COMPARISON OF MOTOR ABILITIES OF YOUNG CHILDREN IN POLAND IN THE YEARS 1996 AND 2006

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Abstract. The first study was conducted in 1996 in 10 (i.e. all) nurseries and 11 randomly selected preschools in Szczecin. The study involved 526 children (257 boys and 269 girls) aged 1–4 years, and 865 children from preschools (448 boys and 417 girls) aged 4–7 years. In 2006, the study was repeated in seven nurseries (i.e. all nurseries that existed in Szczecin at the time) and 11 preschools in the city of Szczecin, i.e. the same as in 1996. The study involved 314 children attending nurseries: 169 boys and 145 girls aged 1.5–4 and 887 preschool children (461 boys and 426 girls) aged 4–6 years. Motor development of nursery children was assessed based on the Denver test in two selected areas. The level of motor development in preschool children was assessed on the basis of a modified Wrocław Physical Fitness Test developed by B. Sekita. Comparison of the results helped answer the question whether and what developmental changes took place over a decade. The results indicated that the level of motor development of children in Szczecin, compared with children examined 10 years earlier, showed no significant differences.

Key words: motor development, nursery child, preschool child

Introduction

The first few years of life are the time of the most significant mental and physical transformations. For example, the biggest changes in the human brain occur in the first two years of age. In the motor development, this period is much longer (Kotarska et al. 2004; Ślenzak et al. 1975; Sekita 1988; Hurlock 1985). Although the literature on the motor development of children and adolescents is quite rich, reports on small children are unfortunately extremely rare (Przewęda 1981). The reasons are manifold. First of all, small children are a very difficult research material. Difficulties of work with nursery and preschool children have put off most of the researchers dealing with motor ability in Poland. Developing an adequate methodology for such young children is another problem (Osiński 1988). The vast majority of currently used tests of motor abilities for this age category has been created for medical

purposes (to determine the degree of mental retardation and other diseases). There is also a problem of the lack of adequate comparative scales (as it is difficult to compare the currently examined children with their peers from the 1980s and 1990s on which we have little data), and no updated tests that could be used for research in the area of physical culture in Poland (Kotarska et al. 2004). According to available literature (Kołłataj et al. 2011; Sygit et al. 2011), on the one hand we experience a growing problem of obesity among children and a significant reduction in physical activity, and on the other hand, there are no accurate methods by which it would be possible to characterize these phenomena and to estimate their effects.

The presented literature data are important reasons to attempt an assessment of the motor development of young children's from an urban agglomeration. Therefore, the aim of this study was to compare the level of motor development in children from nurseries and preschools in the city of Szczecin over a decade, and to answer the question of whether and what changes have occurred in their motor development over a 10-year period.

Material and methods

The first study was conducted in 1996 in 10 (i.e. all) nurseries in Szczecin and 11 randomly selected preschools in Szczecin. The study involved 526 children (257 boys and 269 girls) aged 1–4 years, and 865 children from preschools (448 boys and 417 girls) aged 4–7 years. In May and April 2006 the study was repeated in seven nurseries (i.e. all nurseries that existed in Szczecin at the time) and 11 preschools in the city of Szczecin, i.e. the same as in 1996. The study involved 314 children attending nurseries: 169 boys and 145 girls aged 1.5–4 and 887 preschool children (461 boys and 426 girls) aged 4–6 years. Younger children were divided into the following age groups – 1.5, 2, 2.5, 3, 4 years, similar to studies conducted by Cieślik et al. (Cieślik et al. 1994). Due to the extremely small size of the material, research was abandoned in the youngest age group – 1-year-olds. Preschool children were divided into three age groups – 4, 5, 6 years, utilizing the following classifications of chronological age: the group of 4-year-olds included all children who on the day of the examination were over 3.51 years old, and did not exceed the age of 4.50 years. A similar classification was adopted in relation to all children in the respective age groups (Kotarska et al. 2004).

Nursery children

The motor development of nursery children was assessed based on the Denver test in two selected areas (Ślenzak et al. 1975). The first concerned the visual-motor coordination determining the child's ability to see things and using hands for grasping and manipulating things. The tests included building a tower of blocks, drawing a circle and a cross, an indication of the longer line, and extracting a small object from a bottle. The second area concerned locomotion and postural control determining a child's ability to sit, walk and jump. Respective tests included climbing stairs, kicking, throwing and catching a ball, standing on one leg and jumping on one leg.

