

Physical Growth of Czech Children and Some Socio-Economic Factors

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ABSTRACT In the 5th Nationwide Anthropological Survey of Children and Adolescents in 1991 (Czech Republic) anthropometric characteristics of some 3% of the Czech population aged 0-18 years were assessed. The survey comprised also a questionnaire addressed to parents. This questionnaire contained some questions concerning the child's health status, family background, dietary habits and basic data on the parents, and the family-history. This paper deals with the impact of the number of children in the family, birth order, the mother's education and size of the community where the child lives, on height and the height-weight ratio of the child. The interaction of the effect of the investigated factors on the mean height and weight-height ratio of the child was tested by multivariate analysis of variance. By using the Z-score of both investigated parameters the effect of age was eliminated. The highly significant effect of different factors on the height and weight-height ratio of the child was confirmed. The interactions of these factors are not significant in any combination. The results were compared with WHO reference data.

INTRODUCTION

Nation-wide anthropological surveys of 0-18-year-old children were carried out in the Czech Republic (former Czech regions of Czechoslovakia) five times during the last 40 years, always after 10-year intervals (Prokopec, 1994). These measurements provide reference data for observation of growth and development in the Czech child population and at the same time ample material for comparison with other populations.

MATERIAL AND METHODS

Czech population: The Czech population is ethnically homogeneous with a relatively small proportion of ethnic minorities. In the examined sample in 1991 non-Czech nationality was recorded in 1.2% of cases, one third of this total (0.4%) being children of Slovak nationality. The growth of the Czech child population is comparable with reference data of the World Health Organization (Vignerova, 1997).

The Socio-economic Conditions: The socio-economic conditions were until 1989, and in majority of cases still are, assessed best by using the level of the parents' education as criterion. Income per head was in the past strongly levelled. Salaries of people with lower education (manual workers) often exceeded those with academic education. Therefore neither income per head nor occupation can serve for satisfactory assessment of socio-economic status. A higher level of education implies awareness of the impact of various factors, such as nutrition, on child development. When associated with better distribution of resources it leads to a healthier lifestyle meeting the child's needs (diet, leisure activities, extra education). It can be anticipated that eventually dramatic changes in the social sphere after 1989 will be reflected in the child population.

Age Groups: The same age groups were used as by WHO. In each category under the age of one year for each sex in the Vth Nationwide Anthropological Survey in 1991, 300-400 children were included, under the age of six years 1000-2000 children of each age group of both sexes, under the age of 18 years 2000 to 3000 male and female subjects resp. in this age group (Lhotska, 1993).

Parents' Education: Since the correlation of mother's education with that of the father has been well established, the present analysis takes into account the mother's education only (Lhotska, 1995).

According to the mother's education the sample is divided into the following four groups:

- (1) elementary school (13.2% mothers)
- (2) apprentice (37.9% mothers)
- (3) high school (39.2% mothers)
- (4) graduate (9.7% mothers)

Number of Children in the Family: Czech Republic falls into the category of countries with an average of two children per family:

Distribution, in percentage, number of

children/family follows:

- (1) One child (12.0 % in analysed sample)
- (2) Two children (59.5 %)
- (3) Three children (23.6 %)
- (4) Four and more children (4.9 %)

Child's Birth Order: The ratio of children in the sample who were born 1st, 2nd, 3rd etc. was as follows:

- (1) 1st (45.7 %)
- (2) 2nd (40.3 %)
- (3) 3rd (11.5 %)
- (4) 4th and subsequent (2.5 %)

Community Size: The size of communities where the children live is divided into four groups:

- (1) 1 - less than 5000 inhabitants (22.7 %)
- (2) 2 - 5000 - 19 999 (28.1 %)
- (3) 3 - 20 000 - 99 999 (33.7 %)
- (4) 4 - 100 000 and more (15.5 %)

Statistics: The actual comparison of the Czech child population with the WHO (World Health Organisation) reference population was done using the programme the ANTHRO (National Center for Chronic Disease Prevention and Health Promotion, CDC, Atlanta, Georgia, USA and Nutrition Unit, WHO, Geneva, Switzerland). This programme evaluates height and weight for 0-18-year-old children in relation to reference values. Height/age, weight/age and weight/height ratio of a child is then expressed in Z-score values (Dibley, 1987; Gorstein, 1994).

RESULTS

Using analysis of variance, the presence of statistical significance of mean values of height in age groups was tested. The following factors were analysed: a) mother's education; b) number of children in the family; c) birth order; d) size of community.

