Sazonova Olga, Vovk Oleg, Hordiichuk Daria, Ikramov Volodimir, Onashko Yulia. Establishing the range of variability of the skull structures in adulthood. Journal of Education, Health and Sport. 2017;7(12):656-664. eISSN 2391-8306. DOI http://dx.doi.org/10.5281/zenodo.1478808
http://ojs.ukw.edu.pl/index.php/johs/article/view/6280
https://pbn.nauka.gov.pl/sedno-webapp/works/886085

The journal has had 7 points in Ministry of Science and Higher Education parametric evaluation. Part B item 1223 (26.01.2017).
1223 Journal of Education, Health and Sport eISSN 2391-8306 7

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 01.12.2017. Revised: 15.12.2017. Accepted: 25.12.2017.

ESTABLISHING THE RANGE OF VARIABILITY OF THE SKULL STRUCTURES IN ADULTHOOD

Olga Sazonova *, Oleg Vovk *, Daria Hordiichuk *, Volodimir Ikramov **, Yulia Onashko ***

Kharkiv National Medical University

*- assistant professor of human anatomy department
**-associate professor of human anatomy department
***- head of human anatomy department

Abstract

One of the most relevant direction of modern craniological anatomy − is an individual variability of the shape, size, position and relations of skull's regions and their structures. The research was conducted on craniometric study of 100 coherent and fragmented skull's bones included in the collections of human anatomy department in Kharkiv National Medical University. For facial skull studies used different measuring instruments and devices: dividers, set of facial lines, protractors, goniometer.In adulthood people of our region there is a direct dependence on the morphological type of the structures of the head and certain indicators of the cranial, altitude-longitudinal and altitude-latitudinal indexes. Most often, there are males with expanded and rounded forms of the skull with a predominance of moderate head size, that is relate them to the brachicranial type of the skull's structure. The middle group consists of males and females who have a classical middle form of the head, and belong to the mesomorphic structure of the skull. The smallest group consists of adulthood people with a narrow and elongated form of the head, referred to the dolichocranial type of skull structure.

Key words: craniometry, facial skull, range of variability.

Introduction. One of the perspective areas of modern anatomy craniology − is individual variability of shape, size, position and relations of cerebral and facial skull and their structures. General and particular craniometry based on conventional linear scales, craniological points, interosseous angles, that allows to determine the different indices and indicators [1-3].

Face bony construction rich in variety of individual parts structure, regions, bones with poorly studied range of variability depending on the age, gender, individual shape of the head. Based on the classic works of famous scientists [4-6], become popular the new perspectives and morphological aspects for improving the current craniology [7-10].

Taking in account the numerous osteological, neurological and vascular complications after surgical, reconstructive and other types of interventions in facial skull [11-13]− seems to be appropriate the craniological research of facial skull that directly optimizes the performance of difficult accesses and reduce economic request of their implementation, it is the **purpose of our work.**

Materials and methods. The research was conducted on craniometric study of 100 coherent and fragmented skull's bones included in the collections of human anatomy department in Kharkiv National Medical University.

For facial skull studies used different measuring instruments and devices: dividers, set of facial lines, protractors, goniometer.

In studying the facial features of the skull was used generally accepted, standard craniological points marked on the skull in two basic projections (Figure 1).

