

The Comparison of Anthropometrical Parameters of the Four-Year-Old Children in the Urban and Rural Slavonia, Croatia, 1985 and 2005

Neda Aberle¹, Mario Blekić¹, Ana Ivaniš² and Ivana Pavlović³

¹ Department of Pediatrics, General Hospital »Dr Josip Benčević«, Slavonski Brod, Croatia

² Croatian Medical Journal, School of Medicine, University of Zagreb, Zagreb, Croatia

³ Private General Practice, Bukovlje, Croatia

ABSTRACT

*The aim of the study is to identify the secular trends in the anthropometrical parameters of the 4-year-old children in Slavonski Brod, Slavonia, Croatia, and the nearby rural area by comparing data of height, weight, and mid-arm circumferences from 2005 with the historical control data published in 1985. The cross-sectional study of 342 children, aged 4 years, from Slavonski Brod and the nearby villages was taken in 2005. The Body height, weight, and mid-arm circumferences were measured and compared with the historical control data from the study performed in 1985 in the same area using the same methods. The data were compared according to sex and the place of residence. Results show that there were no significant differences in the body height, weight, mid-arm circumference and body mass index (BMI) between the urban and rural children in 2005. The Children in 2005 were significantly shorter (103.7 ± 8.3 cm vs. 108.3 cm in 1985, $P < 0.001$, one-sample *T* test) and had lower weight (17.4 ± 2.7 kg vs. 17.9 kg, $P = 0.001$, one-sample *T* test) compared with their counterparts in 1985. In 2005 there was no significant difference in the body mass index (kg/m^2) between girls and boys in total (15.9 ± 2.12 , vs. 16.1 ± 1.8 , $p = 0.262$, Independent samples *t*-test). Differences between the urban and rural parameters have disappeared over the last 20 years, which could be assigned to life-style changes in the rural areas.*

Key words: anthropometrical parameters; child, preschool; rural population; urban population, Slavonski Brod, Croatia, weight, height, mid-arm circumference, BMI

Introduction

The Growth and development of children are the indicators of health and quality of nutrition in a population. The anthropometrical characteristics vary through the time, depending on ethnical, socio-economic, political, and environmental factors. The Body height and weight vary also throughout the world as well as between the rural and urban areas in the same geographical region^{1,2}.

In the last few decades, many studies in Europe³⁻⁶, the North America^{7,8}, and Australia⁹ have observed an increased prevalence of the overweight and obese children of the different ages.

In the Netherlands, there were 20% more 6-year-old children who had BMI in the 90th percentile in 1996–1997 than in 1980³. Similar research in Australia showed that the children aged 7–12 years were heavier and taller in

1997 than in 1985⁹, and the same result was obtained in Germany, where the anthropometrical parameters were compared in 1975–1995 period¹⁰. It is considered that the main reason for the higher prevalence of children's obesity is decreased body activity⁵. The National Health Examination Survey in the USA reported that the strongest predictor of obesity during adolescence is the time spent in front of the TV and the computer¹¹.

The Obesity of children is becoming a public-health problem in Croatia as well¹². An increase in the prevalence of overweight and obese children in Croatia was reported by Prebeg et al¹³, based on the research of growth and development of the population of school children in the period between 1973 and 1991. The same trend continued, as shown in the study of children aged 7–12, in the period between 1997 and 2002¹².

The research from 1985¹⁴, which analyses the 4-year-old children from the town of Slavonski Brod, Slavonia, Croatia and the nearby rural areas, showed that the place of residence had an influence on the height of the children. At that time, the children aged 4 were 5–7 cm were taller in the rural areas than the children of the same age in the urban environment. The Body weight of the girls from the rural area in 1985 was considerably higher compared with the girls from the urban area, but also compared with the boys from both the rural and urban area.

According to the same study¹⁴, the anthropometrical parameters from 1985 leaped from the world normative (Nelson Textbook of Pediatrics).

The anthropometrical parameters of children are the important indicator of nutrition quality for a certain region. Taking into consideration the »growth swing« of the preschool children, we wanted to test the possible negative impact of The Croatian 1991–1995 War on the post war period growth and development of children in Slavonski Brod (change of habits – decreased breast feeding, significantly lower standard, destroyed families, etc.). The same parameters were compared with the research conducted 20 years ago¹⁴, when this region lived in the economic prosperity.

