



Measurements of Face and Head Anthropometric Criteria in 18 to 30 Year Old Native Students of Hamadan University of Medical Sciences and their Comparison with Caucasian People and other Iranian Races

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ABSTRACT

Anthropometry is the science of measuring the dimensions of the human body. Head and face anthropometry is used in various fields such as normal growth studies, clinical investigations of syndromic patients with jaw and face anomalies, and the treatment plan for maxillofacial surgeries. The criteria being studied in the field of head and face anthropometry include criteria related to head, face, eyes, nose, mouth and ears. Several studies is conducted in non-Iranian races, especially the Caucasian race. But unfortunately, anthropometric information in Iranian race has many shortcomings. Given the differences of these criteria in diverse races, we decided to study and evaluate anthropometric criteria in an Iranian and Hamadan population in this study. A cross-sectional study is conducted in a limited geographical area of Hamadan province. From among the accessible samples, 250 male and female Iranian 18 to 30 years old (125 male and 125 female) native students of Hamadan University of Medical Sciences who had no history of surgery and any symptoms of syndromic or major trauma on the face and head were chosen and included in the study after obtaining a written consent form. Landmarks were marked with the help of marker pen on the face firstly, and then the interested distances were measured with a calibrated caliper and analog micrometers. The data were finally analyzed using SPSS23 and R 3.1.0 software. All the anthropometric measurements examined in this study in men showed more value than those of women, and only the height of the palpebral fissure (ps-pi) in women was higher than men. All anthropometric measurements showed a significant difference between means in the both male and female groups ($p < 0.05$), except for the height of upper lip vermilion (ls-sto). 23 cases of the measured criteria in men and 21 cases in women, showed a significant difference compared to their homogeneous in Caucasian race. Also, the results of this study showed many differences with the studies of other Iranian colleagues on other Iranian races. Given the considerable differences in these measurements between our studied samples and the Caucasian race, the measurements obtained in the Caucasian race cannot be used as a criterion for the treatment plan for Iranian surgeons and dentists. Also, considering the combined Iranian race and the diversity of physical dimensions in different regions of Iran and the considerable differences in the standards of studies of Iranian societies, further studies with wider geographic dispersion is required.

Key words: Anthropometry, Iran, Caucasian Race

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Anthropometry is a term composed of two Greek words of (Anthropos), meaning human and (metrin), meaning measurement and it is the science of measuring the dimensions of human body, and it is applied in various fields such as studying the normal growth of individuals, clinical

INTRODUCTION

examinations of syndromic people and people with facial and jaw abnormalities, as well as in the treatment plan of maxillofacial surgery [1]. Craniofacial anthropometry is a useful method in evaluating the soft and hard tissue of the face and head [2]. Due to the increasing importance of this science and the severe need of the country in recent years, special attention is paid to this issue, so that anthropometry was discussed at the Medical Commission of the Council of Scientific Research of the country, established in 1991 to determine the priorities of the medical group [3]. One of the requirements of clinical studies in the field of the head and face anthropometry is having the standard criteria by which, one can compare the obtained information from the clinical studies. Several factors must be taken into consideration before starting normal growth studies. The first is population, or populations that are supposed to be studied. Unfortunately, the number of anthropometric studies done in the field of growth and development of head and face is few. Most studies are conducted in European communities or European people of North American [1]. The largest study in the North American population was the study by Farcas on Toronto's 6 to 18 year old school children [4]. The second factor in planning an anthropometric study is the choice of criteria to be measured. In order to achieve better results, the criteria should be chosen that are more clinically applicable, and it is important to determine them before starting the measurement.

The criterion that is examined in the field of head and face anthropometry include criteria related to head, face, eyes, nose, lips and mouth and ears [2].

