

PERCENTILE VALUES OF PHYSICAL FITNESS LEVELS AMONG POLISH CHILDREN AGED 7 TO 19 YEARS – A POPULATION-BASED STUDY

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SUMMARY

Aim: The objective of the study was to report gender and age-specific percentile values for fourteen commonly used field-based physical fitness tests among a national representative sample of Polish children aged 7 to 19 years.

Methods: A descriptive cross-sectional and population-based study examines the physical fitness among a random and large national representative sample of schoolchildren aged 7 to 19 years in Poland. A sample of 49,281 children and adolescents (25,687 boys and 23,594 girls) was assessed by the EUROFIT fitness test battery, the International Committee on the Standardization of Physical Fitness Tests and Cooper Test of physical fitness. The LMS statistical method was used.

Results: Smoothed gender and age-specific percentiles for the physical fitness tests in boys and girls aged 7 to 19 years are reported and expressed as both tabulated and curves values (2.3rd, 9th, 25th, 50th, 75th, 91st, and 97.7th). Figures showed greater physical fitness levels in boys, except for the flamingo balance, sit-and-reach, and stand-and-reach tests, in which girls performed slightly better. There was also a trend towards increased physical fitness levels as the age increased in both boys and girls.

Conclusion: The percentile values provided will enable the correct interpretation and monitoring of fitness status of Polish children.

Key words: physical fitness, fitness testing, children, adolescent, young

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INTRODUCTION

Physical fitness is nowadays considered as a powerful marker of health and quality of life in childhood (1, 2). Although all the clinical manifestations usually appear in adulthood, the aetiological commencement of the disease seems to occur in childhood (3). In this regard, a higher physical fitness level in children has been associated with more positive health-related outcomes, regarding the present and future risk for obesity, cardiovascular disease, skeletal health, and even mental health related to depression, anxiety, mood status and self-esteem (1, 2).

Although physical fitness is in part determined genetically, it can also be significantly influenced by environmental factors such as physical activity (4, 5). Unfortunately, children and youth nowadays rarely meet the minimum daily physical activity recommendation (6, 7). In Poland for instance, currently only 10–24% of children meet the recommended daily levels of physical activity (7). In addition, a clear-cut secular trend to higher body mass index and poorer levels of physical fitness among Polish children have been observed in the last decades (8, 9). Health promotion policies of our countries should be therefore designed to promote health-related levels of physical fitness from childhood (1). Since in Poland all children attend school, it may play an important role in public health and in promotion of healthy behaviours such as encouraging children to achieve recommended levels of physical activity (1).

For the above mentioned reasons, introducing physical fitness testing in educational setting seems to be an important national

health issue (10). However, for the optimal interpretation of the children's physical fitness levels, up-to-date reference values from a random and large representative sample of the studied population are therefore required. Ortega et al. (10) recently proposed some reference values of physical fitness among European adolescents. Unfortunately, children's physical fitness levels depend on several biological and environmental factors which differ in each country. Since the preceding study was based on a convenient sample of the population (i.e. it was only arbitrarily selected 3,428 adolescents from ten big European cities, and none of the Polish city was included), these references are not valid for evaluation of the physical fitness levels of Polish children. In addition, the previous study did not provide the reference values for children under 13 years of age. Consequently, the purpose of the present study was to report gender and age-specific percentile values for fourteen commonly used field-based physical fitness tests among a random and large national representative sample of Polish children aged 7 to 19 years.

MATERIALS AND METHODS

Participants

The study was a part of the project "Health of Polish children and adolescents with regard to the growth and level of physical fitness" registered at the Polish Ministry of Science and Higher Education and the Polish National Sciences Centre (N N404

078036). This project was a descriptive cross-sectional and population-based study that examined the growth and physical fitness in a random and large national representative sample of schoolchildren aged 7 to 19 years in Poland.

Participants were selected by a two-phase proportional cluster sampling using as a reference the census database of the Polish National Ministry of Education (retrieved from the Educational Information System). Firstly, the schools were randomly selected from each province according to geographic localization (rural, urban-rural, urban) with regards to age and gender. Out of 696 schools invited to participate, a total of 518 schools agreed to participate in the study. In the second phase, classes from these schools were randomly selected. All children from the selected classrooms were invited to participate in the study. Finally, 413 schools (59% of invited schools) conducted a study in accordance with all requirements.

A total of 49,281 children and adolescents (25,687 boys and 23,594 girls), aged 7 to 19 years finally participated in the study. To make maximum use of the data, all valid data on physical fitness tests were included in this report. Consequently, sample sizes vary for different physical fitness tests. The final number of children reflected the area, province, region and national proportion for each gender and age group.

The principals and physical education teachers of each selected school centre were contacted and informed about the project and their permission to conduct the study was requested as well. After the approval was obtained, data was collected and processed anonymously by physical education teachers as pedagogical diagnosis in accordance with the national curriculum. Voluntary participation and confidentiality of the study were emphasized. The study was approved by the Ethics Committee of the Józef Piłsudski Academy of Physical Education in Warsaw.

Table 1. Smoothed gender and age-specific percentile values for the flamingo balance and plate tapping tests among Polish children aged 7–19 years

Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th	Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th
Flamingo balance test* (n)																	
Boys	24,938								Girls	22,990							
7	1,218	1.0	3.0	6.0	10.0	15.0	28.0	–	7	1,177	1.0	2.0	4.0	8.0	13.0	22.0	–
8	1,511	1.0	3.0	5.0	9.0	14.0	22.0	–	8	1,490	1.0	2.0	4.0	7.0	12.0	19.0	–
9	1,647	1.0	2.0	4.0	8.0	12.0	19.0	–	9	1,537	1.0	1.0	3.0	6.0	11.0	18.0	–
10	1,928	1.0	2.0	4.0	7.0	11.0	18.0	–	10	1,921	1.0	1.0	3.0	5.0	9.0	14.0	28.0
11	2,034	1.0	1.0	3.0	7.0	11.0	18.0	–	11	2,032	1.0	1.0	3.0	5.0	10.0	16.0	–
12	2,142	1.0	1.0	3.0	7.0	10.0	16.0	–	12	2,072	1.0	1.0	3.0	5.0	9.0	14.0	–
13	2,228	1.0	2.0	3.0	7.0	11.0	16.0	–	13	2,121	1.0	1.0	3.0	5.0	9.0	14.0	–
14	2,188	1.0	1.0	3.0	6.0	10.0	15.0	–	14	2,106	1.0	1.0	2.0	5.0	8.0	13.0	–
15	2,090	1.0	1.0	3.0	5.0	9.0	15.0	–	15	2,087	1.0	1.0	2.0	5.0	8.0	12.0	–
16	2,431	1.0	1.0	3.0	5.0	9.0	14.0	31.0	16	2,061	1.0	1.0	2.0	4.0	8.0	13.0	–
17	2,358	1.0	1.0	3.0	5.0	9.0	14.0	–	17	1,945	1.0	1.0	2.0	4.0	8.0	12.0	–
18	2,031	1.0	1.0	3.0	5.0	8.0	12.0	20.0	18	1,791	1.0	1.0	2.0	4.0	7.0	11.0	20.0
19	1,132	1.0	1.0	3.0	5.0	8.0	13.0	–	19	650	1.0	1.0	2.0	4.0	7.0	11.0	24.0
Plate tapping test (s)																	
Boys	25,293								Girls	23,238							
7	1,254	13.7	15.5	17.6	20.1	23.0	26.6	31.1	7	1,189	14.2	15.8	17.8	20.2	23.1	26.7	31.2
8	1,546	13.0	14.4	16.2	18.3	21.0	24.3	28.7	8	1,545	13.1	14.6	16.3	18.3	20.9	24.0	27.9
9	1,701	12.2	13.4	14.9	16.7	19.0	21.9	25.7	9	1,585	12.3	13.5	14.9	16.6	18.7	21.4	24.8
10	1,966	11.5	12.5	13.8	15.4	17.3	19.8	23.2	10	1,946	11.3	12.3	13.5	15.0	16.9	19.2	22.4
11	2,068	10.8	11.7	12.9	14.3	16.0	18.2	21.1	11	2,062	10.7	11.6	12.6	14.0	15.6	17.8	20.8
12	2,142	10.0	10.9	12.0	13.3	14.9	16.9	19.5	12	2,086	10.1	10.9	11.9	13.2	14.7	16.6	19.3
13	2,260	9.3	10.2	11.2	12.5	14.0	15.9	18.3	13	2,138	9.5	10.3	11.2	12.3	13.7	15.5	17.9
14	2,208	8.6	9.6	10.6	11.8	13.3	15.1	17.4	14	2,116	9.2	9.9	10.8	11.9	13.3	15.0	17.3
15	2,097	8.3	9.2	10.2	11.3	12.8	14.5	16.7	15	2,085	9.0	9.8	10.6	11.7	13.0	14.7	16.9
16	2,443	8.2	9.0	9.9	11.0	12.4	14.0	16.1	16	2,067	8.9	9.7	10.6	11.7	13.1	14.8	17.0
17	2,372	8.1	8.8	9.7	10.8	12.1	13.7	15.9	17	1,950	8.8	9.6	10.5	11.7	13.0	14.7	16.6
18	2,063	8.0	8.7	9.6	10.6	11.9	13.6	15.8	18	1,810	8.7	9.5	10.5	11.6	12.9	14.4	16.2
19	1,173	8.0	8.7	9.5	10.5	11.8	13.4	15.6	19	659	8.5	9.5	10.5	11.7	13.1	14.7	16.6

