

ANTHROPOMETRIC PARAMETERS AS INDICATORS OF GROWTH ACCELERATION AND OBESITY PREDICTORS IN PREADOLESCENTS

Snezana Gligorijevic

At the beginning of the 21st century, the phenomenon of growth acceleration with secular trend has been brought into question. Better life conditions brought about the expansion of nutritional changes with the consequent epidemics of obesity. Preadolescent period is very vulnerable to environmental factors. The aim of the paper was to investigate the growth acceleration by means of anthropometric parameters among urban preadolescents in Nis. Cross-sectional design study was carried out in the period from October 2006 to April 2007, comprising 1489 third grade pupils from the urban elementary schools in Nis (736 girls and 753 boys). After collecting data about anthropometric parameters (body height and body weight) from medical records from the School Dispensary in the Primary Health Care Center Nis, data were systematized by sex and statistically processed. BH and BW were statistically significantly higher in boys compared to girls (BH: $t=3,547>t=3,291$ for $p<0,001$; BW: $t=2,514>t=1,96$ for $p<0,05$). According to percentile distribution, there are more girls (16, 03%) with BH over P85 than boys (15, 01%). In percentile distribution of BW, boys are predominant (15% vs. 14.54%). The ratio between BW and BH², known as BMI, is higher than P85 in 15.08% of girls and 14.87% of boys. Girls are more exposed to the harmful effects of environmental factors, because there is no growth acceleration compared to girls from the study from 1993 (for BH, $t=-3,39$, and for BW, $t=-3,57$; both values were higher than $t=3,29$ for error level $p<0,001$). Regression of growth acceleration along with obesity prevalence increase are matters of concern requiring the planning of urgent intervention from the aspect of healthy nutrition promotion. *Acta Medica Medianae* 2008;47(2):15-19.

Key words: anthropometry, growth acceleration, obesity, preadolescents

Center for Hygiene and Human Ecology, Public Health Institute Nis

Contact: Snezana Gligorijevic
Center for Hygiene and Human Ecology, Public Health Institute
50 Dr Zoran Djindjic Blvd.
18000 Nis, Srbija
Tel.: 018 233 587 lokal 141, fax: 018 233 587
E-mail: snefly@yahoo.com

Introduction

The last century brought important acceleration of physical growth in the population of industrially developed countries - average 1 cm per 10 years and also the increase in body size at all ages. This phenomenon is defined as secular trend in growth acceleration. However, in the last two decades there was a mild regression of this trend - at the beginning of the 20th century growing used to be completed by the age of 25 and nowadays it is completed by the age of 18-20.

When the basic determinants are increasing (height growth, shorter period of growth and early development), body mass (BM) is also increasing, which is a predictor of obesity. Evaluation of the results of systematic medical

check-ups makes continuous follow-up of anthropometric parameters possible (1), as well as evaluation of harmonical development (2). Innovations in applicable knowledge (3) brought about numerous studies on the basis of which the World Health Organisation declared a new standard for school children (4).

Growth acceleration is the result of better life conditions (proper nutrition, physical activity, availability of health protection and less frequent getting ill), while obesity of children is due to bad eating habits and physical inactivity - a phenomenon associated with a crisis.

Problematic social conditions are greatly expanding and they are the consequence of great urbanisation and the west culture influence that affects every aspect of life, especially among schoolchildren who are hypersensitive to world trends. The mentioned trends are an integral part of NUTRITIONAL TRANSITION which, together with sedentary way of life (remaining inactive for most of the day), brings multiple health risks. Obesity, as a disease or as a chronic disease risk factor, occurs in younger population. In that way, the notion of health loses its sense because youth and absence of diseases are no longer

equal indicators for quality of life. In the preadolescent period (peaceful period of development and growth) the factors of society are dominant. They can be prevented in order to eliminate extra food from the diet that threatens to replace acceleration of growth (instead of an increase in body height-BH there is an increase in body mass index-BMI which is an anthropometric tool for obesity).