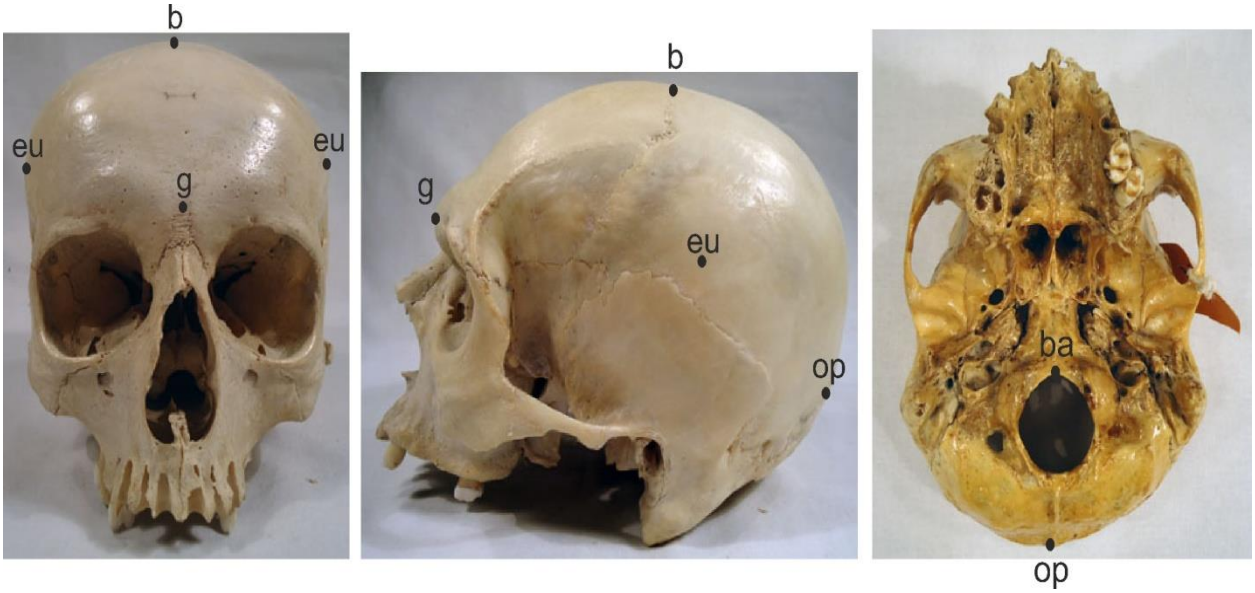


Fig.1. Craniometric points with parameters of the skull in the frontal (A) and sagittal planes (B).

To determine an individual anatomical variability of these structures was studied a number of key indexes. The main cephalic index is calculated using the formula:

$$\text{Ind}_{\text{cranial}} = \frac{\text{cranial transverse dimension (width)}}{\text{skull's longitudinal size (length)}} \times 100,$$

where the width is set between the parietal tubers corresponding to craniological point eurion (eu) and the length corresponding to the size from the bridge of the nose - point glabella (gl) to the external occipital protuberance, related with a point opistocranion (op).

The ranges of primary cephalic index under 75 - examined skulls related to dolichocranic type; 75-79,9 – mesocranic type; 80 and over - brachicranic.

Altitude-longitudinal cranial index determined by the formula:

$$\text{Ind. a/l} = \frac{\text{skull height}}{\text{skull length}} \times 100,$$

where the height is the distance from the middle of the large oppening in basion point (b), and on the alive person instead of this point used tragus of the ear to the highest point of the sagittal suture obelion (ob). The length of the skull measured as in determining the main (cranial) index.

With indicators less than 70,0 – determined the platycephalic structure type of the skull (short form); 70-74,9 - mesocephalic type (moderate form); 75,0 or more - ortocephalic type (high form).

In addition, calculated altitude-latitudinal index of the skull by the formula:

$$\text{Ind. a/l} = \frac{\text{skull height}}{\text{skull width}} \times 100,$$

where the height is a fixed size defined by previous index, and the width is known from the cranial index.

According to this index was conducted the gradation of observed skulls: objects with an index less than 92% - tapeinocephalic skull type (short head); 92,0-97,9% - metriocephalic type (moderate head); 98% or more - macrocephalic type (large head).

All calculations perfomed by computer program using the digital standard package of the tables and initial datas.

Results and discussion. According to received craniometric data, during adulthood defined the range of variability of the main parameters of the skull and its sections, which is evidenced by the main indexes (Table 1).

Table 1

The range of sizes and indexes of the skull in adulthood (cm)

№	Gender / Investigated signs	Male	Female
1	The length of the skull (gl-op)	17,2-19,8	16,3-18,5
2	The width of the skull (eu-eu_1)	13,5-15,8	13,0-15,6
3	The height of the skull (ob-b_a)	14,1-16,2	13,4-16,1
4	Cephalic index	71,6-88,2	74,2-90,3
5	Altitude-longitudinal index	71,8-79,2	68,5-76,9
6	Altitude-latitudinal index	84,0-105,2	92,7-110,1

The length of the skull among adulthood males is in the range from 17,2 to 19,8 cm; females - from 16,3 to 18,5 cm. Accordingly, the width of the skull varies from 13,5 to 15,8 cm; females - from 13,0 to 15,6 cm with a tendency to increase in the male representatives.

