

**ANTHROPOMETRIC PARAMETERS OF THE HEAD AND  
MAXILLOFACIAL PART IN CHILDREN WITH DIABETES MELLITUS  
AND IT IS COMPLIANSE TO THE PRINCIPLE OF THE GOLDEN RATIO**

**Sh.J. Teshaev, M.B.Norova, GS Yadgarova, U.I. Nurov, R.R.Baymuradov**

*Bukhara State Medical Institute Named after Abu Ali Ibn Sina, Uzbekistan*

**Actuality of the problem.** Diabetes is a chronic syndrome of hyperglycemia, developing as a result of the impact of genetic and exogenous factors. Prevalence of the disease among the population of various countries and ethnic groups is 1 - 3%. Given the frequency of undiagnosed diabetes in the form of individual countries exceeds 6%. Nowadays, more than 120 million people are suffering from this disease around the globe. The annual number of newly diagnosed cases exceeds 6 - 10% relative to the total number of patients, which leads to their doubling every 10 – 15 years [2,3,4,9,15,16]. According to various authors, from 3.5 to 8% of all patients with diabetes are children. It often occurs in children between the ages of 6 to 13 years [6,7,10,13].

In 2007 the total population of children in the world (0-14) reached 1.8 billion, of which 0.02% had diabetes. This means that approximately 440,000 children have diabetes and 70,000 new cases are diagnosed each year [5,8].

Diabetes mellitus occurs in children relatively sharply and without cure, usually acquiring heavy progressive course [7,8,12]. This development of diabetes in children is due to the intensive growth of the body of the child and, accordingly, enhanced metabolism. The period of diabetes in children depends on the age of the child, when the disease begins. The younger the child, sick with diabetes, the harder it runs and the more various the threat of complications are [5,6,12,14].

Among these complications occurring in children, one of the first symptoms is a peculiar development of the maxillofacial part, which can be seen visually. It is also accompanied by body shape - hypersthenics. These symptoms are often observed at medium or severe diabetes. In the mild form of diabetes mellitus in patients with children there may nearly be no complaints and symptoms of the disease [2,4].

In recent years much attention is being paid to psychosocial and physical factors in the management of the first type of diabetes in children and adolescents. This helps to psychological adaptation, educational functions, family dynamics, social support, stress tolerance and improving quality of life in children and adolescents with type 1 diabetes [8,16].

Monitoring of growth and development and use of graphs percentile growth is a determining factor in the treatment of children and adolescents with diabetes. In the work of many authors an increase in growth during the installation of the diagnosis of

type 1 diabetes have been reported. The exact mechanism and the question of whether or not to keep this increase in growth remains to be elucidated [2,5,6,14].

In literature, very few people work on the morphometric parameters of a particular area of the body or body parts of children with type 1 diabetes, and these data are contradictory.

Limits of variation of the anthropometric parameters of body parts of children of the same age tend to go beyond the size of the oscillations in younger or older children. This is a transgressive variability which provides necessity of quantitative determinations. Defining this variability in the body between healthy children and children with various diseases of the same age, early diagnosis gives the lag or lead development of the child's body. These results are the methodological basis for the development and improvement of anthropometric methods of diagnosis and treatment of this population [1,2].

A lot of rules and standards have been suggested to describe the ideal proportions of the human body, but it is the golden ratio which defines its true beauty. The golden proportion was first described in 4. BC. It represents unique division line AB into two segments (AC and CB) such that AB is divided by the AU and the ratio is equal division of the segment AC NE. The result of this division is the number  $\phi$ , equal to 1.618. Thus, the golden ratio is the ratio of interactive proportions, in which the whole is connected with its big part, as a big part is connected with a small part [Shaparenko PF, 1994].

The form in the basis of which there is a combination of symmetry and the golden ratio contributes to the best visual perception and the emergence of feelings of beauty and harmony. Proportions of the various parts of our body are the number very close to the golden section. If these proportions coincide with the value of the Fibonacci numbers (1: 1,618), the appearance or the human body is considered to be perfectly folded [9].

In addition, the study of morphometric parameters of the head and the dental system in diabetes mellitus in childhood may be one of the first signs of the diagnosis of this pathology.

