RELATIONSHIP BETWEEN CHARACTERISTICS OF MORPHOFUNCTIONAL DEVELOPMENT IN CHILDREN AGED 7–10

ZWIĄZEK CECH ROZWOJU FIZYCZNEGO I MOTORYCZNEGO DZIECI W WIEKU 7–10 LAT

Ewa Zięba[1], Grażyna Nowak-Starz[2]

[1] Department of Obstetrics, Gynaecology and Obstetrics-Gynaecological Nursing, Institute of Nursing and Obstetrics
 The Faculty of Health Sciences of Jan Kochanowski University of Humanities and Sciences in Kielce, Poland
 Manager of Department: Prof. Włodzimierz Baranowski, MD, PhD
[2] Department of Developmental Age Research, Institute of Public Health
 The Faculty of Health Sciences of Jan Kochanowski University of Humanities and Sciences in Kielce, Poland
 Manager of Department: Prof. Włodzimierz Baranowski, MD, PhD

SUMMARY

Introduction. Development of humans is a result of continuous influence of an invariable factor – genotype and an incredibly quickly variable factor, comprising a great number of components, i.e. the environment. Early school period is characterised by a peculiar distinction in raising and education, as this is the period when a child is on his or her way from childhood to the outset of adolescence. A level of morphofunctional development reached by a child affects his or her success in further education and life. The purpose of the research presented in this paper was to determine relationship between characteristics of an individual and the level of morphofunctional development in pupils aged 7–10.
Materials and methods. The research was carried out in a primary school in the Świętokrzyskie Province. In total, 149 pupils were examined, including 79 boys and 70 girls. The following characteristics were measured: height /B-v/, chest diameter at the xiphoidale level / xi/, body weight. For all examined characteristics, essential statistic characteristics were computed: $\bar{x}$, s/ allowing for genders of examined subjects. Intergroup differences were standardized on the standard deviation of the whole examined population; Student test t^0 or Cochran-Cox test C^0 was applied, depending on the significance of vibration differences. The significance of vibration differences was verified with the use of Snedecor's F test.
Research results. The research subject was a phenomenon of ontogenetic development, including an assessment of the level of physical development in the aspect of pupils' functioning. Characteristics such as the level of morphofunctional development are strongly related to socioeconomic conditions. Prior to comparing specific areas of pupils' development, examined subjects' development conditions were determined.
Discussion. It is evident from the analysis that pupils' socioeconomic conditions are similar and do not statistically differ from those referenced in literature. The group of children aged 7–10 included in the research departs from developmental standards for children at this age. Body height of examined boys is lower by 1.09 cm and body height of examined girls is lower by 0.30 cm than the ones provided in the standard. Significant differences were determined in the examined subjects' body weights. It is worth mentioning that 59.4 % boys and 73.6 % girls had their body weights lower than standard weights. Furthermore, differences in chest diameter were determined for the two genders. An arithmetic mean of measurements was higher by 0.79 cm (boys) and by 1.72 cm (girls) than standard values. Among the examined locomotor features, the most significant differences were determined in strength, and the least significant differences in suppleness. In the light of selected tests, examined boys and girls' fitness is average. The research undertaken suggests that there is a relationship between morphological and functional characteristics. A child in the process of development should be dealt with in the most comprehensive possible way to reflect the great number of factors that affect physical and locomotor development. Children's development depends on social background, parents' education, a number of children in a family and the extent of characteristics physical development (body height and weight) socioeconomic factors (prosperity and pay), ect.
Conclusions of the research are of great importance in practical terms, as they do not only reveal lower development indexes in a great share of examined subjects, but also a rather clear differentiation of the indexes. Conclusions are of importance not only for physical education teachers who are supposed, taking advantage of curricular requirements, to promote the development of substandard characteristics, but also for other teachers. Conclusions obtained in own research bear out the necessity of simultaneous examination of a number of conditions of children's' development.

Key words: phisical development, morphofunctional development, ontogenetic, physical activity.