*Since the LMS method could not be used for the flamingo balance test, percentile values were estimated using standard procedures. Missed values (–) represent the scores that were not retained because children failed more than 15 times in the first 30 seconds.

Table 2. Smoothed gender and age-specific percentile values for the sit-and-reach and stand-and-reach tests among Polish children aged 7–19 years

Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th	Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th
Sit-and-reach test* (cm)																	
Boys	25,080								Girls	23,241							
7	1,259	–11.3	–6.5	–2.1	2.0	5.9	9.7	13.2	7	1,193	–9.6	–4.7	–0.3	3.8	7.7	11.3	14.7
8	1,556	–11.8	–6.9	–2.3	1.9	5.9	9.7	13.4	8	1,539	–9.4	–4.5	0.0	4.1	8.0	11.7	15.2
9	1,694	–12.3	–7.2	–2.6	1.8	5.9	9.8	13.6	9	1,582	–9.2	–4.3	0.3	4.5	8.4	12.2	15.8
10	1,976	–12.9	–7.6	–2.9	1.6	5.8	9.8	13.6	10	1,952	–8.9	–3.8	0.8	5.1	9.1	13.0	16.7
11	2,063	–13.4	–8.0	–3.1	1.5	5.7	9.8	13.7	11	2,078	–8.5	–3.3	1.5	5.9	10.0	14.0	17.7
12	2,156	–13.6	–8.0	–3.0	1.7	6.1	10.3	14.3	12	2,095	–7.9	–2.5	2.4	6.9	11.2	15.3	19.1
13	2,280	–13.3	–7.5	–2.3	2.6	7.2	11.5	15.6	13	2,144	–7.2	–1.6	3.5	8.3	12.7	16.9	20.9
14	2,207	–12.7	–6.5	–1.0	4.1	8.9	13.4	17.7	14	2,101	–6.5	–0.7	4.5	9.4	14.0	18.3	22.4
15	2,111	–11.9	–5.5	0.3	5.6	10.6	15.3	19.7	15	2,096	–6.2	–0.3	5.1	10.1	14.7	19.2	23.4
16	2,356	–11.4	–4.7	1.2	6.7	11.8	16.5	21.1	16	2,050	–6.4	–0.3	5.2	10.3	15.1	19.6	24.0
17	2,277	–11.3	–4.5	1.6	7.1	12.2	17.0	21.5	17	1,948	–6.8	–0.6	5.1	10.3	15.2	19.9	24.3
18	2,010	–11.3	–4.4	1.7	7.2	12.3	17.1	21.6	18	1,804	–7.6	–1.1	4.8	10.1	15.1	19.8	24.2
19	1,135	–11.2	–4.2	1.9	7.5	12.6	17.4	21.9	19	659	–8.7	–1.7	4.4	9.8	14.8	19.5	23.8
Stand-and-reach test* (cm)																	
Boys	25,063								Girls	23,050							
7	1,251	–13.3	–8.6	–4.3	–0.2	3.7	7.4	11.0	7	1,195	–11.6	–6.8	–2.5	1.6	5.5	9.2	12.7
8	1,554	–13.7	–8.8	–4.3	–0.1	3.9	7.7	11.4	8	1,542	–11.5	–6.7	–2.2	1.9	5.8	9.5	13.0
9	1,698	–14.2	–9.0	–4.3	0.1	4.2	8.1	11.8	9	1,586	–11.2	–6.3	–1.8	2.4	6.3	10.1	13.6
10	1,957	–14.8	–9.3	–4.4	0.0	4.2	8.2	11.9	10	1,938	–10.7	–5.6	–1.0	3.2	7.2	11.0	14.6
11	2,074	–15.2	–9.5	–4.5	0.1	4.3	8.4	12.2	11	2,069	–10.0	–4.8	–0.1	4.2	8.3	12.2	15.9
12	2,150	–15.3	–9.5	–4.3	0.4	4.8	8.9	12.7	12	2,093	–9.1	–3.8	1.0	5.4	9.6	13.6	17.4
13	2,263	–15.0	–8.9	–3.5	1.3	5.8	10.0	14.0	13	2,128	–8.1	–2.7	2.3	6.9	11.2	15.3	19.2
14	2,171	–14.3	–7.9	–2.3	2.7	7.4	11.7	15.8	14	2,088	–7.2	–1.7	3.4	8.1	12.5	16.7	20.7
15	2,046	–13.3	–6.7	–1.0	4.2	9.0	13.5	17.7	15	2,033	–6.8	–1.2	4.0	8.7	13.2	17.5	21.5
16	2,392	–12.5	–5.8	0.0	5.3	10.2	14.7	19.0	16	2,011	–6.7	–1.1	4.1	8.9	13.4	17.7	21.8
17	2,331	–12.1	–5.4	0.5	5.8	10.6	15.1	19.4	17	1,921	–6.9	–1.1	4.1	8.9	13.5	17.8	21.9
18	2,035	–11.8	–5.1	0.7	5.9	10.7	15.1	19.3	18	1,789	–7.3	–1.4	3.8	8.7	13.2	17.5	21.6
19	1,141	–11.4	–4.8	0.9	6.1	10.8	15.2	19.3	19	657	–7.8	–1.9	3.4	8.3	12.8	17.1	21.1

*Feet tangent was set at 0 cm.

Measures

Participants' physical fitness was assessed by fourteen commonly used field-based physical fitness tests proposed for children and adolescents. Particularly, the EUROFIT fitness test battery (11), International Committee on the Standardization of Physical Fitness Tests (ICSPFT) (12), and Cooper (13) test were used. Briefly, body balance was assessed by the flamingo balance test (n); upper-body speed by the plate tapping test (s); and flexibility by the sit-and-reach and stand-and-reach tests (feet tangent at 0 cm) (cm). Then, lower-body muscular explosive strength was evaluated by the standing broad jump (cm); upper-body muscular maximum strength by the handgrip test (Saehan Sh5001 Hand Dynamometer, Korea) (kg); and abdominal and upper-body muscular endurance strength by the sit-ups in 30 seconds (n) and the bent-arm hang tests (s), respectively. Speed was evaluated by the 50 m dash test (s) and speed-agility by the 10 x 4 m shuttle run (s) and 10 x 5 m shuttle run tests (s). Finally, the cardiorespiratory fitness was as-

sessed by the 20 m endurance shuttle run (laps), endurance run (s), and Cooper tests (m). The best score of two attempts was retained for all tests, except for the flamingo balance, sit-ups in 30 seconds, bent-arm hang, 10 x 4 m shuttle run, 10 x 5 m shuttle run and cardiorespiratory fitness tests, which were performed only once.

