The representation method was used in order to determine the studied somatic parameters and motor skills of 1,147 boys at the age of 17-19 years. Schools participating in the studies were randomly picked and the research involved all boys from the selected schools.

The sampling frame met the following conditions:
– completeness; random selection included all secondary schools,
– up-to-datedness (schools were selected for the school year 2014/2015).

After choosing the schools, one section of classes was selected in each of them and subjected to the study. The study of somatic parameters (body height and weight) was conducted in accordance with the guidelines adopted in anthropology. Body height was measured by means of the measuring stations provided in medical scales which had been previously checked accurately to 0.1 cm.

The International Physical Fitness Test battery was used to assess motor skills. This test provides an overall assessment of the muscle groups of the whole body. The IPFT is not aimed at any of the basic sports disciplines. Following a proper warm-up, students dressed in a sports outfit commenced the tests. The course of the tests was in accordance with the instructions for performing IPFT battery appropriately (Pilicz, 1997).

Manifestations of motor skills are not treated in this paper as a group characterized by the psychophysical properties (capabilities) which are not included in the categories and standards adopted in physics, but as a capability of projection of various muscle groups by the fulfilment of test tasks (Mynarski, 1995).

It was assumed that motor skills were manifested as groups of psychomotor properties (capabilities) the measurement of which was the quality of performing particular motor tests that required the right work of the muscles.

Methods of statistical analysis

The correlations between the studied measurable parameters were established by estimating the Pearson linear correlation coefficient. The zero hypotheses (H_o) were formulated – assumptions that there is no significant difference between the value of the estimator and the parameter or between the empirical and theoretical distribution.

The distribution of determinants and correlates of motor development was compared and the determinants of physical and motor development included: gender, age (from 17 to 19 years) and the correlates included: motility determined by eight motor tests (IPFT), somatic parameters (body height and weight).

The correlation coefficient (the Pearson coefficient) r_{xy}always meets the condition: $-1 \leq r_{xy} \leq 1$. The correlation coefficient (the Pearson coefficient) is a symmetric measure, i.e. $r_{xy}=r_{yx}$. The coefficient mark r_{xy} tells us about the direction of the correlation: a plus sign – the positive linear correlation, i.e. as the value of one parameter grows the mean values of another parameter increase, a minus sign - the negative linear correlation, i.e. as the value of one parameter grows the mean values of another parameter decrease.

The absolute value of the correlation coefficient, that is [r_{xy}], tells us about the strength of correlation. If the absolute value [r_{xy}]: is smaller than 0.2, there is no linear correlation between the studied parameters,
0.2 – 0.4 – clear but low linear dependency,
0.4 – 0.7 – moderate linear dependency,
0.7 – 0.9 – significant linear dependency,
above 0.9 – very strong linear dependency.

The correlation dependence between parameters *x* and *y* is characterized by the fact that strictly defined mean values of one parameter are attributed to the values of one parameter. All calculations and graphics have been prepared using the program Statistica 2013.1.

Table 1. Numerical characteristics of the studied somatic parameters and motor skills of 17-year-old boys

Test	$\overline{X}$	**min**	**max**	**S**	**v**
Body height (cm)	177.45	159.00	197.00	6.62	3.73
Body weight (kg)	71.31	49.00	97.00	8.47	11.88
Standing long jump (cm)	199.67	100.00	312.00	36.00	18.03
Hand-grip dynamometer (1kg)	40.22	15.00	74.00	14.27	35.48
Sit-ups (number)	27.50	10.00	45.00	5.54	20.16
Time of bent-arm-hang (s)	5.99	0.00	21.00	3.63	60.51
Run of 50 m (s)	8.52	6.30	12.60	1.19	13.98
Run of 1000 m (s)	230.49	181.00	378.00	45.82	19.87
4x10m shuttle run ()	11.24	6.90	21.70	3.31	29.40
Sit-and-reach (cm)	9.87	-14.00	34.00	10.45	105.90

S – standard deviation, v- variability coefficient, $\overline{X}$- arithmetic mean

Table 2. Correlations between the studied somatic parameters and motor skills of 17-year-old boys

	Body height (cm)	Body weight (kg)	Standing long jump (cm)	Hand-grip dynamometer (1kg)	Sit-ups (number)	Time of bent-arm-hang (s)	Run of 50m (s)	Run of 1000m(s)	4x10m shuttle run(s)	Sit-and-reach (cm)
Body height (cm)	1.000	**0.631**	**0.264**	0.131	0.168	0.091	0.056	-0.070	-0.013	**0.221**
Body weight (kg)		1.000	**0.239**	0.063	0.134	0.019	-0.024	0.004	-0.136	0.175
Standing long jump (cm)			1.000	**0.481**	**0.393**	-0.040	**0.215**	-0.063	**0.292**	-0.010
Hand-grip dynamometer (kg)				1.000	**0.233**	0.002	**0.357**	-0.180	**0.351**	-0.030
Sit-ups (number)					1.000	0.007	0.042	-0.095	0.073	**0.262**
Time of bent-arm-hang (s)						1.000	-0.049	-0.086	-0.042	0.093
Run of 50m (s)							1.000	0.025	**-0.256**	0.078
Run of 1000m (s)								1.000	0.030	0.174
4x10m shuttle run (s)									1.000	0.196
Sit-and-reach (cm)										1.000

The analysis of the correlations between the studied somatic parameters and motor skills of boys aged 17 suggested that clear but low positive dependency occurred between body height and standing long jump as well as sit-and-reach.

Likewise, clear positive dependency was observed between body weight and standing long jump. No linear correlation was revealed between other somatic parameters and motor skills. The figures of dependencies between the studied motor skills have been shown in Table 2. Graphic dependencies of motor skills on somatic parameters in 17-year-old boys have been displayed in Figures 1-3.

