Socio-Economic Differences in the Development of Six-Year-Old Children in Rural Areas of East Poland

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Abstract

The aim of this study is to evaluate socio-economic differences in physical, cognitive, and motor development among six-year-old children living in rural areas. The study encompassed 228 children, including 118 girls and 110 boys living in different rural settlements in the Świętokrzyskie Province in Poland, who were selected through a combination of nonprobability and random sampling. The study was carried out from April to June 2014. A questionnaire was used to collect information from the parents of the children concerning the parents' education, number of children in the family, and the number of persons per room. Based on the concept of socio-economic status (SES), three levels of quality of life conditions of each family, i.e., high, average, and low, were distinguished. The study noted considerable differences in BMI, and especially the cognitive development of the children with respect to the socio-economic status of their family. It was observed that children from rural areas who live in bad socio-economic conditions are exposed to a wide range of negative factors affecting their health, which leads to lower educational results and negative long-term biological and psychosocial consequences. The chance for more rapid alignment of development deficits for those children would have been their earlier cover of school duty.

Keywords Six year old children · Socio-economic status · Physical development · Motor fitness · Cognitive development

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1 Introduction

The socio-economic status (SES) is a cohesive and reliable prognostic for the wide range of lifelong term results, including physical and mental health.

A child's development depends on biological potential (genetic factors), the environment, and the interaction between these factors. The analysis of a person's socio-economic environment distinguishes various groups of extrafamilial and cultural modifiers, along with the level of urbanization in a person's place of residence. Another group encompasses intrafamilial factors, which are determined based on parents' level of education, their professional status, number of children in the family, and financial and living conditions. The effect of these factors on children's health is only indirect.

Consequently, neither the socio-economic status of a child's family nor any of its indicators directly affect the course of the child's development (Evans 2015; Ackerman et al. 2004). This effect may only be indirect, i.e., each of the factors that contribute to the socio-economic status of a child's family impacts certain elements of the child's lifestyle, and it is these elements that directly affect the development of the child's body. A higher socio-economic status of a family allows for providing a proper and well-balanced diet, a place for studying and resting, better medical care, and a hygienic lifestyle.

A low socio-economic status of a family brings such dangers as: an unfavorable income-to-needs ratio (the income is insufficient to fulfill basic needs), low standard of residence, dangerous and polluted neighborhood, and limited access to good quality care and education, and related family problems. Pre-school children are very exposed impacted by the consequences of poverty, which cause problems with learning and behavioral disorders to a greater extent during early childhood than in later life (Bradley and Corwyn 2002; Sameroff and Fiese 2000; Repetti et al. 2002; Atzaba-Poria et al. 2004; Bernier et al. 2016).

A child's school readiness is analyzed across multiple dimensions with respect to complex determinants of ontogenesis. Whether these criteria are fulfilled depends on the appropriate development in each sphere of a child's development (i.e., mental, physical, and social spheres), which is referred to as the harmoniousness of development (Ackerman et al. 2004; Czapiński 2013). Family environment is a significant factor determining the optimal course of a child's development in the pre-school period, and the favourable factors such as the improvement of the economic state, proper nutrition, adequate hygiene and access to healthcare cause the increase the pace of growth and development – a positive trend (Kowal et al. 2011; Bejer 2011; Drozd et al. 2017; Brańka 2014).

The cognitive development refers to all mental activities forms related to organising and process information, that is those actions that correlate with the thinking process, therefore they embrace intelligence and level of thinking. That is why in this case in psychological practice one uses standardized test – the scale of intelligence measurement (Birch and Malim 2001), remembering the fact that children cognitive development depends not only on hereditary factors, but also social ones such as: parents education and the socio-economic state of the family (Jaworowska and Szustrowa 2000).

Despite the fact that the general living conditions of children from rural areas in Poland have improved in recent years, a socio-economic distance can still be observed

between different social classes in this population (Halamska 2014; Janowski 2017; Nowak 2012; Asienkiewicz and Wandycz 2014; Saczuk 2012; Wilczewski 2013). Similar stratification was also noted in other countries (Patterson et al. 2014; Burchinal et al. 2008; Lämmle et al. 2012; Li et al. 2012; Ujević et al. 2013; Wickham et al. 2016; Tarasenko et al. 2016; Evans and Kantrowitz 2002; Clark et al. 2001).