**The purpose and objectives of the study.** The aim of our study was to determine the anthropometric parameters of the head and maxillofacial of nine-year-old healthy children and children with diabetes mellitus and correspondence of the results to the Golden Section.

**Materials and methods.** The studies were conducted in school and, the children's department of the regional endocrinology clinic. The resulting morphological

parameters were studied by dividing the children into 2 groups: nine-year-old healthy children (I - group), 9-year-olds with diabetes (II - group). Clinical and anthropometric methods followed by statistical data processing were used to obtain the parameters of the face and head. The measurements were made between standard craniometrical points with calipers (division value 0.1 mm). Head circumference - measured by measuring tape, the longitudinal dimension of the head, the transverse dimension of the head, zygomatic and mandibular facial diameter measured by tazomer. Palpation of soft tissues of the face found point: trichion (tr) - the point at the intersection of the median plane of the front hairline; nasion (n) - a point at the intersection of nose forehead seam with the median plane; subnasale (sn) a point connection of the nasal septum with the upper lip (skin under nose point); gnation (gn) -the lowest point of the base of the lower jaw; zygion (zy) -the most protruding outward point of the zygomatic arch. Between the data points were determined physiognomic facial height (tr-gn), morphometric facial height (n-gn), zygomatic diameter (zy-zy), the lower the distance (sn-gn), medium (n-sn) and upper (tr-n ) parts of the face.

To check the golden section ratio we used:  $tr-gn / n-gn$  (in accordance with the golden ratio should be 1: 1,618).

**The results and the discussion of the study.** Research showed that head size of 9 boys of the first group size circumference ranged from 50.2 to 56.1 cm, on average -  $53,42 \pm 0,14$  cm. Longitudinal diameter of the head varies from 16, 2 to 17.8 cm on average -  $16,78 \pm 0,12$  cm., and the transverse size of the head ranged from 11,8sm to 13,4sm average -  $12,15 \pm 0,09$  cm. transverse size of the forehead varies from 9.85 cm to 11.4 cm, an average -  $10,57 \pm 0,1$  cm. Multilevel or vertical head diameter is in the range of 11.8 - 13.5 cm, with an average -  $12,16 \pm 0,07$  cm. Zygomatic diameter ranging from 9.0 cm to 10.4 cm in average -  $9,39 \pm 0,12$  cm. and mandibular diameter varies from 8,7sm to 10.2 cm in average -  $9,51 \pm 0,12$  cm. morphological face height ranged from 12.0 cm to 13.2 cm - on average  $12,5 \pm 0,14$  cm., and physiognomic face height of 17.0 cm to 18.2 cm - average -  $17,48 \pm 0,21$  cm.

Analysis of the morphometric parameters of the head and maxillofacial of the nine-year-old healthy girls of the first group showed that the length of the head circumference ranged from 51.2 to 56.1 cm, on average -  $53,9 \pm 0,14$  cm. Longitudinal diameter of the head varies from 16.5 to 17.9 cm, an average -  $16,80 \pm 0,12$  cm. and the transverse dimension of the head from 12.8 cm to 14.4 cm in average -  $13,45 \pm 0,09$  cm. The transverse dimension of the forehead ranged from 10.1 cm to 12.3 cm on average -  $11,05 \pm 0,1$  cm. Vertical head diameter varies from 12.9 cm to 14.5 cm on average -  $13,76 \pm 0,07$  cm. Zygomatic diameter ranging from 9.1 cm to 10.4 cm in average -  $9,7 \pm 0,12$  cm. and mandibular diameter ranging from 8.1 cm to 9.9 cm on

average -  $9.05 \pm 0.12$  cm. morphological face height of 12.1 cm, to 13.9 cm - an average of  $12.85 \pm 0.14$  cm. physiognomic face height of 17.7 cm to 19.0 cm - on average -  $18.14 \pm 0.21$  cm.