STRESZCZENIE

Wstęp. Rozwój człowieka jest wynikiem ciągłego oddziaływania czynnika stałego – genotypu oraz czynnika niezwykle szybko się zmieniającego, o olbrzymiej ilości komponentów otaczającego go środowiska. Okres wczesnoszkolny charakteryzuje się swoistą odrębnością w wychowaniu i nauczaniu, gdyż dziecko przebywa ważną drogę rozwoju od dzieciństwa po początek dorastania. Od tego jaki poziom rozwoju fizycznego i motorycznego osiągnie, zależeć będzie jego sukces w następnych latach nauki i powodzenie nie tylko w szkole, ale także w życiu.

Celem prezentowanych badań było ustalenie związków między cechami jednostki, a poziomem rozwoju fizycznego, motorycznego uczniów w wieku 7–10 lat.

Materiał i metody. Badania przeprowadzono w szkole podstawowej województwa świętokrzyskiego. Ogółem przebadano 149 uczniów, w tym 79 chłopców i 70 dziewcząt. Pomiarami objęto następujące cechy: wysokość ciała /B-v/, obwód klatki piersiowej na wysokości xiphoidale /xi/, masę ciała. Dla wszystkich badanych cech wyliczono podstawowe charakterystyki statystyczne: $\overline{x}$, s/ z uwzględnieniem płci badanych. Różnice międzygrupowe normowane na odchylenie standardowe całej badanej populacji; zastosowano test Studenta t^0 lub C^0 t Cochrana-Coxa w zależności od istotności różnic wibracji, które sprawdzono testem F Snedecora.

Wyniki. Zjawisko rozwoju ontogenetycznego, w tym ocena poziomu sfery fizycznej w aspekcie funkcjonowania uczniów, były przedmiotem przedstawionych badań. Cechy takie jak: poziom rozwoju fizycznego i motorycznego są silnie związane z warunkami socjoekonomicznymi. Przed dokonaniem porównań określonych sfer rozwoju uczniów określono warunki, w jakich rozwijali się badani.

Omówienie. Z analizy wynika, że warunki socjoekonomiczne uczniów są podobne i nie różnią się statystycznie od tych, które podaje literatura. Badana grupa dzieci w wieku 7–10 lat odbiega od norm rozwojowych przewidzianych dla dzieci w tym wieku. Wysokość ciała u badanych chłopców jest mniejsza o 1,09 cm od przewidywanej normy, a dziewcząt o 0,30 cm. Znaczną różnicę stwierdzono u badanych w masie ciała. Zwraca uwagę fakt, że 59,4% chłopców i 73,6% dziewcząt osiągnęło wyniki masy ciała będące poniżej normy. Stwierdzono ponadto różnice dotyczące obwodu klatki piersiowej, które odnotowano w przypadku obydwu płci. Średnia arytmetyczna pomiaru z badań u chłopców była większa o 0,79 cm od przewidywanej normy, u dziewcząt zaś o 1,72 cm. Spośród badanych cech motorycznych największe różnice zaobserwowano w mocy, a najmniejsze w gibkości. Ogólna sprawność fizyczna w świetle wybranych testów wskazuje na sprawność badanych chłopców i dziewcząt na poziomie średnim. Przeprowadzone badania sugerują istnienie powiązań między cechami morfologicznymi i funkcjonalnymi. Dziecko w procesie wychowania należy ujmować w sposób możliwie najbardziej wszechstronny, tak jak wszechstronnie uwarunkowany jest rozwój fizyczny i motoryczny. Rozwój dzieci jest uzależniony od pochodzenia społecznego, wykształcenia rodziców, liczby dzieci w rodzinie, poziomu cech charakteryzujących rozwój fizyczny (wysokość i masa ciała), oraz od czynników społeczno-ekonomicznych (poziomu zamożności, wysokości zarobków) itp. Wnioski wyprowadzone z badań mają duże znaczenie praktyczne, ukazują nie tylko niższe wskaźniki rozwoju u znacznego odsetka badanych, ale również dość wyraźnie zróżnicowanie tych wskaźników.

Wnioski są ważne nie tylko dla nauczycieli wychowania fizycznego, którzy winni, wykorzystując wymagania programowe, intensyfikować rozwój cech będących poniżej normy, ale również dla nauczycieli innych specjalności. Wnioski otrzymane z badań własnych potwierdzają konieczność równoczesnego badania wielu uwarunkowań rozwoju dzieci.

