American Journal of Medicine and Medical Sciences 2023, 13(11): 1794-1797
DOI: 10.5923/j.ajmms.20231311.40

Comparative Parameters of Height and Weight Measurements in Healthy and Children with Congenital Heart Diseases 3-10 Years Old

N. K. Khamidova, R. R. Baymuradov

Bukhara State Medical Institute, Bukhara, Uzbekistan

Abstract Anthropometry is a generally accepted method for assessing a child's growth and development. The main anthropometric parameters that determine the physical development of children and adolescents are weight, height, chest circumference and body surface area. **The purpose of the study** was to study the parameters of physical development of healthy children and children with congenital heart diseases aged 3-10 years. **Materials and methods.** 400 healthy children from 3 to 10 years old were studied, of which 200 were girls and 200 were boys. **In conclusion**, we state that in healthy and sick 6-year-old boys and girls with congenital heart diseases, similar parameters were obtained with children 3-5 years old, where the trend and intensity of changes were the same, and in sick children 6 years old, the main anthropometric parameters (height, weight, BSA and chest circumference) were significantly reduced in relation to the data of healthy children of the same age, and this applied to both sexes studied.

Keywords Anthropometry, Children, Chest circumference

1. Introduction

The growth of various body parameters is an important indicator for assessing the health of children [1]. Children's development can be assessed through a life history, physical examination, and anthropometric measurements. Anthropometry is a generally accepted method that can be used for younger generations [5]. In children, measurements reflect general health, nutritional adequacy, and growth and development over time [3]. Also, these parameters are a mirror of the social and economic well-being of the country [4].

Anthropometric parameters are interpreted by comparison with reference data for age and sex. Interpretation of an individual child's anthropometric measurements will depend on the reference data used. Clinicians are often faced with a dilemma when choosing a height reference for anthropometric assessment among various national and international growth standards [5]. Therefore, the standards set by the World Health Organization are used and accepted in at least 125 countries [2,6]. The main anthropometric parameters that determine the physical development of children and adolescents are weight, height, chest circumference and body surface area. There is a lot of information in modern literature that provides these indicators separately, but it is difficult to find general information linking all these parameters together.

Received: Nov. 6, 2023; Accepted: Nov. 23, 2023; Published: Nov. 25, 2023
Published online at http://journal.sapub.org/ajmms

Purpose of the study: to study the parameters of physical development of healthy children and children with congenital heart diseases aged 3-10 years old.

2. Materials and Methods

400 healthy children and children with congenital heart diseases from 3 to 10 years old were studied, of which 200 girls and 200 boys. The study involved children from secondary school No. 2 and preschool No. 51 in the city of Bukhara. Anthropometric parameters of sick children were measured in the private clinic “Nasriddin Shams”. Before conducting the research, consent was obtained from the parents of the children involved in the research.

To study the morphofunctional state and characteristics of puberty in children aged 3-10 years, well-known methods of anthropometry and physiometry were chosen. Anthropometric measurements included determination of the following parameters: body weight (kg); height (cm); chest circumference (cm); body surface area (m^2).

Body length was measured by a medical stadiometer (with an accuracy of 0.5 cm); body weight - on medical scales (accurate to 50 g).

A tape measure was used to measure chest circumference. The following formula was used to determine the body surface area:

BSA = (weight (kg)0.425 * height (cm)0.725)/139.2

All results were statistically processed and the degree of reliability of the indicators was determined.

3. Research Results

The results obtained show that in sick 3-year-old boys with congenital heart diseases, the average height was 90.80±0.49 cm, which is 1.08 times significantly lower than the parameters of healthy children of the same age (P<0. 05) – table. 1. Almost the same results were obtained in sick 3-year-old girls.

