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Body composition of Tashkent school-aged boys

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Abstract

Background: Body composition in periods of childhood, puberty and adolescent is a marker of metabolic changes that occur during these periods of growth and maturation, and, thus, it is an important information regarding child and adolescent health.

Purpose: The purpose is to study the age-related body index mass and body composition in the different age school boys in Tashkent city.

Method: Boys body composition was measured by analyzer “Tanita BC 543” (Japan) in the morning between 9.00-10.00 p.m. Body composition parameters were determined in boys of three stage of development: childhood (seven year old), early adolescence (twelve year old), and late adolescence age (eighteen year old).

Results: The obtained data show that as boys grow and develop, mass of all body components increased. The greatest increase was in adipose tissue, and the least one was in content of bone minerals. It was found 7-year-old children were underweight, but by the age of 18 there weight approached the normal value. However, weight normalization occurs due to an increase in adipose tissue. It is indirectly indicated a growing risk in the boys predisposition to the diabetes.

Keywords: Child; Adolescent; Body composition; Body mass index

1. Introduction

Currently, to assess public health the bioimpedance analysis and determination of body mass index are widely used. Bioimpedance analysis is based on measuring the electrical conductivity of biological tissues, such as adipose, muscle, body bone minerals etc. [1]. Taking in account the non-invasiveness, ease of use and low material costs of this method, the use of bio-impedance metry is convenient for mass screenings and the subsequent justification of medical and preventive programs for the correction of nutrition and lifestyle of organized groups [2; 3].

Body composition in adults, when the ratio of body components is more or less stable, has been extensively well investigated [2, 3, 4]. In children and adolescents the body composition except genetic and climatic-geographic conditions depends on the high rates of growth and development [5]. Therefore, the common standards for body composition in children and adolescents has not been well studied. Thus there is a need for additional research in this direction. Detection of negative shifts in weight and body composition will help starting prevention work on their correction and prevention of undesirable health consequences timely [6].

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The purpose of the research is to study the age-related body index mass and body composition in the different age school boys in Tashkent city.

2. Material and methods

2.1. Tested school boys

Boys of different age from the 243rd secondary school in Tashkent took part in the study. Body composition parameters were studied in 3 periods of development: childhood, early adolescence and late adolescence. In the first group, children were seven (7.1 ± 0.4), years old, in the second and third groups boys were twelve (12.1 ± 0.7) and eighteen (17.8 ± 0.5) years old respectively. Only indigenous Uzbeks were tested. Voluntary informed consent was obtained from all participating children and their parents.

2.2. Anthropometry measurement

Height and body weight were identified with minimal clothing and bare feet. Body height was measured to the nearest 0.5 cm using a mechanical stadiometer RM 2 Diakoms (Russia). Body mass were measured using analyzer Tanita BC-543 (Japan). The body mass index was calculated by the formula $BMI = m/h^2$ where m was a school boy's weight in kilograms and h^2 was their height in meters squared.

2.3. Body composition analysis

Analysis of body composition was carried out in the morning between 10.00-11.00 using the analyzer "Tanita BC-543" according to the standard scheme. A comparative assessment of the values of body height, body weight, body mass index, fat mass, lean mass, muscle mass, bone mineral mass and total water content was carried out.

2.4. Statistics

Comparison of indicators was performed depending on age, as well as calculation of mean group values (M) and standard error of the means (SE). Differences were considered significant at $p \leq 0.05$. Data processing was carried out using the standard package of statistical functions Microsoft Excel, 2010.

3. Results

3.1. Anthropometric measurement

Table 1 shows body height, body weight and body mass index in school boys of different ages. It turned out that 7 year old boys had a body mass index below the normal value of WHO standards. (13.1-17.0). However, as children grew and developed, their body mass index increased. So, in 12-year-old adolescents, the body mass index manifested itself at the lower limit of the norms, and in 18-year-old adolescents, the body mass index approached the values of the WHO norms (16.9-24.3).