The Denver Test, originally the Denver Developmental Screening Test, was created in 1970 by Frankenburg, Fandal and Dodds (Ślenzak et al. 1975). The entire test consists of 105 elements arranged in order of their performance by a child from the earliest days of its life to 6 years. These tests are divided into four areas: individual-social, speech, eye-hand coordination and control of locomotion and posture; in our paper only the latter two were selected.

The table of the Denver Test form shows the child's age. Each of the 105 elements is represented by a rectangle placed on a scale to indicate the age when 25%, 50%, 75%, 90% of properly developed children are able to perform the given test. The technique of using the test is as follows: a vertical line denoting the child's age is drawn through

all the tested areas. Tests crossed by the line in the table should be resolved by the child. If the task has been performed correctly, it is denoted as P (positive), as N (negative) when the child is not able perform the task, R if it refused to perform the task, and NO when it had no opportunity to perform the task, for example, no opportunity to ride a tricycle. Results denoted as "NO" and "R" are considered to be neither negative nor positive, and are not taken into account in the interpretation of results. In performing each task, a child is allowed three attempts before an 'N' rate is given. A higher number of attempts could result in the child's learning from the researcher. The negative rate on the left side of the 'lifeline' means that the child could not perform a task already performed by 90% of younger children (delay in development). The test results indicate an abnormality in development, when within one tested area there are two or more delays. For a greater detail of assessment, the following scores were introduced: 3 points – the task performed in the 90–75% range, 4 points for the 75–50% range and 5 points for the "most difficult tasks" – 50–25% range.

Preschool children

The level of motor development of preschool children was determined on the basis of a modified Wrocław Physical Fitness Test developed by Sekita (Sekita 1988). It consists of four sub-tests:

- strength test (throwing a medicine ball) – distance of a throw with a 1 kg medicine ball from over the head,
- power test (long jump) – the distance of a long jump performed simultaneously with both legs from one place,
- speed test (20 m run) – time of the run over a distance of 20 m,
- agility test (agility run) – time of the 'swing' 4 × 5 meter run including carrying a block.

The proposed set of tests was tested for accuracy, reliability, selectivity and objectivity twice: in 1974 and 1981 (Sekita 1977; Arska-Kotlińska et al. 1993) and obtained positive results.

This test provides scoring tables that take into account the child's age, sex as well as urban and rural environments. With tables, one can read a number of points assigned to a given measurement and assess each test separately, or to sum up the number of points a child received for the performance of four tests. All experiments were conducted by the same person, after demonstrating and explaining the tests. Tests of strength, power and agility were held indoors, and the speed test was performed outdoors, in the field or garden. The sequence of tests was as follows: 1 – test of agility, 2 – power test, 3 – strength test, 4 – speed test.

The collected material was analyzed statistically by calculating characteristics for all the examined children: arithmetic mean, standard deviation, the probable error of the arithmetic mean, and probable error of the standard deviation. Differences between means of the tested traits were assessed using the Student's t test (Kotarska et al.2004; Arska-Kotlińska et al. 1993).

Results

A. Nursery children

Table 1 summarizes the results achieved by children in eye-hand coordination test and in the test of locomotion and postural control (the more points the better the rating) surveyed in 2006. The distribution of points in individual age groups was rather irregular, as higher means occurred sometimes in younger and sometimes in older groups. Therefore, we observed no age-related regularities.

In the coordination test, both boys and girls received the highest score in the oldest group and the lowest in the youngest group, i.e. two-year-olds. Comparing the "adjacent" age groups, only one statistically significant difference was found, between the 2.5 and 3-year-old girls, in favor of the older ones (Figure 1). In boys, the level of coordination was fairly similar across different age groups. Girls had a slightly larger range of results, as the older groups (3 and 4 years) had better results than 2 and 2.5-year-olds.