Most measurements of head and face are done based on the classical methods of physical anthropometry. Of course, changes have been made in some of them, and some others have been newly invented [2]. These measurements can be linear or angular. Measurements in each area of the set of head and face are separately listed. Seventy out of the 132 cases are singular and 62 are in pairs. The number of linear measurements cases is 103 and that of angular is 29. The 62 cases that are in pairs include 124 measurements, so the number of components that are measured in the study of head and face from an individual is increased to 192 [2]. For ease of use and knowledge of these criteria and having a common language in anthropometrics, these landmarks are labeled by Latin and Greek terms, and any person active in the field of anthropometry should be

familiar with these terms their abbreviations [2]. The present study examined 27 anthropometric craniofacial sizes in about 250 adults aged 18 to 30 years and with normal facial pattern. In fact, the purpose of limiting the age of the samples to 18 to 30 was that, basically, it is the age of fertility. In addition, facial growth has typically ended in this age; besides, facial dimensions are not yet affected by changes due to aging (such as loss of a large number of teeth and loss of face height). Considering the increase in statistics of facial and body cosmetic surgeries, it is important to use reference criteria for head and face anthropometric ratios and sizes in Iranian race.

Several studies have been carried out in the field of anthropometric science in different non-Iranian races, especially the Caucasian race and currently, most cosmetic surgeries in the maxillofacial area are performed using reference criteria derived from studies in the Caucasian race. Unfortunately, anthropometric information in Iranian race has many shortcomings. Considering the differences in these criteria in different races, we decided to study and evaluate anthropometric measures and distances in an Iranian population, that is, Hamadan population in this study.

MATERIALS AND METHODS

A cross-sectional study in the geographical area of Hamadan province was done in 2016; 250 male and female Iranian and native Hamadan students were chosen from the available samples in Hamadan University of Medical Sciences who had no history of surgery, any syndromic or major trauma symptoms in head and face, and included in the study after the written consent form was received. The samples included 125 male and 125 female. The sample size was obtained regarding the available data from the studies using the sample size method for the two independent male and female population (based on several important separate variables of the sample size was calculated for the two groups of women and men and the appropriate sample size was determined). All individuals studied have been explained that the information collected is merely used in this study and their identity and personal information will remain intact. The inclusion criteria included all available male and female students of Hamadan University of Medical Sciences, aged between 18 to 30, Iranian and native of Hamadan, who had no syndromic symptoms or a history of head and face surgeries

or major trauma in the head and face. The condition of being considered as native of Hamadan was defined as that the father, mother and both grandparents of their father and mother all be born in Hamadan province. The instruments used include a 20 cm digital sliding caliper (Figure 2-1), made in China (Guanglue Measuring Instrument Co., Ltd.), with a precision of 0.01 mm, for examining linear measurements which included 27 anthropometric measurements of the face. Since the caliper arms were not long enough to examine some of the sizes, such as the bizygomatic width, and adding another arm to the caliper would lead to reduction in the measurement accuracy of the device, hence an analog micrometers made in China (Shoka Gulf) with a precision of 0.01 mm was used. In order to check the accuracy of the two devices and compare them together, the length of 10 objects, which were already measured in size, were measured by both devices, which showed a very little difference between of 0.01 to 0.02 mm. When measuring between two soft tissue landmarks (such as nose wings, lip corners, and ear landmarks), it was monitored that the tip of the caliper just touches the skin surface without any pressure on it. In all of the measurements performed in this study, the patient's head was at rest position.

Defining the position of rest: This position is determined by the individual's feelings about the normal balance of the head [8]. When examining the size of endocanthion and exocanthion, eyes were resting closed, and the mouth of patient was resting closed when examining the width of the mouth. 23 anthropometric criteria used to examine the measurements in this study are presented below. Landmarks were first marked on the face with the help of markers, and then the distances were measured using a calibrated caliper. All measurements on males were done by a man and all measurements on females were done by a woman. To ensure the accuracy of the measurements, 10 random cases of the analyses were repeated in male and 10 cases in female. Then, the results of these 20 repeated cases were compared with the initial results by Kappa coefficient and in the case of inconsistency, the recommendation of another person (the main implementer of the plan) was also used. Also, to ensure that there is no difference between the methods of measurements done in men and women, 10 analyses cases of males and 10 females were randomly done by both male and female

observers and their results were compared with each other and in the case of inconsistency, the recommendation of someone else (the main implementer of the plan) was used. To analyze the observations, descriptive tables and charts and multivariate analysis methods were used to compare the meanings in the two groups.