Materials and Methods

Participants

In April and May of 2005, we conducted a cross-sectional study on 342 children born in 2001, from the town of Slavonski Brod, Croatia and 10 nearby villages. The villages were chosen to cover the whole area of Slavonski Brod County. Presuming the difference in height of children from rural and urban area measured in 2005 would be similar as the difference shown 20 years ago, which was 7.5 cm for girls and 5.4 cm for the boys, to detect the difference of 5 cm in height with presuming standard deviation of 4 cm, we needed at least 21 children in each group to achieve the power of 0.99 with the level of significance set at $p=0.05$.

The rural children were chosen randomly from the primary health care physician lists by using random numbers selection method, 10–30 children from every village. The urban children were chosen from the lists of the 2 primary health care physicians and from 1 kindergarten and playroom, with the consent of the parents and the kindergarten teachers.

The children with the chronic disease and/or growth disorders were excluded from the study. The criteria for exclusion were a chronic illness with the duration longer than three months or a disease that requires an inpatient treatment for more than a month per year or an extended health and/or social service care¹⁵.

The study was approved by the Ethical Committee of General Hospital »Dr Josip Benčević«, Slavonski Brod.

Methods

All the measurements were carried out in the morning, with the children in the underwear. The body height and weight were measured with the aberration of 1 cm in body height and 100 g in body weight. We used the standard equipment, i.e. the weighing-machine and the height scale M130 (TMM, Zagreb, Croatia, 1988). The weighing-machine was calibrated in 2005. The mid-arm circumferences measurement¹⁶ was also recorded. The anthropological parameters were compared by gender and the place of residence. Also, the obtained parameters were compared with the parameters from the study conducted in April and May of 1985 with the same methods and in the same area¹⁴. The precise mean age of the children measured within the research is not known but the sampling data in 2005 were collected in the same manner as in 1985, at the same time of the year (April – May), so it was reasonable to expect that the use of the comparable size sample allows proper comparison of the data.

Statistical analysis

The mean values were calculated for the body height, weight, the mid arm circumference, and body mass index. The independent samples t tests were used for comparison of anthropometrical parameters for the rural and the urban children measured in 2005. The one-sample t test was used for the comparison of data obtained in 2005 and the data from the study performed in 1985, which were used as the referent values. Since the standard deviation of the anthropometrical parameters of 1985 was not calculated, it was not possible to use the Independent-samples t test. Also, BMI for children in 1985 is not known (due to the absence of analytical data) and comparison is not made while it would be a very approximate value.

All analyses were performed using SPSS for Windows (release 13, SPSS Inc., Chicago, IL, USA).

Results

The four-year-olds in 2005 showed significantly lower values of the body height, the body weight, and the mid arm circumference than the children in 1985 (Table 1). The girls in 2005 had significantly lower body height, body weight, and the mid arm circumference than the girls in 1985 while the boys had significantly lower body height and the mid arm circumference than the boys in 1985 (Table 1).

The girls and the boys who lived in the rural and the urban area in 2005 did not show significant differences in the body height, weight, and the mid arm circumference (Table 2 and 3).

The girls who lived in the rural area in 1985 were significantly taller and heavier than the girls who lived in the same rural area in 2005 (Table 2).

The mid arm circumference of the girls from the urban area was significantly bigger in 1985 than from the girls from the same urban area in 2005, but there were

TABLE 1
ANTHROPOMETRICAL PARAMETERS OF FOUR-YEAR-OLD CHILDREN IN 1985 AND IN 2005

Parameter	Girls			Boys			Total		
	1985 (n=217)	<i>P</i> *	2005 (n=182)	1985 (n=175)	<i>P</i> *	2005 (n=160)	1985 (n=392)	<i>P</i> *	2005 (n=342)
Height (cm)	107.6	<0.001	103.8 ± 4.9	109.0	<0.001	104.8 ± 4.5	108.3	<0.001	104.3 ± 4.7
Weight (kg)	18.6	<0.001	17.2 ± 3.1	17.7	0.937	17.7 ± 2.3	17.9	0.002	17.4 ± 2.7
Mid-arm circum- ference (cm)	17.6	<0.001	16.9 ± 1.8	17.5	<0.001	17.0 ± 1.5	17.5	<0.001	16.9 ± 1.7

*One sample t test, Referent mean values from JELIĆ A, et al¹⁴

no significant differences in body height and weight between these two groups (Table 2).