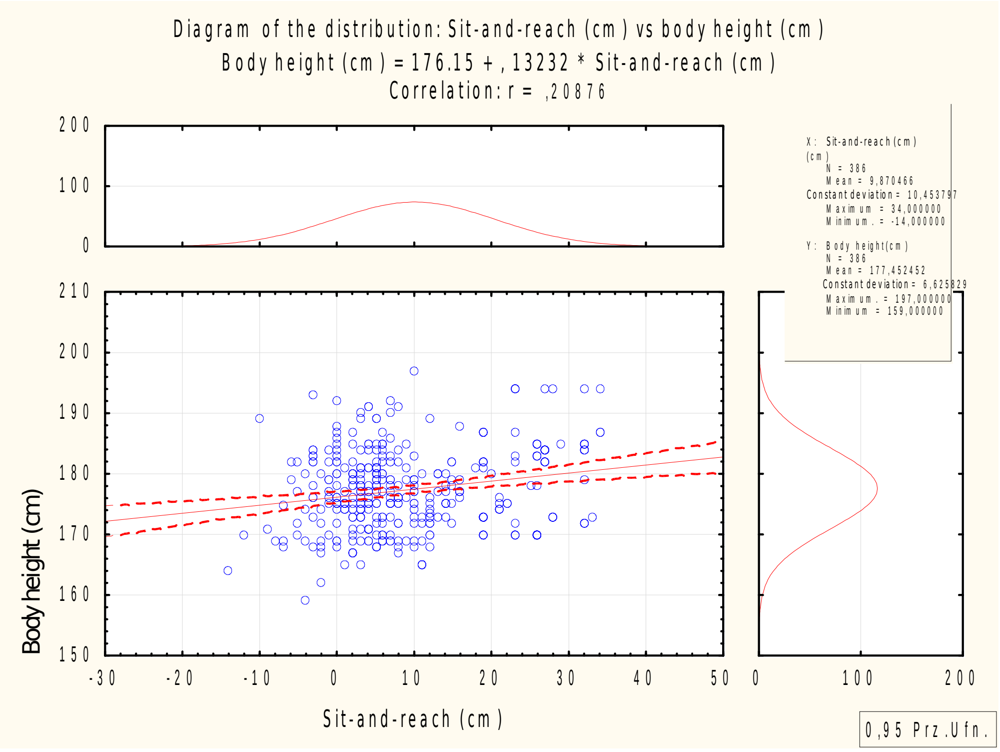

Fig. 1. Graphical presentation of correlations between body height and sit-and-reach of 17-year-old boys

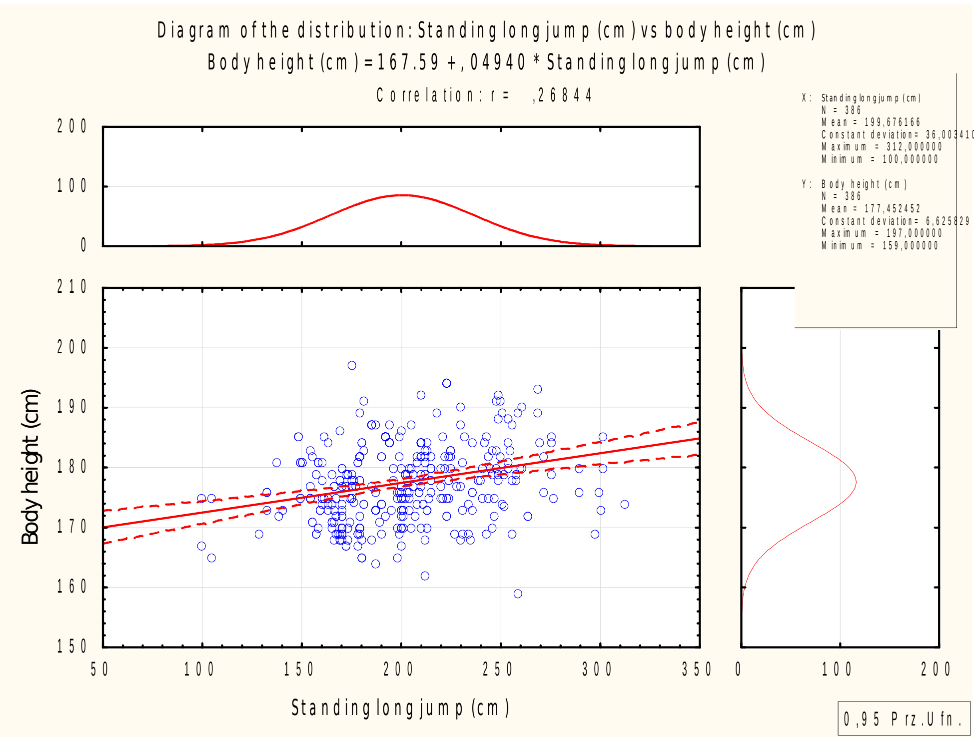

Fig. 2. Graphical presentation of correlations between body height and standing long jump of 17-year-old boys

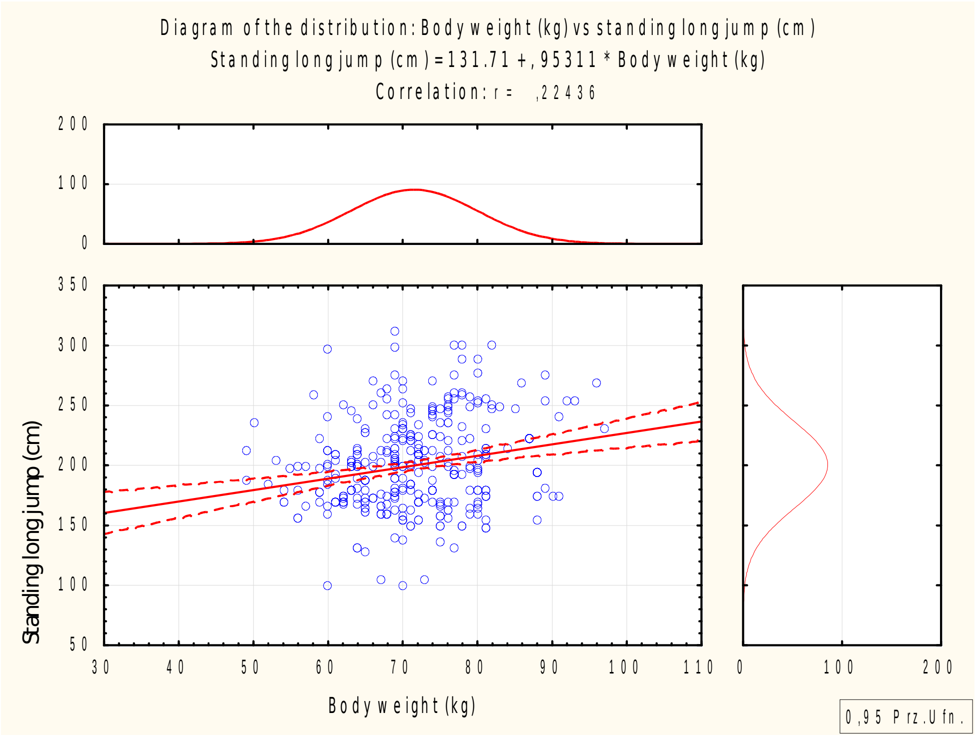

Fig. 3. Graphical presentation of correlations between body weight and standing long jump of 17-year-old boys