In the second test of locomotion (Table 1), the highest average scores were obtained by children from the youngest group. The lowest scores were obtained by 2-year-old boys and a 2.5-year-old girls. Similar as in the case of coordination, comparison between age groups resulted in the observation of two significant differences: between 1.5 and 2-year-old boys, and 2 and 2.5-year-old girls. In both cases, better results were achieved by younger children. The graphic presentation of means shows that the level of locomotion was similar in the studied age groups of boys, except for the youngest group, which clearly achieved the best results (Figure 2). Girls' level of locomotion was quite high in the youngest group and then decreased, then reaching the lowest means in the "middle" age group, and again rising until the oldest age group (Figure 2).

Table 1. Ontogenetic variation of coordination and locomotion of children

Sex	Age groups (years)	n	Child's coordination						Child's locomotion					
			min / max	M	S_M	σ	V_s	SIG	min / max	M	S_M	σ	V_s	SIG
Boys	01/05/12	19	1.20 / 4.00	01/02/56	0.70	0.16	27.31	–	1.60 / 4.75	01/03/88	0.92	0.21	23.71	–
	2	29	0.00 / 3.60	01/02/55	0.84	0.16	32.76	0.03	0.60 / 4.25	01/02/72	0.94	0.18	34.68	4.20**
	02/05/12	38	1.20 / 3.80	01/02/71	0.74	0.12	27.39	0.84	0.00 / 4.60	03/03/12	01/01/00	0.16	32.91	01/01/28
	3	67	0.60 / 4.30	01/02/65	0.80	0.10	30.24	0.38	0.75 / 5.00	01/02/75	0.97	0.12	35.31	01/01/41
	4	16	0.00 / 4.50	01/02/91	01/01/14	0.28	39.22	01/04/12	1.25 / 4.75	01/03/15	0.88	0.22	27.98	01/01/49
Girls	01/05/12	15	0.60 / 4.20	01/02/81	01/06/12	0.27	37.81	–	1.25 / 4.50	01/03/61	0.92	0.24	25.41	–
	2	27	1.00 / 4.10	01/02/53	0.82	0.16	32.39	0.94	1.60 / 5.00	01/03/33	0.86	0.17	25.82	0.99
	02/05/12	32	1.20 / 4.00	01/02/57	0.84	0.15	32.56	0.17	0.60 / 4.50	01/02/79	01/01/14	0.20	0.60	2.03*
	3	60	1.50 / 4.80	03/07/12	0.71	0.09	23/01/12	2.99*	1.00 / 4.60	01/03/18	0.90	0.12	28.18	01/01/83
	4	12	1.00 / 4.50	01/03/19	0.94	0.27	29.37	0.52	2.50 / 4.70	01/03/58	0.78	0.23	21.81	01/01/43

Legend for Tables 1–7: n – sample size; M – arithmetic mean; σ – standard deviation, S – probable error of the standard deviation; V_s – coefficient of variation; S_M – probable error of the arithmetic mean; Student's t test – the result of the Student's t-test.