Table 1. Comparative parameters of height and weight indicators in sick children with heart defects aged 3-5 years

Age, gender		Height, cm	Weight, kg	BSA, m^2	Chest circum-ference, см
3 years old healthy	boys	97,93±0,49	15,38±0,32	0,64±0,05	53,70±0,38
	girls	97,35±0,53	15,08±0,31	0,63±0,05	52,70±0,41
3 years old with CHD	boys	90,80±0,49*↓	13,0±0,26*↓	0,56±0,04*↓	50,15±0,33*↓
	girls	90,40±0,43*↓	12,75±0,26*↓	0,56±0,04*↓	49,75±0,34*↓
4 years old healthy	boys	104,25±0,52	17,40±0,34	0,70±0,06	54,70±0,40
	girls	103,95±0,51	16,65±0,33	0,69±0,05	53,50±0,37
4 years old with CHD	boys	97,75±0,43*↓	14,10±0,28*↓	0,61±0,04*↓	51,45±0,31*↓
	girls	96,65±0,49*↓	13,80±0,28*↓	0,60±0,04*↓	51,10±0,31*↓
5 years old healthy	boys	110,60±0,53	19,39±0,35	0,77±0,06	57,25±0,37
	girls	109,05±0,50	19,25±0,38	0,76±0,06	54,45±0,32
5 years old with CHD	boys	101,90±0,46*↓	15,65±0,31*↓	0,66±0,04*↓	52,95±0,31*↓
	girls	100,95±0,45*↓	15,45±0,30*↓	0,65±0,04*↓	52,35±0,31*↓

Note: * is a sign of inter-gender reliability of indicators, ↓ is the direction of changes.

In sick 4-year-old children, there is also a significant decrease in height in relation to healthy children without heart disease, and this is observed in both sexes - respectively, in boys 97.75 ± 0.43 cm versus 104.25 ± 0.52 cm (1.07 times significant difference, P<0.05) and in girls 96.65±0.49 cm versus 103.95±0.51 cm (1.08 times difference, P<0.05). Almost the same picture is observed in the compared children in terms of weight, where there were significant differences between the parameters in both boys (1.23 times significantly greater in healthy people, P <0.01) and girls (1.21 times difference in favor of healthy girls, P<0.05). We observed significant differences in BSA indicators, where in healthy children of both sexes the parameters were significantly higher (P<0.05) in relation to the data of sick 4-year-old children. We observed the same trend and intensity of changes in the chest circumference (P<0.05).

Almost the same trend is observed in 5-year-old children, regardless of gender, that is, in children with congenital heart diseases, all 4 compared indicators were significantly reduced (P<0.05). When comparing parameters between sick boys and girls, no statistically significant differences were found (P>0.05); all indicators were close to each other. This fact was observed in all examined children aged 3-5 years, which indicates the negative impact of heart defects on the physical development of children in this age category.

To complete the picture and to better understand these differences between sick and healthy children, we have developed an original table indicating the degree of differences between the indicators (Table 2). To do this, we took the ratio of all 4 parameters of healthy children to the data of sick children with congenital heart diseases (times difference).

Table 2. Multiplicity of differences between the height and weight parameters of healthy and sick children 3-5 years old

Age, gender		Height	Weight	BSA	Chest circumference
3 years old	boys	1,08	1,18	1,14	1,07
	girls	1,08	1,18	1,13	1,06
4 years old	boys	1,07	1,23	1,15	1,06
	girls	1,08	1,21	1,15	1,05
5 years old	boys	1,09	1,24	1,17	1,08
	girls	1,08	1,25	1,17	1,04

These parameters indicate the degree of significant differences between sick and healthy children, as can be seen from the table, the greatest changes were observed in the weight and BSA of children, since here is the greatest difference between the parameters of the compared groups.

The study of these indicators was also carried out in the age category of children 6-10 years old, where the height and weight parameters of healthy children and children with congenital heart diseases were subjected to comparative analysis. The results obtained show that in sick 6-year-old boys, growth parameters were significantly reduced by 1.07 times in relation to the data of healthy individuals - respectively, 117.30±0.51 cm versus 110.00±0.57 cm. (P< 0.05). The results for 6-year-old girls were very close to these data - 115.20±0.49 cm versus 109.85±0.56 cm (1.05-fold difference, P<0.05) - table. 3.

Table 3. Comparative height and weight parameters in healthy children and patients with heart defects 6 years old

Age, gender		Height, cm	Weight, kg	BSA, m^2	Chest circum-ference, см
4 years old healthy	boys	117,30±0,51	21,48±0,38	0,84±0,06	58,25±0,37
	girls	115,20±0,49	21,20±0,40	0,82±0,06	57,20±0,40
4 years old with CHD	boys	110,0±0,57*↓	17,80±0,31*↓	0,74±0,06*↓	54,65±0,34*↓
	girls	109,85±0,56*↓	17,45±0,31*↓	0,73±0,05*↓	53,90±0,33*↓

Note: * is a sign of inter-gender reliability of indicators, ↓ is the direction of changes.