Table 3. Numerical characteristics of the studied somatic parameters and motor skills of 18-year-old boys

Test	$\overline{X}$	min	max	S	v
Body height (cm)	178.47	163.00	200.00	6.14	3.44
Body weight (kg)	71.00	51.00	102.00	8.04	11.33
Standing long jump (cm)	202.33	130.00	303.00	29.62	14.64
Hand-grip dynamometer (1kg)	42.50	15.00	72.00	12.12	28.52
Sit-ups (number)	25.42	7.00	46.00	6.20	24.38
Time of bent-arm-hang (s)	6.08	0.00	20.00	4.22	69.39
Run of 50m (s)	8.19	6.40	12.50	1.13	13.84
Run of 1000m (s)	224.92	156.00	378.00	32.13	14.28
4x10m shuttle run ()	11.07	7.00	20.45	3.58	32.37
Sit-and-reach (cm)	9.87	-22.00	34.00	12.13	122.85

S – standard deviation, v- variability coefficient, $\overline{X}$- arithmetic mean

Table 4. Correlations between the studied somatic parameters and motor skills of 18-year-old boys

	Body height (cm)	Body weight (kg)	Standing long jump (cm)	Hand-grip dynamometer (1kG)	Sit-ups (number)	Time of bent-arm-hang (s)	Run of 50m (s)	Run of 1000m (s)	4x10m shuttle run (s)	Sit-and-reach (cm)
Body height (cm)	1,000	**0,574**	**0,280**	-0,054	**0,237**	0,028	-0,116	-0,022	**-0,346**	**0,316**
Body weight (kg)		1,000	0,149	-0,149	0,114	-0,002	-0,052	-0,131	**-0,265**	0,156
Standing long jump (cm)			1,000	**0,290**	**0,286**	0,073	**0,219**	-0,037	0,140	**0,203**
Hand-grip dynamometer (kg)				1,000	0,124	0,064	**0,430**	-0,049	**0,363**	-0,012
Sit-ups (number)					1,000	0,077	0,016	0,137	-0,042	**0,361**
Time of bent-arm-hang (s)						1,000	0,040	0,121	-0,026	0,004
Run of 50m (s)							1,000	0,101	**-0,380**	**0,239**
Run of 1000m (s)								1,000	0,063	-0,149
4x10m shuttle run (s)									1,000	**0,286**
Sit-and-reach (cm)										1,000

Table 4 shows correlations between the studied somatic parameters and motor skills of 18-year-old boys. It can be emphasised that clear but low positive dependence appeared between body height and standing long jump, sit-ups and sit-and-reach. A similar but negative correlation was observed between body height and weight and the 4 x 10m shuttle run.

No linear correlation was noticed between the remaining somatic parameters and motor skills. The correlations marked in Table 4 occurred between the considered motor skills. Graphical dependencies of motor skills on somatic parameters of 18-year-old boys have been shown in Figures 4-8.

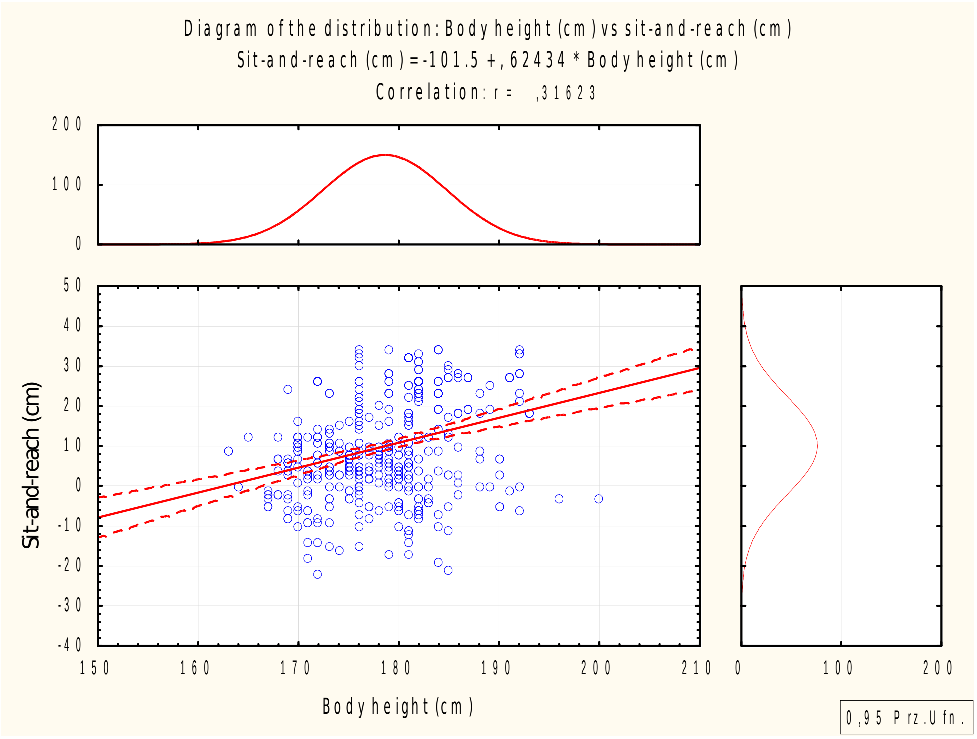

Fig. 4. Graphical presentation of correlations between body height and sit-and-reach of 18-year-old boys.

