Research Article

Facial Anthropometry among Saudi Population

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Abstract

Aims: the objectives of this study are the assessment of the following facial anthropometric parameters of adult Saudi population: IntercanthalDistance (ICD), Inter-alar Width (IAW), Inter-commissural Width (ICW) and Maxillary Inter-canine Distance (MIC). And to compare these parameters (ICD, IAW, ICW, and MIC) between Saudi males and females and to determine the correlation between investigated facial parameters. **Materials & Methods:** The study was conducted at King Khalid University, two hundreds and ten subjects both males and females ranging in age from 17 to 35 years were included in this prospective cross-sectional analytical study. Simple random selection of all students, interns and patients who had fulfilled the criteria of selection and accept to participate in the study by signing consent form. Electronic Digital Caliper with resolution of 0.01 mm was used for all measurements. **Results & Discussion:** Data were collected and analyzed using SPSS version 13.0. Mean, Standard Deviation (SD), minimum, maximum and Standard Error of Mean (SEM) were calculated. Unpaired t-test was used to determine the difference in means between males and females. Pearson's linear correlation coefficient was used to measure the degree of linear relationships between the three facial measurements for each subject. **Conclusion:** The present study establishes a preliminary baseline value for intercanthal distance, inter-alar width; inter-commissural width and maxillary inter-canine distance in adult Saudis.

Keywords: Anthropometry; Intercanthal distance; Inter-alar width; Inter-commissural width; Maxillary inter-canine distance

Introduction

Anthropometry is the branch of the human science that involves the systematic physical measurement of the human body. It composed of two Greek words; Anthro meaning man and meter means measure, thus it is the branch of biometrics that analyses the quantity of hard and soft tissues of human body. [1]

Documentation of anthropometric parameters of the face give researchers and clinician considerable insight into craniofacial growth and development which in turn, has many practical applications including classification, diagnosis and treatment of craniofacial anomalies, evaluation and treatment of post traumatic deformities and in the field of forensic medicine as well. The quantitative determinations of facial parameters are of great importance in preoperative, postoperative assessment and reestablishment of facial harmony in plastic and reconstructive surgeries. [1]

Leslie Farkas with his textbook and publications on the anthropometry of the head and face has pioneered the field of anthropometry and promoted these measurements to be of great importance to medical professionals involved in craniofacial surgery. However, his reports and the majority of other anthropometric studies available are limited to Caucasians and number of studies exists for other races. Facial proportions vary significantly between races and most patients prefer maintaining their core ethnic features. Hence applying Caucasian norms to other ethnic groups may result in dissonant facial proportions. [2-7]

Methods of anthropometric evaluation include direct anthropometry *i.e.* the direct measurement of surface dimensions. This method is accurate, simple, non-invasive, and has minimal equipment costs, and is well accepted by anthropologists. Other indirect methods like photogrammetry, Cephalometry and three-dimensional anthropometry can be also used. [2]

The aim of this study is to establish a baseline quantitative anthropometric data for Saudi population by measuring the following parameters of a random sample of Saudi students: Inner intercanthal distance, inter- alar width of the nose, maxillary inter-canine distance and inter-commissural width and to explore the significant correlation between these facial measurements in the study sample.

Anthropometry is applied in medical diagnosis for evaluation and treatment of facial abnormalities such as correction of dentofacial anomalies, reconstruction of post traumatic deformities and orthognathic surgeries in order to retain the overall esthetics balance of the face. Since anthropometric parameters which based on age, sex, geographical location and human traits are unique for each specific population, thus each anthropometric study should be conducted on a particular and predetermined age, sex and racial group.

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This study aims to find out the mean values of anthropometric parameters in normal sample of Saudi population so as to create a base line data and to explore the significant correlation between the facial measurements in the population studied needed for facial analysis that is important in clinical practice and forensic medicine.

Aim of the study

To assess the following facial anthropometric parameters of adult Saudi population: Intercanthal Distance (ICD), Inter-alar Width (IAW), Inter-commissural Width (ICW) and Maxillary Inter-canine distance (MIC). And to compare these parameters (ICD, IAW, ICW, and MIC) between Saudi males and females and to determine the correlation between investigated facial parameters.