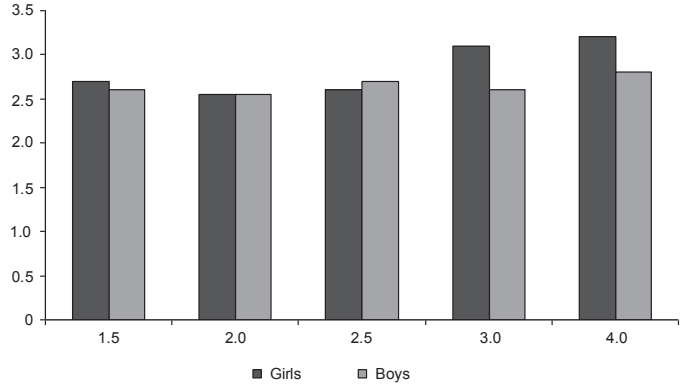

Figure 1. Coordination in age groups of nursery children

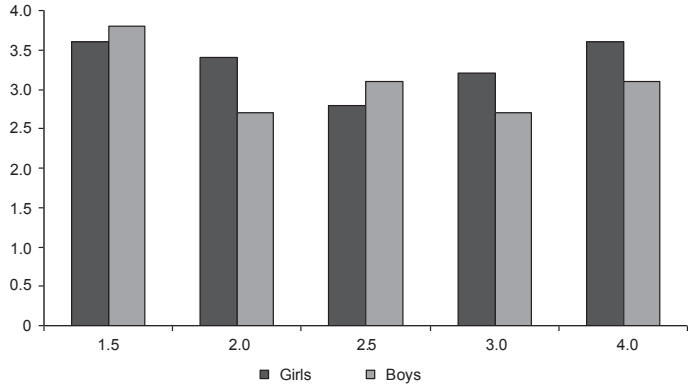

Figure 2. Locomotion in age groups nursery children

Motor development was also compared between boys and girls, with significant differences found in the coordination of 3-year-olds (in favor of girls), and in locomotion of 2 and 3-year-olds, again with better results of girls (Table 2). In the other age groups, results slightly higher than average were sometimes obtained by boys and sometimes by girls, without any distinct regularities. The differences were statistically insignificant.

Table 2. Differences between mean coordination and locomotion results of boys and girls

Age groups (years)	Coordination	Locomotion
1.5	0.25	0.27
2.0	0.02	0.61*
2.5	0.15	0.25
3.0	0.41*	0.43*
4.0	0.28	0.44

* $p < 0.05$.

Tables 3 and 4 show the level of motor development of children surveyed in 2006 and their peers attending nurseries 10 years earlier. It was found that boys surveyed in 1996 and 2006 (Table 3) obtained similar results in eye-hand coordination tests in almost all age groups. The exception was the oldest group, where 4-year-olds examined 10 years later received a higher score (statistically significant difference). Results of comparison were similar for girls. The results obtained by girls from different age groups were quite similar – an exception was noted again in only one group – 2.5-year old girls, where much better results were observed in 1996.

Table 4 includes the corresponding results for the locomotion and postural control. In boys, in all age groups, values slightly higher than the arithmetic mean were reported in children surveyed in 2006. Despite this regularity, only 2.5-year-old boys scored significantly higher than their peers examined 10 years earlier. Differences in other age groups were smaller and statistically insignificant.

Among the girls (except for the youngest age group), also slightly higher average values were observed in those surveyed in 2006, but similar to the boys – the differences were not statistically significant. Very clear differences in the resulting score were observed in 2 year old girls, in favor of girls examined in 2006.

Table 3. Eye-hand coordination of children examined in 1996 and 2006

Sex	Age groups (years)	1996			2006			Student's t test
		n	M	σ	n	M	σ	
Boys	1.5	26	2.49	0.85	19	2.56	0.70	0.79
	2.0	32	2.59	0.78	29	2.55	0.84	0.64
	2.5	56	2.75	0.88	38	2.71	0.74	0.62
	3.0	88	2.76	0.76	67	2.65	0.80	1.41
	4.0	46	2.15	0.98	16	2.91	1.14	2.67*
Girls	1.5	27	2.78	0.93	15	2.81	1.06	0.16
	2.0	51	2.89	0.73	27	2.53	0.82	2.08
	2.5	46	2.97	0.76	32	2.57	0.84	2.33*
	3.0	78	3.04	0.73	60	3.07	0.71	0.37
	4.0	51	2.76	0.90	12	3.19	0.94	1.12

* $p < 0.05$.

Table 4. Locomotion and postural control of children examined in 1996 and 2006

Sex	Age groups (years)	1996			2006			Student's t test
		n	M	σ	n	M	σ	
Boys	1.5	26	3.66	0.98	19	3.88	0.92	0.57
	2.0	32	2.38	0.97	29	2.72	0.94	1.04
	2.5	56	2.53	0.94	38	3.03	1.00	2.49*
	3.0	88	2.77	0.97	67	2.75	0.97	0.17
	4.0	46	3.02	0.92	16	3.15	0.88	0.86
Girls	1.5	27	3.79	0.88	15	3.61	0.92	0.67
	2.0	51	2.50	1.01	27	3.33	0.86	6.38**
	2.5	46	2.76	0.88	32	2.79	1.14	0.19
	3.0	78	2.88	0.92	60	3.18	0.90	2.01
	4.0	51	3.35	0.80	12	3.58	0.78	1.63

* $p < 0.05$; ** $p < 0.001$.

B. Preschool children

Further analysis concerned the level of motor development of preschool children. Table 5 presents means obtained by the boys and girls. As expected, in the first test – throwing a medicine ball, the mean results increased with age. Statistically significant difference was observed in 4 and 6-year-olds, where boys had definitely more strength. Similarly, in a power test (long jump) – the mean results increased with the age of children.