Table 4. Results of studying the main anthropometric indicators of healthy and sick children with congenital heart diseases aged 7-10 years

Age, gender		Height, cm	Weight, kg	BSA, m^2	Chest circum-ference, см
7 years old healthy	boys	122,30±0,52	23,35±0,42	0,89±0,06	60,0±0,37
	girls	122,0±0,49	22,95±0,50	0,88±0,07	59,63±0,51
7 years old with CHD	boys	114,45±0,54*↓	20,10±0,35*↓	0,80±0,05*↓	55,95±0,36*↓
	girls	112,65±0,48*↓	19,10±0,33*↓	0,77±0,04*↓	54,95±0,36*↓
8 years old healthy	boys	127,50±0,51	26,25±0,45	0,97±0,07	61,97±0,38
	girls	126,13±0,36	24,83±0,39	0,91±0,04	60,28±0,30
8 years old with CHD	boys	119,60±0,44*↓	20,95±0,37*↓	0,84±0,05*↓	58,70±0,36*↓
	girls	118,05±0,41*↓	20,60±0,34*↓	0,83±0,05*↓	57,80±0,38*↓
9 years old healthy	boys	133,80±0,55	29,83±0,51	1,06±0,07	65,43±0,45
	girls	133,50±0,51	29,60±0,47	1,05±0,06	63,48±0,55
9 years old with CHD	boys	124,05±0,56*↓	23,86±0,40*↓	0,91±0,06*↓	59,90±0,37*↓
	girls	123,05±0,50*↓	23,28±0,36*↓	0,90±0,05*↓	59,15±0,38*↓
10 years old healthy	boys	138,68±0,57	32,70±0,55	1,13±0,08	67,20±0,42
	girls	138,25±0,38	32,40±0,41	1,12±0,08	65,70±0,46
10 years old with CHD	boys	129,30±0,50*↓	26,15±0,42*↓	0,98±0,06*↓	61,35±0,40*↓
	girls	128,50±0,50*↓	25,30±0,40*↓	0,96±0,06*↓	60,45±0,40*↓

Note: * is a sign of inter-gender reliability of indicators, ↓ is the direction of changes.

Almost the same significant differences were obtained in the weight of children, where the parameters of sick children remained reduced in both boys (21.48±0.38 kg versus 17.80±0.31 kg, $P<0.05$) and girls (17.80±0.31 kg versus 17.45±0.31 kg, $P<0.05$), that is, the trend and intensity of the decrease was the same as when studying the growth of patients. Further study of other indicators also had the same trend, BSA and chest circumference in boys were significantly reduced by 1.14 and 1.07 times, respectively ($P<0.05$), and in girls the difference was similar to the data for boys - respectively, a decrease was noted in 1.12 and 1.06 times ($P<0.05$).

Identical studies were carried out in children aged 7-10 years, the results of which are given in table. 4.

The results obtained show that the observed trend of decreased indicators in sick children continued in children 7-10 years old, although the growth of anthropometric indicators depending on age continued to increase, but still these parameters were significantly low compared to the data of healthy children without congenital heart diseases.

Thus, in 7-year-old children, height was significantly reduced by 1.07 times (122.30±0.52 cm versus 114.45±0.54 cm, $P<0.05$), and weight by 1.16 times (23.35±0.42 cm versus 20.10±0.35 cm, $P<0.05$). While BSA and chest circumference were reduced by 1.11 (0.89±0.06 m^2 versus 0.80±0.05 m^2, $P<0.05$) and 1.07 (60.0±0.37 cm versus 55.95±0.36 cm, $P<0.05$) times respectively. This fact indicates a growth retardation in sick children compared to their healthy peers.

The study of height and weight parameters in sick 7-year-old girls also shows the following picture, where all studied parameters are significantly reduced ($P<0.05$) compared to the data of healthy peers. In terms of height, this decrease was 1.08 times, in weight 1.20 times, and in terms of BSA and chest circumference, 1.14 and 1.09 times, respectively ($P<0.05$). All the results obtained were close to the data of 7-year-old boys.