It was established that the length of the skull among adulthood males is between 17,2 cm to 19,8 cm with an interval of 2,6 cm and width ranging from 13,5 cm to 15,8 cm – with an interval of 2,3 cm. Thus, altitude parameter is ranging from 14,1 cm to 16,2 cm and 2,1 cm interval.

For females of this age, skull dimensions are within the length of 16,3 -18,5 cm with an interval 2,2 cm; width -13,0 – 15,6 cm with an interval 2,6 cm and height - from 13,4 to 16,1 cm with an interval 2,7 cm.

All this is indicating a certain and intense variation of external parameters of the skull in adulthood with a typical ranges depending on gender. If it is determined the process of increasing the length and width of the skull in males with an intervals of 2,6 cm and 2,3 cm, among females, it would be sustained and achieve the scale of range in the length and width of 2,2 cm and 2,6 cm.

For the total height of the skull it is typical moderate range during adulthood, determining from 2,1 to 2,7 cm. This parameter is very stable and complete index for adulthood people. Schematic range of skull's variability in adulthood shown on Figure 2.

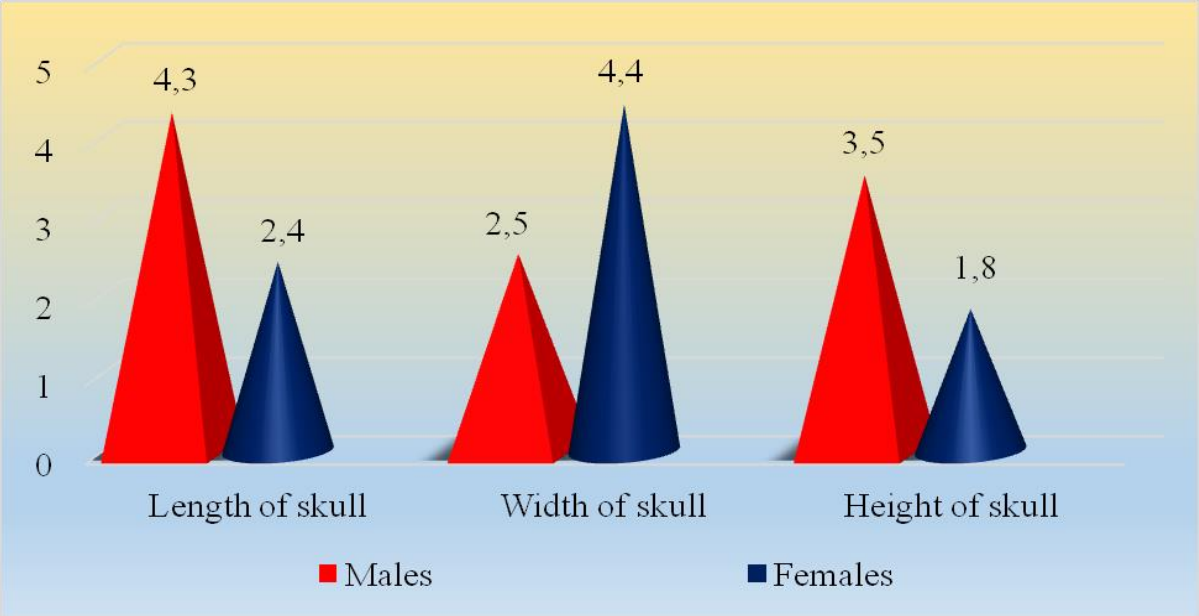


Fig. 2. Relative range of linear dimensions of the skull among males and females in adulthood (cm)

It was found that according to the gender cephalic index is in range 71,6 to 90,3, that prove the wide range of variability in adulthood. Among males, the index ranged from 71,6 to 88,2, females - from 74,2 to 90,3.

Thus, during adulthood there are representatives of all three structure types of the skull, due to their origin (Table 2).