A detailed manual of tests instructions was designed and thoroughly read by every physical education teacher before the data collection started (14). Together with the manual of tests instructions, the necessary tests instruments were supplied to schools beforehand. Physical education teachers were strongly advised to perform the physical fitness tests according to provided manual instructions in order to minimize the potential intra- and inter-rater variability. Along these lines, the field-based physical fitness tests administered by physical education teachers in school settings are shown to be highly reliable (15). Furthermore, it is worth pointing out that additional measures were employed in order to obtain more reliable data, e.g. evaluating all students during the same period of a day

Table 3. Smoothed gender and age-specific percentile values for the standing broad jump and handgrip tests among Polish children aged 7–19 years

Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th	Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th
Standing broad jump test (cm)																	
Boys	25,617								Girls	23,481							
7	1,273	68.7	82.8	96.8	110.6	124.3	138.0	151.6	7	1,218	66.1	79.2	91.9	104.2	116.3	128.1	139.7
8	1,573	77.3	92.3	107.1	121.7	136.1	150.3	164.5	8	1,567	72.5	85.3	98.2	111.2	124.1	137.1	150.1
9	1,721	86.1	101.9	117.3	132.4	147.3	162.0	176.5	9	1,607	80.2	93.4	106.9	120.6	134.4	148.4	162.6
10	1,996	94.2	110.7	126.8	142.4	157.8	172.8	187.6	10	1,973	88.9	102.9	117.2	131.7	146.4	161.2	176.2
11	2,105	101.4	118.7	135.5	151.7	167.6	183.1	198.3	11	2,100	95.2	110.0	125.0	139.9	155.0	170.1	185.2
12	2,185	109.9	128.5	146.3	163.4	180.1	196.4	212.3	12	2,121	100.2	115.9	131.6	147.0	162.4	177.6	192.7
13	2,298	120.9	140.8	159.8	178.1	195.7	212.8	229.5	13	2,164	105.6	122.1	138.3	154.3	170.1	185.7	201.1
14	2,244	133.5	154.3	174.0	192.8	210.9	228.4	245.4	14	2,132	110.1	127.1	143.7	160.0	175.9	191.6	207.1
15	2,136	145.5	166.4	186.2	205.0	223.0	240.3	257.1	15	2,113	112.6	129.7	146.3	162.4	178.2	193.6	208.8
16	2,461	153.6	174.1	193.4	211.7	229.2	246.0	262.2	16	2,067	112.0	129.1	145.5	161.4	176.9	192.0	206.8
17	2,377	157.9	178.2	197.2	215.2	232.3	248.7	264.4	17	1,950	110.9	128.0	144.4	160.2	175.5	190.3	204.8
18	2,071	159.8	180.1	199.1	216.9	233.9	250.0	265.5	18	1,809	111.6	128.6	144.9	160.6	175.9	190.8	205.3
19	1,177	160.2	180.7	199.7	217.5	234.3	250.3	265.6	19	660	113.2	129.7	145.6	161.1	176.3	191.1	205.6
Handgrip test (kg)																	
Boys	25,430								Girls	23,411							
7	1,268	4.8	6.8	9.0	11.4	13.8	16.5	19.2	7	1,208	3.3	5.5	7.7	10.0	12.2	14.5	16.7
8	1,561	6.4	8.8	11.3	13.9	16.6	19.5	22.4	8	1,556	4.7	7.0	9.4	11.9	14.4	17.0	19.7
9	1,709	8.2	10.6	13.2	16.0	18.8	21.8	24.9	9	1,588	6.4	8.8	11.3	14.0	16.8	19.7	22.7
10	1,982	10.4	12.9	15.6	18.6	21.7	25.0	28.6	10	1,961	8.5	11.0	13.6	16.5	19.6	22.9	26.3
11	2,094	12.1	14.8	17.7	21.0	24.6	28.5	32.9	11	2,091	10.6	13.3	16.2	19.4	22.8	26.5	30.4
12	2,169	14.0	17.1	20.6	24.5	29.0	33.9	39.4	12	2,108	12.7	15.7	19.0	22.5	26.2	30.2	34.3
13	2,277	16.6	20.5	25.0	30.1	35.8	42.1	49.2	13	2,159	14.5	17.9	21.5	25.3	29.2	33.3	37.5
14	2,231	19.9	24.9	30.4	36.4	42.8	49.8	57.2	14	2,132	15.4	19.3	23.2	27.3	31.4	35.6	39.8
15	2,119	24.4	29.9	35.9	42.1	48.6	55.5	62.6	15	2,119	16.0	20.2	24.3	28.5	32.7	36.8	40.9
16	2,418	28.2	34.1	40.1	46.4	53.0	59.7	66.5	16	2,073	17.6	21.5	25.4	29.4	33.4	37.4	41.4
17	2,363	30.5	36.5	42.8	49.2	55.7	62.4	69.2	17	1,953	18.8	22.4	26.1	29.8	33.7	37.8	41.9
18	2,064	31.8	37.9	44.3	50.8	57.4	64.3	71.2	18	1,804	19.5	22.9	26.5	30.2	34.1	38.2	42.4
19	1,175	32.5	38.6	45.0	51.6	58.4	65.3	72.5	19	659	19.8	23.2	26.8	30.6	34.6	38.8	43.1

(from 8:00 a.m. to 2:00 p.m.) or performing all tests in indoor sport facilities that lead to more consistent environmental conditions.

Statistical Analysis

The data were first scrutinized for potential outliers within each gender-specific group using a conservative cut-off of ± 5 standard deviations (SD) (16). Only scores that were considered to be biologically implausible were excluded from the dataset. Then, smoothed percentile values were estimated (separately for each gender and for each physical fitness test) by the LMS method (17).

Unfortunately, the LMS method does not work with zero or negative values. Therefore, since a large number of children scored 0 in the bent-arm hang test and 0 or below in the sit-and-reach and stand-and-reach tests, previously a constant was summated up to make these variables positive (1 s and 40 cm, respectively). After the estimation of percentile values, scores of these tests

were reversed back by subtracting the same constant from the percentiles results. On the other hand, according to the protocol of flamingo balance test (11), when children failed more than 15 times in the first 30 seconds the scores were not retained. As for the flamingo balance test the scores of larger number of children were not retained on this basis, these values were computed by a large score (i.e. 100) and then the percentile values were estimated using standard procedures. For the rest of physical fitness tests no other special consideration had to be taken into account.

According to Cole (18), the percentiles with equal two thirds SD scores spacing (2.3rd, 9th, 25th, 50th, 75th, 91st, and 97.7th) were reported within 1-year age groups from 7 to 19 years. For more practical and interpretable basis, participants were assigned to truncated age categories (e.g. 10 years category included children aged 10.00–10.99 years). Smoothed percentiles were estimated using the LMS chartmaker Pro version 2.54 for Windows (Medical Research Council, UK).