Studies have shown that head circumference length of 9 year old boys of the second group (children with diabetes) ranges from 50.4 to 56.4 cm, on average -  $53.62 \pm 0.14$  cm. Longitudinal diameter of the head ranges from 16.1 to 18.0 cm, on average -  $16.8 \pm 0.12$  cm. a cross head size ranged from 11.7 cm to 13.7 cm on average -  $12.45 \pm 0.09$  cm. transverse dimension forehead varied from 10.1 cm to 11.6 cm in average -  $10.87 \pm 0.1$  cm. Vertical head diameter ranges from 11.8 cm to 13.5 cm in average -  $12.16 \pm 0.07$  cm. Zygomatic diameter ranging from 9.0 cm to 10.7 cm in average -  $9.5 \pm 0.12$  cm. and mandibular diameter ranging from 8.9 cm to 10.6 cm in average -  $9.98 \pm 0.12$  cm. Morphological face height of 11.7 cm to 12.9 cm - average  $12.05 \pm 0.14$  cm and physiognomic face height of 16.7 cm to 17.7 cm - average -  $16.98 \pm 0.21$  cm.

Analysis of the morphometric parameters of the head and maxillofacial of nine-year-old girls of the second group showed that the length of the head circumference ranged from 52.9 to 55.8 cm, with an average of -  $54.89 \pm 0.14$  cm. The longitudinal diameter of the head is within 16.7- 18.0 cm, on average -  $17.5 \pm 0.12$  cm. Transverse head size ranged from 13.0 cm to 14.7 cm on average -  $13.95 \pm 0.09$  cm. transverse size of the forehead ranged from 10.9 cm to 12.7 cm on average -  $11.05 \pm 0.1$  cm. Vertical head diameter varies from 13.0 cm to 14.9 cm on average -  $14.46 \pm 0.07$  cm. Zygomatic diameter ranging from 9.5 cm to 10.4 cm in average -  $9.7 \pm 0.12$  cm. and mandibular diameter ranging from 8.7 cm to 10.9 cm average -  $9.89 \pm 0.12$  cm. morphological face height is in the range - 11.0 - 13.1 cm, average -  $12.2 \pm 0.14$  cm., and physiognomic face height from 17.0 - 18.3 cm - average -  $17.94 \pm 0.21$  cm.

The three division of face is generally accepted in anthropologists: the top - from the border of the hairy part of the forehead to the middle brow, middle - from the middle brow to under nose points lower - from under nose point to the chin. When these three dimensions are correct the face is considered to be the ideal corresponding to the Golden Section.

The measurements showed that the upper part of the face in 9-year-olds boys of the first group ranges from 5.8 cm to 6.6 cm, on average -  $5.91 \pm 0.12$  cm, and in 9 years old girls from 5.7 cm, up to 6.9 cm, on average  $6.03 \pm 0.16$  cm. Middle part of the face of boys of the first group ranged from 5.7 cm to 6.6 cm on average  $5.95 \pm 0.14$  cm, and in 9 year-old girls within - 5.5-6.8 cm, on average -  $6.04 \pm 0.15$  cm. The lower part of the face in 9-year-olds boys of the first group ranges from 5.9 cm to 6.5

cm on average  $5,82 \pm 0,15$  cm, and 9-year-old girls in this group ranged from 5.5 cm to 6,8sm in average -  $6,12 \pm 0,14$ sm.

The comparison shows that the ratio of the distance from the tip of the chin to the top of the eyebrows in males ( $12,5 \pm 0,16$ sm) to the distance from the top of the eyebrows to the top of ( $7,6 \pm 0,14$ sm) is - 1: 1.65.

The ratio of the distance from the tip of the chin to the top of the eyebrows ( $12,5 \pm 0,16$ sm) to the distance from the top of the eyebrows to the top of ( $7,7 \pm 0,16$ sm) in girls is 1: 1.62.

Examining the conformity morphometric parameters of the face of 9-year-old children with diabetes to the principle of the golden ratio have shown that the upper part of the face in 9-year-olds boys ranged from 5.7 cm to 6,3sm, on average -  $5,85 \pm 0,11$ sm, while in the 9 year old girls it was from 5,6sm to 6,9sm, on average  $6,06 \pm 0,13$ sm. The middle part of the face in 9-year-olds boys ranged from 5,3sm to 6.4 cm on average  $5,65 \pm 0,12$ sm, while the 9 year old girls within - 5,3-6,6sm, on average -  $5,95 \pm 0,14$ sm. The lower part of the face in 9-year-olds boys with diabetes ranges from 5,4sm to 6,2sm, on average  $5,49 \pm 0,13$ sm, and 9 year old girls, this parameter varied from 5,3sm to 6,4sm in average -  $5,85 \pm 0,13$ sm.