Those studies refer to the diagnosis of different development spheres of six-year old's in Poland (Kopik 2007), where a very significant different in the level of mental development were observed among urban and rural children in a favour of urban children. In rural children group more average results, and significantly less high results were observed, moreover those studies found that children who attended the preschool were characterized by a higher level of mental development.

Therefore, it is important to evaluate the differences in children's physical and psychomotor development with respect to the socio-economic status of their families, especially on the threshold of school education, because a lower level of a child's development may have a negative effect on school performance. This is especially important because the causes of failures in learning generally do not appear individually, but occur as a complex set of factors, in which developmental (biological) determinants are accompanied by negative social factors (Trzcińska et al. 2007; Sirin 2005; Malecki and Kilpatrick 2006; Kim et al. 2013; Schickedanz et al. 2015; Probst et al. 2016; Jaworowska and Szustrowa 2000).

At the age of six or earlier children attend the first grade in 22 out of 28 UE member states, and in 134 out of 202 states throughout the whole world. In Poland the issue of lowering the school age became the subject of many disputes. The 2015/2016 school year was the only school year when the six-year old's where obligated to study. Against the opinion of the neurologists the key argument that stopped the reform was as follows: Six-year old's are not enough emotionally mature to become pupils (Kruszewska 2018).

Thus, the aim of this study is to evaluate the socio-economic differences in the physical, cognitive, and motor development among six-year-old children living in rural areas of Świętokrzyskie Province in Poland.

2 Materials and Methods

The study investigated 228 six-year-old children, including 118 girls and 110 boys, who attended pre-school facilities in different rural settlements in the Świętokrzyskie Province in Poland. The Institutional Review Board of Bioethics Committee of The Jan Kochanowski University in Kielce, approved all procedures used in the study. The study was conducted in accordance with recognized ethical standards according to the Declaration of Helsinki regarding human experimentation as it was adopted in 1964 and revised in 2013. The study was carried out from April to June 2014. The group of six-year-old children encompassed children aged between five years, six months, and one day and six years and six months. A combination of nonprobability and random sampling was used, because, while different rural pre-school facilities were selected that predominantly operated alongside schools, many parents did not give consent for their child to participate in the study. The inclusion criteria were a lack of health contraindications for performing a voluntary physical exercise workout. During a

qualification interview, the participants were instructed about the scope of the study and were informed that they could opt out at any stage without providing a reason.

The study area was not chosen accidentally, because Świętokrzyskie Province is the middle region often counted as the “B” region of Poland that means it belong to the “Eastern Wall” part, the part which is characterized by lower than average standard of living and not that advanced socio-economic development in regard to central and west Poland. In the sample selection was used the intentional-aleatory selection, because among 13 counties of Świętokrzyskie Province one had been chosen, and it was aleatory; that was buski county. Next one has designated different preschool facilities, that were functioning most often alongside schools. Those facilities were situated at the area of all seven village municipalities of that county. In those municipalities the population vary between 4 and 8 thousand, whereof the majority are elder people.

The study evaluated various spheres of development, which were treated as direct and positive measures of the children’s health, in particular: physical development, motor fitness, and cognitive development. The evaluation of physical development involved the measurement of body height and body mass, which were used to calculate BMI (body mass in kg/body height in m²). Body height was measured using an anthropometer with the head positioned in the eye-ear plane to an accuracy of 1 mm, and body mass was measured on a SECA mechanical scale to an accuracy of 100 g.

Motor fitness was assessed with a test involving four trials (Jopkiewicz et al. 2011): two-handed overhead 1 kg medicine ball throw (cm); standing long jump (cm), 20 m run from a standing start position(s); 4 × 5 m shuttle run while moving a block(s). Furthermore, the results obtained in each trial were converted into points, the sum of which constituted the basis for determining a child’s general motor fitness. All measurements were taken before noon, and the workouts were preceded by a warm-up.

Cognitive development was evaluated with Raven’s Progressive Matrices (the colored version), designed for testing pre-school and early school-age children (Jaworowska and Szustrowa 2000). The test tasks engage a child’s perception and thought processes (attention, global analytic and synthetic perception, and drawing conclusions). The children solved test tasks in groups of two to four and under the supervision of a psychologist. They sat at a distance from one another, and so had better conditions for concentration and working individually.