Table 4. Smoothed gender and age-specific percentile values for the sit-ups in 30 seconds and bent-arm hang tests among Polish children aged 7–19 years

Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th	Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th
Sit-ups in 30 seconds test (n)																	
Boys	25,501								Girls	23,336							
7	1,272	5.2	8.7	12.2	15.6	18.9	22.2	25.5	7	1,213	5.0	8.3	11.6	14.8	18.1	21.3	24.5
8	1,576	6.8	10.6	14.1	17.6	21.0	24.2	27.5	8	1,568	6.3	9.8	13.1	16.4	19.7	22.9	26.1
9	1,704	8.5	12.3	15.9	19.4	22.7	25.9	29.0	9	1,580	7.8	11.3	14.7	18.0	21.2	24.4	27.5
10	1,980	9.9	14.0	17.7	21.3	24.6	27.9	31.0	10	1,958	9.5	13.1	16.5	19.8	23.1	26.2	29.3
11	2,100	11.3	15.3	19.1	22.6	25.9	29.1	32.1	11	2,096	10.7	14.2	17.6	20.9	24.0	27.1	30.1
12	2,178	12.8	16.7	20.3	23.7	26.9	29.9	32.9	12	2,116	11.7	15.1	18.3	21.5	24.4	27.4	30.3
13	2,295	14.7	18.4	21.8	25.0	28.0	31.0	33.9	13	2,155	12.6	15.8	19.0	22.1	25.0	27.9	30.7
14	2,241	15.8	19.3	22.7	25.8	28.9	31.9	34.7	14	2,127	13.0	16.3	19.4	22.5	25.5	28.4	31.2
15	2,134	16.5	19.9	23.2	26.5	29.6	32.7	35.7	15	2,111	13.1	16.3	19.5	22.5	25.5	28.5	31.4
16	2,456	16.9	20.1	23.3	26.4	29.5	32.6	35.6	16	2,060	12.8	16.0	19.0	22.1	25.1	28.0	30.9
17	2,371	17.0	20.3	23.4	26.5	29.6	32.7	35.7	17	1,945	12.7	15.8	18.8	21.9	24.9	27.9	30.9
18	2,068	17.1	20.3	23.4	26.5	29.4	32.3	35.1	18	1,805	12.9	16.0	19.1	22.1	25.2	28.3	31.3
19	1,172	16.9	20.2	23.3	26.3	29.2	32.0	34.7	19	656	12.8	15.9	19.0	22.0	25.1	28.2	31.2
Bent-arm hang test (s)																	
Boys	23,954								Girls	23,424							
7	1,269	0.0	0.3	1.8	4.5	9.5	18.6	34.4	7	1,213	0.0	0.2	1.4	3.7	8.1	16.6	32.6
8	1,571	0.0	0.5	2.1	5.3	11.2	21.7	39.4	8	1,564	0.0	0.2	1.4	3.8	8.4	17.0	33.3
9	1,713	0.0	0.6	2.5	6.3	13.4	25.6	46.1	9	1,602	0.0	0.2	1.6	4.2	9.1	18.5	35.8
10	1,993	0.0	0.7	2.9	7.4	15.7	30.1	53.9	10	1,968	0.0	0.4	1.9	4.9	10.7	21.6	41.6
11	2,101	0.0	0.8	3.4	8.6	18.1	34.1	60.0	11	2,097	0.0	0.4	2.1	5.4	11.8	23.8	45.5
12	1,957	0.0	1.1	4.3	10.5	21.3	38.5	64.6	12	2,120	0.0	0.5	2.2	5.8	12.7	25.6	48.8
13	2,101	0.0	1.6	5.8	13.3	25.2	42.7	67.0	13	2,162	0.0	0.5	2.4	6.2	13.6	27.3	51.7
14	2,026	0.0	2.5	8.1	17.1	30.2	48.1	71.2	14	2,127	0.0	0.6	2.6	6.5	14.2	28.2	53.1
15	1,932	0.0	3.6	10.4	20.7	34.7	52.6	74.6	15	2,108	0.0	0.6	2.7	6.8	14.6	28.8	53.7
16	2,192	0.1	4.4	12.0	22.8	36.9	54.2	74.7	16	2,062	0.0	0.6	2.6	6.7	14.3	28.0	51.8
17	2,157	0.2	5.0	13.0	24.2	38.3	55.2	74.9	17	1,935	0.0	0.6	2.5	6.4	13.7	26.8	49.5
18	1,856	0.3	5.3	13.6	24.8	38.7	55.2	74.2	18	1,807	0.0	0.6	2.6	6.5	13.9	27.1	49.7
19	1,086	0.3	5.6	13.9	25.0	38.4	54.2	72.2	19	659	0.0	0.6	2.7	6.8	14.4	28.1	51.5

RESULTS

Tables 1–7 show the smoothed gender and age-specific percentiles for physical fitness tests in boys and girls aged 7 to 19 years. The percentile values (2.3rd, 9th, 25th, 50th, 75th, 91st, and 97.7th) were reported within 1-year age groups assigned to truncated age categories. Therefore, if children want to compare their physical fitness level with the percentile values hereby provided, they should simply look at their truncated age. For flamingo balance, plate tapping, 50 m dash run, 10 x 5 m shuttle run, 10 x 4 m shuttle run, and endurance run tests lower values indicate better performance. Therefore, the percentiles have to be interpreted in the opposite way (i.e. the percentile 2.3rd is better than the 9th, and so on).

Figures 1–4 represent the smoothed gender and age-specific percentiles (2.3rd, 9th, 25th, 50th, 75th, 91st, and 97.7th) for physical fitness tests in boys and girls aged 7 to 19 years (except for the flamingo balance test for which the LMS method could

not be used). Generally, the Figures show greater physical fitness levels in boys, except for the flexibility levels (sit-and-reach and stand-and-reach tests), in which girls performed slightly better. It can be observed that physical fitness in girls was generally more homogeneous than in boys. There was also a trend towards increased physical fitness levels as the age increased in both boys and girls, although boys appeared to reach a plateau at 16 to 18 years and girls at 13 to 15 years.

DISCUSSION

Physical fitness is currently considered a powerful marker of health and quality of life in childhood (1, 2), highlighting the need of a widespread physical fitness evaluation among children (10). Unfortunately, the importance of physical fitness tests as significant diagnostic information about the health status of children is commonly ignored (19). Additionally, the correct interpretation

Table 5. Smoothed gender and age-specific percentile values for the 50 m dash and 10 x 4 m shuttle run tests among Polish children aged 7–19 years

Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th	Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th
50 m dash test (s)																	
Boys	25,203								Girls	23,058							
7	1,253	9.2	9.8	10.5	11.3	12.3	13.5	15.0	7	1,198	9.5	10.2	10.9	11.8	12.8	14.1	15.8
8	1,563	8.7	9.3	10.0	10.8	11.7	12.9	14.3	8	1,549	9.1	9.7	10.4	11.2	12.2	13.4	14.9
9	1,697	8.3	8.9	9.5	10.3	11.2	12.3	13.6	9	1,588	8.7	9.3	10.0	10.7	11.6	12.8	14.1
10	1,969	8.0	8.5	9.1	9.8	10.7	11.7	13.0	10	1,939	8.3	8.8	9.5	10.2	11.0	12.0	13.3
11	2,087	7.6	8.1	8.7	9.4	10.3	11.2	12.4	11	2,073	8.0	8.5	9.1	9.7	10.5	11.5	12.6
12	2,156	7.3	7.8	8.3	9.0	9.8	10.7	11.8	12	2,102	7.8	8.2	8.7	9.4	10.1	11.0	12.2
13	2,270	6.9	7.3	7.9	8.5	9.2	10.0	11.1	13	2,147	7.6	8.0	8.5	9.0	9.7	10.6	11.7
14	2,215	6.6	7.0	7.5	8.0	8.7	9.5	10.6	14	2,109	7.5	7.9	8.3	8.9	9.5	10.4	11.5
15	2,098	6.5	6.8	7.2	7.7	8.3	9.1	10.2	15	2,071	7.5	7.9	8.3	8.8	9.5	10.3	11.4
16	2,389	6.4	6.7	7.1	7.5	8.1	8.9	9.9	16	2,004	7.4	7.8	8.3	8.8	9.5	10.4	11.5
17	2,319	6.4	6.7	7.0	7.5	8.0	8.7	9.8	17	1,883	7.4	7.8	8.3	8.9	9.6	10.5	11.7
18	2,027	6.3	6.6	7.0	7.4	8.0	8.7	9.7	18	1,747	7.4	7.8	8.3	8.9	9.7	10.6	11.8
19	1,160	6.3	6.6	7.0	7.4	8.0	8.7	9.8	19	648	7.3	7.8	8.3	9.0	9.7	10.6	11.8
10 x 4 m shuttle run test (s)																	
Boys	25,003								Girls	22,885							
7	1,216	12.0	12.9	13.9	15.0	16.3	17.9	19.8	7	1,169	12.5	13.4	14.4	15.6	16.9	18.3	20.0
8	1,513	11.6	12.4	13.3	14.3	15.5	17.0	18.8	8	1,494	12.1	12.9	13.9	14.9	16.1	17.5	19.2
9	1,669	11.2	11.9	12.8	13.7	14.9	16.3	18.0	9	1,548	11.8	12.5	13.4	14.4	15.5	16.8	18.4
10	1,940	10.9	11.6	12.3	13.2	14.3	15.6	17.3	10	1,932	11.5	12.2	12.9	13.8	14.8	16.1	17.6
11	2,050	10.7	11.3	11.9	12.8	13.8	15.0	16.7	11	2,063	11.2	11.9	12.6	13.4	14.3	15.5	16.9
12	2,127	10.4	10.9	11.6	12.3	13.3	14.5	16.0	12	2,074	11.0	11.5	12.2	13.0	13.9	15.0	16.4
13	2,249	10.0	10.6	11.1	11.9	12.8	13.9	15.5	13	2,125	10.8	11.4	12.0	12.7	13.6	14.7	16.1
14	2,180	9.8	10.3	10.8	11.5	12.3	13.5	15.1	14	2,071	10.7	11.3	11.9	12.6	13.5	14.6	16.0
15	2,065	9.6	10.0	10.5	11.2	12.0	13.1	14.7	15	2,017	10.6	11.2	11.8	12.6	13.5	14.6	16.0
16	2,413	9.5	9.9	10.5	11.2	12.0	13.1	14.6	16	2,014	10.6	11.2	11.9	12.6	13.6	14.8	16.3
17	2,355	9.4	9.9	10.5	11.2	12.0	13.1	14.7	17	1,927	10.6	11.2	11.9	12.7	13.7	14.9	16.4
18	2,055	9.4	9.8	10.4	11.1	12.0	13.1	14.8	18	1,797	10.6	11.2	11.9	12.8	13.7	14.9	16.3
19	1,171	9.4	9.9	10.5	11.2	12.1	13.3	15.2	19	654	10.6	11.2	11.9	12.7	13.7	14.8	16.0

