

ANTHROPOMETRIC INDICATORS OF GROWTH AND NUTRITIONAL STATUS IN THREE -YEAR-OLD MACEDONIAN CHILDREN

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Abstract

Growth monitoring and promotion of optimal growth are essential components of primary health care for children. Serial measurements of weight, height/length, for all children, and measurements of circular and transversal parameters compared with growth of a large sample population help to confirm a child's healthy growth and development. It also allows early identification of potential nutritional or health problems and enables prompt action before a child's health is seriously compromised.

The aim of the study is evaluation of sex-specific differences in anthropometrical parameters as indicators of growth.

The study included 200 healthy 3 years old preschool children from Macedonian nationality. Thirteen anthropometric parameters were measured, defining longitudinal, circular and transversal dimensionality of the skeleton using standard technique and instruments for measurement. The following indices were selected and calculated: weight-for-age; height-for-age and BMI. Skin-folds (triceps, scapula and thigh) were also measured.

Sex-specific differences for almost all anthropometric parameters were detected, but they were not significant. Girls showed higher values than boys regarding height, weight but for BMI were significant in boys. Values at the 50th percentile in girls were 16.8 kg for BW, 102 cm for BH and 16.5 kg/m². The values of these parameters in boys were 18 kg for BW, 96.93 cm for BH and 17.5 for kg/m² for BMI. The values for skin fold for triceps were higher in girls (13.1 ± 3.5) instead of boys (12.2 ± 3.3).

The results obtained can be used for criteria for assessment and detecting deviations in growth and nutritional status in preschool children.

Keywords: anthropometry, growth, nutritional status, preschool children.

Introduction

Globally, obesity is a significant public health problem [1] and a number of studies reporting an increasing prevalence of obese and overweight children in Europe, USA, Canada etc. [2-4].

The age and sex-specific body mass index in (kg/m²) or BMI is the most common method for assessing weight status and health risks in children [5-6].

The improvement in the economic situation and the modernization of the society has led to an increase in the consumption of high-energy foods and an alarming increase in sedentary behavior. Excess body weight at a young age is associated with adverse health outcomes, including metabolic disorders, cardiovascular risk factors, and impaired physical development.

These are probably the main reasons why obesity rates in preschool children more doubled over the past decade [7-9].

Growth and nutritional status are fundamental indicators of child health and reflect the complex interaction between genetic, environmental and lifestyle factors. Anthropometric measurements, such as body weight, height and body mass (BMI), are widely used to assess growth patterns and nutritional status in children. These indicators provide reliable and non-invasive tools for evaluating both undernutrition and overweight, including obesity.

Preschool age represents a critical period for growth and development, during which nutritional imbalances may have lasting effects on health. Monitoring growth and nutritional status in early childhood enables timely detection or deviations from normal growth trajectories and supports the implementation of effective preventive and intervention strategies [10].

The consequences of overweight and obesity imply that the definition of who is overweight and especially who is obese, is of utmost importance. Macedonian Ministry of health adopted the World Health Organization's international references and the weight-for-height index as the official criterion to evaluate the nutritional status of preschool children both in terms of undernutrition and overnutrition.

The aim of this study is to assess anthropometric indicators of growth and nutritional status, with a particular focus on obesity in three-year-old children. The findings may contribute to a better understanding of early childhood health and support evidence based public health policies and nutritional interventions.

Material and Methods

The study included 200 healthy preschool children at age 3, from both sexes. It excluded children with systemic and metabolic diseases that may affect the growth development of children, as well as those children with family history of systemic illness.

Anthropometric characteristics of the children at the age of 3 years were obtained from kindergartens in Macedonia. Each age group was divided into two groups by sex (boys and girls).

Anthropometry

Anthropometrical measures were taken in line with the International Biological Programme (IBP). Children were asked to take off their shoes for the height measuring and to take off any over-clothing for weight measuring and their anthropometric points and levels were marked on the body of the child.

The following parameters were measured; body weight, body height, BMI, arm length, leg length, circumferences of the upper arm, thigh and calf, diameter of elbow and knee. Skin –folds (biceps, scapula and thigh) were also measured. The instruments for measuring were standard and were regularly calibrated before measuring.

The following standard anthropometric instruments were used; anthropometer by Martin for measuring of height and lengths with reading precision of 1 mm; and medical weighing scale for measuring of weight with precision of 0.1 kg; metal tape for measuring of circumferences with precision of 1 mm.

According to the WHO recommendations for assessment of nutritional status in preschool children the following indices were calculated; weight-for age; height-for age and BMI.

Definitions

For categorization of the values of the anthropometric indices, the following percentile cutoff points were used, below 5th percentile for category of extremely low values; from 5th to 85th percentile for mean values; and from 85th to 95th percentile for category of above average values. The index weight-for age was used for quantitative grading of the nutritional status in preschool children.

Children with the weight -for-age index under the 5th percentile were considered as underweight for their age, while overweight children were dose with the weight-for-age index from 85th -95th percentile.

If the values of the weight-for-age index were within the range of 5th to 85th percentile were considered to be with normal weight. [11-13].

Statistics

The obtained data for the relevant variables were analysed with descriptive statistics presented with measures of central tendency and its deviation (arithmetic mean \pm standard deviation) along with ranges expressed in percentiles.

Results

The mean values and standard deviations of the examined anthropometric parameters in children aged 3 years and their sex differences are presented in table 1.