Methodology

210 subjects were included in this prospective cross-sectional analytical study. Simple random selection of all students, interns and patients at KKU/COD who had fulfilled the criteria of selection and accept to participate in the study by signing consent form. The sample size was calculated based on the mean and standard deviation of a similar study. There were 105 males and 105 females ranging in age from 17 to 35 years. The study was approved by the Ethical Research Committee (ERC) KKU/COD. Samples with following criteria were excluded from the study

- Facial defects or deformities.
- Facial trauma.
- Previous orthodontic treatment.
- Advanced periodontal diseases.
- Previuos Facial surgery.

Variables studied

Inner intercanthal distance, inter alar width of the nose, maxillary inter canine distance and inter commissural width.

Facial anthropometric measurements

Electronic Digital Caliper with resolution of 0.01 mm (Absolute Digimatic,Yuzuki) was used for measurements. Each subject was seated in a dental chair with the head upright, looking forward with the maxillary teeth parallel to the floor.

To minimize intra-observer error, all variables were measured twice by the same investigator; a third measurement was taken in case where the initial two measurements showed a large discrepancy and the mean value of the measurements was taken [Figure 1]. The following measurements were recorded:

- Inter canthal distance from the inner canthus of one eye to the inner canthus of the other.
- Interalar width from external width of the ala of the nose at the widest point.
- Intercommissural width in the relaxed state.
- Maxillary Intercanine distance from the distal surface of one canine to the other.

Statistical analysis

Data were collected and analyzed using SPSS version 13.0

Mean, Standard Deviation (SD), minimum, maximum and Standard Error of Mean (SEM) were calculated. Unpaired t- test was used to determine the difference in means between males and females. Pearson's linear correlation coefficient was used to measure the degree of linear relationships between the three facial measurements for each subject. P-value of <0.05 was considered to be statistically significant.

Results

A total of two hundred and ten subjects have been included in this study. Ninety-seven (46.1%) were males and one hundred and thirteen (53.8%) were females [Figure 2]. The age range between 17-35 years old. The overall mean age was 23.48 ± 3.2 years (24.06 ± 3.5 for male subjects, 22.97 ± 2.9 for female subjects).

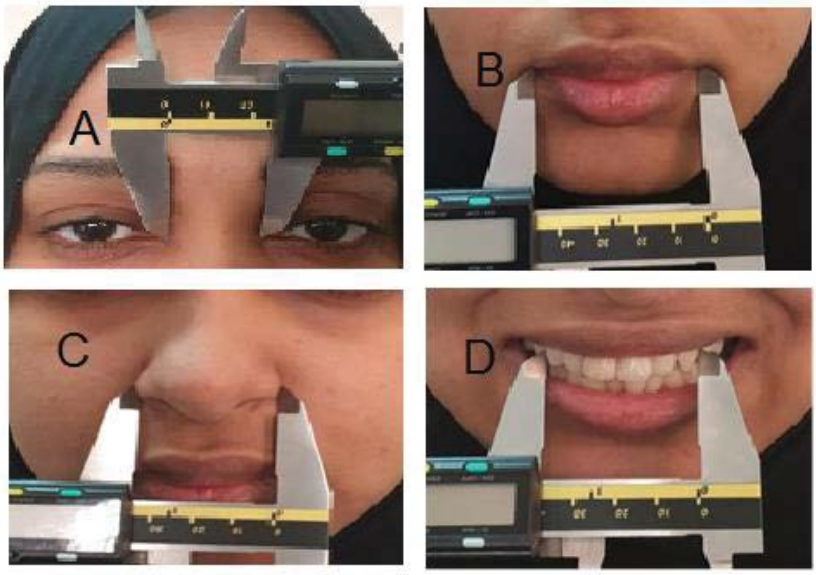

Figure 1: Facial measurements recorded in the present study (A: Intercanthal distance, B: Inter-commissural width, C: Inter-alar width, D: Maxillary inter-canine distance).

The different variables were higher for male than for female. The mean and the standard deviation for the study group for the variables IntercanthalDistance (ICD), Inter-alar Width (IAW), inter commissural width, and maxillary Inter-canine Distance (ICD) is shown in Table 1.

The result for the groups based on gender is shown in Table 2. The result for different variable was greater for males than females. Gender differences were observed with regard to all parameters, which were found to be significantly larger in males compared to females (P<0.05). This was confirmed using the Student's t-test. Sexual differences were observed with regard to all parameters, which were found to be significantly larger in males compared to females (P<0.05). The Student's t-test reveals statistically significant differences of all these four facial measurements between males and females (P<0.05).