When considering the results obtained from 8-year-old boys and girls with various heart defects, identical data were found, that is, the trend and intensity of the decrease was the same. In sick boys, in all 4 parameters (height, weight, BSA, chest circumference), the decrease in the attitude of healthy peers was 1.07, 1.25, 1.15 and 1.06 times, respectively ($P<0.05$). Girls with congenital heart diseases also had reduced parameters - 1.07, 1.21, 1.10 and 1.04 times, respectively ($P<0.05$). Noteworthy is the fact that for some indicators the intensity and frequency of differences was low in girls compared to boys.

It should be emphasized that similar results were obtained in 9-year-old and 10-year-old children with congenital heart diseases, that is, all the studied parameters were significantly low in relation to the data of healthy children ($P < 0.05$), and this applied to both sexes. The extent and intensity of the decline

was similar to other age categories described previously.

4. Conclusions

Thus, the results obtained from a comparative analysis of the height and weight parameters of healthy and sick children with congenital heart diseases of both sexes show that all the studied parameters (height, weight, BSA and chest circumference) were significantly different from each other, and these differences were almost the same in both sexes. All average indicators of height, weight, BSA and chest circumference were significantly reduced in children with heart defects in relation to these data in healthy children. The greatest differences were observed in weight and BSA ($P<0.05$). It should be emphasized that there were no statistically significant differences between the indicators of sick boys and girls, which indicates that heart defects equally negatively affect the anthropometric indicators of both sexes.

In healthy and sick 6-year-old boys and girls with congenital heart diseases, similar parameters were obtained with children 3-5 years old, where the trend and intensity of changes were the same, and in sick children 6 years old, the main anthropometric parameters (height, weight, BSA and chest circumference) were significantly reduced in relation to data from healthy children of the same age, and this applied to both sexes studied.

The results obtained from studying the height and weight parameters of children aged 7-10 years old with congenital heart diseases showed that their height, weight, BSA and chest circumference were on average low in relation to the data of healthy children of the same age, and all indicators differed statistically significantly between itself ($P<0.05$). It must be emphasized that this applied to both boys and girls with congenital heart diseases. It follows from this that, firstly, congenital heart diseases have a negative impact on the physical development of children 7-10 years old, which is characterized by reduced parameters of height, weight, BSA and chest circumference, secondly, the decrease was observed equally in both sexes, and thirdly, the trend and the intensity of the decrease were similar to each other except for weight and BSA, which were slightly higher than other compared indicators.

REFERENCES

[1] Beker L. Principles of growth assessment. Pediatr Rev 2006; 27: 196-198. https://doi.org/10.1542/pir.27-5-196.

[2] De Onis M. Update on the implementation of the WHO child growth standards. World Rev. Nutr. Diet. 2013; 106: 75–82.

[3] Fryar CD, Gu Q, Ogden CL, Flegal KM. Anthropometric Reference Data for Children and Adults: United States, 2011-2014. Vital Health Stat 3 Anal Stud. 2016 Aug; (39): 1-46. PMID: 28437242.

[4] Gurzkowska B, Kułaga Z, Litwin M, Grajda A, Świąder A, Kułaga K, Góźdź M, Wojtyło M. The relationship between selected socioeconomic factors and basic anthropometric parameters of school-aged children and adolescents in Poland. Eur J Pediatr. 2014 Jan; 173(1): 45-52. doi: 10.1007/s00431-013-2109-1. Epub 2013 Aug 6. PMID: 23918294; PMCID: PMC3890069.

[5] Singh P, Gandhi S, Malhotra RK, Seth A. Impact of Using Different Growth References on Interpretation of Anthropometric Parameters of Children Aged 8-15 Years. Indian Pediatr. 2020 Feb 15; 5 7(2): 124-128. PMID: 32060238.

[6] World Health Organization. Child Growth Standards and the Identification of Severe Acute Malnutrition in Infants and Children: A Joint Statement by the World Health Organization and the United Nations Children's Fundation. World Health Organization; Geneva, Switzerland: 2009.