The effect of the mother's education on child's height was highly significant in all age categories, with the exception of the youngest ones (Table 1). The effect of the number of children in the family on the attained height varies. It is highly significant in all age groups between 10 and 18 years. The effect of birth order was significant only in some age groups and seems incidental. The effect exerted by the size of the community on the mean height of children was very low in majority of under 10s and rose after that age.

Based on the above, only data collected in a sample of children older than 10 years were further analysed. The interaction of the effect exerted by the investigated factors on the mean height and weight-height ratio was tested by multivariate analysis of variance. Z-score for mean height and weight-height ratio, calculated from individual values in relation to the WHO reference were used to eliminate the effect of age. The data of 34 000 children from 10 to 18 years was processed. Grouping the age categories, the highly significant effect of three of the four of the factors, i.e. the mother's education, the number of children in the family and the size of the community, on the height and body weight-height ratio of the child was confirmed. No significant effect was identified in case of the birth order. Further analysis, however, showed that interactions of these factors in any combination did not have any significant effect on height and weight-height ratio.

For each of the three statistically significant socio-economic factors the difference in the mean Z-score of the height (upper parts of graphs) and weight-height ratio (lower parts) was assessed. Figure 1 shows an increasing mean height and a slightly declining value of the body weight-height ratio with mother's education. Figure 2 shows a declining mean height and almost stationary mean body weight-height ratio with the increasing number of children in the family. Figure 3 shows that with increase in community size there was no clear difference in mean height or the body weight-height ratio among the categories. These charts were plotted using the data for boys, the picture would be the same for girls.

These three charts seem to indicate that mother's education has the greatest impact on differences in the mean height in all of the assessed age groups. In fact, the following figures illustrate the interplay between the mother's education and the two other socio-economic factors.

- The higher the mother's education, the smaller the number of children in the family.
- The greater the size of the community, the lower the ratio of mothers with elementary education and the higher the ratio of university educated mothers.

Table 1 : Statistical significance of mean values of height in age groups (n=78 354)

Age group (years)	Boys				Girls			
	Mothers' education	Number of children	Birth order	Size of community	Mothers' education	Number of children	Birth order	Size of community
1.00 - 1.24					*			
1.25 - 1.49	**	*						
1.50 - 1.74	*				**	**	**	
1.75 - 1.99	**	*	*		**	**	**	
2.00 - 2.49	**				**	**	*	*
2.50 - 2.99	**	**	**	*	**		*	
3.00 - 3.49	**	**	*		**		*	
3.50 - 3.99	**	*	**		**		**	
4.00 - 4.99	**	**	**		**		**	
5.00 - 5.99	**	**	**		**		*	
6.00 - 6.99	**		*	**	**			
7.00 - 7.99	**	**	*		**	**		
8.00 - 8.99	**	**	**	**	**		*	*
9.00 - 9.99	**	**	*		**	**		*
10.00 - 10.99	**	**		**	**	**	**	**
11.00 - 11.99	**	**	**		**	**		**
12.00 - 12.99	**	**	*	**	**	**		
13.00 - 13.99	**	*			**	**	*	**
14.00 - 14.99	**	**	**	**	**	**	*	**
15.00 - 15.99	**	**	*	**	**	**	**	**
16.00 - 16.99	**	**	*	*	**	**	**	**
17.00 - 17.99	**			**	**	**		**