Słowa kluczowe: rozwój fizyczny, rozwój motoryczny, ontogreneza sprawność fizyczna.

INTRODUCTION

The notion of development is used in a number of scientific areas, including medicine, biology, physics, economics, physiology, anthropology, auxology, pedagogy and psychology, as well as in philosophy at the highest level of generalisation. Each of them defines development in a slightly different way. Auxology, similarly to other life sciences, refers to ontogenetic development (ontogenesis), that is a process of transformation of an organism from the moment of fertilisation of an egg cell by a sperm cell to an individual's death [1].

The course and level of ontogenetic development are results of genetic and environmental factors. A genotype, i.e. a gene pool passed on from parents to children, directly and invariably determines only some biological features called qualitative features, like eye colour or blood group. Most features, in turn, are quantitative features - height, body weight, erythrocyte count, intelligence, that are results of congenital (endogenous) and environmental (exogenous) factors [1, 2].

Hereditary and environmental factors underlie all the processes in the ontogenetic development of a human. A genetic excipient of the locomotor development is made up by a group of phenomena that determine the quality and rate of the morphological and physiological development. Hereditary properties that directly affect children's locomotor development include locomotor abilities. They originate as a total of properties with neuromuscular coordination being the principal one. Another congenital factor that affects the locomotor development is the somatic structure, i.e. body build type, sense modality, temper.

Early sitting, standing and walking enriches children's locomotor experiences, improves coordination and early shapes locomotor habits. More rapid children's locomotor development allows them to make social contacts easier, participate in motion-based plays, and at school age, to take part in sports tournaments and further develop their fitness. One must admit that more rapid physical fitness is a positive phenomenon in terms of children's general development, and, as a consequence, their mental and social development as well [3].

Children with a great congenital mobility usually become mature in terms of locomotor development earlier than their less mobile peers. Physical fitness and physical endurance are to a great extent connected with body built, height and body mass of an individual. Despite hereditary predispositions to physical fitness which are usually genetically determined, there are numerous environmental factors affecting its level.

Children growing and raised in different social environments differ substantially. In optimal environmental conditions, an organism can reach its max-

imum. In extremely bad conditions, when humans are subject to excessive physical strain or malnutrition, periodic arrest or delay of development may occur. Most significant environmental factors include home and child-raising circumstances, level of parents' awareness in respect of needs of a growing organism. This is related to parent's education. Other factors related to domestic environment include an ability to recognise and develop a child's talents, attention paid to general life hygiene and health, rational nutrition and keeping the right balance between work and relaxation.

Studies of population prove that children of white collar origin, living in urban areas, having parents educated at a university level are characterised by the highest general physical fitness.

Rural children are no match to children of white collar origin in respect of general physical fitness. Children of blue collar origin are in turn somewhere in between. Children of white collar origin are generally of the rapidity-and-agility type, whereas children of blue collar origin of the endurance-and-force type [4].

Early school age is a particularly important period in a child's life marked with intensive transformations in terms of physical and mental characteristics. The principal aspect of a child's locomotor activity is its mobility, so called hunger for movement, as well as sensitivity to environmental stimuli, which makes it difficult for a child to concentrate on a one activity at a time [4].

AIM OF CONTRIBUTION

Development of humans is a result of continuous influence of an invariable factor – genotype and an incredibly quickly variable factor, comprising a great number of components, i.e. the environment. Early school period is characterised by a peculiar distinction in raising and education, as this is the period when a child is on his or her way from childhood to the outset of adolescence. A level of morphofunctional development reached by a child affects his or her success in further education and life. The purpose of the research presented in this paper was to determine relationship between characteristics of an individual and the level of morphofunctional development in pupils aged 7–10.

MATERIAL AND METHOD

The research was carried out in a primary school in the Świętokrzyskie Province. In total, 149 pu-

pils were examined, including 79 boys and 70 girls. The following characteristics were measured: height /B-v/, chest diameter at the xiphoidale level /xi/, body weight. For all examined characteristics, essential statistic characteristics were computed: /$\bar{x}$, s/ allowing for genders of examined subjects. Intergroup differences were standardized on the standard deviation of the whole examined population. Student test t^0 or Cochran-Cox test C^0 was applied, depending on the significance of vibration differences. The significance of vibration differences was verified with the use of Snedecor's F test (table 1–5).