Table 2

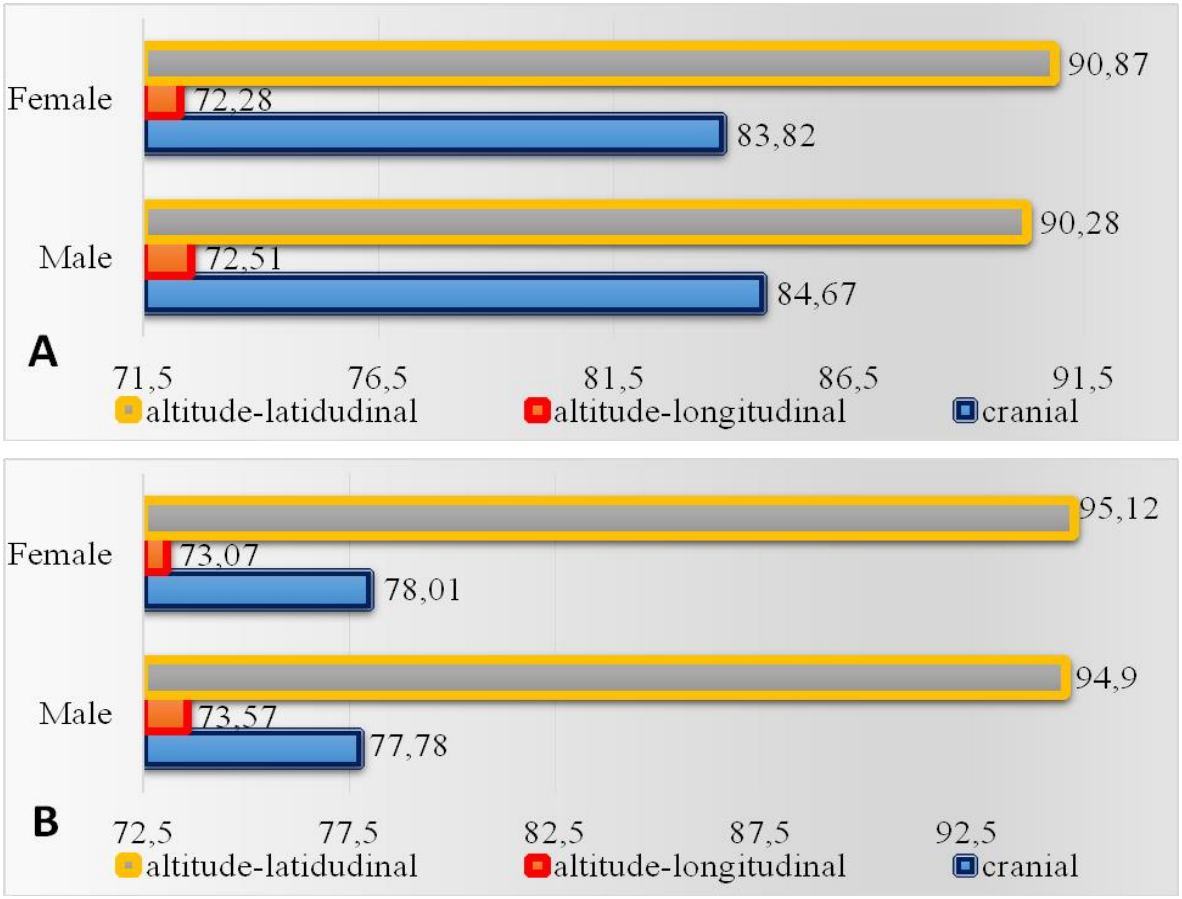
The range of individual differences in size and indexes of the skull in adulthood (cm)

№	Form of skull / Research features	Brachicranial		Mesocranial		Dolichocranial	
		Male	Female	Male	Female	Male	Female
1	The length of the skull	17,2-17,9	16,0-16,8	17,8-18,3	16,7-17,2	18,0-19,8	17,0-18,5
2	The width of the skull	14,9-15,8	14,0-15,6	14,2-14,9	13,6-14,1	13,5-14,2	13,0-13,1
3	The height of the skull	14,3-16,2	14,2-16,1	14,4-14,9	14,0-14,5	13,4-14,2	13,5-14,3
4	Cephalic index	81,8-90,3	82,2-88,9	76,3-79,0	75,9-78,8	71,6-74,7	71,9-74,2
5	Altitude-longitudinal index	68,4-74,9	68,0-74,1	72,0-76,1	72,2-75,3	76,8-79,2	76,2-79,3
6	Altitude-latitudinal index	84,6-97,7	84,0-96,9	93,0-97,1	93,3-96,2	105,7-110,1	105,0-109,2

According to our data, the length of the skull in adulthood have a range of variability depending on extreme forms of its structure. The greatest level of this parameter is set in dolichocranial males and females.

