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Investigating Neurocranial Sizes And Cephalic Indices Of Male Newborns In North of Tehran Using Millimetric Cephalometry

Reza Soltani[1], Fakhrodin Aghajanpour[1], Mohammad Amin Shahrbaf[2], Ramin Pouriran[2], Mohsen Norouzian[3], Fateme Fadaei[3], Hojjat-Allah Abbaszadeh[3], Reza Mastery Farahani[3]

1- Department of reproductive biology and anatomy, Student Research Committee, Shahid Beheshti University of Medical science, Tehran, Iran
2- Student Research Committee, School of Medicine, Shahid Beheshti University of Medical science, Tehran, Iran

3- Department of reproductive biology and anatomy, Shahid Beheshti University of medical science, Tehran, Iran

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Corresponding Author
Reza Mastery Farahani
Biology and Anatomical Sciences Department, School of MedicineShahid Beheshti University of Medical Sciences, Tehran, Iran.
Tel: +98 21 2387 255
Fax: +98 21 2243 9976
Email: realmastery@hotmail.com

ABSTRACT

Background: Anthropometric studies have been introduced as the second priority of research in the field of medical sciences in Iran. Information obtained from such studies are used in industry and medical sciences, including the manufacturing of prostheses, gas masks, and surgical instruments. Considering the effect of genetic, age, sexual, climatic, and geographical factors and their high importance on anthropometric sizes, the aim of the present project is to investigate the neurocranial sizes of the cephalic indices of one-day-old male newborns in north of Tehran.

Materials and Methods: This cross-sectional descriptive study was carried out on 100 neurocranial sizes of one-day-old male newborns in Shohada-e-Tajrish Hospital in Tehran using millimetric cephalometry. Measurements were performed according to the protocol and by a ruler, cephalometer, and tape meter (0.5mm precision rate). The data were collected and recorded in the relevant forms and then processed and analyzed by a biostatistics software.

Results: The present research showed that the mean head length, head width, ear height, head circumference, brain volume, brain weight, cephalic index, and the brain index was 118.2 mm, 94.3 mm, 71.3 mm, 348.5 mm, 415.1 ml, 429.2 g, 78.1%, and 12.8%, respectively. Frequency of different head phenotypes has been reported according to the cephalic index as follows: round head (65%), long head (20%), broad head (12%), and super-broad head (3%).

Conclusion: The results of the present study showed that the cephalic index of one-day-old male newborns in Tehran was lower than those born in Kermanshah, Sistan and Baluchestan, and Qazvin, which can be explained by the impact of gender, climate, and geographical area on neurocranial dimensions and sizes.

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INTRODUCTION

Anthropometrics refers to the measurement of various parts of the human body, which has several applications and is used to classify the skull shape and its developmental pattern. The neurocranial contents are of great importance because they form a major part of the nervous system. Cephalometry is widely used in medical sciences (embryology, pediatrics, neurosurgery) [1], dentistry [2], forensic medicine [3], and industries [4]. Therefore, this kind of research has been determined as the second priority research at the national level. So far, many studies have been conducted on the collection of anthropological data, especially by the US Air Force, and the most complete reference has been published in 1978 by the US Aerospace Organization. This reference contains findings from 306 body dimensions of 91 different populations worldwide [5]. Cephalometry is one of the main branches of the anthropometry that examines the head sizes of a living individual.

Considering the complex characteristics, the important position and role of the skull, its dimensions, sizes, coordinates, and characteristics can be studied from any perspective. Today, cephalometry is considered as a method for the diagnosis of some diseases [6]. Considering the extensive medical and industrial applications of the results obtained from anthropometry research, these studies are in the top priority in some countries, such as the United States [7]. Cephalometry, as an important part of the anthropometry, measures and investigates craniofacial dimensions and its findings are used in different branches of medicine and some other sciences [8]. Cephalometry is usually carried out based on various methods, including photogrammetry, ultrasound, CT scan, MRI [9], and the use of standard lateral skull radiographs or cephalograms [10]. Cephalometry is also is a technique that summarizes the human neurocranial complexities using geometric relationships [11]. Anthropometry can help determine the nature of clinical observations and differentiate conventional syndromes from specific syndromes [12]. Anthropometry can be used to diagnose growth disturbances in children and to detect carriers of some genes (e.g., the gene x -linked hypohydrotic ectodermal dysplasia. [13]. Knowledge of the normal values for craniofacial components is also necessary for craniofacial surgeries [12]. In this regard, researchers in various countries and societies have sought to collect craniofacial anthropometric measurements so that they define and present a proportional face in their community [14].

Considering the effect of gender, age, ethnicity, socioeconomic, and environmental factors on the head sizes, it is necessary to carry out such research in different communities of different age groups. Therefore, the aim of the present study is to determine the neurocranial dimensions and sizes of one-day-old neonates in the north of Tehran based on a millimetric cephalometry.