of physical fitness levels requires comparing the scores obtained in a particular child with reference values of population of the same gender and age. In this context, the study provides gender and age-specific percentile values for fourteen commonly used field-based physical fitness tests in a random and large national representative sample of Polish children aged 7 to 19 years.

Schools are the most suitable settings to identify children with poor levels of physical fitness and to promote healthy behaviours (1). Hence, these reference values constitute undoubtedly an important tool in the educational setting. This information allows the physical education teachers to early detect children with health problems and start immediate intervention. For instance, children that scored below the 2.3rd percentile should be taken as a “warning signal” due to their potential pathology. Therefore, these children should undergo clinical evaluation for the coexistence of other risk factors that may induce any future disease (20), and should be encouraged to follow a healthier lifestyle e.g., engaging in the recommended daily levels of physical activity,

reducing time in sedentary activities, or following a healthy diet. Then, the effect of intervention on the level of the child’s physical fitness could be observed by following the evolution of percentile lines through the years.

Furthermore, the percentile values provided in the study could represent two additional contributions. From the point of view of prevention, these references enable the diagnosis and detection of those physical fitness components in children that are most deteriorated (e.g. below the 9th or 25th percentile) and susceptible to improvement with a physical exercise programme (20). On the other hand, the current reference values could also be used by physical education teachers and coaches for the sport talent identification. In this case, children that have scored above the 91st or 97.7th percentile should be considered a talent for those sports for which that particular physical fitness component is relevant.

The results of the study show greater physical fitness levels in boys than in girls in all ages, except for the balance (flamingo balance test) and flexibility (sit-and-reach and stand-and-reach

Table 6. Smoothed gender and age-specific percentile values for the 10 x 5 m shuttle run and 20 m shuttle run tests among Polish children aged 7–19 years

Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th	Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th
10 x 5 m shuttle run test (s)																	
Boys	25,447								Girls	23,358							
7	1,269	19.0	21.2	23.5	25.8	28.1	30.4	32.64	7	1,215	20.0	22.2	24.4	26.6	28.7	30.9	33.0
8	1,570	18.3	20.3	22.4	24.5	26.7	29.0	31.26	8	1,561	19.2	21.2	23.3	25.4	27.5	29.6	31.7
9	1,705	18.0	19.7	21.5	23.4	25.5	27.7	29.95	9	1,598	18.8	20.7	22.6	24.6	26.6	28.6	30.7
10	1,990	17.7	19.2	20.8	22.6	24.6	26.8	29.25	10	1,966	18.3	20.0	21.9	23.8	25.7	27.7	29.7
11	2,099	17.1	18.5	20.1	21.9	23.9	26.2	28.77	11	2,095	17.5	19.3	21.1	23.0	25.0	27.0	29.2
12	2,180	16.8	18.1	19.6	21.2	23.1	25.3	27.73	12	2,109	17.4	19.0	20.7	22.4	24.3	26.2	28.1
13	2,236	16.8	17.9	19.2	20.6	22.2	24.0	25.99	13	2,142	17.4	18.9	20.4	22.1	23.7	25.5	27.3
14	2,225	16.4	17.5	18.7	20.0	21.5	23.1	24.92	14	2,112	17.4	18.8	20.3	21.9	23.5	25.1	26.9
15	2,127	15.8	16.9	18.2	19.5	21.0	22.6	24.38	15	2,098	17.3	18.7	20.2	21.8	23.5	25.2	26.9
16	2,444	15.5	16.7	18.1	19.5	21.0	22.6	24.31	16	2,055	17.3	18.8	20.3	21.9	23.6	25.3	27.1
17	2,370	15.3	16.5	17.9	19.3	20.8	22.4	24.14	17	1,945	17.3	18.8	20.3	22.0	23.6	25.4	27.1
18	2,064	15.5	16.7	17.9	19.3	20.7	22.3	23.95	18	1,805	17.1	18.7	20.2	21.9	23.6	25.3	27.2
19	1,168	15.8	16.9	18.1	19.3	20.7	22.3	23.94	19	657	17.1	18.6	20.2	21.9	23.5	25.3	27.1
20 m shuttle run test (laps)																	
Boys	24,921								Girls	22,761							
7	1,238	5.0	8.0	12.0	17.0	24.0	32.0	42.0	7	1,195	5.0	8.0	11.0	15.0	21.0	28.0	37.0
8	1,534	6.0	9.0	14.0	21.0	29.0	39.0	52.0	8	1,536	6.0	9.0	12.0	17.0	24.0	32.0	42.0
9	1,677	6.0	10.0	16.0	24.0	34.0	46.0	60.0	9	1,578	6.0	10.0	14.0	20.0	28.0	37.0	49.0
10	1,943	7.0	12.0	19.0	28.0	39.0	53.0	69.0	10	1,905	7.0	11.0	17.0	24.0	33.0	44.0	57.0
11	2,021	7.0	14.0	22.0	32.0	45.0	59.0	76.0	11	2,052	8.0	13.0	19.0	27.0	37.0	49.0	63.0
12	2,119	9.0	16.0	26.0	37.0	51.0	67.0	84.0	12	2,057	9.0	14.0	21.0	30.0	40.0	53.0	67.0
13	2,209	11.0	20.0	31.0	44.0	58.0	75.0	92.0	13	2,095	10.0	16.0	23.0	32.0	43.0	55.0	70.0
14	2,138	14.0	24.0	36.0	50.0	65.0	81.0	99.0	14	2,040	11.0	17.0	25.0	33.0	44.0	56.0	71.0
15	2,071	17.0	28.0	41.0	55.0	70.0	86.0	103.0	15	2,005	11.0	17.0	25.0	34.0	44.0	56.0	70.0
16	2,416	18.0	30.0	43.0	57.0	72.0	88.0	104.0	16	1,993	10.0	16.0	24.0	33.0	43.0	54.0	67.0
17	2,334	19.0	31.0	44.0	59.0	73.0	89.0	105.0	17	1,886	9.0	16.0	23.0	32.0	41.0	52.0	64.0
18	2,051	19.0	31.0	45.0	59.0	74.0	89.0	104.0	18	1,771	9.0	15.0	23.0	31.0	41.0	51.0	63.0
19	1,170	18.0	31.0	45.0	59.0	74.0	88.0	103.0	19	648	8.0	15.0	23.0	32.0	42.0	52.0	64.0

tests) in which girls performed slightly better. These differences became greater with increasing age. Furthermore, there was a trend towards increased physical fitness levels as the age increased in both boys and girls, although generally boys appeared to reach a plateau at 16 to 18 years while girls did so earlier at 13 to 15 years. The previous studies found similar results. For example, the studies on European children and adolescents found that boys performed better in cardiorespiratory fitness (10, 19–22), muscular strength (10, 20, 23, 24), or speed (10, 20, 25). However, the same studies found that girls performed better in flexibility tests (10, 20, 26). Additionally, the same studies found a plateau approximately at the same ages. All these differences might be due to biological factors (gender-related changes in lean body weight and body fat or hormonal changes), and also to environmental factors (social interests, peer influence or lack of motivation toward physical activity) that undoubtedly urge girls to be less active than boys.