Table 1. Height, body mass and chest measurement examined girls

Examined feature	$\bar{x}$	E $\bar{x}$	s	v
body height	137.48	1.19	6.98	5.08%
body mass	29.77	0.95	5.55	18.60%
chest cireumference	64.62	1.09	8.37	9.85%

Table 2. Height, body mass and chest measurement examined boys

Examined feature	$\bar{x}$	E $\bar{x}$	s	v
body height	138.09	0.80	4.53	3.28%
body mass	31.48	0.69	3.95	12.55%
chest cireumference	66.90	0.60	3.44	5.19%

Table 3. Body mass (in kg) of exsamined boys and girls against a background of standard

Body mass	Boys		Girls	
	$\bar{x}$	s	$\bar{x}$	s
standard	33.00	5.60	32.50	7.00
oron findings	31.48	3.95	29.78	5.55

Table 4. Chest measurement (in cm) of exsamined boys and girls against a background of standard

Body mass	Boys		Girls	
	$\bar{x}$	s	$\bar{x}$	s
standard	65.40	4.70	62.90	5.70
oron findings	66.19	3.44	64.62	6.37

Table 5. Body height (in cm) of exsamined boys and girls against a background of standard

Body mass	Boys		Girls	
	$\bar{x}$	s	$\bar{x}$	s
standard	139.00	6.60	137.70	6.70
oron findings	138.09	4.53	137.50	6.98

DISCUSSION

The research subject was a phenomenon of onto-genetic development, including an assessment of the level of physical development in the aspect of pupils' functioning. Characteristics such as the level of mor-phofunctional development are strongly related to socioeconomic conditions. Prior to comparing specific areas of pupils' development, examined subjects' development conditions were determined. It is evident from the analysis that pupils' socioeconomic conditions are similar and do not statistically differ from those referenced in literature. The group of children aged 7–10 included in the research departs from developmental standards for children at this age. Body height of examined boys is lower by 1.09 cm and body height of examined girls is lower by 0.30 cm than the ones provided in the standard. Significant differences were determined in the examined subjects' body weights. It is worth mentioning that 59.4% boys and 73.6% girls had their body weights lower than standard weights (tab. 6).

Table 6. Findings of body mass against a background of standard

Range of standard	Numbers of boys		Numbers of girls	
	n	%	n	%
above standard	10	31.3	9	26.4
standard	3	9.4	-	-
below standard	19	59.4	25	73.6
altogether	32	100.1	34	100.0

Furthermore, differences in chest diameter were determined for the two genders. An arithmetic mean of measurements was higher by 0.79 cm (boys) and by 1.72 cm (girls) than standard values. Among the examined locomotor features, the most significant differences were determined in strength, and the least significant differences in suppleness. In the light of selected tests, examined boys and girls' fitness is average. The research undertaken suggests that there is a relationship between morphological and functional characteristics. A child in the process of development should be dealt with in the most comprehensive possible way to reflect the great number of factors that affect physical and locomotor development. Children's development depends on social background, parents' education, a number of children in a family and the extent of characteristics physical development (body height and weight) socioeconomic factors (prosperity and pay) ect. Conclusions of the research are of great importance in practical terms, as they do not only reveal lower development indexes in a great share of

examined subjects, but also a rather clear differen-tiation of the indexes. Conclusions are of importance not only for physical education teachers who are supposed, taking advantage of curricular requirements, to promote the development of substandard characteris-tics, but also for other teachers. Conclusions obtained in own research bear out the necessity of simultaneous examination of a number of conditions of children's' development (table 7–16, figure 1–6).