Differences between boys and girls were not significant. It should be noted that boys always obtained slightly higher mean results. In the run for 20 meters, duration of the test decreased with age, both among boys and girls. Statistically significant difference appeared in 5-year-olds – with boys being faster than girls. It is somewhat surprising that the oldest age group of girls achieved slightly better results than boys (although the difference was not statistically significant). In the last test – concerning agility (shuttle run 4 × 5 m), a statistically significant difference was observed between the 5-year old boys and girls. Boys turned out to be more agile.

Table 5. Sex-based development of physical fitness of preschool children

Test	Age (years)	Boys						Girls						Student's t test
		n	M	min	max	σ	S_M	n	M	min	max	M	S_M	
Medicine ball throw	4	179	156.62	50.00	340.0	43.57	3.26	161	146.10	50.00	230.00	34.24	2.70	2.457*
	5	157	189.91	80.00	400.0	50.63	4.04	145	178.62	60.00	470.00	49.88	4.14	1.949
	6	125	235.92	100.00	440.0	67.25	6.02	120	215.08	80.00	410.00	57.88	5.28	2.594*
Long jump	4	179	78.04	30.00	140.0	22.75	1.70	161	76.05	20.00	120.00	19.12	1.51	0.870
	5	157	91.39	30.00	180.0	25.46	2.03	145	89.01	6.00	150.00	23.59	1.96	0.843
	6	125	110.76	50.00	180.0	22.30	1.99	120	104.94	50.00	190.00	24.72	2.26	1.936
20 meter run	4	179	6.02	4.23	8.40	0.93	0.07	161	6.09	4.22	9.90	0.83	0.07	0.750
	5	157	5.37	3.47	12.60	1.03	0.08	144	5.64	4.11	7.45	0.84	0.07	2.438*
	6	125	5.02	3.49	8.09	0.74	0.07	120	4.98	4.05	7.15	0.71	0.06	0.441
Agility run	4	179	11.84	8.37	16.43	1.60	0.12	161	12.08	8.92	18.63	1.42	0.11	1.461
	5	157	10.77	7.20	16.99	1.56	0.12	145	11.21	8.75	15.17	1.31	0.11	2.659*
	6	125	10.00	4.27	14.91	1.31	0.12	120	10.12	7.61	14.50	1.40	0.13	0.683

* $p < 0.05$.

Finally, we made the comparison of the level of motor development of preschool children surveyed in 1996 and 2006. Table 6 shows the results obtained by boys. In a strength test, a statistically significant difference was observed in 4-year-olds, in favor of boys surveyed in 2006. In other age groups, slightly better results were obtained by the boys surveyed 10 years earlier. However, these differences were not statistically significant.

In the power test, boys examined in 1996 achieved better results. Statistically significant differences occurred in 5 and 6 year olds. The speed of boys examined in 2006 and their peers tested 10 years earlier was similar, and no age group showed significant differences. In the last of the tests – the agility test – 4 year olds from 2006 were more agile than their peers in preschools in 1996. The agility results obtained in other age groups were similar.

Table 7 shows the analogous results of girls. Similar to boys, results increased with age. In a strength test, similarly to boys, a statistically significant difference was reported in favor of 4-year-old girls surveyed in 2006. Arithmetic means obtained in the older age groups were similar. In the jumping test girls also obtained results similar to boys. Five and six-year-old girls surveyed in 1996 jumped significantly further. Speed of girls was similar

in 1996 and 10 years later. Agility results of girls were similar to boys. Statistically significant difference occurred in the youngest age group, in favor of girls surveyed in 2006 (Kotarska et al. 2010)