The boys who lived in the rural area in 1985 were significantly taller than the boys who lived in the same rural area in 2005. The boys who lived in the urban area in 1985 were significantly taller and had a bigger mid arm circumference than the boys who lived in the urban area in 2005 (Table 3).

In 2005 there was no significant difference in the body mass index (kg/m²) between urban and rural areas for both girls and boys (Table 2, 3) as well as between girls and boys in total (15.9 ± 2.12, vs. 16.1 ± 1.8, *p*=0.262, Independent samples t-test). The study from 2005 also shows that the leap from the world normative¹⁷ no longer exists.

Discussion

The results of our study showed that the four-year-old children in 2005 were 4 to 5 cm shorter and about 500 g lighter than in the 1985, notwithstanding the place of residence. The difference was more distinct among the children who lived in the rural area. The rural children were in average 8 cm shorter in 2005, compared with the rural children in 1985. The difference recorded among the urban children was less obvious. There were no differences in girls' height between 2005 and 1985, whereas the boys who lived in the town were about 2 cm shorter in 2005 than in 1985. Perhaps, the reasonable assump-

tion that the BMI in 2005 is overall bigger than in 1985, especially considering the boys, cannot be proven due to the absence of analytical data from 1985.

According to the research done by Čatipović et al¹⁸, the height of the 4 year-old children in Croatia was 103.9 cm for the boys and 103.1 cm for the girls. The weight was 17.3 kg for the boys and 16.91 kg for the girls. These measures correspond to our results from 2005. These data could be explained by certain changes in the habits and the way of life. More and more parents who live in the rural area work in the industry, performing jobs that demand the whole day absence from their home. Also, since there are more and more people in the rural areas who live in the nuclear families, i.e., without the grandparents, children are rarely provided with the regular traditional cooked meals of fresh and quality food¹². The life style of the rural children themselves has also changed – they spend more time in front of TV and the computer, consume refined sugars, and are less physically active^{12,19,20}. The children are often lonely, which can cause frustrations, manifested by increased consumption of an inappropriate food. Consequently, the behavioral forms and the life-style of children in the rural areas have become similar to the urban life style, which could be associated with the lack of differences in anthropometrical parameters of the children in both areas²¹.

The 1991–1995 war in Croatia might be an important additional element contributing to the decrease of the body height and weight of the 4-year-old children in The Slavonski Brod County. The economical progress of Sla-

TABLE 2
ANTHROPOMETRICAL PARAMETERS OF FOUR-YEAR-OLD GIRLS FROM URBAN AND RURAL AREA IN 1985 AND 2005

Parameter	Girls in area:						<i>P</i> **
	Rural		Urban		<i>P</i> *		
	1985 (n=168)	2005 (n=95)	1985 (n=49)	2005 (n=87)			
Height (cm)	111.3	103.2 ± 5.3	103.8	104.6 ± 4.2	0.102	0.056	
Weight (kg)	18.9	16.9 ± 3.0	17.4	17.5 ± 3.1	0.681	0.138	
Mid-arm circumference (cm)	17.1	16.9 ± 1.8	17.9	16.9 ± 1.8	<0.001	0.990	
Body mass index (kg/m ²)	–	15.8 ± 1.9	–	16.0 ± 2.3	–	0.497	

