Comparative Anthropometric Analysis of Facial Dimensions and Types in Qazvin, Iran and DeraGhazi Khan, Pakistan

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ABSTRACT

Introduction: Cephalometry is an efficient tool for anthropometric studies. This study sought to assess facial dimensions and types of adults residing in Qazvin (Iran) and Dera Ghazi (DG) Khan (Pakistan).

Methods: In this cross-sectional study, a total of 300 ethnic populations of Qazvin and 365 ethnic populations of DG Khan aged between 18-55 years were randomly selected and evaluated. The subjects had no maxillofacial deformities or history of head/facial trauma. Facial height and breadth, nasion-prosthion height, upper facial index, total facial index, facial type and profile were evaluated in subjects.

Results: The difference in total facial index between males of Qazvin and DG Khan was statistically significant (P<0.005). This index was significantly different between Qazvin and DG Khan females as well (P<0.005). The mean upper facial index was greater in Qazvin males and females compared to DG Khan and the difference in this respect between males of the two locations was statistically significant (P=0.006). The most and the least common facial types in Qazvin were hyperleptoprosopic and euriprosopic types, respectively; whereas, leptoprosopic and mesoprosopic types were the dominant facial types among males and females of DG Khan; hypereuryprosopic face was rare in both genders. Orthognathic profile was the dominant facial profile in Qazvin and DG Khan while the least common profile in both locations was prognathic profile.

Conclusion: Based on the obtained results, facial index in both genders residing in Qazvin was significantly greater than that those residing in other countries and this may be due to the long facial height and narrow facial breadth in this area.

Key Words:
Anthropology, Cephalometry, Populations, Iran, Pakistan

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1. Introduction

Physical anthropometry assesses body dimensions, and measurement of the head and neck dimensions via cephalometry is regarded an important part of anthropometry [1]. This is performed directly via anthropometric measurements or indirectly via magnetic resonance imaging (MRI), computed tomography (CT), radiography, ultrasonic cephalometry and stereological methods [2].

In addition to the conventional anthropometry, photoanthropometry is also used in medical and anthropological research. This is done by longitudinal and angular measurements made on conventional photographs. This method is particularly suitable for mentally retarded children in whom direct facial measurement may not be feasible. This method can help diagnose some syndromes [3]. Cephalometry has several applications in forensic medicine, genetic studies, plastic surgery, pediatric dentistry and assessment of the health of newborns [4-6]. Also, measurement of facial indexes can determine the facial type, ethnicity, race and sex of anonymous individuals [7]. Evidence shows that bioenvironmental, geographical and biological factors as well as ethnicity, sex and age affect body dimensions particularly in the head and neck region [4, 6, 8]. For instance, black people mostly have a narrow face (leptoprosopic) and prominent cheeks while orientals often have a wide face (euryprosopic) with more prominent cheeks. The retrognathic profile is common in Caucasians while the prognathic profile is more common in East Asia and Central Europe [9].

Cephalometric studies have several applications particularly in the clinical medicine. Tsai et al. in their study on patients with obstructive sleep apnea (OSA) found that this disorder can cause structural changes in the head and neck region and retrognathia and micrognathia are commonly seen in such patients. They reported a reduction in the total facial index and an increase in the head index in Caucasians with OSA. They stated that the head and facial indexes might be used for diagnosis of OSA [10]. Osteoporosis also affects the facial dimensions and indexes and decreases the total facial index and the upper facial index [11].

Pakistan and Iran are neighboring countries with two different ethnic populations. Not many studies have evaluated facial dimensions in the Iranian and Pakistani populations. This study sought to assess the facial dimensions, type and facial profile of individuals residing in Qazvin, Iran and DG Khan, Pakistan. The results were compared between males and females within and between the two countries.