Table 6. Numerical characteristics of motor tests of boys in 1996 and 2006

Test	Age (yrs)	Boys												Student's t test
		1996						2006						
		n	M	min	max	σ	S_M	n	M	min	max	σ	S_M	
Medicine ball throw	4	104	142.11	60.00	270	37.98	3.72	179	156.62	50.00	340.00	43.57	3.26	3.27*
	5	141	194.23	100.00	340	43.35	3.65	157	189.91	80.00	400.00	50.63	4.04	0.82
	6	112	237.86	140.00	390	52.62	4.97	125	235.92	100.00	440.00	67.25	6.02	0.43
Long jump	4	104	73.89	30.00	120.00	20.74	2.03	179	78.04	30.00	140.00	22.75	1.70	1.07
	5	141	103.90	50.00	160.00	18.88	1.59	157	91.39	30.00	180.00	25.46	2.03	8.76**
	6	112	117.23	70.00	170.00	19.05	1.80	125	110.76	50.00	180.00	22.30	1.99	2.57*
20 meter run	4	104	6.16	4.50	9.00	0.93	0.09	179	6.02	4.23	8.40	0.93	0.07	0.61
	5	141	5.36	4.08	7.23	0.58	0.09	157	5.37	3.47	12.60	1.03	0.08	0.12
	6	112	4.99	3.86	6.47	0.55	0.05	125	5.02	3.49	8.09	0.74	0.07	0.38
Agility run	4	104	12.25	9.07	16.81	1.50	0.15	179	11.84	8.37	16.43	1.60	0.12	2.62*
	5	141	10.70	8.04	14.70	1.27	0.11	157	10.77	7.20	16.99	1.56	0.12	0.88
	6	112	9.87	8.22	11.97	0.79	0.07	125	10.00	4.27	14.91	1.31	0.12	1.13

* $p < 0.05$.

Table 7. Numerical characteristics of motor tests of boys in 1996 and 2006

Test	Age	Girls												Student's t test
		1996						2006						
		n	M	min	max	σ	S_M	n	M	min	max	σ	S_M	
Medicine ball throw	4	117	135.09	60.00	240.00	32.30	2.99	161	146.10	50.00	230.00	34.24	2.70	3.09*
	5	115	174.39	100.00	290.00	38.96	3.63	145	178.62	60.00	470.00	49.88	4.14	0.79
	6	107	211.59	13.00	340.00	45.42	4.39	120	215.08	80.00	410.00	57.88	5.28	0.51
Long jump	4	117	78.33	40.00	120.00	18.94	1.75	161	76.05	20.00	120.00	19.12	1.51	0.68
	5	115	98.65	10.00	170.00	20.24	1.89	145	89.01	6.00	150.00	23.59	1.96	5.84**
	6	107	111.73	60.00	150.00	17.75	1.72	120	104.94	50.00	190.00	24.72	2.26	2.49*
20 meter run	4	117	6.45	4.75	9.95	0.84	0.08	161	6.09	4.22	9.90	0.83	0.07	4.72**
	5	115	5.43	4.11	7.44	0.70	0.07	144	5.64	4.11	7.45	0.84	0.07	2.53*
	6	107	5.20	4.04	7.69	0.63	0.06	120	4.98	4.05	7.15	0.71	0.06	2.81*
Agility run	4	117	12.26	9.43	15.44	1.23	0.11	161	12.08	8.92	18.63	1.42	0.11	0.63
	5	115	10.77	8.50	14.77	1.11	0.10	145	11.21	8.75	15.17	1.31	0.11	2.72*
	6	107	10.23	8.22	14.00	1.02	0.10	120	10.12	7.61	14.50	1.40	0.13	2.01

* $p < 0.05$; ** $p < 0.001$.

Discussion

The progressive development of civilization improves the living standards of families, but on the other hand, imposes certain limitations to human physical activity which in turn affects general health (Abu-Omar et al.2004;

Abu-Omar; Rutten et al. 2004). Proper assessment of physical activity of various groups, determination of the conditioning factors and causes of differences is very important (Bouchard et al.1994; Biernat 2005).

Physical activity usually results in the significant improvement in functional capacity and health, and can often prevent certain diseases or reduce their severity. It has been proven that regular physical activity improves the overall well-being, improves overall physical and mental health, helps to maintain an independent lifestyle, helps to control certain conditions (e.g. stress, obesity) and diseases (e.g. diabetes), reduces the risk of certain diseases (such as coronary artery, hypertension, diabetes), helps to minimize the effects of certain disabilities and may help in the treatment of pain. Research results show that systematic physical activity significantly affects the decline in mortality from cardiovascular disease and overall mortality; it also reduces the risk of obesity, overweight, diabetes, osteoporosis and cancer (Aadahla et al. 2002; Bownik et al. 2009; Bulzacka 2008; Gross 1999).