A questionnaire was used to collect information from the parents of the children that would help to determine the socio-economic status (SES) of the family. The following data were taken into account: mother’s and father’s education, number of children in the family, and the number of persons per room. Different categories of these variables were ascribed points arbitrarily. The sum of these points indicated the socio-economic status (SES) (Jopkiewicz et al. 2011). Based on the SES concept, three levels of quality of life conditions of each family, i.e., high, average, and low, were distinguished. Among the study participants, 31.9% children had a low socio-economic status, 43.9% children had an average socio-economic status, and 24.2% children had a high socio-economic status. These results are mostly consistent with the demographic data presented by the Central Statistical Office of Poland (GUS 2013; MEN 2010).

The family SES was defined on mother and father education level base (both counted on the scale from 1 to seven points), the number of children in the family (1–5 pt) and density – that is the number of people for one room (1–5 pt). The sum of each category variable gave the SES result. Basing on the SES idea (Waliszko et al.

1987) three groups of “level of goods” (what regards to the family living conditions) were pointed out as follows: high, average, and low. The division was done on the base of arithmetic average, standard deviation and curve of results distribution (Jopkiewicz et al. 2011).

The correlation between continuous variables was evaluated using the analysis of variance (ANOVA). The significance of differences in variance was determined with Snedecor’s *F*-test, which was expanded with post hoc tests of multiple comparisons of least significant difference (LSD). The correlations between the categorized variables were evaluated using Spearman’s rank correlation test and effective hypothesis decomposition. Statistical probability was assumed at 0.05 and higher.

3 Results

The six-year-old boys had higher mean values of body height and body mass, and slightly lower relative body mass than the girls. Both the girls and the boys displayed similar intersubject variability; the differences between the mean values were statistically insignificant only in the case of BMI (Table 1).

Statistically significant differences and correlations are given in boldface (in Tables 1, 2, 3 and 4).

Boys showed slightly higher motor fitness in terms of arm strength (medicine ball throw), power (standing long jump), speed (20 m run), and agility (4 × 5 m shuttle run). Both the boys and the girls displayed a similar intersubject variability, and the differences between the mean values were statistically insignificant only in the case of agility (Table 2). On the other hand, no significant differences between the sexes were observed in the Raven’s test for both the raw results and the centile results, which seems perfectly understandable (Table 2).

Analysis of the socio-economic status of the family indicated considerable differences of BMI and cognitive development of the children, determined on the basis of raw and centile results of the Raven’s test. A higher socio-economic status of the family correlated with a higher value of standard body mass of the researched children, as well as with a higher level of the children’s cognitive development. The study, however, did not observe any correlations between the socio-economic status of the family and the motor fitness of the researched children (Table 3).

SES of the family is the substantially differing factor of Raven’s test result, and also at some point in regard to girls and all examined children on the whole of the BMI factor value. However, those connections are directly proportional, because the better

Table 1 Basic somatic traits and BMI of six-year-old children living in rural areas

Trait	Boys (<i>N</i> = 110)				Girls (<i>N</i> = 118)				<i>d</i>	<i>t</i>
	<i>N</i>	$\bar{X}$	<i>s</i>	<i>v</i>	<i>N</i>	$\bar{X}$	<i>s</i>	<i>v</i>		
Body height (cm)	110	117.9	5.0	4.2	118	117.3	6.0	5.1	0.58	2.293
Body mass (kg)	110	22.1	3.7	16.5	118	21.7	3.8	17.7	0.38	3.049
Body mass index (kg/m ²)	110	15.9	2.0	12.8	118	16.1	2.7	12.0	−0.57	1.698

Table 2 Motor fitness and cognitive development of six-year-old children living in rural areas

Trial	Girls (N = 118)			Boys (N = 110)			d	t
	$\bar{X}$	s	v	$\bar{X}$	s	v		
20 m run (s)	5.4	0.6	11.1	5.2	0.7	13.5	0.2	1.986
4 × 5 m shuttle run (s)	10.4	1.1	10.6	10.3	1.2	19.8	0.1	0.879
Standing long jump (cm)	101.0	12.7	12.6	105.2	16.9	16.1	4.2	2.056
Medicine ball throw (cm)	273.9	59.1	21.6	285.8	56.6	19.8	11.9	2.193
Raven's test (points)	22.3	5.2	23.3	23.3	5.9	25.3	1.0	1.676
Raven's test (centiles)	67.3	26.2	38.9	69.6	25.7	36.9	2.3	1.153

socio-economic situation of the family, for both boys and girls, and for the whole six-year old's was substantially correlated with better result of Raven's test (Table 4).