The ratio of the distance from the tip of the chin to the top of the eyebrows of the boys of the second group ( $11,8 \pm 0,13$ sm) to the distance from the top of the eyebrows to the top of ( $7,2 \pm 0,11$ sm) is 1: 1.64, while in the girls of the second group ( $12,2 \pm 0,12$ sm /  $7,6 \pm 0,10$ sm) it is 1: 1.60.

At first glance, the parameters of the faces of children of the second group seems larger than the children of the first group. But measurements show the opposite result. Among the children surveyed, this pattern has established itself and, in particular girls with diabetes have created difficulties in the anthropometric measurements of the maxillofacial region, as they have a highly developed adipose tissue of the cheeks.

Thus, studies have shown that morphometric parameter of the heads of the children with diabetes is larger than healthy ones. In our opinion this is due to the constant changes in the level of insulin (hormone status) in a young body, which affects the volume of the brain (cerebral edema).

Parameter of the face of healthy children is larger than children with diabetes. This demonstrates the backwardness of the developing bones of the face and dental system in diabetes. And the fullness of the face is due to the accumulation of fat tissue and swelling in the area for a given pathology.

Anthropometric parameters of the head and jaw face area in girls is bigger than boys in both groups. This demonstrates the backwardness of the morphometric

parameters of the head and maxillofacial region in boys in comparison with the girls in the same age.

The ratio of the upper, middle and lower parts of the face in girls of the both groups is closer to the law of the golden ratio, compared to boys.

In the first group relationship between the parameters of face parts is more appropriate to the number of parameters or Fibonacci golden ratio compared with the second group. In the second group the size of the upper segment of the face is more than the lower segment.

The transverse dimensions of the face (malar and mandibular diameter) is greater in children of the second group while the longitudinal is in the first.

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## **АНТРОПОМЕТРИЧЕСКИЕ ПАРАМЕТРЫ ГОЛОВЫ И ЧЕЛЮСТНО-ЛИЦЕВОЙ ОБЛАСТИ У ДЕТЕЙ С САХАРНЫМ ДИАБЕТОМ И ИХ СООТВЕТСТВИИ К ПРИНЦИПУ ЗОЛОТОЙ ПРОПОРЦИИ**

**Ш.Ж. Тешаев, М.Б.Норова, Г.С. Ядгарова, У.И. Нуров, Р.Р.Баймурадов**  
*Бухарский государственный медицинский институт*  
*им. Абу Али ибн Сина, Узбекистан*

Исследования показали, что морфометрические параметры головы у детей с сахарным диабетом больше чем у здоровых. По нашему мнению это происходит из за постоянного изменения уровня инсулина (гормонального статуса) в молодом организме, который повлияет на объём головного мозга.

Параметры лица у здоровых детей больше чем у детей с сахарным диабетом. Это свидетельствует об отставании от развития костей лица и зубочелюстной системы при сахарном диабете. А полнота лица происходит из-за накопления жира и отёчности тканей этой области при данной патологии.

Антропометрические параметры головы и челюстно -лицевой области у девочек больше, чем у мальчиков у обеих групп. Это свидетельствует об отставании морфометрических параметров головы и челюстно-лицевой области у мальчиков, по сравнению девочек находившихся в этом возрасте.

Соотношение верхней, средней и нижних частей лица у девочек обеих групп более близки к закону золотой пропорции, по сравнению мальчиков.

В I- группе соотношение параметров частей лица более соответствует к числу Фибоначчи или параметрам золотой пропорции по сравнению II-группы. Во второй группе размеры верхнего отрезка лица больше чем нижнего.

Поперечные размеры лица (скуловой и нижнечелюстной диаметр) больше у детей II- группы, а продольные – у первой.

## **ANTHROPOMETRIC PARAMETERS OF THE HEAD AND MAXILLOFACIAL PART IN CHILDREN WITH DIABETES AND THEIR CONNECTION WITH THE PRINCIPLE OF THE GOLDEN RATIO**

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