*- p < 0.05 **- p < 0.01

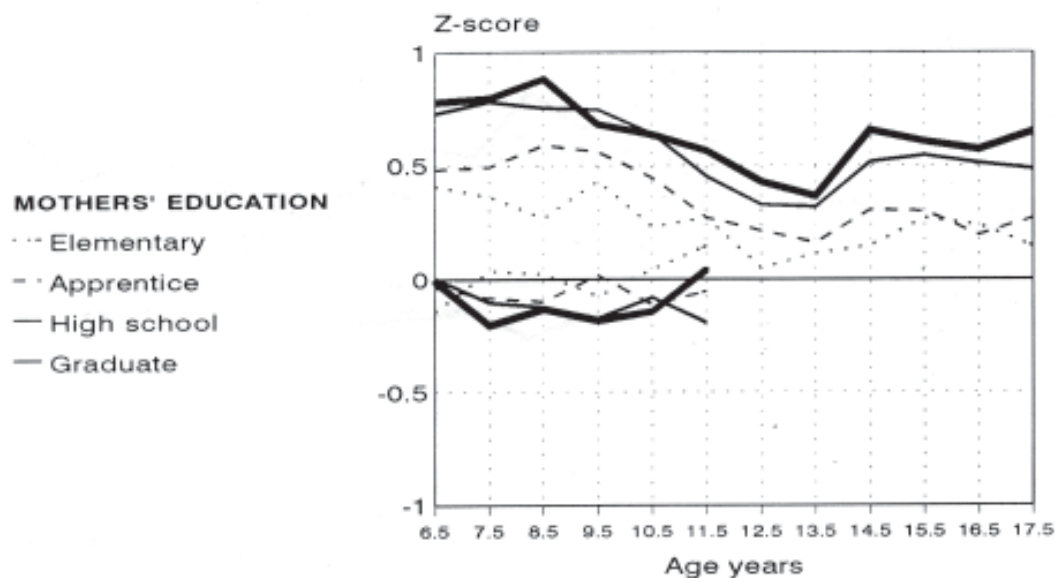


Fig. 1. Mean height/age and weight/height ratio by age groups and mothers' education. Boys, n=16 651

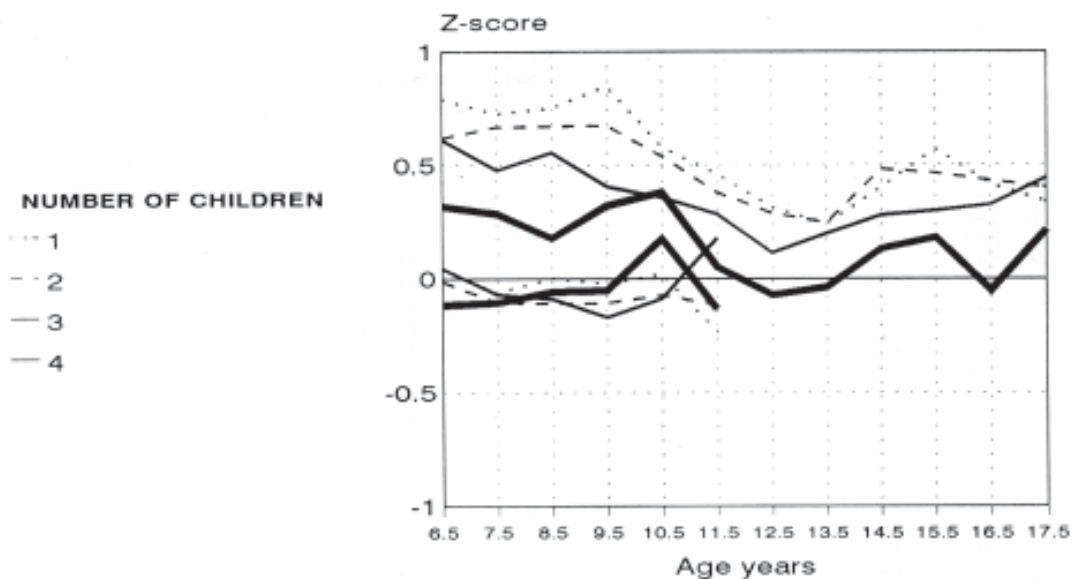


Fig. 2. Mean height/age and weight/height ratio by age groups and number of children in the family. Boys, $n=16\ 651$

