Websites:
http://www.lifesciencesite.com
http://www.sciencepub.net

Emails:
editor@sciencepub.net
sciencepub@gmail.com

Life Science Journal

MARSLAND PRESS
Multidisciplinary Academic Journal Publisher

Cephalometry and Determination of Facial (Prosopic) Index of Persian Adolescents

Fatemeh Pouya[1, 2], Seyed Hosein Vaghefi[1], Seyed Parviz Raygan[1], Farahnaz Ghaffri Nejad[3]*

[1]Department of Anatomy, Kerman University of Medical Science, Kerman, Iran. [2]Kerman Neuroscience Research Center, Kerman University of Medical Sciences, Kerman, Iran. [3]Department of Rehabilitation, Shiraz University of Medical Sciences, Shiraz, Iran.
* Correspondence: fghafarinejad@yahoo.com
Address: Department of Rehabilitation, Abiverdi 1 Street, Chamran Boulevard, Shiraz, Iran.
Postal Code: 71345-1733
Tel: +987116265108
Fax: +987116272490

Abstract: Craniofacial measurements are considered to be important tools for studying different races. In this study which was conducted on Persian adolescents living in Kerman / Iran, beside of height and weight of participants, se veral measurements of skull were done, and different forms of faces were determined. The study was conducted on 732 participant including 366 male and 366 female participants with age between18-20. Cranial length and breadth a nd brain volume are higher in male people comparing it female participants. The predominant type of face was meso prosopic in both sexes (male: 1/36 and female: 1/44.43). These findings were discussed in the article.

[Fatemeh Pouya, Seyed Hosein Vaghefi, Seyed Parviz Raygan, Farahnaz Ghaffri Nejad. **Cephalometry and Determination of Facial (Prosopic) Index of Persian Adolescents.** Life Sci J 2021;18 (7):24-28]. ISSN 1097-8135 (print); ISSN 2372-613X (online). http://www.lifesciencesite.com. 4.doi:10.7537/marslsj180721.04.

Keywords: Cephalometry, Facial index, Head, Face.

1. Introduction

The adult human skull is consist of two parts of different embryological origins: 1)Neurocranium 2)Viscerocranium. The neurocranium is a defensive arch surrounding the brain and brain stem. The viscerocranium is shaped by the bones supporting the face (Carlson, 2000). The geometry of the cranial base and its fossas: anterior, middle and posterior changes rapidly, particularly during the first trimester of pregnancy. So, the first trimester is vital for growth of skull defects (Derkowski et al., 2003). At birth, the human skull is made up of 44 distinct bony components. As development happens, several of these bony components slowly fuse together into solid bone such as frontal bone (Gale et al., 2006). The posterior fontanel typically closes by eight weeks, but the anterior fontanel can continue open up to eighteen months. The anterior fontanel is set at the connection of the frontal and parietal bones (Li et al, 2007).

By knowledge of child development, we can recognize apparent deviation from normal patterns. Also, we can realize disease in children. One of the most obvious signs of development of children is height increase. Height growth rate is related to heredity, environment and gender. The minimum height of girls' baby is 43/5Cm and maximum height of girls 'baby is 58Cm (Behrman, 2004).Body weight is another indicator of development (Behrman, 2004).

Increased cranial circumference in the first year of life is due to the faster growth of brain. At birth, the cranial circumference is 32/6-37/2Cm (mean= 35Cm). 8-10cm is added to the cranial circumference in the first months after birth (mean= 44Cm). Cranial circumference increase about 3Cm in 6-12 months (mean= 47Cm) (Behrman, 2004). Head circumference increased when height become taller. Male persons are supposed to have a larger head circumference on average of 1.38Cm than female individuals.

The objectives of the present study are; determination of development aspect including height and weight as well as cephalometry and determination of anatomical types of head and facial indexes in Persian adolescents.

2. Material and Method

The total sample volume determined for the present study was 732 (366 male and 366 female) with age varying between 18 - 20 years old. Measurements were performed at different districts of the Kerman city / Iran. Samples were selected through random number table and among the pre-college high schools and adult schools of district of 1 and 2 of education. All of participants' height and weight were measured, and then measurement of cephalometry and anthropometry including head length head breadth, ear height and cranial circumference, prosopic length and breadth

were measured. Brain weight and index and facial index and form were calculated.

The researcher had to apply for a letter of permission from the Kerman Ministry of Education to enter the selected college and adult schools. Data for the present study were collected through below mentioned methods:

2.1. Measurement of height and weight

Respondents' height was measured by goniometer when respondents stand and hands hanging. Weight was measured using a weighting scale. Respondents stand with bare feet (without shoes) on weighing scale and take extra clothes.