Pearson's correlation test demonstrated positive and significant correlation between all the four variables (intercanthal distance, inter-alar width, inter commissural width and maxillary inter canine distance). This was valid for both males and females [Table 3].

Figure 2: Total percentages of subjects included in the study.

Table 1: The mean, standard deviation and range of the inter-canthal distance, inter-alar width, inter-commissural width and the maxillary inter-canine distance.

Variable	Mean ± SD (mm)	Range (mm)
Inter-canthal distance	30.29 ± 2.7	22.21-37.79
Inter-alar width	32.97 ± 3.1	23.38-43.66
Inter-commissural width	46.84 ± 5.8	34.66-60.97
Maxillary inter-canine distance	38.20 ± 2.4	30.83-47.12

Discussion

Anthropometry, a subcategory of anthropology, is concerned with dimensions of the human body. [1] It is associated with physical differences, especially as it relates to skeletal and racial groups. Facial anthropometric indices are of great value in several clinical specialties including oral and maxillofacial surgery, plastic surgery and forensic medicine. [8]

Studies on facial anthropometric measurements and their correlations have been reported in several populations including Arabs, Nigerians, Chinese and Turkish. [4,9-12] In the present study, quantitative data of the facial parameters were collected in typical individuals among Saudi adults.Study population included females and males ranging in age between 18 and 35 years.

Farkas et al., have established a data base of anthropometric measurements made on the face, using the method of manual anthropometry among twenty-five different population, which were considered over a hundred ratios.[3]

Body sizes differ according to certain variable including age, sex, race, climate, and regional conditions. The part in which this variation is most significant is the facial region. The eyes are the most distinctive feature on the face, studies reported that intercanthal distance is attained mostly by the first year[13] and there is no difference between young and older groups in the

Table 2: The mean, standard deviation and range of the inter-canthal distance, inter-alar width, inter-commissural width and the maxillary inter-canine distance for males and females.

Variable	Males (n=97)		Females (n=113)	
	Mean ± SD (mm)	Range (mm)	Mean ± SD (mm)	Range (mm)
Inter-canthal distance	31.12 ± 2.5	22.21-37.21	29.57 ± 2.7	23.17-37.79
Inter-alar width	34.05 ± 2.9	23.87-43.66	32.03 ± 2.9	23.38-39.68
Inter-commissural width	52.00 ± 3.5	35.63-60.97	42.42 ± 3.1	34.66-52.19
Maxillary inter-canine distance	38.89 ± 1.9	34.32-43.41	37.61 ± 2.7	30.83-47.12

Table 3: Correlations between the inter-canthal distances, inter-alar width, inter- commissural width and maxillary inter-canine distance.

Variable		Inter-canthal-distance	Inter alar width	Inter-commissural width	Maxillary inter-canine distance
Intercanthaldistance	PC	-	.375**	.396**	.343**
	P value		.000	.000	.000
Inter-alar width	PC	.375**	-	.501**	.416**
	P value	.000		.000	.000
Inter-commissural width	PC	.396**	.501**	-	.513**
	P value	.000	.000		.000
Maxillary inter-canine distance	PC	.343**	.416**	.513**	-
	P value	.000	.000	.000	

PC (Pearson's Correlation), **: Correlation is significant at the 0.01 level (2-tailed).

intercanthal distance. In this study the average of intercanthal distance was found to be 30.29mm for the whole study group and found to be 31.12mm and 29.57mm for male and female respectively. This result is narrower than the result obtained for Malaysian different races, [14] for the result of Sudanese[15] and Arab population of Al Basra. [16] Our result is similar to that obtain by Bangar and Ozturk in studies among the Indian and Turk respectively for the male subjects which may indicate a similar ethnic background [Table 4]. [17,18]

Through prenatal development, the medial nasal process, developed from the first branchial arch, governs the nose dimensions as well as the location of the maxillary canines. [4,19] Inter-alar dimension differ among different ethnicity. Studies proposed that climates play role in determine the inter-alar dimension.The nasal aperture becomes much wider in hot climate than the cold. The wider nasal aperture existing in all African and Asian ethnic groups in both genders.[3] Our study result confirms that the inter-alar dimension is significantly larger in male than female, which is consistent with other studies in the region. [4,9] The Saudi male and female show a mean of 34.05mm and 32.03mm respectively, which consider being among the narrowest comparing with other ethnic groups [Table 5]. [4,9,20-22]