Effective hypothesis decomposition clearly showed that the mean values of BMI differed significantly between each category of the socio-economic status of the family (SES: 1 – low; 2 – average; 3 – high), and this concerns both the boys and the girls (Fig. 1); the differences are stronger among the girls than among the boys. A higher socio-economic status of a family corresponds with an increase in standard body mass, and, likely, obesity as well.

Figure 2 and the analysis of the results of the Least Significant Difference (LSD) test based on one-way analysis of variance indicate that, as far as the Raven's test is concerned, there are no significant differences between the sexes, which is understandable; however, there are significant differences between various categories of SES. Namely, a higher category of SES is accompanied by a higher level of cognitive development, especially in the boys. On the other hand, these relationships are less visible among the girls with respect to both the raw results and the centile results of the Raven's test (Figs. 2 and 3).

Table 3 Analysis of intergroup variance in different traits of physical development, motor fitness, and cognitive development of six-year-old children living in rural areas with respect to the socio-economic status of the family

Trait	SS Effect	df Effect	MS Effect	SS Error	MS Error	F	p
Body height	158.5	5	31.7	5963.5	30.5	1.036	0.397
Body weight	217.7	5	43.5	3814.5	19.5	2.226	0.053
BMI	64.9	5	12.9	1083.4	5.6	2.338	0.043
20 m run	3.0	5	0.6	77.4	0.4	1.517	0.186
4 × 5 m shuttle run	790.5	5	158.1	2740.2	140.5	1.125	0.348
Standing long jump	20.9	5	2.2	267.6	1.4	1.601	0.162
Medicine ball throw	20,309.4	5	6556.6	9525.0	3362.2	1.208	0.307
General fitness	6018.5	5	1203.7	245,386	1259.8	0.955	0.456
Raw results of the Raven's test	622.7	5	124.5	4937.7	28.2	4.413	0.000
Centile result of the Raven's test	12,735.5	5	2547.1	107,351	616.9	4.128	0.001

Table 4 The correlation coefficients of Spearman's rank concerning the results of Raven's and wsk tests. BMI of six-year-old rural children in regard to the family socio-economic status

Trait	Study group	Socio-economic status of the family	
		R	<i>p</i>
Raw results of the Raven's test	Girls (N = 118)	0.33	0.05
	Boys (N = 110)	0.34	0.01
	Girls and Boys in Total (N = 228)	0.35	0.01
Centile result of the Raven's test	Girls (N = 118)	0.30	0.05
	Boys (N = 110)	0.31	0.01
	Girls and Boys in Total (N = 228)	0.32	0.01
BMI	Girls (N = 118)	0.22	0.05
	Boys (N = 110)	0.17	–
	Girls and Boys in Total (N = 228)	0.20	0.05

Further statistical analysis using the LSD test allowed for evaluation of the significance of differences between the three SES levels. It revealed that there is no statistical difference between the results of the Raven's test obtained by the girls from families with an average and high SES. However, a low socio-economic status caused significant differences among both the girls and the boys (Figs. 2 and 3).

4 Discussion

SES is precisely related to education results. The low level of SES bins with decreased educational success (Sheridan and MCLaughlin 2016; Shonkoff and Garner 2012).

Cognitive development concerns all forms of mental activity related to organizing and processing information, i.e., actions that involve thought processes, and, therefore,

Fig. 1 Effective hypothesis decomposition of BMI with respect to the socio-economic status of the family. Vertical bars denote 0.95 confidence intervals (in Figs. 1, 2 and 3)

Fig. 2 Effective hypothesis decomposition of raw results of the Raven's test with respect to the socio-economic status of the family

encompass intelligence and level of thinking. In psychological practice, cognitive development is evaluated with standard tests, that is, intelligence scales (Kopik 2007). In the present study, cognitive development of six-year-old children was evaluated with the colored version of Raven's Progressive Matrices, which test deduction abilities, i.e., abilities that do not depend on individual experience (gained knowledge).

Cognitive development of children depends not only on hereditary factors, but is also affected by social factors, such as parents' education and the socio-economic status of the family (Matute Villaseñor et al. 2009; Ghosh et al. 2015; Ranabhat et al. 2016; GUS 2013; Jaworowska and Szustrowa 2000). A clear correlation between the level of cognitive development and the socio-economic status of the family was observed in the researched children. Analysis of variance, correlation coefficients of Spearman's rank and effective hypothesis decomposition revealed that these correlations are statistically

Fig. 3 Effective hypothesis decomposition of the centile results of the Raven's test with respect to the socio-economic status of the family

significant with respect to the six-year-old children, both the girls and the boys (Table 3, Figs. 2 and 3).