So, determined the skull sizes (length, width and height) are related with individual features and within the studied age gradually stabilized depend on extreme forms and structure of the head and skull.

There is a definite relation between the overall shapes of the head, cranial, altitude-longitudinal and altitude-latitudinal indexes for the first time received a comprehensive study of adulthood people taking in account the academic teaching position of V. Shevkunenko about individual anatomical variability. In this regard, it was found that adulthood people of brachicranial type structure of the skull usually combined orthocephaly (moderate head) values of altitude-longitudinal index and tapeinocephaly (short head) - of altitude-latitudinal index (Fig. 3 A). Mesocranial type of skull in adulthood people often combined with orthocephaly (moderate head) and mesocephaly (also moderate head) (Fig. 3 B). Dolichocephalic type of the skull structure, accompanied by hipsicephaly (high head) in combination with macrocephaly (large head) (Fig. 3 C).



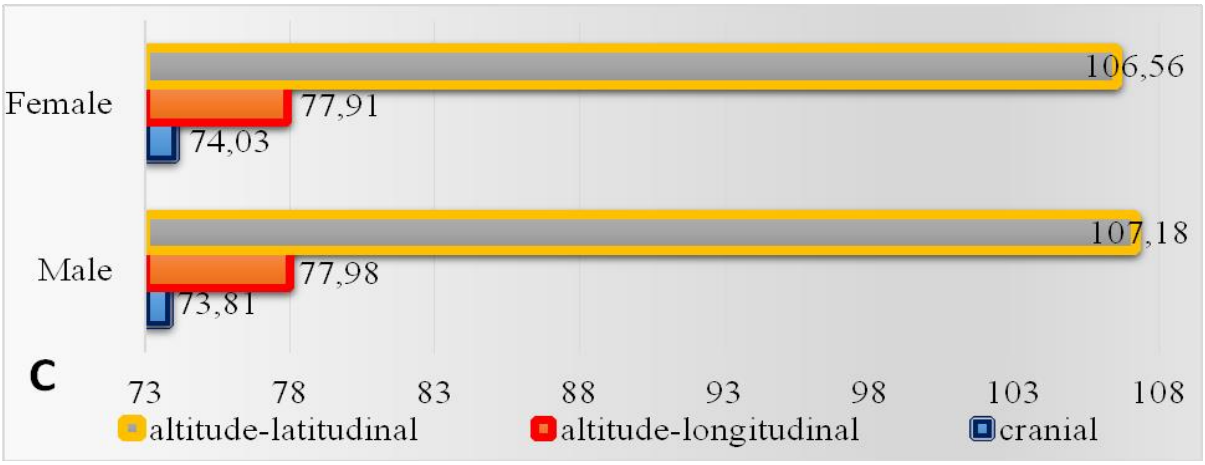


Figure 3. The range of variability between the cranial, altitude-longitudinal and altitude-latitudinal indexes found in adulthood people (scheme): A - with brachicranial type; B – with mesocranial type; B – with dolichocranial type.

Thus, adulthood people in our geographic area has a direct correlation of morphological structure type of the head with some variations of cranial, altitude-longitudinal and altitude-latitudinal indexes. The most common - males with wide and rounded forms of skull with a predominance of moderate head and stabilization of all parameters, that related them to brachicranial type of skull structure.

This group is the largest, meets the range of variability of the above indices based on people who live in the east of Ukraine. Central group consists of males and females with an average classic shape of the head, and refer to the type - mesomorphic structure of the skull. The smallest group consists of adulthood people with a narrow and elongated head, referred to dolichocranial type of skull's structure.