The landmarks used in this study included landmarks on head, face, eye, nose, mouth, ear. 27 anthropometric measurements were performed in different parts of the head and face.

Face

Face width (zy'-zy'), mandible width (go'- go'), face height (tr-gn'), height of one upper one-third of the face (tr-g'), height of middle one-third of face (g'-sn'), and the height of the lower one-third of the face (sn'-gn').

Eye

The distance between two eyes (en-en), eye width (ex-ex), the length of right and left palpebral fissure (ex-en), height of the right and left palpebral fissure (ps-pi).

Nose

Nose width (al-al), nose height (n'-sn'), nose length (n'-prn), height of nose tip to base (sn'-prn), and length of right and left wings (ac-prn).

Mouth

Height of the upper lip (sn'-sto), height of vermillion of upper lip (ls-sto), height of lower lip (sto-sl), height of vermillion of lower lip (sto-li), and width of mouth (ch-ch).

Ear

Width of right and left ears (pra-pa), length of right and left ears (sa-sba).

All of the above measurements were linear performed by digital caliper and, of course, the face width measurement, was done by analog micrometers in resting position of head.

To analyze the data, descriptive tables and charts, one sample T-test, mean comparison test for two independent samples (two sample T), and

multivariate analysis test were used. The data were analyzed using SPSS23 and R 3.1.0 software.

RESULTS

Out of 250 cases, 125 of them (50%) were female and 125 (50%) were male. The age range was between 18 to 30 years old. None of these 250 individuals and their children had craniofacial syndromes, cleft lip or palate. 80% of the samples were resident in Hamadan city and the rest in other cities of Hamadan province.

Table 1: Anthropometric measurements of the samples

	Anthropometric index	Standard deviation ± mean(mm)
Face	zy'-zy'	136/40±5/58
	go'-go'	104/9±26/18
	tr'-gn'	10±186/59
	tr'-g'	53/72±38/6
	g'-sn'	69/24±09/24
	sn'-gn'	67/5±90/65
Nose	al-al	35/3±67/92
	n'-sn'	53/3±49/85
	n'-prn	49/4±85
	sn'-prn	21/2±17/94
	ac-prn (r)	2±35/59
Eye	ac-prn (l)	34/2±79/47
	en-e	33/2±30/37
	ex-ex	31/5±97/11
	ex-en (r)	33/2±08/94
	ex-en (l)	32/3±84/50
	ps-pi (r)	9/1±91/44
Mouth	ps-pi (l)	9/1±96/34
	sn-sto	22/2±24/86
	ls-sto	7/1±97/24
	sto-sl	18/2±95/55
	sto-li	9/1±91/36
Ear	ch-ch	3/62±49/51
	pra-pa (r)	35/96±4/39
	pra-pa (l)	36/4±08/09
	sa-sba (l)	4±63/46
	sa-sba (r)	62/5±90/07

All anthropometric measurements in this study in men showed a greater proportion than women, except for the height of the palpebral fissure (ps-

pi), which was higher in women than in men. Using T-test, only height of the upper vermillion lip (ls-sto) between the two sexes had no statistically significant difference (P<0.05). Other anthropometric measurements showed a significant difference between the two groups in men and women (p<0.05). The least difference between men and women was observed in height of upper vermillion lip (ls-sto) and the greatest difference in face height (tr-gn) (Table 2).