The results of our study confirm the previous observations of Jaworowska and Szustrowa (2000), Abad et al. (2004), Conger et al. (2010), Tabriz et al. (2015), Parisi et al. (2010), and Hanscombe et al. (2012) concerning the correlations between cognitive development and the socio-economic status of a child's family. The abovementioned authors revealed that a higher socio-economic status of a child's family correlates with a higher level of the child's development. The obtained results indicate that the force of influence of socio-economic factors on the diversification of cognitive development in girls and boys is probably not constant but is clearly visible on the threshold of school education.

Moreover, in national research on six-year-old children group, which were executed by A. Kopik (2007), distinct differences in cognitive development level of children from urban and rural areas were observed. The results were similar to these ones conducted by the authors of this article. As far as it concerns children from rural areas, authors observed more mediocre results (6.1% more than in children from urban areas group) and lower number of high results (even more than 12%). The researchers indicated that the differentiated factors, were social factors and the access to educational and care institutions.

Similar research concerning the cognitive development, conducted by Anum (2014) with the participation of children from rural and urban areas in Ghana with the use of Raven's Progressive Matrices (the colored version), showed that expected gradual change of the results is linked to the age. This factor was however different in the groups of children from rural and urban areas. Children from rural areas achieved much lower results in comparison with children from urban areas. The difference between children from rural and urban areas is explained by the author as differences in social and economic possibilities for children, including higher rate of poverty in rural areas. The achieved results also dispute the assumptions, which state that the matrices measure abilities, which are not influenced by education and cultural factors. Other researchers paid attention to similar issues (La Paro and Pianta 2000; Nisbett et al. 2012; Matthews and Gallo 2011) by highlighting that such factors as socio economic status, place of living, level of parents education, may influence the development of cognitive processes, the school achievements, life success, health and the lifespan as a consequence of the aforementioned factors.

Children from poor environments, especially rural ones, are more exposed to negative health consequences (Bradley and Corwyn 2002; Sameroff and Fiese 2000; Repetti et al. 2002; Atzaba-Poria et al. 2004; Bernier et al. 2016), which determine development in adult life and affect the condition of the subsequent generations. The strength of this effect depends on the occurrence of poverty during ontogenesis and its persistence in the life cycle. The negative impact of environmental effects is especially clear in the education, health, and productivity of an individual (Probst et al. 2016).

Families with a poor financial situation have problems with fulfilling basic needs, which may strongly hinder a child's cognitive development (Sameroff and Fiese 2000; Patterson et al. 2014; Lämmle et al. 2012; La Paro and Pianta 2000). The most serious barrier is the lack of motivation to study in children demotivated in their environment or motivated inadequately to their abilities, which is often the case with children from poor families (Nisbett et al. 2012). Parents, busy with work and focused on contending

with financial problems, neglect their children's mental and cultural upbringing. On the other hand, a child's intellectual development benefits from a higher socio-economic status of the family, which helps to provide many cognitive stimuli, and thus creates better conditions for the development of various abilities.

The results of those studies are convergent with observations included in report entitled "Six-year old's in Poland" (Kopik 2007), in which the authors emphasise that, the socio-economic situation of the family affects the child preparation for education commencement, it's attitude for school and its further carrier. Furthermore, the authors emphasise also that the average net income in rural children families is more differentiated, however substantially lower than the national average in Poland. The rural children also benefit from medical and psychosocial support more seldom than their city peers, moreover in the rural children group exist quite considerable percentage of those who are not being prophylactically tested medically (Kopik 2007).

5 Conclusions

1. The cognitive development of six-year-old children living in rural areas correlates to a large extent with the socio-economic status of their family, and the impact of these factors seems to be similar in both girls and boys.
2. The motor fitness of six-year-old children living in rural areas does not vary depending on the socio-economic status of their family, and varies only slightly depending on sex, with boys showing a higher motor fitness.
3. Children from rural areas who live in poor socio-economic conditions are exposed to a broad range of negative health effects, which, in turn, may cause lower educational results and negative long-term biological and psychosocial consequences.
4. The socio-economic situation of the family plays a significant part in the rural six-year old's development contributing the significant differentiation in their physical and especially mental development level. The results of those studies indicate the need of the return to starting school at the age of six, with at least two years period of preschool attendance, as it is in other European countries and on the whole world.

Compliance with Ethical Standards

Conflict of Interest There are no conflicts of interest.

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