Unfortunately, in recent times, more and more children experience little physical activity, which adversely affects their development (Półtorak 2004). The decreasing levels of motor development coincide with an increased incidence of various diseases, overweight or posture defects. This phenomenon is of particular importance in relation to a small child. During the time of nursery and the beginning of preschool the child's activities begin to resemble those of adults. Of course, its motor skills are far different from the movements of an adult, but in this period a child is characterized by a great desire to move and act. In the preschool, we observe the child's first peak of motor activity and reaching mental and emotional maturity sufficient for attending school properly.

Therefore, it seems particularly important to systematically monitor and assess physical and motor development of a small child (Przęweda 1985). Without information regarding the level of fundamental motor skills, it is difficult to determine the direction and strength of changes related to the increasingly widespread obesity and reduced physical activity. Without this type of data, one can not speak about the "lower level of physical fitness", "reduced ability" or "deteriorating predispositions". Consideration should be given to the fact that this period of life is accompanied by the most rapid changes in the physical sphere, and that this age is the most convenient period for the early correction of any deficiencies related to motor development (Osiński 1988; Bucher et al. 1981; Schmidt 1988).

The test used to evaluate the motor development of 'nursery' children helped to determine the results in the form of points. Therefore, it was possible to compare their motor abilities between age groups. It was characteristic that the best coordination results were achieved by the oldest children. It was different with locomotion, where the highest mean result was obtained by the youngest children. Sexual dimorphism was distinct in coordination in 3-year-olds, and in locomotion in 2 and 3-year-olds. In each of these cases, better results were obtained by girls, which confirms the well known fact of their better eye-hand coordination, locomotion, and postural control at this age. It is also worth noting that in each age group a higher average scores were obtained in locomotion than coordination.

The examination of preschool children showed better motor development of boys. Statistically significant differences were most pronounced in 5-year-olds. Only the long jump results were similar for both sexes. One could say that sexual dimorphism in motor development is revealed during preschool, albeit only slightly. This observation is confirmed in other papers (Sekita 1977; Gniewkowska 1965; Burdukiewicz et al. 1997; Szklarska 1988). In the group of preschool children, it was observed that over the 10-year period the level of motor development decreased among boys – except for the 4-year-olds. In the group of girls, similar to nursery children, better results were observed sometimes in groups examined in 2006, and sometimes in those studied in 1996, so it is therefore difficult

to talk about distinct regularities. In both sex groups, it was found that in four-year-olds strength and agility was better developed in children surveyed in 2006. On the other hand, the children attending preschools in 1996 were better in long-jumping – which was clearly visible in 5 and 6-year-olds. Speed was developed at similar levels in children surveyed in both time periods.

It could be assumed that the differentiation of the abilities of the examined preschool children would be more pronounced in the activities that depend on the level of somatic development (Kotarska et al. 2004). According to Starosta (1993), the level of locomotion is decreasing among Polish children. As human motor ability is considered to be trained and more sensitive to environmental changes than somatic features (Kotarska et al. 2010), the effects of the impact of socio-economic factors on the motor abilities are quickly revealed. For many years, urbanization has shown to be an important factor affecting the results of motor tests. The differences are the greater the more extreme contrast between the compared environments, concern changes inside the examined social strata and depend on parents' education, technical infrastructure and degree of urbanization (Ignasiak et al. 1993; Mleczko et al. 2000; Nowacka-Dobosz 2006; Raczek 1986; Szopa et al. 1986; Mleczko 1991).

Conclusions

1. The level of motor development in nursery children in the examined age groups studied in 1996 and 2006 was similar.

2. In the group of nursery children there was a distinct sexual dimorphism in coordination (older age group) and in locomotion (2 and 3-year-olds). In each of these cases girls achieved better results.

3. In each age group of nursery children, higher mean scores were obtained in locomotion than in coordination.

4. Among preschool children, dimorphic differentiation of motor development occurred throughout the entire period of preschool, although with different intensity for each motor test.

5. The level of motor development in preschool children studied in 1996 and 2006 showed no significant differences in tests. It can therefore be assumed that social and economic changes between 1996 and 2006 did not have a significant effect on the level of motor development of the children in preschools in Szczecin, neither positive nor negative.

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