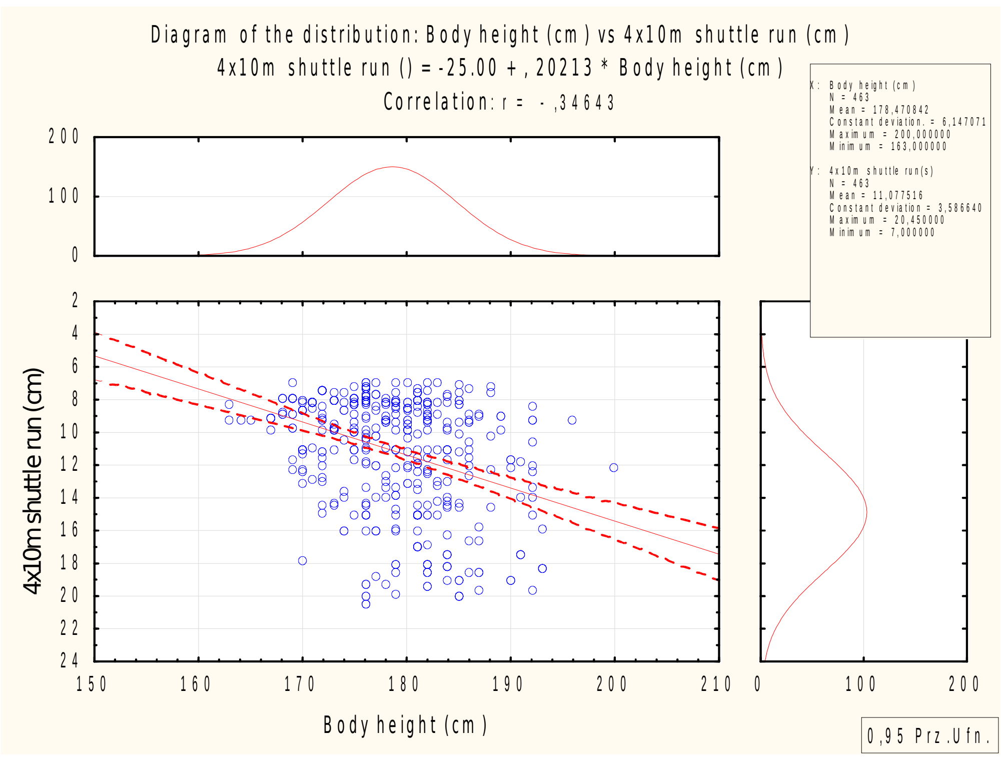

Fig. 5. Graphical presentation of correlations between body height and 4 x 10m shuttle run of 18-year-old boys

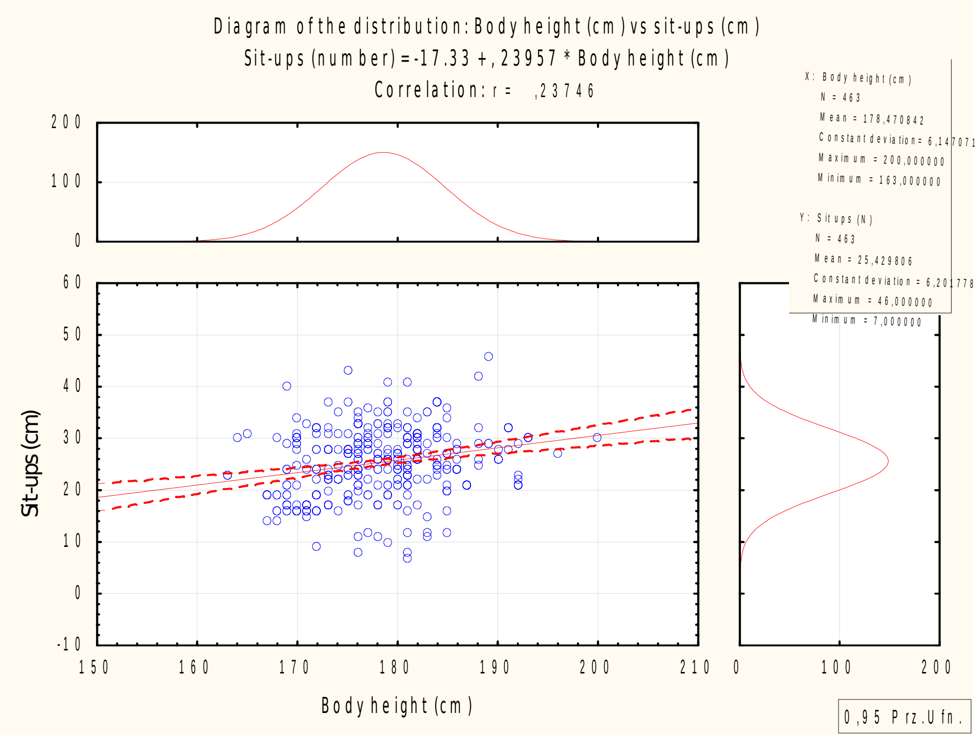

Fig. 6. Graphical presentation of correlations between body height and sit-ups of 18-year-old boys

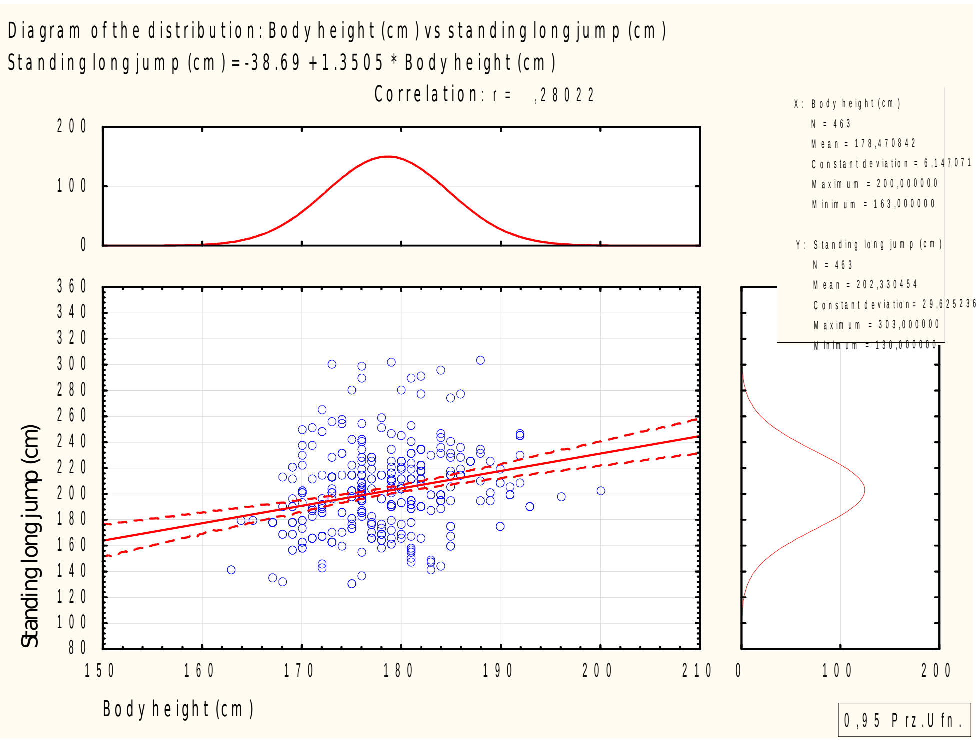

Fig. 7. Graphical presentation of correlations between body height and standing long jump of 18-year-old boys