2.2. Measurement of cranial circumference

Head circumference is a measurement of head around its largest area. It measures the distance from above the eyebrows and ears and around the back of the head. A very small head size (called microcephaly) or very slow growth rate may be a sign that the brain is not developing properly (Kimmel et al., 2007).

2.3. Cranial length and breadth

Cranial length is defined as distance between forehead and inion that be measured by caliper cephalometery. The head of the persons under study should be to the front side, eyes and ears parallel with the ground.

Cranial breadth is defined as maximum distance between parietal bones which was measured by caliper-cephalometery If possible, eyes and ears should be parallel with the ground.

2.4. Auricular height

Auricular height is defined the distance between tragus and vertex that be measured by Goniometer.

2.5. Bizygomatic Breadth

Bizygomatic breadth is defined as width or breadth of the face from the widest part of one zygomatic arch to the widest part of the other that be measured by caliper cephalometery.

2.6. Facial Length

Facial length is defined the direct measurement from Gnathion to Nasion that be measured by Colis.

2.7. Cranial measurement and index

The analysis of the measurements of head has different parts including: division of maximum of the width of head to the length maximum, multiply the result number of this by one hundred, the gained number is called cephalic index of head. This index shows the anatomic type of head, the amount of this index is varied from 65-95 and usually is changeable from 70-90.

Standard four groups are:

1. Dolico-Cephalic: Dolico-cephalic head is defined as having a relatively long skull with a cranial index of 74.9 or less.

2. Meso-Cephalic: Meso-Cephalic head is defined as having a head that is not particularly short or long from front to back (relative to its width from left to right) with a cranial index of 75-79/9.

3. Brachio-Cephalic: Brachio-Cephalic is defined as having a short, broad head with a cephalic index 80-84/9. In these infants skull length is short.

4. Hyper Brachio-Cephalic head is defined as having a very short, broad head with a cephalic index above 85.

2.8. Facial Measurement and Index

Total facial index = Distance between Nasion to Gnathion × 100

Width of cheek

This index represents the anatomical type and shape of the facial. This index varies between 65-105. Based on the index listed, people facial is divided to five international anatomical groups:

2.8.1. Hyper Eury-Prosopic

Hyper eury-prosopic has facial index 79/9 and less. This facial form can be seen in infants with brachy head.

2.8.2. Eury-Prosopic

Eury-Prosopic has facial index 80-84/9. In these facial forms, forehead is broad, facial form is vertical, and frontal sinus is narrow.

2.8.3. Meso-Prosopic

Meso-Prosopic has facial index 85-89/9. Facial form is round.

2.8.4.Lepto-Prosopic

Lepto-Prosopic has facial index 90-94/9. In these forms of facial, nose is outstanding and the forehead is steep.

2.8.5. Hyper Lepto-Prosopic

Hyper Lepto-Prosopic has facial index 95.

The following formulas use to calculatethe brainsize in male and female:

Male: V.B= 0.000337(L-11)(B-11)(H-11) +406.01CC

Female: V.B= 0.000400 (L-11) (B-11) (H-11) + 206.60 CC

H= Ear Height, B=Cranial Breadth, L=Cranial Length

In above formula all dimensions are given millimeters. After calculating, brain volume is achieved based on Cubic centimeter. Cranial and facial growth is related to overall body growth. This relationship is examined through comparison of cephalometric and anthropometric measurement. First, the brain weight is calculated by using specific weight of brain (1.03). Next, ration is achieved by dividing of specific weight of brain on total weight of the body, that this ratio is called brain index. Brain index is reported 12% in newborn and 2% in adult (Artner et al., 2003).

3. Result

The mean height of males was 177.02 ± 6.84 cm and the mean weight of males was 65.72 ± 12.42kg. For females the mean of height was 158.1 ± 4.42 and weight was 59.67 ± 3.57 kg.

Descriptive analysis of head length and head breath was shown in Table 1. There is a significant difference in cranial length between male and female. This means that mean of cranial length is higher in male compared to female.

As shown in Table 2, there is not a significant difference in ear height between male and female. This means that mean of ear height is approximately equal in male and female. According to two parameters such as cranial length and cranial breadth in male, it seems that cranial circumference parameter in male be greater compared to female. Also, cranial index is listed in Table 2.