The position of the maxillary canine determined the position of the other teeth in the dental arch. Maxillary inter-canine distance can be used to determine the size of the teeth during replacement of missing teeth. [23] In the present study, the difference between males and females in relation to maxillary inter-canine distance was found to be significant. In comparison with other ethnic groups, Saudis were found to have maxillary inter canine distances wider than that in Chinese and Malay population. [20-22] Our finding which is consistent with results obtained from a study performed on Arab population confirms that a wide anterior maxillary arch might be an ethnic feature for Arabs [Table 6]. [4]

When considering the width of the mouth (Inter-commissural Width), it was found to be 1.5 times the inter-alar dimension which resemble the result for Arabs in the middle east and North American Caucasians. [4,24] Studies stated that the ratio between mouth width and inter-alar width depends on the face type. Saudi Arab females shows to be the narrowest (42.4mm) in comparing to other ethnic groups. Arab and Arian females from Basra showed to have a mean of 47.5 mm and 48.4mm respectively. [16] Another study reported the inter commissural width for Saudi female as 48.13 mm. [4] This variation may be due to different method used or it may indicate a multiple ethnic origin among Saudis [Table 7].

All the four parameters show a positive correlation which is significant for all, this allow the maxillofacial surgeons, esthetic surgeons to use any of this parameter to predict the other during dentofacial correction.Stephan et al have stated that the maxillary inter-canine distance was correlated to the inter commissural width, in Europeans and Central/Southeast Asians it was 75.8% of the mouth width. [25] In our study, the maxillary inter-canine distance was 74.78% of the mouth width, for Saudi male and 88% for the female; the difference in female may be due to the difference in measurements criteria.

Our study has certain limitations, the age group was limited (18-35 years) and it was confined for the Southern region only. Future studies including wider age group and cover the different areas are recommended.

Conclusion

The present study establishes a preliminary baseline value for intercanthal distance, inter-alar width, inter commissural width and maxillary inter-canine distance in adult Saudis.

The study can be a foundation for further studies that can assist in future analysis, diagnosis, and planning of correction of different deformities, orthognathic surgery or orthodontic treatment, malformations or posttraumatic disfigurements in Saudi adults.

Table 4: The mean of inter-canthal distance among different populations.

Author and year	Population	Sample size	Inter-canthal distance (mm)	
			Male	Female
Ozturk [18]	Turk	140	30.7	30.3
El-Sheikh [15]	Sudanese	114	33.4	32.4
Al-Jassim [16]	Arian	132	33.1	32
	Arab	759	32.2	31.6
Bangar [17]	Indians	250	31.58	30.58
Packiriswamy [14]	Malaysian Malay	200	35.2	34.1
	Malaysian Indian	200	33.8	32.9
	Malaysian Chinese	200	37.1	36.2

Table 5: The mean of inter-alar width among different populations.

Author and year	Population	Sample size	Inter-alar width (mm)	
			Male	Female
Keng [20]	Chinese	118	39.60	36.41
Dharap et al. [21]	Malays	266	39.80	36.20
Arslan et al. [9]	Turks	173	37.00	32.70
Gomes et al. [22]	Brazilian	81	43.19	38.79
Dharap et al. [4]	Arabs	168	37.14	33.21

Table 6: The mean of maxillary inter-canine distance among different populations.

Author and year	Population	Sample size	Maxillary inter-canine distance (mm)	
			Male	Female
Keng [20]	Chinese	118	35.60	34.96
Dharap et al. [21]	Malays	266	36.7	36.2
Gomes et al. [22]	Brazilian	81	54	53.5
Dharap et al.[4]	Arabs	168	39.66	36.38

Table 7: The mean of inter-commissural width among different populations.

Author and year	Population	Sample size	Inter-commissural width (mm)	
			Male	Female
Arslan [9]	Turkish	173	50.02	47.3
Aljassim [16]	Arab	759	49.7	47.5
	Arian	132	51.8	48.4
Dharap et al. [4]	Arabs	168	52.86	48.63

Conflict of Interest

The authors and planners have disclosed no potential conflicts of interest, financial or otherwise.

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