Aim

The aim of the study was to investigate the growth acceleration by means of anthropometric parameters among urban preadolescents in Nis.

Material and Methods

Cross-sectional design study was carried out in the period from October, 2006 to April, 2007. The samples were the third grade students of elementary schools during the school year 2006/7. One thousand five hundred and thirty three children were anthropometrically examined (the plan was to examine 2000 children in population of 3rd grade of elementary schools from Nis and the rest were from rural schools). Of that number, 46 boys and 32 girls were not included in anthropometric measures in the third grade, so they were instantly excluded from further investigation. The final sample involved 1489 children: 736 girls and 753 boys. The average age at the time of systematic check-ups was 9,52+-0,38 years for boys and 9,5+-0,37 years for girls.

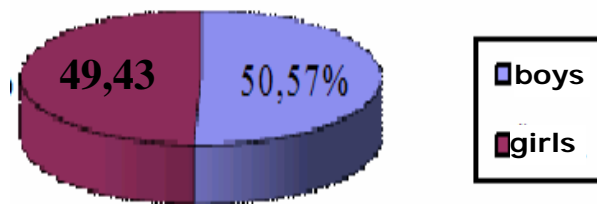
Analyses of anthropometric parameters were carried out in the Health Care Center - Primary School Dispensary in Nis. After gathering all data on anthropometric parameters (Body height-BH and body weight-BW), Microsoft Office Excel 2007 database was made.

Anthropometric parameters (BH and BW) were statistically processed: variety amplitude (mini-max), arithmetic mean, standard deviations and percentile values (p5,p15,p50, p85,p95) as cross-sectional points in the scale of distribution. Percentile distribution was expressed using index of structure. Student's t test for large independent samples was used to prove statistical significance in difference in anthropometric parameters between genders in comparison to previous researches carried out in the same area.

Results

Anthropometric measures involved 1489 pupils of the third grade of elementary schools in Nis. There were 736 girls (50,7%) and 753 boys (50,7%) included. Body height is an important

indicator of growth acceleration. Table 1 shows the amplitude of variety (min/max), arithmetic mean (Xsr) and standard varieties for body height in boys and girls. Boys had higher values for body height than girls and the difference in BH was statistically significant ($t=3,547 > t=3,291$ for $p < 0,001$).



Graphic 1. Structure of examinees by gender

Table 1. Statistical parameters for BH for boys and girls

Body height	girls	boys
Min-max	118,5-160	117-162
X sr.± SD	139,23±6,69	140,47±6,79
$t=3,547 > t=3,291$ for $p < 0,001$		

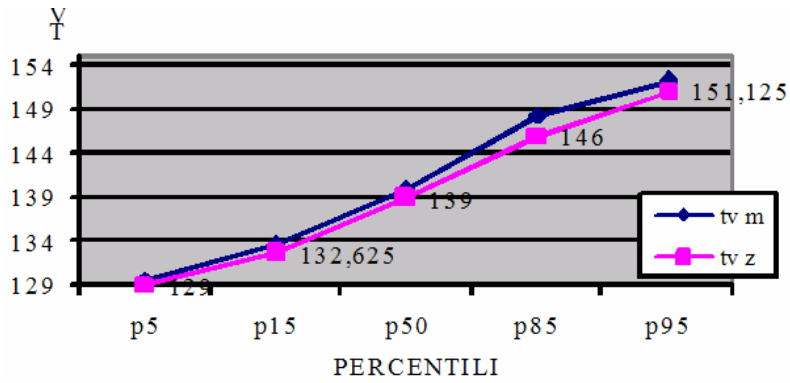
Boys had higher values for body weight compared to girls and the difference was statistically significant ($t=2,514 > t=1,96$ for $p < 0,05$). Table 2 shows amplitude variety (min/max), arithmetical mean (Xsr.) and standard varieties for body weight for boys and girls.