2. Materials & Methods

This cross-sectional study was conducted on 300 ethnic populations residing in Qazvin, Iran (160 males and 140 females) and 365 ethnic populations residing in DG Khan, Pakistan (181 males and 175 females) aged between 18-55 years. Subjects were selected randomly and the inclusion criteria were physical and mental health (no history of head and neck anomaly or trauma), residing in Qazvin and DG Khan for three generations (from both mother's and father's sides) or for at least 100 years and no history of moving out of Qazvin or DG Khan during their life time for more than 5 consecutive years.

Some facial parameters were quantitatively evaluated in this study according to standard indexes. These parameters were measured using a spreading caliper in centimeters. To assess the facial profile, images captured by a digital camera (Canon Power Shut 550) were used. The study variables included:

-Facial breadth: The distance between the prominences of the cheeks (bizygomatic breadth)

-Facial height: The vertical distance between the nasion and the gnathion (nasion-gnathion height)

-Nasion-prosthion height: The vertical distance between the nasion and the prosthion

-Upper facial index: This index was calculated using the following equation:

-Total facial index or Prosopic Index: This index was calculated using the following equation:

Facial shape was classified based on the total facial index as follows (Table 1):

Table 1. Facial types based on the total facial index.

Facial type	Total facial index (%)
Hypereuryprosopic	<75 and 75-79.9
Euryprosopic	80-84.9
Mesoprosopic	85-89.9
Leptoprosopic	90-94.9
Hyperleptoprosopic	>95

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Table 2. The mean and SD of facial breadth and facial height in Qazvin and DG Khan residents in two groups of males and females.

Variables	Qazvin		DG Khan	
	Males	Females	Males	Females
Facial breadth (cm)	12.49±0.61	12.4±0.55	13.11±0.86	12.71±0.91
Facial height (cm)	12.83±1.03	11.98±0.93	11.83±0.72	11.15±0.78

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Facial profile was determined using digital images by drawing two axes on the facial image. One horizontal line was drawn from the center of a pupil anteriorly and another line was drawn vertical to the previous line along the face until reaching the upper lip. Three types of profiles were defined accordingly:

Orthognathic: The vertical line contacts the lower lip and the chin point.

Retrognathic: The chin point is posterior to the vertical line.

Prognathic: The chin point is anterior to the vertical line and the lower lip is anterior to the upper lip.

Obtained data were transferred to a computer and analyzed using SPSS version 16. Descriptive statistics were used to determine the frequency percentage and to summarize the data. The t-test was applied to compare the mean values between males and females in Qazvin and DG Khan residents. $P<0.05$ was considered statistically significant.

3. Results

In this study, 300 subjects residing in Qazvin including 160 males and 140 females and 356 subjects residing in DG Khan including 181 males and 175 females aged between 18-55 years were evaluated. The mean and standard deviation (SD) of facial breadth and facial height in males and females residing in Qazvin and DG Khan are summarized in Table 2.

Based on Table 2, the mean facial width in DG Khan males and females was greater than that in males and females residing in Qazvin. The mean (±SD) total facial height in males and females of Qazvin was 102.88±10.28 cm and 96.69±7.67 cm, respectively. These values were 90.55±7.64 and 87.87±5.76 cm in males and females of DG Khan, respectively (Table 3). The difference in total facial index in males residing in Qazvin and DG Khan was significant ($P<0.005$). This index was also significantly different between females residing in Qazvin and DG Khan ($P<0.005$).

According to Table 1 (standard descriptive classification of total facial index), hyperleptoprosopicfacial type had the highest frequency among males and females in Qazvin (55.6% and 52.1%, respectively) while euriprosopicfacial type was the least common. However, in DG Khan males, leptoprosopic face was the dominant type (39.3%) while mesoprosopicfacial type (45.7%) was the most common among females. Hypereuryprosopic face was the least common form in both sexes. The descriptive frequency distribution of total facial index in Qazvin and DG Khan residents is shown in Table 4.

The total facial index in males and females residing in Qazvin was higher than that in DG Khan residents. In both populations, the total facial index was higher in males than in females. The difference in total facial index between males in Qazvin and DG Khan and females in the two populations was not significant ($P\leq0.005$).