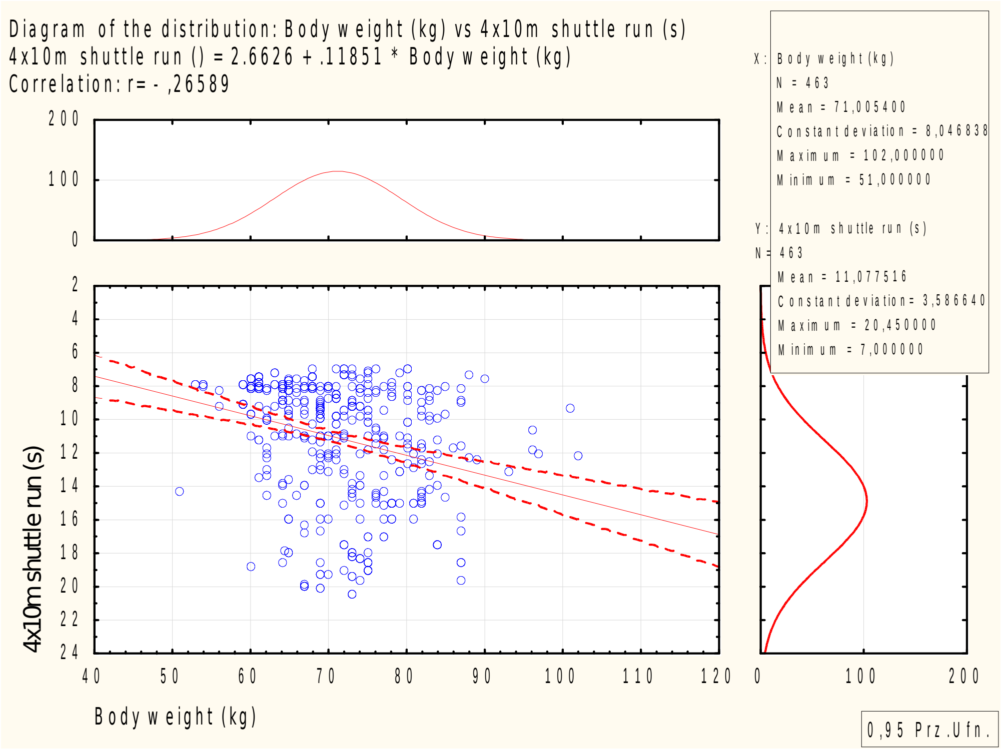

Fig. 8. Graphical presentation of correlations between body weight and 4 x 10m shuttle run of 18-year-old boys

Table 5. Numerical characteristics of the studied somatic parameters and motor skills of 19-year-old boys

Test	$\overline{X}$	min	max	S	v
Body height (cm)	178.43	165.00	196.00	5.74	3.22
Body weight (kg)	72.75	57.00	120.00	7.19	9.89
Standing long jump (cm)	203.58	145.00	306.00	34.19	16.79
Hand-grip dynamometer (1kg)	48.90	15.00	77.00	15.28	31.25
Sit-ups (number)	28.38	14.00	41.00	4.75	16.75
Time of bent-arm-hang (s)	6.44	0.00	26.00	5.66	87.93
Run of 50m (s)	7.78	6.10	11.50	1.21	15.64
Run of 1000m (s)	222.10	181.00	387.00	31.35	14.11
4x10m shuttle run ()	9.83	7.10	19.70	2.31	23.55
Sit-and-reach (cm)	6.74	-15.00	34.00	8.70	129.19

Table 6. Correlations between the studied somatic parameters and motor skills of 19-year-old boys

	Body height (cm)	Body weight (kg)	Standing long jump (cm)	Hand-grip dynamometer (1kg)	Sit-ups (number)	Time of bent-arm-hang (s)	Run of 50m (s)	Run of 1000m (s)	4x10m shuttle run (s)	Sit-and-reach (cm)
Body height (cm)	1.000	**0.675**	**0.332**	**0.256**	0.025	0.022	**0.331**	-0.021	0.179	0.023
Body weight (kg)		1.000	**0.227**	0.105	-0.013	-0.053	**0.299**	**-0.206**	0.058	0.183
Standing long jump (cm)			1.000	**0.343**	0.123	-0.048	**0.359**	-0.044	**0.361**	0.016
Hand-grip dynamometer (kg)				1.000	0.063	-0.005	0.063	0.052	**0.264**	0.025
Sit-ups (number)					1.000	-0.022	0.022	-0.085	0.023	0.154
Time of bent-arm-hang (s)						1.000	0.018	0.062	-0.069	0.021
Run of 50m (s)							1.000	-0.115	**-0.337**	0.116
Run of 1000m (s)								1.000	-0.096	**0.292**
4x10m shuttle run (s)									1.000	0.118
Sit-and-reach (cm)										1.000

Table 6 displays correlations between the studied somatic parameters and motor skills of 19-year-old boys. It is noted that clear but low positive dependence appeared between body height and standing long jump, hand-grip dynamometer and a run of 50m.

Similarly, clear but low positive dependency was observed between body weight and standing long jump as well as a run of 1000m. No linear correlation was noticed between other somatic parameters and motor skills.

The remaining correlations have been presented in Table 6. Graphical dependencies of motor skills on somatic parameters of 19-year-old boys have been shown in Figures 9-14.