Also data from the study were compared with criteria obtained in the studies by Fereh Vash, Pezeshki Rad, Alawi, Heidari and Caucasian reference race. A statistically significant difference was observed in all cases in anthropometric indices between Hamadan population and Iranian population (study by Fereh Vash) (p<0.001). Also, a statistically significant difference was observed in comparison of anthropometric indices of women and men in the Hamadan population and Mashhad population (study by Pezeshki Rad) in ex-ex, en-en, ch-ch, sa-sba, and go'-go' (p<0.001).

Results of comparison of anthropometric indices between Hamadan and Esfahan populations (study by Alawi), showed that there is a significant difference in the mean scores of Hamadan and Esfahan women in zy'-zy, go'-go, en-en, ls-sto, sto-li, ch-ch (p<0.001), but in all cases, there was a significant difference between the two population in men's population (p<0.05).

In comparison of anthropometric indices of nose between Hamadan women and Sistani and Baluchi women, a statistically significant difference was observed only in zy'- zy' (p<0.001).

Comparisons between the Hamadan population and the Caucasian race have been reported in Table 3. In the comparison of the anthropometric criteria of our study of Hamadan population with other populations and races, most of the criteria showed significant differences.

Table 2: Statistical results of anthropometric measurements separated by gender

Anthropometric index	Male		Female		Test result	
	Mean	Standard deviation	Mean	Standard deviation	p- value	T
zy'-zy'	140/45	3/68	132/66	3/96	<0/001	16/651
go'-go'	108/27	6/93	100/24	9/41	<0/001	7/685
tr'-gn'	192/79	7/23	172/21	8/96	<0/001	13/181
tr'-g'	55/41	6/84	51/35	5/97	<0/001	4/995
g'-sn'	70/09	4/48	68/09	3/73	<0/001	3/829
sn'-gn'	71/44	71/44	64/35	4/25	<0/001	12/705

Table 3: Comparison of anthropometrics indices between Hamadan and Caucasian women:

	Anthropometric index	Mean of Hamadan Men	Mean of Caucasian Men	T	p-value	Mean of Hamadan women	Mean of Caucasian women	T	p-value
Face	zy'-zy'	1340/45	139/1	4/111	<0/001	132/36	130/46	6/613	<0/001
	go'-go'	108/27	105/6	4/316	<0/001	100/24	94/5	6/821	<0/001
	tr'-gn'	192/79	187/2	8/651	<0/001	179/21	173/3	7/377	<0/001
	tr'-g'	55/41	57	-2/588	<0/011	51/35	52/7	-2/511	<0/013
	g'-sn'	70/09	67/2	7/212	<0/001	68/09	63/1	-14/959	<0/001
	sn'-gn'	71/44	72/6	-2/838	<0/005	64/35	64/3	0/157	<0/876
Eye	en-en	33/69	33/3	1/819	<0/071	32/90	31/08	5/488	<0/001
	ex-ex	99/60	91/2	17/752	<0/001	95/02	87/8	21/074	<0/001
	en-ex (r)	34/43	31/3	14/463	<0/001	31/73	30/7	7/462	<0/001
	en-ex (l)	34/08	31/3	13/318	<0/001	31/59	30/7	2/491	<0/014
	ps-pi (r)	9/31	10/8	-12/033	<0/001	10/50	10/9	-3/482	<0/001
	ps-pi (l)	9/45	10/8	-11/340	<0/001	10/47	10/9	-4/128	<0/001
Nose	al-al	37/79	34/9	11/034	<0/001	33/54	31/4	6/593	<0/001
	n'-sn'	55/11	54/8	1/024	0/308	51/88	50/6	3/989	<0/001
	n'-prn	51/98	50	6/916	<0/001	47/72	44/7	9/436	<0/001
	sn'-prn	21/96	19/5	7/898	<0/001	20/39	19/7	3/855	<0/001
	ac-prn (r)	36/63	35	8/558	<0/001	33/36	31/5	11/040	<0/001
	ac-prn (l)	36/42	35	8/083	<0/001	33/16	31/4	11/318	<0/001
Mouth	sn'-sto	22/98	22/3	2/751	0/007	21/49	20/1	5/689	<0/001
	ls-sto	8/10	8	0/792	0/430	7/84	8/7	-9/976	<0/001
	sto-sl	20/11	19/7	1/902	0/059	17/79	17/8	-0/015	0/988
	sto-li	10/17	9/3	6/559	<0/001	9/64	9/4	2/343	0/021
	ch-ch	53/30	54/5	-4/358	<0/001	49/68	50/2	-1/775	0/078
	pa-pra (r)	38/72	36/9	6/106	<0/001	33/20	33/5	-0/939	0/350
Ear	pa-pra (l)	38/63	36/4	8/191	<0/001	33/53	33/7	-0/550	0/584
	sa-sba (r)	65/15	62/7	7/361	<0/001	60/86	59/6	3/442	<0/001
	sa-sba (l)	65/36	62/9	7/514	<0/001	60/44	59/9	1/188	0/237