Table 2. Statistical parameters for BM for boys and girls

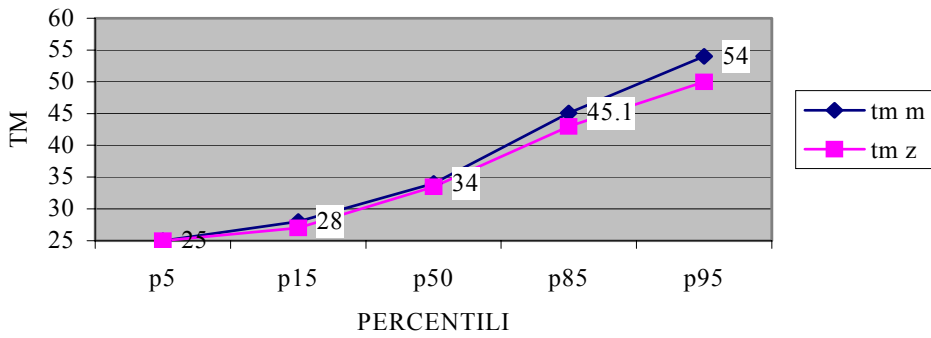
Body height	girls	boys
Min-max	20-69	19-77,5
X sr. ± SD	35,02±8,24	36,14±8,93
$t=2,514 > t=1,96$ for $p < 0,05$		

After determination of borderline percentile values of BH and BW (P5, P15, P50, P85, P95) for boys and girls, the scales were made and showed in Graphs 2 and 3.

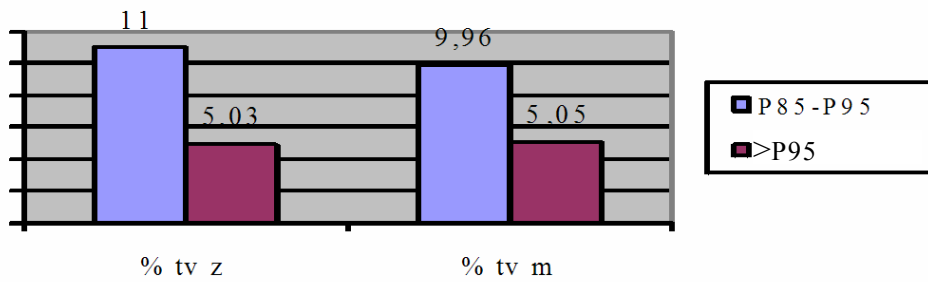
The distribution in relation to certain percentile cross-section points for body height, body weight is showed in Graphs 4,5 and 6. Besides the fact that the boys were statistically taller than girls, the percentile distribution was in favor of tall girls (16,03% of girls to 15,01% of boys). However, percentile distribution of body weight was in favor of boys (15% to 14,54%). Body mass index (BMI), which is the body weight divided by the square of the height, had values higher than P85 in 15,08% of girls and in 14,87% of boys.



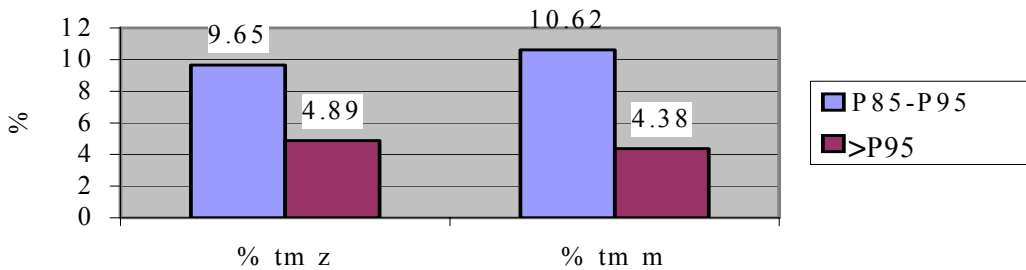
Graph 2. Percentile scale of BH by genders