Tale 7. Findings of chest measurement mass against a background of standard

Range of standard	Numbers of boys		Numbers of girls	
	n	%	n	%
above standard	19	59.5	19	55.7
standard	1	3.1	2	5.9
below standard	12	37.4	13	38.3
altogether	32	100.0	34	100.0

Table 8. Findings of body height against a background of standard

Range of standard	Numbers of boys		Numbers of girls	
	n	%	n	%
above standard	12	37.6	15	44.1
standard	3	9.4	4	11.8
below standard	17	53.2	15	44.1
altogether	32	100.2	34	100.0

Table 9. Numerical characteristic of physical proficiency estimated by International Test of Physical Proficiency examined girl (score)

Examined feature	$\bar{x} \pm E$	s	v	Emin-Emax
50 dash	45.652 ± 1.298	10.546	32.100	17.600–76.000
standing long jump	44.121 ± 1.331	10.812	23.137	16.000–76.000
shuttle lun	69.818 ± 1.043	8.474	12.137	51.000–99.000
bend trunk	40.924 ± 1.798	14.534	35.514	0.000–67.000

Table 10. Numerical characteristic of physical proficiency estimated by International Test of Physical Proficiency examined boys (score)

Examined feature	$\bar{x} \pm E$	s	v	Emin-Emax
50 dash	45.652 ± 1.298	10.546	24.725	17.000–61.000
standing long jump	45.121 ± 1.331	10.812	23.962	16.000–76.000
shuttle lun	69.818 ± 1.043	8.474	12.137	51.000–99.000
bend trunk	40.924 ± 1.798	14.534	35.514	0.000–67.000

Table 11. Numerical characteristic of physical proficiency estimated by International Test of Physical Proficiency examined girls (severe findings)

Examined feature	$\bar{x} \pm E$	s	v	Emin-Emax
50 dash	9.926 ± 0.175	1.023	10.310	8.600–12,000
standing long jump	142.934 ± 2.823	22.933	16.105	55.000–197.000
shuttle lun	11.262 ± 0.177	0.995	8.835	9.000–13.800
bend trunk	0.015 ± 0.927	7.533	5.022	-17.000–43.000

Table 12. Numerical characteristic of physical proficiency estimated by International Test of Physical Proficiency examined boys (severe findings)

Examined feature	$\bar{x} \pm E$	s	v	Emin-Emax
50 dash	9.788 ± 0.164	0.930	9.501	8.200–11.900
standing long jump	10.700 ± 2.823	22.933	16.105	55.000–197.000
shuttle lun	10.700 ± 0.141	0.798	7.457	9.600–12.800
bend trunk	0.015 ± 0.927	7.533	5.022	-17.000+43.000

Table 13. Points result of quickness examined boys and girls against a background of physical proficiency

Estimated range of level proficiency	score	boys		girls		altogether	
		n	%	n	%	n	%
high efficiency	above 60	2	1.5	-	-	2	1.5
average efficiency	40 ÷ 59	48	36.3	52	39.4	100	75.8
low efficiency	below 40	14	10.6	16	12.1	30	22.7
altogether		64	48.5	68	51.5	132	100.0

Table 14. Points result of shuttle lun examined boys and girls against a background of physical proficiency

Estimated range of level proficiency	score	boys		girls		altogether	
		n	%	n	%	n	%
high efficiency	above 60	58	43.9	54	40.9	112	84.8
average efficiency	40 ÷ 59	6	4.6	10	7.5	16	12.1
low efficiency	below 40	-	-	4	3.1	4	3.1
altogether		64	48.5	68	51.5	132	100.0

Table 15. Points result of bend trunk examined boys and girls against a background of physical proficiency

Estimated range of level proficiency	score	boys		girls		altogether	
		n	%	n	%	n	%
high efficiency	above 60	-	-	2	1.5	2	1.5
average efficiency	40 ÷ 59	52	39.4	56	42.4	108	81.8
low efficiency	below 40	12	9.1	10	7.6	22	16.7
altogether		64	48.5	68	51.5	132	100.0

Table 16. Points result of standing ling jump examined boys and girls against a background of physical proficiency