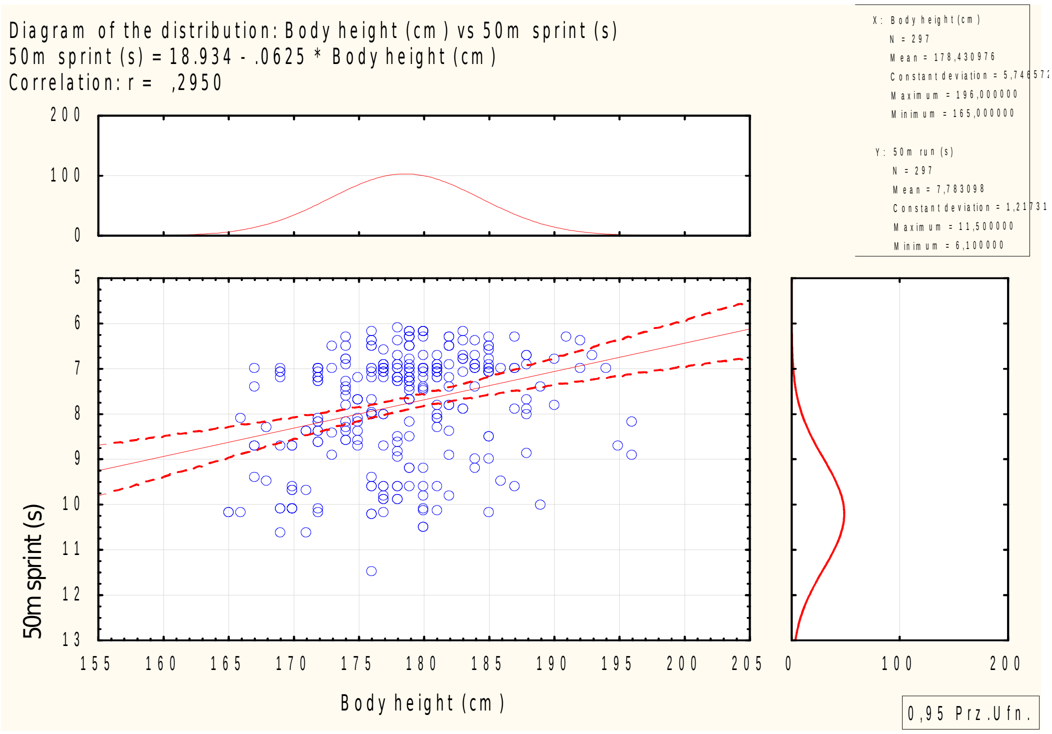

Fig. 9. Graphical presentation of correlations between body height and a run of 50m of 19-year-old boys

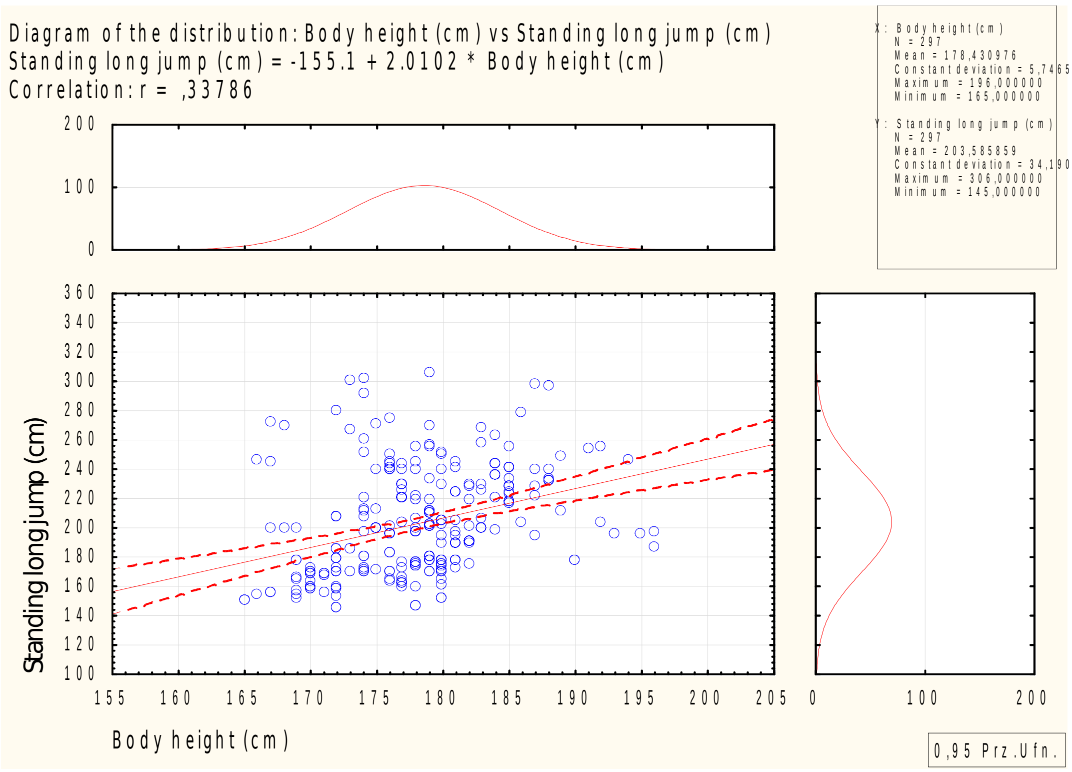

Fig. 10. Graphical presentation of correlations between body height and standing long jump of 19-year-old boys

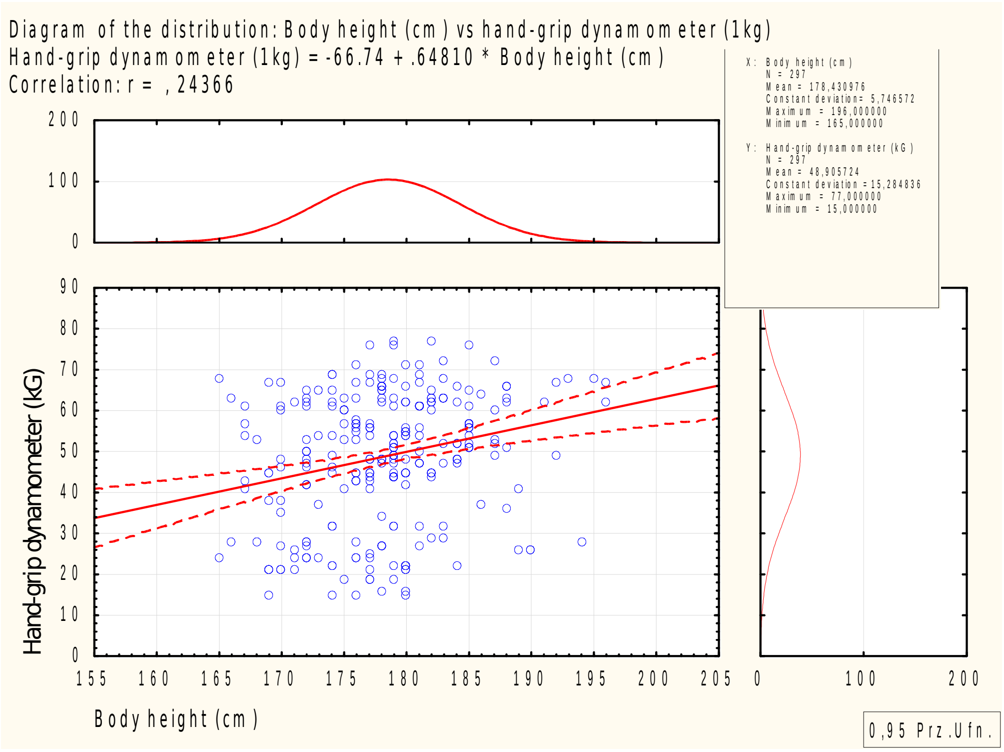

Fig. 11. Graphical presentation of correlations between body height and hand-grip dynamometer of 19-year-old boys