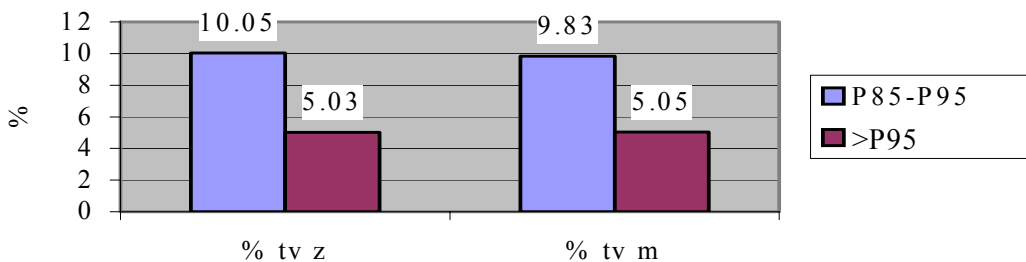
Graph 3. Percentile scale of BW by genders



Graph 4. Percentile distribution by genders



Graph 5. Percentile distribution of BW by genders



Graph 6. Percentile distribution of BMI by genders

Discussion

For school-going children and young adults screening of health condition is conducted in primary health facilities through systematic check-ups followed by the evaluation of obtained results. In some studies, the validity of self-estimation of anthropometric parameters have been estimated. (7,8). Anthropometric measures are non-invasive, cheap and objective methods that provide adequate data for comparison with the results gathered by the same methodology.

It is possible to evaluate growth acceleration only after its comparison with previous researches conducted in the same area. Comparison with the world reference values for BH and BM was not done due to the WHO attitude to this matter.

A lot of cross-sectional studies have been conducted in Nis (9,10,11,12,13). Having in mind previous results of anthropometric researches done in the area of Nis, the existence of positive acceleration was evaluated by the Student's t-test. A deviation in comparison to medical check-ups from 1981, especially from 1993, was recorded. The girls were more exposed to harmful environmental factors, since they lack growth acceleration in comparison to 1993. Malnutrition and physical inactivity in female population led to the prevalence

of obesity and excessive obesity, while extreme undernourishment was scarce.

Harmful environmental influences are best manifested through inadequate family diets as well as school meals. Increase in the prevalence of obesity nowadays that affects every second child in developed countries is associated with nutritional transition, thus escalating global epidemic of overweight and obesity. The problems of acceleration and obesity can be controlled and managed by adequate promotion of healthy lifestyles.

Conclusion

Based on the previous considerations, it can be concluded that:

- Preadolescents of Nis are vulnerable to environmental factors.
- Growth acceleration is under environmental influence.
- Boys are statistically taller and heavier than girls.
- Girls have statistically lower values of BH and BW in comparison to the girls of the same age from the year of 1993.
- Increase in obesity among the preadolescents is an issue of concern and requires urgent intervention from the domain of healthy nutrition promotion.