DISCUSSION

The aim of this study was to examine and measure the anthropometric criteria of head and face in native students of Hamadan University of Medical Sciences from 18 to 30 years old. All anthropometric measurements in this study in men showed a greater proportion than women, except for the height of fissure (ps-pi), which was higher in women than men. All differences between men and women were statistically significant (except for the upper lip vermilion height). The least difference between men and women was observed in the upper lip vermilion height (ls-sto) and the greatest difference in face height (tr'-gn').

Fareh Vash *et al.*, conducted a study on 208 (104 men and 104 women) visiting the department of plastic surgery at Imam Khomeini Hospital in Tehran [5]. 12 studied criteria were similar to Hamadan population, including face width (zy'-zy'), mandible width (go'-go'), height of lower one-third of face (sn'-gn'), the distance between two eyes (en-en), length of right and left palpebral fissure (en-ex), nose width (al-al), nose height (n'-sn'), height of nose from base to tip (sn'-prn), mouth width (ch-ch) and length of right and left

ears (sa-sba). Mandible width was significantly lower in Hamadan men and women than in their homogeneous mandible width in Iranian population studied by Fareh Vash, and the other criteria were significantly larger. Comparing the results obtained in this study with the results of Pezeshki Rad in the adults of Mashhad [6], the 9 similar anthropometric measurements investigated in these two studies included face width (zy'-zy'), mandible width (go'-go'), distance between the two eyes (en-en), eye width (ex-ex), width of the soft tissue of nose (al-al), nose height (n'-sn'), mouth width (ch-ch), ear width (pa-pra), and ear length (sa-sba). The measurements of face width, distance between the two eyes, eye width, mouth width and ear width in both studied sexes were significantly greater than Mashhad population. Mandible width and nose width in both sexes of Hamadan population were smaller than Mashhad population, which was significant in mandible width. Comparing the results obtained in this study with the results obtained by Alawi in the adults in Isfahan [7], among the 8 similar anthropometric measurements in these two studies including face width (zy'-zy'), mandible width (go'-go'), height of lower one-third of face (sn'-gn'), distance between two eyes (en-en),

width of soft tissue of nose (al-al), height of upper lip vermilion (ls-sto), height of lower lip vermilion (sto-li) and mouth width (ch-ch), facial widths, the distance between two eyes, height of upper lip vermilion and mouth width in both sexes of Hamadan population were significantly greater than that of the adults in Isfahan. Also, nose width was in men and women of Hamadan was greater than Isfahan men and women, which was significant in men. Mandible width, height of lower one-third of face and height of lower lip vermilion in men of Hamadan were significantly smaller than Isfahani men. In addition, mandible width and lower lip vermilion height were significantly lower in Hamadan women than Isfahan women. Comparing the results of our study and the study of Heidari and his colleagues at Zahedan University of Medical Sciences [8], which was performed on 200 Balochi subjects and 200 Sistani subjects, from among the three common criteria studied including face width (zy'-zy'), nose height (n'-sn') and nose length (sn'-prn), all criteria in Hamadan women were significantly larger than Sistani population, and also face width in Hamadan women was significantly larger than Baluchi women, nose height and length in Baluchi women was significantly larger than that of Hamadan women.