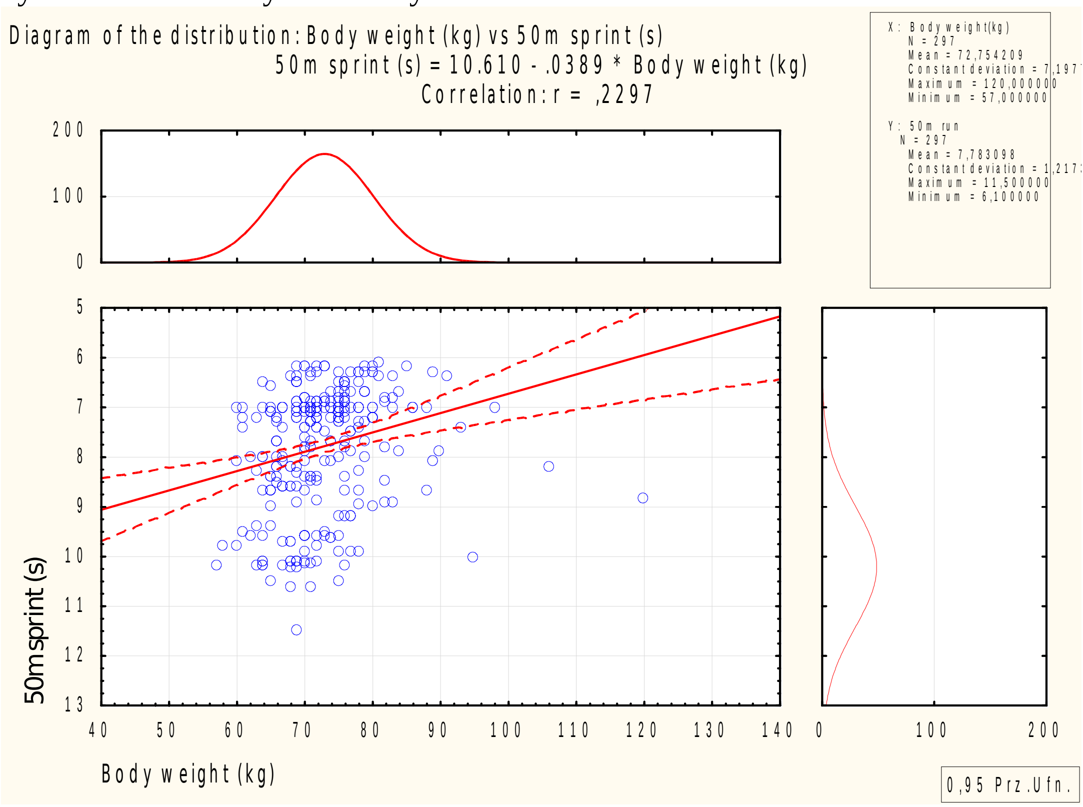

Fig. 12. Graphical presentation of correlations between body weight and a run of 50m of 19-year-old boys

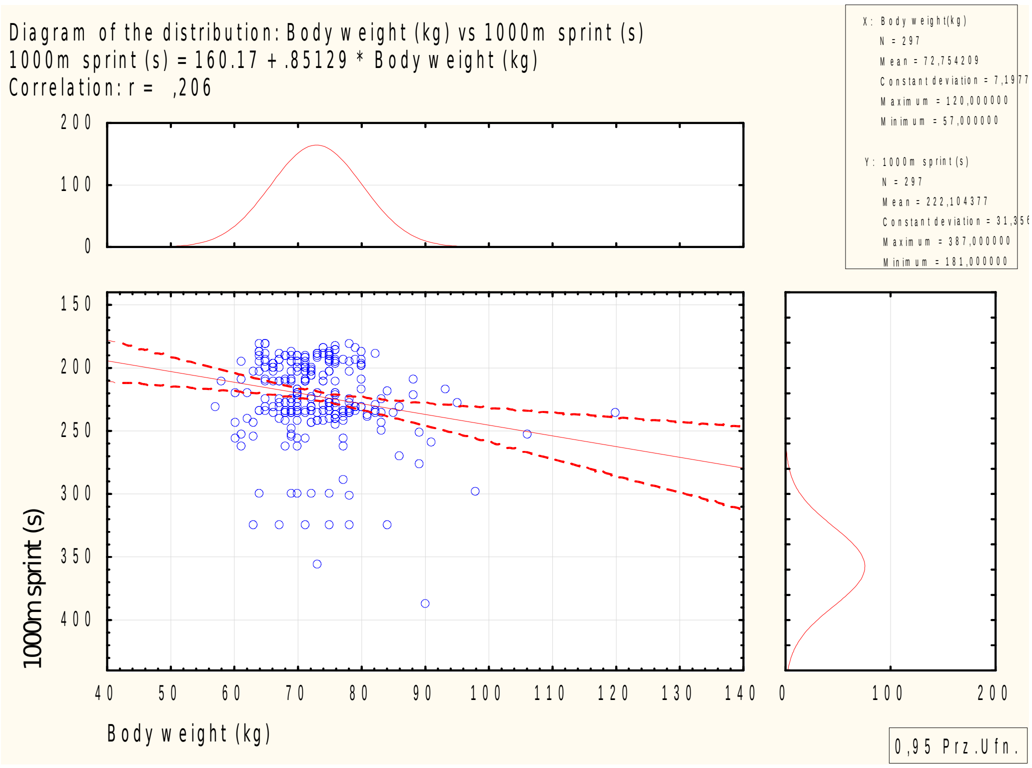

Fig. 13. Graphical presentation of correlations between body weight and a run of 1000m of 19-year-old boys