Table 1. Body weight, body height, BMI, lengths and circumferences of the extremities in pre-school children of 3 years-old -children (mean and standard deviation).

Sex	n	Body weight (kg)	Body height (cm)	BMI (kg/m ²)	Lengths (cm)			Circumferences (cm)		
					Arm	Leg	Upper arm	Forearm	Thigh	Calf
B	100	18.7 \pm 2.8	101.1 \pm 5.2	18.30 \pm 2.5	40.6 \pm 2.3	51.8 \pm 4.4	15.6 \pm 1.6	15.3 \pm 1.5	24.7 \pm 3.5	20.8 \pm 2.4
G	100	18.4 \pm 4.4	103.3 \pm 6.6	17.3 \pm 3.3	40.4 \pm 3.4	53.3 \pm 5.4	15.0 \pm 1.9	14.9 \pm 2.8	25.9 \pm 3.8	20.6 \pm 3.1

Three years old boys had body weight of 18.7 \pm 2.8 kg, height of 101.1 \pm 5.2 cm and BMI of 18.3 \pm 2.5 kg/m². The same parameters in girls were weight 18.4 \pm 4.4, height 103.3 \pm 6.6 cm and BMI 17.3 \pm 3.3 kg/m².

The above -mentioned parameters slowly increased with age in girls than boys.

The values of skin -folds are presented in table 2. and there are also increased in girls.

Table 2. Values of skin-folds in pre-school children of 3-years old children

	<i>biceps</i>	<i>scapula</i>	<i>thigh</i>
Boys	10.8 \pm 3.7	8.8 \pm 1.9	11.1 \pm 3.2*
X\pmSD			
Girls	11.6 \pm 3.9*	10.00 \pm 3.1*	10.5 \pm 3.0
X\pmSD			

Three-year-old boys have the following cut-off points in the range from 5th to 85th percentiles for the three studied parameters: weight-for-age from 14 to 21 kg; height-for-age from 95 to 105.5 cm and BMI from 15.3 to 20.1 kg/m². The girls of the same age had the following cut-off points: from 14 to 23.7 kg for weight-for-age parameter; 95.5 to 109 cm for height-for -age and for BMI from 13.7 to 20.4 kg/m². Table 3.

Table 3. Sex-specific percentiles of the indexes: weight-for-age, height-for-age and BMI in 3 years children

	<i>PERCENTILES</i>								
BOYS	5	10	15	25	50	75	85	90	95
Weight-for-age	14	14.9	15.4	17	19	20	21	21	23.1
Height-for-age	95	96	96.8	97.3	100	104.8	105.5	107.3	110.4
BMI	15.3	15.5	16.1	16.7	18.1	19.2	20.1	21.2	23.1
GIRLS									
Weight-for-age	14	14.9	15	15	16.8	20	23.7	25	27.1
Height-for-age	95.5	96	97	98.5	102	107.5	109	110.1	111.8
BMI	13.7	14	14.4	15.3	16.5	18.8	20.4	20.8	23.6

Borderline values for (5th and 90th percentile) in girls were 95.5 cm (5th percentile) and 110.1cm (90th percentile) for height-for-age, 14 and 25 kg for weight-for-age and 13.7 and 20.8 kg/m² for BMI. Boys had the following values for the same parameters: 95 cm (5th percentile) and 107.3 cm (90th percentile) for height-for-age; 14 and 21 kg for weight-for-age and 15.3 and 21.2 kg/m² for BMI.

Discussion

Several anthropometric parameters which are generally used for assessment of the growth and nutritional status in preschool children were examined in our study. Girls showed higher values than boys regarding weight, height and BMI. Our results are in agreement with the results reported in other anthropometric studies [14,15].

The height-for-age index of the children and their chronological age are linearly related. Low values of this index below 5th percentile, point out to long term disordered nutrition.

For 3-years old boys the values of this parameter for the 50th percentile in our study was 100 cm, against 95 cm found in the CDC reference population [16-18] and the values for the weight-for-age parameter in our study was 19 kg, which was higher than 15kg for the CDC reference population.

Anthropometric CDC and NCHS values have been accepted by the WHO as international standard for estimation of the growth and nutritional status and they comprise age categories from 1 to 77 years.

The category of children with small body height and weight for their age being detected with the cut-off 5th percentile are considered as children underweight for their age.

Circumferences are sensitive indicators for the nutritional status, especially the upper arm and thigh circumferences. The comparison of our results with those reported for other population in other studies [19] is another confirmation for the existence of population differences in anthropometric characteristics, which depend on many internal genetics and external factors.[20].

There is a high prevalence of childhood overweight or obesity in this preschool population, regardless of growth references used. Similar statistics are being reported in other developed countries [21].

The short and long-term physical health risks for children associated with excess weight include hyperinsulinemia, hypertension, glucose intolerance, type II diabetes, increased risk of early cardiac disease, and other difficulties.

Childhood obesity is a significant public health concern and accurate measurement and classification is important in determining the degree of this health problem. [22].

Conclusion

We have determined cutoff points from 5th to 90th percentile for anthropometric parameters which are routinely used in assessment of growth and nutritional status in preschool children. These results may be applied as criteria for assessment of growth and nutritional status in 3-year-old children.

Additionally, anthropometric parameters have practical importance for planning certain preventive measures and activities in the field of children in one country.

Childhood obesity is a public health problem and is also associated with increased morbidity or mortality. A consensus is urgently needed on the most valid and reliable growth references to use to measure and monitoring a child's growth for both research and clinical purpose,

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