Table 1: Descriptive Analysis of Head Length, Head Breadth between Male and Female

Variable	Cranial Length				Cranial Breadth			
Gender	Min	Mean	Max	SD	Min	Mean	Max	SD
Male (18 years)	143	186.6	250	9.112	136	147.1	192	6.543
Female (18 years)	160	182.8	197	.673	135	142.1	178	.760
Male (19 years)	152	187.3	210	9.049	137	149.1	161	5.651
Female (19 years)	165	183.5	194	.613	144	143.3	176	.752
Male (20 years)	152	188.2	202	10.24	142	150.3	195	8.913
Female (20 years)	174	182.9	203	.559	146	144.1	179	.743

Table 2: Descriptive Analysis of Ear Height, Cranial Circumference, Cranial Index between Male and Female

Variable	Ear Height				Cranial Circumference				Cranial
Gender	Min	Mean	Max	SD	Min	Mean	Max	SD	Index
Male (18 years)	100	122.7	145	7.456	52	56.9	61.5	1.69	78.7
Female (18 years)	115	123.1	135	0.575	500	537.9	610	1.201	77.7
Male (19 years)	105	122.8	140	8.063	4.5	57	60	1.42	79.6
Female (19 years)	120	123	140	0.615	545	536.6	615	1.310	78.09
Male (20 years)	110	124.1	135	7.323	55	57.4	61	1.43	79.8
Female (20 years)	115	123.3	140	0.680	540	537.4	620	1.420	78.7

Cranial different forms is consist of dolico-cephal, meso-cephal,brachio-cephal and hyper brachio-cephal. The results of the present study indicate that meso-cephal form is prominent in two gender (male %41.3, female %47.3) followed by brachio-cephal (male %36.6, female %40.4), hyper brachio-cephal (male %15, female %o.8) and dolico-cephal (male %68, female %5.3).

Differences of brain volume, brain weight, and brain index between male and female were shown in Table 3.

Table 3: Descriptive Analysis of Brain Volume, Brain Weight, and Brain Index of Respondents

Variable	Brain volume				Brain weight				Brain Index
Gender	**Min**	**Mean**	**Max**	**SD**	**Min**	**Mean**	**Max**	**SD**	
Male (18 y.)	920	1306.18	1706	101.45	953	1351.9	1766	105.03	2.14
Female (18 y.)	967.8	1216.15	1476.1	100.99	1002	1259.1	1528	104.42	2.15
Male (19 y.)	1080	1323.97	1591	98.65	1117	1370.3	1647	102.13	2.10
Female (19 y.)	1018.8	1229.01	1476.1	95.244	1054	1272.0	1528	98.53	2.13
Male (20 y.)	1156	1347.33	1683	132.58	1197	1394.4	1741	137.06	2.02
Female (20 y.)	1069.9	1234.36	1505.9	94.63	1107	1277.5	1059	97.89	2.08

As shown in Table 4, there is a significant difference in prosopic length and prosopic breadth between male and female. This means that mean of prosopic length and prosopic breadth in male is higher compared to female.

Table 4: Descriptive Analysis of prosopic length, prosopic breadth and prosopic of respondents

Variable	Prosopic Length				Prosopic Breadth				Prosopic Index
Gender	Min	Mean	Max	SD	Min	Mean	Max	SD	
Male (18 y.)	101	113.6	122	9.012	108	127.5	177	8.39	89.7
Female (18 y.)	9.3	107.6	12	0.679	11.1	125.1	22.3	2.81	86.01
Male (19 y.)	102	115.4	127	5.145	112	130.4	141	6.92	88.5
Female (19 y.)	9.1	108.3	12.1	0.779	11.3	125.4	22.1	2.57	86.36
Male (20 y.)	102	117.2	137	6.731	120	133.3	141	4.86	87.9
Female (20 y.)	9.2	108.5	12	0.772	11.2	127.1	22.4	2.78	85.36

The percentages of prosopic forms male and female participats were shown in table 5: The most frequent form in both sexes was meso-prosopic form.

Table 5: Frequency distribution of prosopic forms in male and female participants

Porosopic Form	Male	Female
Meso porsopic	36	44.35
Lepto prosopic	25.3	13.34
Eury prosopic	21.8	34.23
Hyper lepto prosopic	9.8	3.62
Hyper eury prosopic	7.1	4.46

4. Discussion

Mean of height and weight is higher in male than compared to female. Due to the age of puberty in boys, it seems that be natural growth. While, reason of difference of height between male and female in present study is puberty in female. This means that puberty is finished in female about 18 years old. While, puberty will continue in male after 18 years. In the present study, mean of height show that Iranian adolescents are shorter compared to American adolescents. Also, mean of weight show that American adolescents male are heavier compared to Iranian male adolescents. While, mean of weight show that Iranian female adolescents are heavier compared to American female adolescents (Parker et al., 2010).

Results indicate that at this time, male growth more than female. On the other hand, growth time is longer in boys compared to girls. Also, there is a significant difference between cranial breadth in male and female. This means that mean of cranial breadth is higher in male compared to female. It indicates that puberty time in male is longer compared to female.