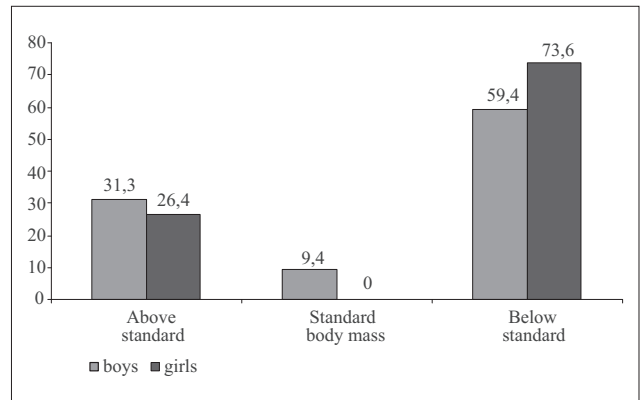| Estimated range of level proficiency	score	boys		girls		altogether	
		n	%	n	%	n	%
high efficiency	above 60	2	1.5	4	3	6	4.5
average efficiency	40 ÷ 59	44	33.3	42	31.8	86	65.2
low efficiency	below 40	18	13.6	22	16	40	30.3
altogether		64	48.5	68	51.5	132	100.0

Fig 1. Percentage of examined pupils (boys, girls) whose body mass (in kg) was up to standard, below or above standard
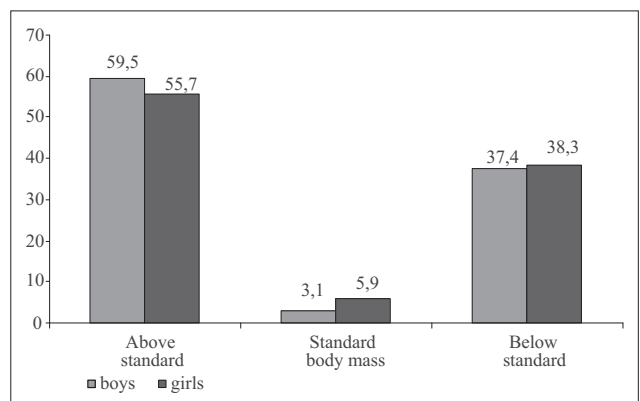

Fig 2. Percentage of examined pupils (boys, girls) whose chest measurement (in cm) was up to standard, below or above standard
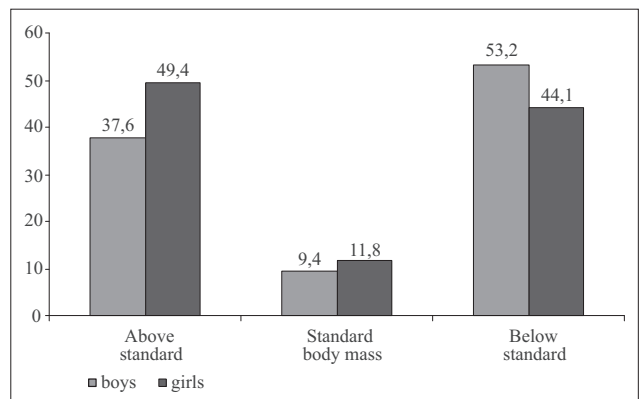

Fig 3. Percentage of examined pupils (boys, girls) whose body height (in cm) was up to standard, below or above standard
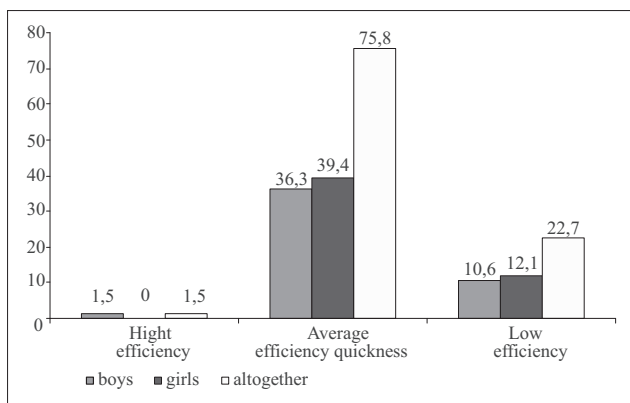
Fig 4. Points result of quickness examined boys and girls against a background of physical proficiency
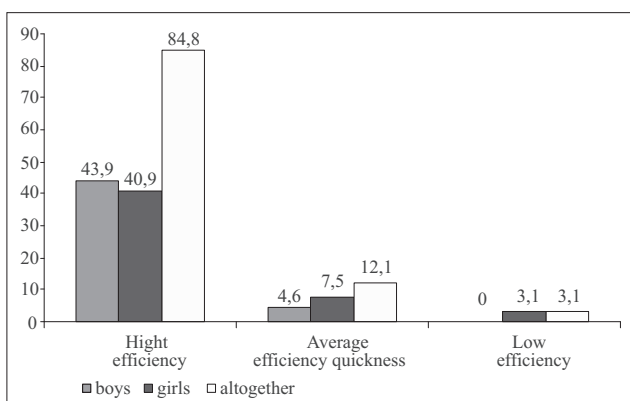