Apart from the ICSPFT and Cooper tests, the EUROFIT fitness test battery was selected in this study because it is probably the most extended, validated and standardized method for assessing children's physical fitness in Europe (27). However, some methodological problems with a few of the tests applied were found. Similarly to previous studies (10, 24), for the bent-arm hang test a substantial number of children that scored 0 (1,889 boys, 8%; 2,684 girls, 12%) was observed. Then, for the flamingo balance test a large number of children that failed all possible attempts (940 boys, 4%; 737 girls, 3%) was also observed. Although there are definitely some differences in physical fitness among these children that failed, the tests were not able to discriminate them. Therefore, its usefulness and future use in children is questionable. In case of the flamingo balance test an alternative option could be to retain the time that child spends in the right position instead of the total number of attempts that he/she performs; though before its use, the validity of the modification of this test should be stud-

Table 7. Smoothed gender and age-specific percentile values for the endurance run and Cooper tests among Polish children aged 7–19 years

Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th	Age	n	2.3rd	9th	25th	50th	75th	91st	97.7th
Endurance run test* (s)																	
Boys	25,694								Girls	22,847							
7	1,248	153.9	172.1	193.6	219.0	249.5	286.4	331.7	7	1,198	164.2	183.0	205.1	231.4	262.8	300.9	347.5
8	1,560	147.2	164.4	184.6	208.6	237.5	272.7	315.9	8	1,550	157.3	175.6	196.8	221.7	250.9	285.5	326.9
9	1,698	139.3	155.1	173.8	196.3	223.7	257.3	299.5	9	1,586	152.0	169.5	189.8	213.2	240.3	272.1	309.3
10	1,964	132.6	147.1	164.5	185.8	212.2	245.8	289.6	10	1,931	141.4	157.2	175.6	196.9	221.7	251.0	285.7
11	1,928	128.3	141.7	158.1	178.7	205.4	241.5	292.8	11	1,962	137.2	151.8	169.0	189.4	213.9	243.6	280.2
12	2,021	211.7	233.7	260.0	292.0	331.6	381.6	446.4	12	1,920	181.2	200.8	223.7	250.6	282.6	321.1	367.7
13	2,265	204.6	223.9	247.0	275.4	310.8	356.4	417.2	13	2,140	180.4	199.4	221.4	246.9	276.6	311.6	353.0
14	2,222	200.1	217.1	237.7	263.1	295.3	337.4	395.2	14	2,110	179.3	198.0	219.6	244.7	274.2	309.0	350.6
15	2,101	193.0	208.5	227.2	250.3	279.7	318.5	372.5	15	2,078	179.3	197.5	218.8	243.8	273.4	308.9	352.0
16	2,433	188.3	202.8	220.2	241.6	268.5	303.6	351.6	16	2,036	179.4	197.2	218.0	242.8	272.7	309.1	354.3
17	2,364	186.6	201.0	218.2	238.9	264.6	297.4	340.7	17	1,907	181.1	198.6	219.2	244.0	274.3	312.1	360.1
18	2,059	185.3	200.2	217.9	238.9	264.6	296.5	337.3	18	1,788	181.5	199.2	220.1	245.2	275.7	313.5	361.4
19	1,172	186.2	201.9	220.4	242.3	268.6	300.9	341.2	19	641	181.2	199.5	220.9	246.1	276.2	312.6	357.2
Cooper test (m)																	
Boys	25,310								Girls	23,156							
7	1,238	850.2	1056.1	1275.0	1506.2	1748.7	2001.9	2265.3	7	1,186	801.7	1007.9	1217.8	1430.9	1646.8	1865.2	2085.8
8	1,555	910.6	1133.0	1366.6	1610.5	1863.7	2125.7	2395.9	8	1,550	871.4	1075.3	1285.7	1502.0	1723.6	1949.9	2180.6
9	1,704	982.3	1221.5	1470.0	1726.5	1990.5	2261.2	2538.2	9	1,585	944.6	1155.2	1372.3	1595.1	1823.1	2055.8	2292.9
10	1,967	1058.1	1311.7	1572.2	1838.7	2110.7	2387.5	2668.8	10	1,935	1035.3	1256.0	1481.3	1710.7	1943.7	2179.9	2419.1
11	2,082	1124.8	1389.5	1658.8	1932.1	2208.8	2488.8	2771.6	11	2,073	1115.3	1337.2	1563.7	1794.2	2028.4	2265.9	2506.5
12	2,151	1187.8	1464.3	1742.8	2023.0	2304.8	2588.0	2872.3	12	2,098	1168.7	1384.6	1607.4	1836.5	2071.5	2311.8	2557.2
13	2,273	1255.9	1543.6	1830.1	2115.6	2400.3	2684.2	2967.5	13	2,142	1171.2	1386.6	1608.2	1835.4	2067.8	2304.9	2546.5
14	2,221	1333.0	1633.8	1929.6	2221.2	2509.3	2794.3	3076.6	14	2,113	1159.6	1384.0	1611.6	1842.1	2075.0	2310.3	2547.7
15	2,086	1418.3	1727.7	2027.8	2320.5	2606.9	2888.0	3164.5	15	2,077	1134.9	1372.7	1609.7	1845.8	2081.3	2316.2	2550.6
16	2,436	1493.9	1797.0	2087.7	2368.5	2641.0	2906.7	3166.3	16	2,040	1099.3	1347.0	1589.4	1827.4	2061.7	2292.9	2521.3
17	2,364	1536.1	1835.6	2119.6	2391.5	2653.4	2907.1	3153.7	17	1,918	1056.7	1317.0	1564.2	1801.6	2031.0	2253.8	2471.0
18	2,060	1529.4	1838.5	2127.9	2402.0	2664.1	2916.0	3159.5	18	1,788	1023.3	1297.4	1552.4	1793.6	2023.8	2245.2	2459.3
19	1,173	1501.7	1823.8	2120.9	2399.4	2663.3	2915.3	3157.4	19	651	1006.4	1286.3	1545.7	1790.2	2023.2	2246.9	2462.8

*According to ICSPFT (12), in the endurance run test boys and girls aged 6–11 years performed 600 m, boys aged 12–19 years performed 1,000 m, and girls aged 12–19 years performed 800 m.

ied. However, since for these two tests there was a large number of children with “problematic scores”, it was decided to use all of them in the study (following the procedure described in the statistical analysis section) in order to not self-select the sample and, therefore, report falsely greater percentiles of the population.

The main limitation of the study is related to its design. Physical fitness reference values in growing children should be preferably obtained from a longitudinal study, which gives the possibility to assess natural changes in individual development. Nevertheless, in the absence of this information, cross-sectional design analyzed by the appropriate statistical methods seems to be suitable. Another limitation of this study could be that the measures were taken by the physical education teachers instead of research team. However, recent studies have shown that physical education teachers achieve good reliability values administering field-based physical fitness tests (15). On the other hand, if the

measures were taken by research team, it could not be possible to obtain information based on such a large representative sample (49,281 children), which undoubtedly constitutes an important strength of the study.