MATERIALS and METHODS

A total of 100 healthy one-year-old male newborns who were born of healthy mothers via normal delivery in Shohaday Tajrish hospital with no musculoskeletal, genetic diseases and specific deformity underwent anthropometric analysis and millimetric cephalometry during the first 24 hours in the period of 2017- 2018. These infants were selected completely randomly. All ethical considerations were observed given the approval of the Ethics Committee. The parents of all these infants were from Tehran. The sample size of this study was 115 infants, 15 of whom were excluded from the study due to different reasons. Initially, written consent was obtained from the parents, and then the demographic characteristics of the infants, including age, gender, and place of residence of the parents, and etc. were collected in pre-designed forms. Infants were weighed while wearing no clothes and diapers using a scale with accuracy of 100 g. Their height was also measured using a tape meter with a precision of 0.5 mm while the infants were being placed in the supine position and their knees straightened from heel to head. Then, head dimensions and sizes of the infants underwent anthropometric measurement using a standard millimetric caliber (Martin Soler) with the accuracy ± 0.5 mm based on the international reference points defined below.

RESULTS

The neurocranial size of 100 infants is shown in Table 1. The mean of the cephalic index, derived from dividing head width to head length multiplied by 100 and the brain index derived from dividing the brain weight to body weight multiplied by 100, were 78.1 and 12.8%, respectively. The head shape was round, long, broad, and super-broad in 65%, 20%, 12%, and 3% of cases, respectively.

Table 1. Neonatal neurocranial sizes in the cephalometry project (2017-2018)

Variable	Minimum	Maximum	Average	Variance	Standard deviation	Median	Mode
Head length (mm)	104.0	127.0	118.2	38.14	6.1	121	121
Head width (mm)	85.0	105.0	94.3	43.1	6.5	91.2	91.0
Ear height (mm)	47.0	100.0	71.3	63.7	8.1	70.0	71.0
Head circumference (mm)	330.0	37.6	348.5	161.2	12.7	352.0	350.0
Brain volume (cc)	305.1	514.9	415.1	740.5	39.1	419.2	393.5
Brain weight (g)	315.2	532.1	429.2	864.9	41.2	434.1	406.4
Cephalic index (%)	66.7	91.0	78.1	24.1	5.1	78.1	80.1
Brain index (%)	8.9	24.9	12.8	21.3	1.9	13.1	11.7

DISCUSSION

Comparison of the results of this study with a study carried out by Farahani-Meybodi on healthy one-day-old female neonates in Qazvin [4], and another one carried out by Eyvazi et al. on healthy one-day-old male neonates in Kermanshah [7] showed that the mean head length in this study was 118.23 ± 6.16 mm, and the same figure was 115±4 mm in Eyvazi's study and 114mm in Farahani-Meybodi, indicating that the head length is greater in the present study than other studies. The mean head width in the present study is 94.349 ± 6.560 mm and is almost the same in comparison to the mean head width of 3 ± 94 mm obtained in Eyvazi's study (90.1 mm), which was 4.3 mm less than the present study. The average ear height in the present study and Meybodi's study was 71.347±8.182 and 70 mm, respectively. The mean head circumference in the present study was 348.54 ±12.70 mm, which is about 4 mm from the mean head circumference obtained in Eyvazi's study (253 ± 12 mm) and 340.4 mm in Meybodi's study, which is about 8.1 mm less than the present study. The average brain volume in the present study and Meybodi' study was 415.13±42.131 and 409 cc, respectively, indicating about 6.1 difference. The average brain weight in the present study and Meybodi' study was 429.2 ±43.2 and 424 g, indicating 5.2 g difference. The cephalic index was 78.12%, 81%, and 78.5% in the present study, Eyvazi's, and Meybodi' study, respectively [12]. Majority of the infants had round heads (65%) in this study, which is similar to Meybodi's study (40%), but broad-head phenotype had the highest frequency in Eyvazi's study (49.05%). In a study on the cephalic index and its comparison in the two Sistani and Baluchi tribes, Zahra Heidari showed that the dominant index was broad head in both Sistani (37%) and Baluchi groups (35.3%).

A comparison of the study design of the present study showed that the mean head length, head width, head circumference, and ear height of infants was greater than the other two studies, but the lower cephalic index was reported in the present study. These differences can be due to differences in place of residence and geographical location.

The results of this study showed that head length, head width, and ear height of neonates born in Shohada-e-Tajrish hospital, Tehran are more than those in Kermanshah, Qazvin, and Turkmen and Fars tribes in Gorgan; however, the cephalic index of the infants in the present project is lower than that of infants in Kermanshah, Sistan and Baluchestan, and Qazvin. These differences can be influenced by factors such as gender, indigenous conditions, geographical, cultural, social differences, and different sample sizes (Table 2). Although genetics is the first effective factor and environmental factors are considered as the secondary factor in determining the head shape, it can be said that reacting to a specific environment indicates the response of the genotype of that population to that environment.

Conclusion

The head shape was round in the present project, like many other provinces of Iran, which can be attributed to the dominance of Iranian neonatal round skulls.

Table 2. Statistical differences between the present project and other similar studies in other provinces of the country in terms of cephalic dimensions

Province		Head length	P-value	Head width	P-value	Round head	P-value	Cephalic index	P-value	Head form
The current project		118.2	0.03	94.3	0.02	348.5	0.06	78.1	0.04	Round head
Kermanshah (9)		115	0.07	94	0.10	352.0	0.09	81.0	0.03	Broad head
Ghazvin(6)		114	0.04	90.1	0.03	340.4	0.02	78.5	0.07	Round head
Gorgan (8)	Turkmen	114.9	0.06	88.7	0.03	352.0	0.09	77.2	0.04	Round head
	Fars	114.8	0.06	89.9	0.02	351.8	0.02	78.4	0.20	Round head

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