As shown in Table 5, there is a significant difference in brain volume and brain weight between male and female. This means that mean of brain volume and brain weight in male is higher compared to female.There is not a significant difference in brain index between male and female. Also, results of the present study indicate that adolescents with higher age show reduction of brain index (Lorenz et al,.2009). Brain volume in infancy could predict intellectual function in adulthood (Raikkonen et al,. 2009; Heinonen et al,. 2008).

Craniofacial measurements are very useful tools for studying different racial groups. People living in Iran belonged to different races. Our samples were obtained in Kerman province in south east of Iran. According to historical references these people are a part of Persian people who have been living in central part of Iran. Our results showed that the most frequent type of face in male participants was meso prosopic followed by lepto prosopic. In female although the dominant type was mesoprosopic but the second frequent type was euryprosopic.

In another study performed in Fars province (which is located in neighborhood of Kerman province in Persia), the most frequent shape of face in the native Fars and Turkaman males was mesoprosopic (%-14 in native and %38.4 in Turkaman). In contrast to our study the dominant type of face of females in both native and Turkaman participants was euriprosopic. (Jahanshahi et al 2008). In one study conducted on Indian students, the most frequent shape of face in male students was mesoprosopic but in female, the dominant form was euriprosopic. The least type in both sexes was hyper euri prosopic (shetti et al 2011). In our study the least type of face was hyper eury prosopic in male participants (%7.1) and hyper lepto prosopic in female participants (%3.62).

This study showed frequency distributions of different types of facial form are different. In females although the dominant. Form in both sexes was the

same. Further investigation including more participants from different parts of Iran may provide a better image of anatomical aspects of people living in Iran.

Acknowledgment

We are thankful to Said Aton and Sedigheh Aminai who collected the data.

References

[1]. Carlson, Bruce M. (2000). Human Embryology & Developmental Biology. Mosby. pp. 166–170. ISBN0-8151-1458-3.

[2]. Derkowski, Wojciech., Kedzia, Alicja., Glonek, Michal. (2003). Clinical anatomy of the human anterior cranial fossa during the prenatal period". *Folia morphologica*, 62 (3), 271–3. PMID14507064

[3]. Gale, C.R, O., Callaghan, F.J, Bredow, M, et al. (2006). The influence of head growth in fetal life, infancy, and childhood on intelligence at the ages of 4 and 8 years. *Pediatrics*. 118, 1486.

[4]. Li, Ruan., Xie, & Wang. (2007). "Investigation of the critical geometric characteristics of living human skulls utilizing medical image analysis techniques". *International Journal of Vehicle Safety* 2 (4), 345–367. Doi: 10.1504/IJVS.2007.016747

[5]. Behrman, K. J. (2004). Nelson Textbook of Pediatrics, 17th edition, W.B. Saunders Company.

[6]. Kimmel, S.R., Ratliff-Schaub, K. (2007). Growth and development. In: Rakel RE, ed. *Textbook of Family Medicine*. 7th ed. Philadelphia, Pa: Saunders Elsevie, chap 31.

[7]. Artner, J., Pekny, P.,& Gergelova, K. (2003). Atlas of human skeletal anatomy. www.jurtajartner.com

[8]. Parker, S.E., Mai, C.T., Canfield, M.A, Rickard, R., Wang, Y., Meyer, R.E., et al. (2010). For the National Birth Defects Prevention Network. Updated national birth prevalence estimates for selected birth defects in the United States.*Birth Defects Res A Clin Mol Teratol*.

[9]. Lorenz, J.M., Whitaker, A.H., Feldman, J.F., et al. (2009). Indices of body and brain volume at birth and at the age of 2 years: relations to cognitive outcome at the age of 16 years in low birth weight infants. *J Dev Behav Pediatr*. 30:535.

[10]. Raikkonen K, Forsen, T., Henriksson, M., et al. (2009). Growth trajectories and intellectual abilities in young adulthood: The Helsinki Birth Cohort study. *Am J Epidemiol*. 170:447.

[11]. Heinonen, K., Raikkonen, K., Pesonen, A.K., et al. (2008). Prenatal and postnatal growth and cognitive abilities at 56 months of age: a longitudinal study of infants born at term. *Pediatrics*. 121, 1325.

[12]. Jahanshahi, M; Golalipour, MJ & Heidari, K. (2008). The effect of ethnicity of facial anthropometry in northern Iran. Singapore Med J, 49 (11): 940-3.

[13]. Shetti VR, Pai SR, Sne ha GK; Gupta c, Chenthan P. (2011) Soumya (facial) index of Indian and Malaysian students. Int y Morphol, 29 (3): 1018-1021.

2/5/2021