Other studies in this field were carried out in the Shiraz population [9] and Shirvan population [10] which of course, was at pre-pubertal ages, which contradicted our study age group, and therefore, it was impossible to compare the results with each other. In general, due to the continuous migration of people from a region and continent to other areas after the Second World War, conducting a broad comparison of face and head indices between different ethnic groups and their large sub-races has become an urgent need in medical science. Also, the morphological changes caused by facial syndromes in the craniofacial complex may be affected by specific racial or ethnic characteristics [2]. Therefore, considering the above and the necessity of racial comparisons, and because few studies have been done in this regard, and the most important and that the credible research comparable to the present study is the Farkas study of the Caucasian race [11], one of our implicit goals in this study is to compare the anthropometric indices studied in this study with Caucasian race.

When comparing Hamadan and Caucasian men, among the 27 studied anthropometric indices,

only 4 indices (including distance between two eyes (en-en), nose height (n'-sn'), upper lip vermilion height (sn'-sto) and lower lip height (sto-sl)) no statistically significant difference was shown between the two groups, while the rest of the indices (including 23 anthropometric indices) were significantly different between the two groups ($p < 0.05$).

The faces of the samples of this study (both men and women) are totally significantly larger in comparison with the Caucasians (both in transverse and vertical dimensions). It should be noted, however, that height of upper one-third of face (tr-g) is smaller in both men and women in Hamadan than in Caucasians. The height of lower one-third of face (sn'-gn') is also greater in Caucasian men. These results were similar to Pezeshki Rad medical research [6] and were different with the results obtained in Alawi's study [12], so that in Alawi's study, two measurements of width and length of face (zy'-zy') and (n'-gn') in Iranians were lower than the Caucasian race. But about size of (go'-go), the results were similar in both studies. The criteria for the eye of our study indicate that in general, the eyes of individuals in Hamadan population are larger than Caucasians, and it is only in height of right and left palpebral fissure, that the Caucasian race shows a bigger value. Also, the distance between eyes (en-en) and eye width (ex-ex) in Hamadan population was bigger than Caucasians, but there was no significant difference between the distance of eyes in Hamadan men and Caucasians. Nose of Hamadan population was larger in all criteria compared to Caucasians. However, despite the higher nose height (n'-sn') in Iranian men than Caucasian men, this difference was not statistically significant. Mouth width (ch-ch) was greater in Caucasians than in Iranians. The results obtained from the present study on the nose width, mouth width and distance between two eyes compared with Caucasians, is fully consistent with the results obtained from the study by Pezeshki Rad [6] and Alawi [12].

In the present study, the size of ear was greater in Hamadan men than Caucasian men, while in Hamadan women, the width of the ears was less and its length was more than Caucasian women. Differences in the size of men's ears were significant in Hamadan men with Caucasian men, while this difference was not significant in women. These results were similar to the results of Pezeshki Rad medical research, except for length

of ears of women which was similar to Caucasian race in their study [6]. From the limitations of the current research was sampling in a limited sample size. It is suggested that due to the complexity of Iranian race and considering the diversity of physical dimensions in different regions of Iran, more studies be conducted with a wider geographic distribution so as to obtain a mean for each of the variables in each of the different ethnic groups in Iran.

CONCLUSION

Except for upper lip vermilion height, all anthropometric measurements examined on samples with normal facial pattern in this study showed a significant difference between men and women. Naturally, all of these measurements were greater in men than in women. Also, due to the considerable differences in these measurements between our samples and Caucasian race, the measurements obtained in Caucasian race cannot be used as a criterion for the treatment plan for Iranian surgeons and dentists. On the other hand, comparing the measurements made in our study with other studies conducted in other ethnic groups of Iran, significant differences in many indices can be observed.

Conflict of interest

There is no conflict of interest.

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