References

1. Gligorijević S, Filipović M, Ristić V. Evaluacija rezultata antropometrijskih merenja sa sistematskih pregleda školske dece-potreba ili luksuz? Zbornik rezimea XXXVI dana preventivne medicine, Niš 2001;58-9.
2. Kostić Z, Gligorijević S, Marković L. Procena staturoponderalnog rasta dece uzrasta sedam godina u Nišu. Zbornik rezimea XL kongresa Antropološkog društva Jugoslavije sa međunarodnim učešćem, Niš, 2001; 73.
3. Gligorijević S, Milutinović S. Aktuelnosti u vezi sistematskih pregleda i ocene ishranjenosti učenika. Aktuelna saznanja o medicinskoj nutritivnoj prevenciji i terapiji kod dece. KME (2) Medicinski fakultet Niš, 2007.
4. Mercedes de Onis et al. Development of a WHO growth reference for school-aged children and adolescents. Bullten of the World Health Organisation 2007;85:660-667
5. Lobstein T, Baur L, Uauy R for the IASO International Obesity Task Force. Obesity in children and young people: a crisis in public health. Obesity Reviews, 2004, 5 (Suppl. 1):4-104.
6. Popkin BM. The shift in stages of the nutrition transition in the developing world differs from past experiences. Public Health Nutrition 2002;5:205-214
7. Tsigilis N. Can secondary school students' self-reported measures of height and weight be trusted? An effect size approach. European Journal of Public Health 2006; 16 (5):532-5.
8. Elgar FJ et al. Validity of self-reported height and weight and predictors of bias in adolescents. Journal of Adolescent Health, 2005; 37:371-375.
9. Milutinović Suzana. Rast i razvoj dece Nišavskog Topličkog Okruga. (magistarska teza) Medicinski fakultet Niš, 2006.
10. Gligorijević S. Prilog proceni ishranjenosti učenika osnovnih škola u Nišu. Specijalistički rad, Medicinski fakultet Niš, 2000.
11. Živković Dragan. Komparativna analiza ishranjenosti školske dece u uslovima produžene ekonomske krize. (magistarski rad) Medicinski fakultet Niš, 1994.
12. Mitrović R. Uticaj produženog školskog boravka na rast, razvoj i uhranjenost školske dece. Doktorska disertacija, Medicinski fakultet Niš, 1981.
13. Nikolić M. Efekti različitih sadržaja izbornorekreativne aktivnosti na pokazatelje morfološkog razvoja. Acta Medica Medianae 2005;44(2): 51-6.

ANTROPOMETRIJSKI PARAMETRI KAO POKAZATELJI AKCELERACIJE RASTA I PREDIKTORI GOJAZNOSTI PREADOLESCENATA

Snežana Gligorijević

Pojava akceleracije rasta, u vidu nastavka sekularnog trenda, dovodi se u pitanje na početku XXI veka. Bolji uslovi života dovode i do ekspanzije nutritivne tranzicije sa posledičnom epidemijom gojaznosti. Period preadolescencije je posebno osetljiv na faktore sredine. Cilj rada bio je utvrđivanje postojanja akceleracije rasta preko antropometrijskih parametara među urbanim preadolescentima u Nišu. Studija preseka ili transversalna studija je sprovedena u periodu oktobar 2006 - april 2007. godine među 1489 učenika trećeg razreda gradskih osnovnih škola u Nišu (736 devojčica i 753 dečaka). Nakon prikupljanja podataka antropometrijskih parametara (telesne visine-TV i telesne mase-TM) iz kartona Savetovaništa Školskog dispanzera Doma zdravlja Niš, podaci su sistematizovani po polu i statistički obradjeni. Dečaci imaju statistički značajno veće TV i TM u odnosu na devojčice (TV: $t=3,547 > t=3,291$ za $p < 0,001$; TM: $t=2,514 > t=1,96$ za $p < 0,05$). Po percentilnoj distribuciji, ima više devojčica sa TV iznad P85 (16,03 %) u odnosu na dečake (15,01%). Kod percentilne distribucije telesne mase, u prednosti su dečaci (15% prema 14,54%). Odnos TM-a prema kvadratu TV, poznatiji kao ITM, ima veće vrednosti od P85 kod 15,08% devojčica i 14,87% dečaka. Devojčice su izloženije štetnom uticaju faktora sredine, jer kod njih izostaje akceleracija rasta u odnosu na vršnjakinje obuhvaćene studijom iz 1993. godine (za TV $t=-3,39$, dok je za TM $t=-3,57$; obe vrednosti t-testa su veće od $t=3,29$ za nivo greške $p < 0,001$). Regresija akceleracije rasta i povećanje prevalencije gojaznosti među preadolescentima zabrinjava i inicira planiranje hitne intervencije iz domena promocije pravilne ishrane. *Acta Medica Medianae 2008;47(2):15-19.*

Ključne reči: antropometrija, akceleracija rasta, gojaznost, preadolescenti