In conclusion, the study provides gender and age-specific percentile values for fourteen commonly used field-based physical fitness tests among a random and large national representative sample of Polish children aged 7 to 19 years. The percentile values provided will enable the correct interpretation and monitoring of fitness status of Polish children. For many practical reasons, the physical education teachers might play a major role in helping to identify children with low levels of physical fitness. Therefore, introducing physical fitness testing in educational settings seems to be an important national health issue. For this purpose, close collaboration between the education system, health care and government appears to be crucial.

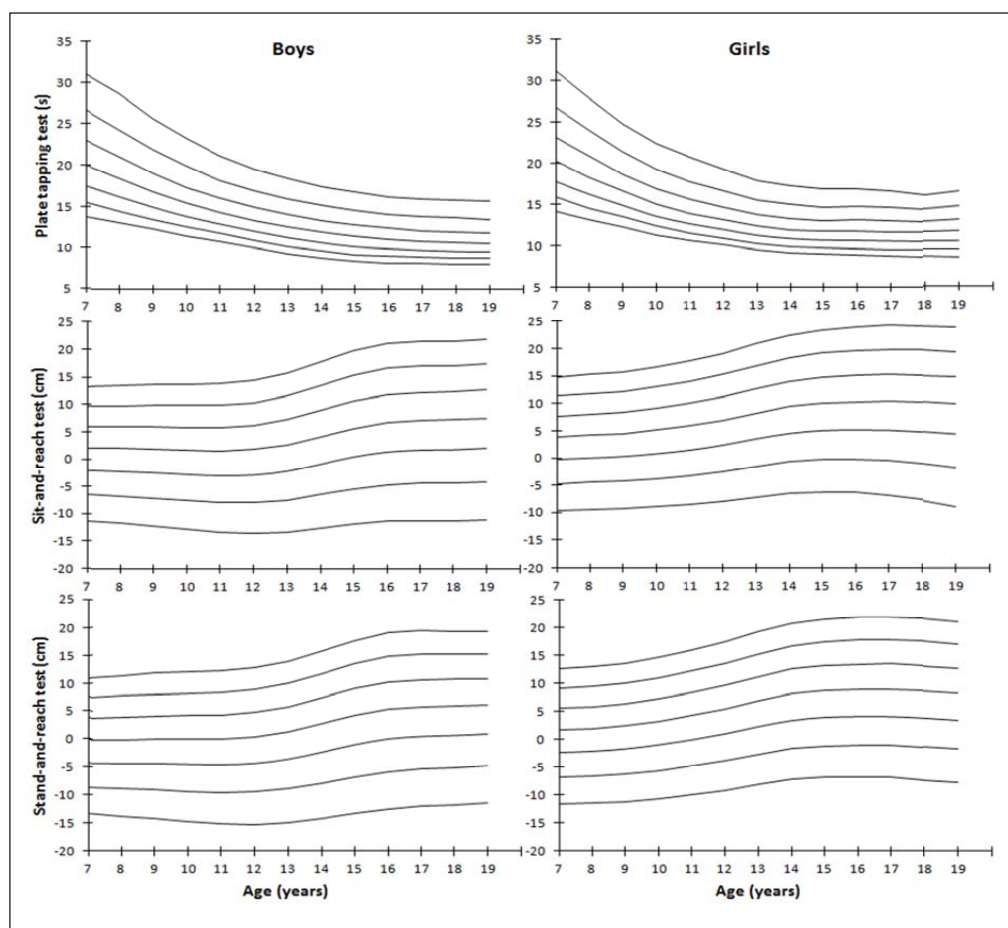


Fig. 1. Smoothed gender and age-specific percentile values (from the bottom to the top: 2.3rd, 9th, 25th, 50th, 75th, 91st, and 97.7th) for the stand-and-reach, sit-and-reach, and plate tapping tests among Polish children aged 7–19 years.

Acknowledgements

The authors gratefully acknowledge all the participating children and adolescents. The authors also acknowledge all physical education teachers involved in the data collection for their efforts and great enthusiasm. We also thank Anna Szczesniak for the English revision.

Conflicts of Interests

None declared

Funding

The study was a part of the project “Health of Polish children and adolescents with regard to the growth and level of physical fitness” registered at the Polish Ministry of Science and Higher Education and the Polish National Sciences Centre (N N404 078036). This study was conducted with the financial support of the Polish Ministry of Science and Higher Education (N N404 078036). Daniel Mayorga-Vega is also supported by a research grant from the Spanish Ministry of Education, Culture and Sport (AP2010-5905).

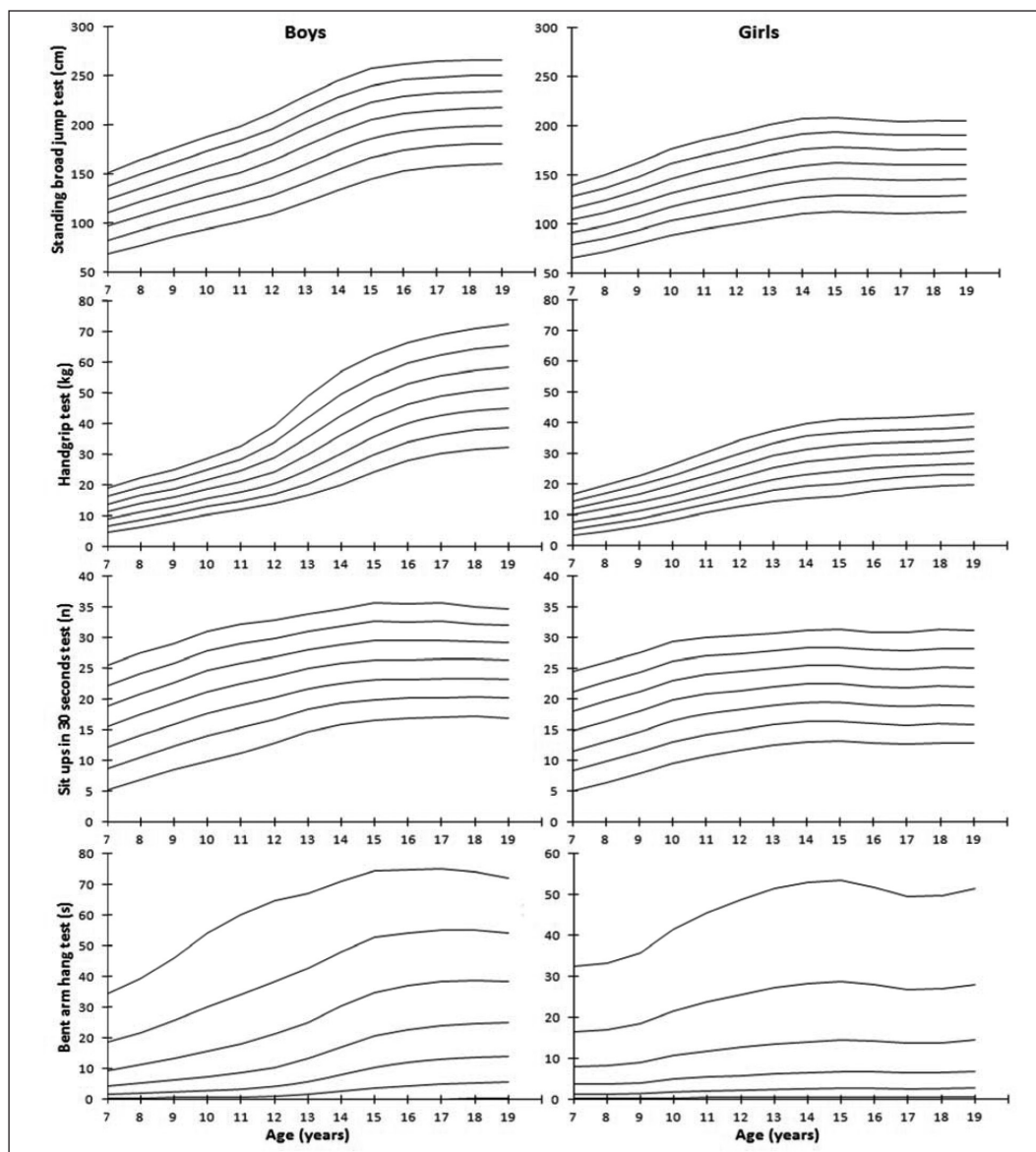


Fig. 2. Smoothed gender and age-specific percentile values (from the bottom to the top: 2.3rd, 9th, 25th, 50th, 75th, 91st, and 97.7th) for the bent-arm hang, sit-ups in 30 seconds, handgrip, and standing broad jump tests among Polish children aged 7–19 years.