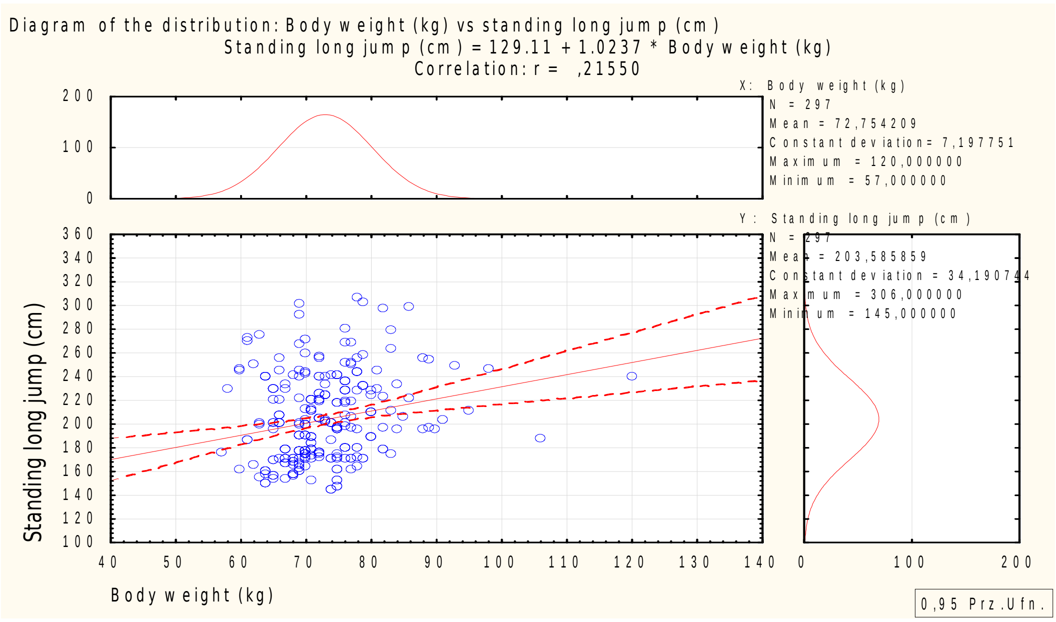

Fig. 14. Graphical presentation of correlations between body weight and standing long jump of 19-year-old boys

Discourse

Reference literature publications concerning somatic features and motor skills mention the impact of basic somatic parameters (body height and weight) on achieving results in motor tests.

Development of human motility at all stages of ontogenesis is the resultant of evolution that our species has undergone and broadly understood environmental, mainly civilisation factors (Szopa 1992). This development depends on endogenic factors, e.g. somatic development, growth of the nervous system, biochemical and physiological changes as well as on exogenic changes such as lifestyle, response to stimuli, intellectual level. Wolański claims that development of the locomotor system and movement habits are the basis of motor activity. He has differentiated five key physical aspects of motor activity: strength, speed, agility, endurance and performance (Wolański, 2005).

Most scientists have been looking for straight-line relationships between somatic parameters and motor skills. The issue of dependence of the somatic structure and motor skills remains unsolved and as far as sport is concerned, this information may be used for estimating the sport result.

Osiński (1988) points out that motor skills (except for static absolute force) reveal multidirectional but always curvilinear correlations with somatic parameters. These are various relationships and should be analysed individually for particular skills (relating to speed, endurance or coordination). Szopa (1992) thinks that slightly lower or similar-to-mean values of body weight and fat matter are the most favourable somatic parameters influencing the achievement of better results in speed, endurance partially coordination tests.

Better results in tests of motor skills are achieved by individuals with slender body type. Results get worse as the somatic parameters more deviate from optimal values (to both directions) and fat matter has the most negative effect impact on motor ability (Osiński, 1988; Szopa, 1992). The issue of morphological conditions of motor properties is the subject of many scientific investigations especially in sports environments.

R. Asienkiewicz and A. Wandycz (2014) examined 161 students at the age of 12 residing in two different environments in terms of urbanization (small towns and villages) located in the county of Nowa Sól, the Lubuskie voivodeship. In accordance with the rules of anthropometry, the measurements of body weight and height were conducted and motor skills were characterized using selected samples included in the L. Denisiuk test and the International Physical Fitness Test. Significantly stronger correlations between test results of motor skills and physique parameters were reported in the group of girls from cities in comparison with their counterparts from rural areas. With regard to boys, a reversed situation was observed because stronger interdependence of the selected samples within motor skills and somatic parameters was noticed in the rural groups of subjects.

An increase in morphological values, in turn, was positively reflected in the medicine ball throw test (strength of arms). Also, among university students, statistical analysis revealed a significant correlation of achieved results of performance tests with the values of somatic parameters and key body components. The subjects (the year 1997) included 116 students who were starting education in pedagogical faculties at the College of Pedagogics in Zielona Góra (Asienkiewicz, 2003).

Relations between morphological parameters and physical fitness in 11-13-year-old boys were reported by I. Kordel. Body height and weight were measured and the level of physical fitness of boys was assessed within the scope of the strength of arms and flexibility test. The study was conducted among 185 boys in primary schools from Zielona Góra in the school year 2005/2006. Statistical analysis revealed significant dependency of performance tests and the level of somatic parameters development (Kordel, 2009).

All studies of the youth have shown some correlations between somatic parameters (body weight and height) and motor skills. This can be observed in numerous scientific papers regardless of the age and residential environment.

Conclusions

When analysing the correlations between the studied somatic parameters and motor skills of 17-year-old boys it can be concluded that clear but low positive dependency occurred between body height and standing long jump and sit-and-reach.

Likewise, clear positive dependency was observed between body weight and standing long jump. No linear relationship was reported between the remaining somatic parameters and motor skills.

When studying the correlations between the studied somatic parameters and motor skills of 18-year-old boys it can be noted that clear but low positive dependency occurred between body height and standing long jump, sit-ups and sit-and-reach test. A similar but negative correlation was observed between body height and weight and the 4x10m shuttle run.

Some correlations were also reported between the studies somatic parameters and motor skills of 19-year-old boys. A clear but low positive dependency occurred between body height and standing long jump, hand-grip dynamometer and 50m sprint.

A clear but low positive dependency was observed between body weight and standing long jump and 50m sprint. A negative dependency was reported between body weight and 1000m sprint.

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