*One sample t test, Referent mean values from JELIĆ A, et al¹⁴

**Comparison of urban and rural area in 2005, Independent samples t test

TABLE 3
ANTHROPOMETRICAL PARAMETERS OF FOUR-YEAR-OLD BOYS FROM URBAN AND RURAL AREA IN 1985 AND 2005

Parameter	Boys in area:						P**
	Rural		Urban				
	1985 (n=137)	P*	2005 (n=78)	1985 (n=38)	P*	2005 (n=82)	
Height (cm)	111.7	<0.001	104.7 ± 4.5	106.3	0.008	104.9 ± 4.6	0.746
Weight (kg)	17.3	0.127	17.7 ± 2.1	18.1	0.212	17.8 ± 2.5	0.820
Mid-arm circumference (cm)	17.0	0.704	16.9 ± 1.6	17.9	<0.001	17.0 ± 1.4	0.661
Body mass index (kg/m ²)	–	–	16.1 ± 1.7	–	–	16.1 ± 1.8	0.927

*One sample t test, Referent mean values from JELIĆ A, et al¹⁴

**Comparison of urban and rural area in 2005, Independent samples t test

vonski Brod County is among the worst in Croatia – monthly incomes are among the lowest in the country while the unemployment is extremely high.

The migration of the affluent families from the area happened during the war by moving to the capital for higher education, or better incomes and business opportunities. At the same time, there was a number of refugees from the neighboring Bosnia and Herzegovina^{22–24} with a lower economical status who came to stay and live in Slavonski Brod. The refugees were mostly of Croatian nationality and the climate across the river Sava quite similar so that the influence of the refugees on the observed sample in 2005 was not expected to be significant. Also, during the last century and due to economical reasons, it occurred a steady and continuous migration of Bosnian Croats to this region. Such conditions have had a significant influence on the socio-economical status of Slavonski Brod County. This probably had a strong im-

pact on the nutritional habits as well^{25–28}. The influence of the war is visible on the nutrition of infants and it has been shown in the study of Zakanj et al²⁹, where significant decrease in the prevalence and duration of breastfeeding in Slavonia was observed. This can explain post-war decrease of the children growth compared with the period of 20 years ago, when this region was exceptionally economically progressive and when the great importance was placed to the traditional family values, reflecting on the growth and development of children.

This study presents that with the precise measurements of anthropometrical parameters of children throughout the years, the usual assumptions on the growth and the development of the children could be proven wrong or not quite correct. Such an effort can give an impetus for some novel nutritional and educational studies and programs.

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N. Aberle

*Department of Pediatrics, General Hospital »Dr Josip Benčević«, Andrije Štampara 42, 35000 Slavonski Brod, Croatia
e-mail: neda.aberle@inet.hr*

USPOREDBA ANTROPOMETRIJSKIH PARAMETARA ČETVEROGODIŠNJE DJECE MJERENE 1985. I 2005. GODINE U GRADU I SELU U SLAVONIJI, HRVATSKA

S A Ž E T A K

Cilj studije je uočiti sekularne promjene antropometrijskih parametara tijekom perioda od 1985. do 2005. godine u Slavanskom Brodu i okolnoj regiji (Slavonija, Hrvatska), uspoređujući tjelesnu visinu i težinu te opseg nadlaktice četverogodišnje djece. Godine 2005. izmjereno je 342 djece u dobi od 4 godine iz Slavanskog Broda i okolnih sela. Praćeni su tjelesna visina, tjelesna težina i opseg nadlaktice te su uspoređivani s podacima iz studije učinjene 1985. godine, na istom području, istim metodama. Podaci su uspoređivani s obzirom na spol i mjesto stanovanja. Rezultati pokazuju da nema značajnije razlike u tjelesnoj težini, tjelesnoj visini, opsegu nadlaktice te indeksu tjelesne mase (BMI) između djece u selu i gradu 2005. godine. Djeca mjerena 2005. su značajno niža ($103,7 \pm 8,3$ cm vs. 108.3 cm in 1985, $P < 0,001$, one-sample T test) i lakša ($17,4 \pm 2,7$ kg vs. 17.9 kg, $P = 0.001$, one-sample T test) od vršnjaka mjenih 1985. godine. Godine 2005. nije bilo značajnije razlike u BMI (kg/m^2) između dječaka i djevojčica ($15,9 \pm 2,12$, vs. $16,1 \pm 1,8$, $p = 0,262$, Independent samples t-test). Tijekom 20 godina nestale su razlike između antropometrijskih parametara djece iz sela i grada što bi moglo biti posljedica promjene načina života u seoskom području.