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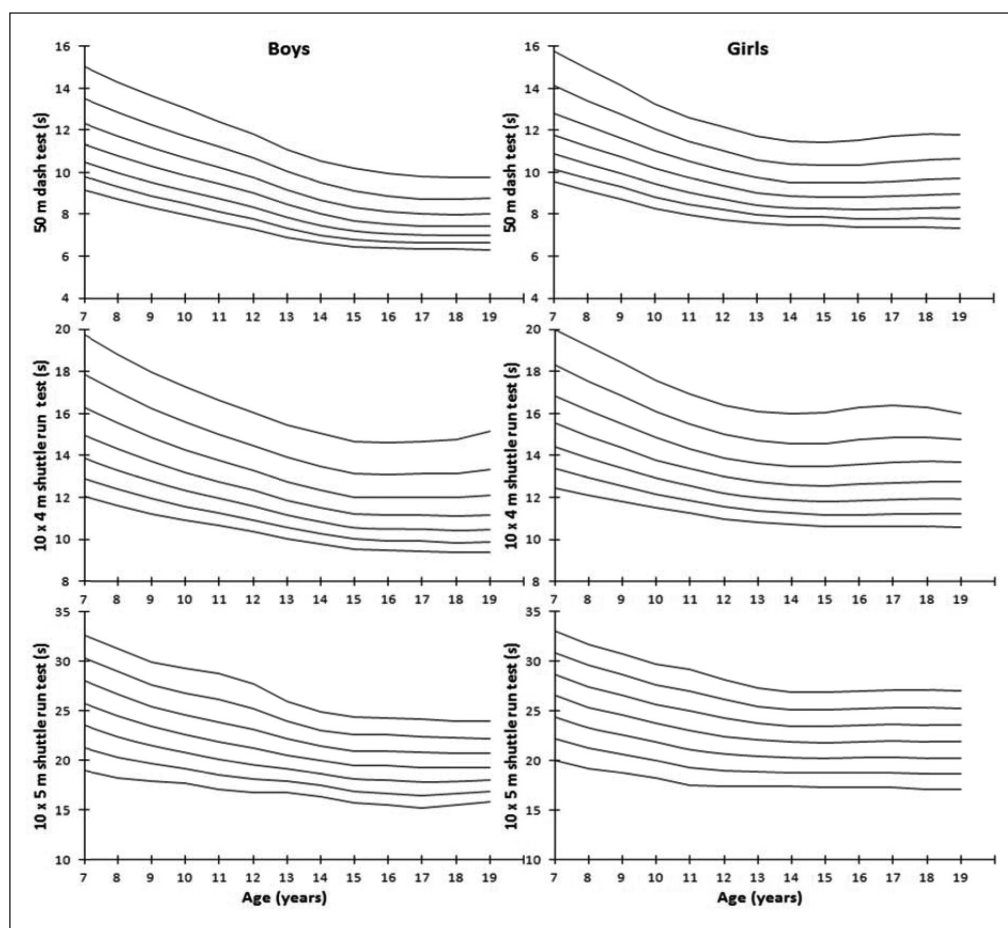


Fig. 3. Smoothed gender and age-specific percentile values (from the bottom to the top: 2.3rd, 9th, 25th, 50th, 75th, 91st, and 97.7th) for the 10 x 5 m shuttle run, 10 x 4 m shuttle run, and 50 m dash tests among Polish children aged 7–19 years.

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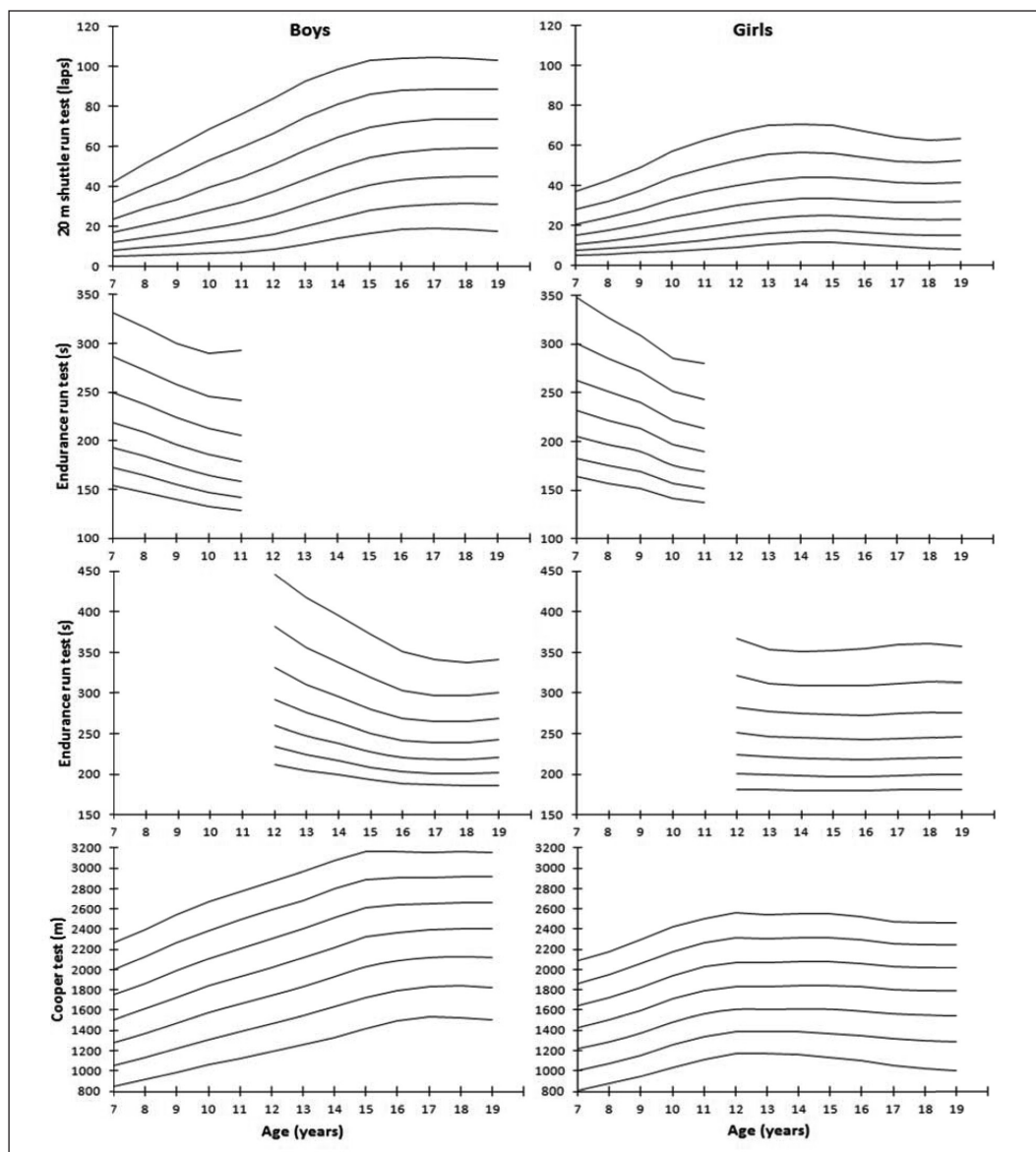


Fig. 4. Smoothed gender and age-specific percentile values (from the bottom to the top: 2.3rd, 9th, 25th, 50th, 75th, 91st, and 97.7th) for the Cooper test, endurance run, and 20 m shuttle run tests and among Polish children aged 7–19 years.

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Received October 29, 2014

Accepted in revised form February 24, 2015