Table 1 Height, body weight and body mass index in schoolboys of different age ($M \pm SE$; $n=36-38$)

Parameters	Age (years)		
	7	12	18
Height (cm)	114.7±9.8	156.4±8.4	174.2±6.2
Weight(kg)	15.3±0.8	32.9±2.7	58.2±4.8
P	-	<0.001	<0.001
BMI	11.5±0.8	13.5±1.4	19.2±1.2
P	-	>0.1	<0.001

P - Statistical significance of differences in comparison with the previous age

3.2. Body composition

Table 2 shows the body composition components of boys in different stage of growth and development. In 12-year-old teenagers, compared with 7-year-old boys, the absolute content of fat, lean mass, muscle mass, mass of minerals of bone tissue and total water increased by 2.1; 1.7; 1.8; 1.2 and 1.6 respectively. The increase of boy's body weight in late adolescence compared with early adolescence was accompanied by an increase in the weight of all body components. In 18-year-old boys fat mass increased by 2.3 times, lean mass by 1.8 times, muscle mass by 1.2 times and bone mineral mass by 1.2 times compared to 12-year-olds. The mineral content in 12-year-olds increased sharply in comparison with 7-year-olds, but then it was remained at the same level during adolescence.

Table 2 Body composition components in schoolboys of different age (M± SE; n=36-38)

Parameters	Age (years)		
	7	12	18
Fat mass, kg	2.5±0.2	7.0±0.3	16.1±0.8
P	-	<0.001	<0.001
Lean weight, kg	12.4±0.7	25.9±1.1	43.1±3.3
P	-	<0.001	<0.001
Muscle mass, kg	9.2±10.2	17.4±0.9	29.2±1.9
P	-	<0.001	<0.001
Bone mineral content, kg	1.2±1.3	2.0±0.2	2.4±0.2
P	-	<0.001	>0.1

P - Statistical significance of differences in comparison with the previous age

When comparing the degree of increase in various body components in 18-year-olds compared with 7-year-olds, it can be seen that the fat mass in 17-year-olds increases 6.4 times, lean mass - 3.5 times, and muscle mass - 3.2 times. The content of minerals in bone tissue in 17-year-olds had 3.0 times more as compared with 7-year-olds. Age-dependent increase in body components is especially pronounced for fat mass, compared with other components of the body

4. Discussion

It is known body mass index deviating from the norm is a clear sign of various pathologies and deterioration of mental and physical performance. Therefore, the analysis of body mass index in children and adolescents, when development rates are high, necessary for the prevention and correction of mental and physical activity disorders. Obtained data show in 7-year-old children were underweight but, as children grew and developed, their body mass index increased. In 17-year-old adolescents the body mass index reaches typical for this age values.

It is revealed that with the growth and development of school boys, their body component ratio shifted. In particular, fat content was 17.6% in 7-year-olds, 21,3% in 12- year-olds and 27.7% in 17- year-olds. The tendency of age-related increase in the percentage of fat in boys is somewhat alarming, because this is due to the growing risk of obesity. Such phenomenon also took place in pediatric population of other regions [7, 8].

McCarthy et al. suggested that the ratio of fat mass to muscle mass could serve as an indicator of metabolic syndrome, given that fat excess effect on glucose sensitivity [7]. However, the relationship between fat-to-muscle mass and metabolic health may be non-linear, as complete absence of body fat, like lipodystrophy, which is associated with insulin resistance [9]. Complete absence of body fat in boys was not observed. The ratio of fat and muscle mass in 7-, 12- and 18-year-olds was equal to 0.4; 0.4 and 0.6. Thus, in late adolescence period boys will find it more difficult to maintain glucose homeostasis than earlier boys. It can be assumed that adolescents are at increased risk of predisposition to diabetes.

5. Conclusion

In general, the obtained data show that as children grow and develop, the mass of main components of body increase. The most expressed increase was in adipose tissue, and the least one was in content of bone minerals. Despite the fact that 7-year-old children were underweight, the 17-year-old adolescence had normal weight. However, weight normalization was mainly due to fat gain. It is indirectly indicated an increase in the predisposition of adolescents to the diabetes millennium.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest associated with this article.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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