Fig 5. Points result of shuttle lun examined boys and girls against a background of physical proficiency
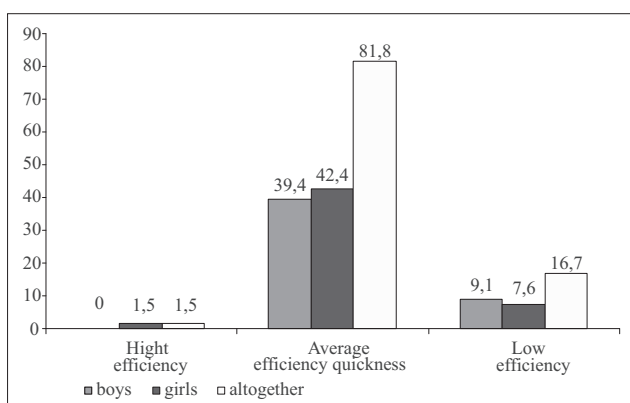

Fig 6. Points result of bend trunk examined boys and girls against a background of physical proficiency

For many years now, the largest group of studies have dealt with environmental conditioning of biological development (Brzeziński, Milicer, Welon, Dutkiewicz, Kołodziej, Przewęda, Mleczko, Siniarska). In auxology, for some time now, tracking of social stratification has been used through analysing its biological manifestations, e.g. social differences in some indicators of children and youths' physical development. Anthropological studies (Bielicki et al.) reveal that a development rate and a final body height show two characteristic types of variability induced by so-

cial environment. These are social gradients and secular trends. Social gradients are differences in terms of physical development that can be seen in a group of persons of different socioeconomic circumstances [5].

In nearly all industrialised societies, children of upper social strata defined by different indicators are better developed over the entire period of development than their peers of bottom social strata (Bielicki). Living conditions of specific populations are taken into account as an environmental differentiation factor. Individual indicators of a social rank determined by a profession, education and social origin or wealth indicators conditioned by, for instance, a number of children in a family or pay levels are also frequently used as a differentiating criterion (Mleczko, Żak, Szopa). It must be pointed out that no environmental factor are taken into consideration when accounting for differences in the development directly affects physical development. It has only indirect impact through, among other things, nutritional habits of a specific family, cultural level, parents' general attitude to children's needs and how they are satisfied [6].

Many researchers proved a phenomenon of lowering of a level of physical development when a number of children in a family gets higher (Bielicki, Malinowski et al.) The analysis of data from the Świętokrzyskie Province shows that children, boys in particular, raised by a single parent are characterised by less advanced physical development (Dutkiewicz et al.) [4].

In 1960–1980 in Poland, there were significant differences between a biological status of rural and urban populations. Children and youth from rural areas were shorter, weighed less and had a faulty posture more frequently. They were also observed to have lower indicators of psychomotor development (Żekoński, Wolański). N. Wolański's studies revealed that rural children were less slender when compared to children from urban areas, and they were characterised by greater muscle strength. However, they were no match to urban children as far as the development of ability to act in a rapid and coordinated manner is concerned. The differences were probably caused by their lifestyle – work, relaxation, stress [7].

CONCLUSION

At present, attention is paid to the need to continue study conditions for the variability of features displayed by individuals and populations in the pubescence period, to collect information about world trends in this respect and improve methodology,

which would allow to explain the existing relationship between genetic, environmental and ecological impact. In order to apply new methodological approaches in the physiology of development to a greater extent, it is necessary to continue epidemiological studies and experimental tests that are significant in endocrinology and medication therapy management (Kopczyńska-Sikorska) [8].

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Adres do korespondencji:

mgr Ewa Zięba
Wydział Nauk o Zdrowiu UJK
25-317 Kielce, Al. IX Wieków Kielc 19
e-mail: esz52@o2.pl
tel. 600 464 303