Summary. The above mentioned features of individual anatomical variability are important for the shapes, sizes, positions and relations of facial skull structures, its indices, upper and lower jaws, the location of the upper and lower rows of teeth. In this regard, the genetic and social aspects have the influence on formation and development of maxillofacial system and formation of normal and pathological types of bite. In addition, the adulthood is the final period of reproductive age with a typical stabilization of dental, alveolar and basic arcs that requires further investigation from position of individual anatomical variability.

References

1. Fedorischeva V.O. Porivnyalniy analiz normalnih cherepiv ta cherepiv z nabutimi deformatsiyami z arheologichnih rozkopok Verhnogo Saltova, Nijnogo Donu,

Hersonesa, Tepe-Kermena.: avtoref. dis. na zdobuttya nauk. stupenya kand. med. nauk: spets. 14.03.01 «normalna anatomiya» – Harkiv, 2009. – 22 c.

2. Evaluation of the bony landmarks in transcondylar approach / N. Barut [and other] // Br J Neurosurg. – 2009. – Vol. 23 (3). – R. 276-281.

3. Guminskiy YU.Y. Vikovi ta statevi osoblivosti komp'yuterno-tomografichnih parametriv riznih viddiliv zorovih nerviv u praktichno zdorovih yunakiv ta divchat Podillya / YU.Y. Guminskiy, A.V. Shayuk, V.V. Yasko // Visnik morfologiï. – 2010. – T. 16, № 1. – S.193-197.

4. Koveshnikov V.G. Ploskost estestvennoy orientirovki golovyi i vliyaniya eë stoykogo izmeneniya na formoobrazovanie cherepa (anatomo - ekspr. issled.): avtoref. dis.na soiskanie uchenoy stepeni dokt. med.nauk / V.G. Koveshnikov.– Saratov,1971– 28 s.

5. Vovk YU.N. Uchenie ob individualnoy anatomicheskoy izmenchivosti akad. V.N.SHevkunenko v morfologicheskih issledovaniyah / YU.N. Vovk, D.B. Bekov //Visnik problem biologiï i meditsini. – 2003 – №3. – S. 3–7.

6. Speranskiy V. S. Osnovyi meditsinskoy kraniologii / V. S. Speranskiy. – M. : Meditsina, 1988. – 278s.

7. Vovk O.YU. Individualnaya anatomicheskaya izmenchivost mozgovogo otdela golovyi i cherepa vzroslogo cheloveka / O.YU. Vovk // Ukraïnskiy jurnal klinichnoï ta laboratornoï meditsini. – 2012. – T. 7, № 3. – S. 80-84.

8. Vovk O.YU. Kraniometricheskie osobennosti cherepa lyudey yunosheskogo vozrasta / O.YU.Vovk // Hirurgiya Donbasu. – 2012. – № 2. – S. 38-41.

9. A novel concept for smart trepanation / A. Follmann, A. Korff, T. Fuertjes [et all.] // J. Craniofac. Surg. – 2012. – Vol. 23(1). – R.309-314.

10. Novyie ustroystva dlya kraniologicheskih issledovaniy / YU.N. Vovk, O.YU. Vovk, A.A. Shmargalev [et all.] / Visnik problem biologiï i meditsini. – 2011.- Vip.3, T.2. – S. 154-158.

11. Gayvoronskaya M.G. Anatomicheskoe obosnovanie implantatsii iskusstvennyih opor zubnyih protezov na verhney chelyusti: avtoref. dis. na soiskanie uchenoy stepeni kand. med. nauk: 14.00.02 / M.G. Gayvoronskaya. – Sankt-Peterburg, 2009. –21s.

12. Timoshenko O. P. Variantyi anatomicheskoy izmenchivosti stroeniya i formyi cherepa / O. P. Timoshenko // Ukraïnskiy morfologichniy almanah. – 2012. – Tom 10, № 1. – S. 133-134.

13. Gaĭvoronskiĭ I. V. Morphometric parameters of facial cranium asymmetry in adult man / I. V. Gaĭvoronskiĭ, E. I. Dubovik, I. V. Kraĭnik // Morfologiia. – 2009. – Vol. 135(2). – R.74-79.