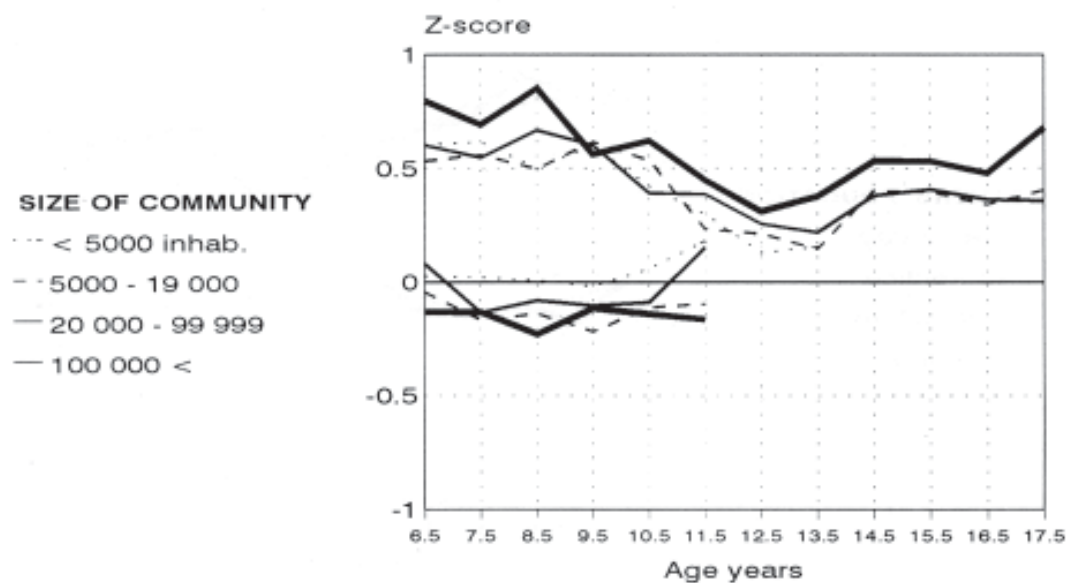


Fig. 3. Mean height/age and weight/height ratio by age groups and size of community. Boys, $n=16\ 651$

Table 2 : Factors differing significantly according to the parent's education

Parents' education	Elementary	Apprentice	High school	Graduate
Ratio of children with low birth weight (less than 2500g)	7.6 %	5.7 %	4.6 %	4.2 %
Breast feeding more than 3 months (% of mothers)	15.2 %	17.4 %	25.9 %	37.8 %
Watching TV by children (hours per week - children up 6 years)	2.1 h	1.8 h	1.5 h	1.3 h
Ratio of parents - smokers				
- Mothers	42.0 %	30.2 %	20.4 %	14.2 %
- Fathers	71.2 %	53.6 %	39.2 %	27.4 %
Parent's mean body height				
- Mothers	163.7 cm	164.8 cm	165.6 cm	165.9 cm
- Fathers	175.3 cm	177.7 cm	178.8 cm	179.3 cm
Parent's mean BMI				
- Mothers	24.9 kg/m ²	24.1 kg/m ²	23.2 kg/m ²	22.9 kg/m ²
- Fathers	26.1 kg/m ²	25.9 kg/m ²	25.6 kg/m ²	25.3 kg/m ²

Other relations observed were:

- The lower education of the mother, the higher the ratio of low birth weight infants (below 2500 g).
- The higher the mother's education the higher the ratio of breastfed infants.
- The higher the mother's education, the lower the mean number of hours per week spent by the child watching television.
- The higher parents' education, the lower the ratio of parents-smokers.
- The parents' education seems to have also an impact on their own height and weight. The higher their education the taller they are and the smaller their mean BMI is.

The values of the above factors differ significantly (Table 2) in relation to the parents' education.

CONCLUSION

The Vth Nation-wide Survey in 1991 provided the last possibility to record growth and development of Czech children in the conditions of the pre-market economy when economic situation of families was levelled out to a great extent. Therefore great diversity of socio-economic conditions, such as extreme poverty or extreme wealth did not exist. However, just like in other societies mother's education seemed

to be a key factor with the greatest impact on child's wellbeing.

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REFERENCES

- Dibley Michael J., MB. BS; Staehling Norman, MS and Nieburg Phillip, MD, MPH; Frederick L. Trowbridge, MD, MSc: Interpretation of Z-score anthropometric indicators derived from the international growth reference, *Am. J. Clin. Nutr.*, 46 : 749-62 (1987).
- Gorstein J., Sullivan K., Yip R., M. de Onis, Trowbridge F., Fajans P. and Clugston G.: Issues in the assessment of nutritional status using anthropometry. *Bulletin of the World Health Organisation*, 72 (2) : 273-283 (1994).
- Lhotska L., Blaha P., Vignerova J., Roth Z. and Prokopec M.: 5th Nationwide Anthropological Survey of Children and Adolescents 1991, Czech Republic. Anthropometric Characteristics, SZU Praha (1993).
- Lhotska L., Blaha P., Vignerova J., Roth Z., Prokopec M.: 5th Nationwide Anthropological Survey of Children and Adolescents 1991, Czech Republic, Evaluation of Parents' Questionnaire, SZU Praha (1995).
- Prokopec M.: Forty years of monitoring child growth in the Czech Republic: Methodologies, outcomes and comparisons, *Auxology 1994, Humanbiol. Budapest*, 25: 231-240 (1994).
- Vignerova J., Lhotska L., Blaha P. and Roth Z.: Growth of the Czech Child Population 0 -18 Years Compared to the World Health Organisation Growth Reference, *Am. J. Hum. Biol.*, 9:459-468 (1997).