In DG Khan, hypereuryprosopic face was the least common type in both genders. This facial type was not seen in

Table 3. Total facial index in residents of Qazvin and DG Khan in two groups of males and females.

Total facial index (%)	Qazvin		DG Khan	
	Males	Females	Males	Females
Mean±SD	102.88±10.28	96.69±7.67	90.55±7.6	87.87±5.8
Minimum	60.54	61.48	67.53	66.86
Maximum	127.97	109.46	106.08	99.19

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Table 4. The frequency distribution of facial types in Qazvin and DG Khan.

Ethnicity	Gender		Facial types based on total facial index				
			Hyperlepto-prosopic	Leptop-rosopic	Mesop-rosopic	Euryp-rosopic	Hypereury-prosopic
Qazvin residents	Males	No.	89	42	28	1	-
		%	55.6	26.3	17.5	0.6	-
	Females	No.	73	39	19	9	-
		%	52.1	27.9	13.6	6.4	-
DG Khan residents	Males	No.	43	71	23	34	10
		%	23.7	39.3	12.7	18.8	5.5
	Females	No.	18	35	80	33	9
		%	10.3	20	45.7	18.9	5.1

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any subjects in Qazvin and euryprosopic face was the least common facial type in Qazvin.

The mean nasion-prosthion height in both genders in Qazvin was higher than that in DG Khan residents. In both populations, this value was slightly greater in males (but not significantly). The mean nasion-prosthion height in males and females of Qazvin was 7.94±0.5 cm and 7.5±0.92 cm, respectively. These values in DG Khan were 7.33±0.48 cm in males and 7.09±0.71 cm in females.

The mean upper facial index in males in Qazvin was 63.75±5.45% (range 50% to 74.04%). This value was 61.08±9.03% in females in Qazvin (range 47.81% to 100%).

In DG Khan, the mean upper facial index was lower than that in Qazvin. This value was 56.04±4.22% in males (range 39.32% to 64.55%). A significant difference was noted in upper facial index between males in Qazvin and DG Khan (P=0.006). The upper facial index was 55.92±5.37% in female residents of DG Khan (range 40.88% to 67.08%). No significant difference was noted in this regard between females residing in Qazvin and DG Khan. Table 5 shows the nasion-prosthion height and the upper facial index. In terms of facial profile, orthognathic profile was the dominant profile in both Qazvin and DG Khan while prognathic profile was the least common in both sexes in both areas (Table 6).

4. Discussion

Facial height and breadth, the total facial index and the upper facial index as well as the dominant facial profile and type were compared between residents of Qazvin and DG Khan, Pakistan.

The mean facial height was greater in male residents of Qazvin compared to the male residents of DG Khan (12.83±1.03 cm versus 11.83±0.72 cm). Previous studies showed that the mean of facial height was lower in Albanian males in Kosovo and Egyptian males compared to the male residents of Qazvin but higher than that in male residents of DG Khan [2, 11]. However, the mean facial height in Malaysian males and Haryanvi and Gujarat populations in India was less than that in DG Khan males [7, 12, 13]. These findings indicated higher mean facial height in males residing in Qazvin compared to other populations in the above-mentioned studies.

The mean facial breadth in males residing in DG Khan was greater than that in males residing in Qazvin. Howev-

Table 5. The mean (± SD) of nasion-prosthion height and the upper facial index in male and female residents of Qazvin and DG Khan.

Variables	Qazvin		DG Khan	
	Males	Females	Males	Females
Nasion-prosthion height (cm)	7.94±0.5	7.5±0.92	7.33±0.48	7.09±0.71
Upper facial index	63.75±5.45	61.08±9.03	56.04±4.22	55.92±5.37

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Table 6. The Frequency distribution of facial profiles in Qazvin and DG Khan residents.

Ethnicity	Sex		Orthognathic	Retrognathic	Prognathic
Qazvin	Male	Number	104	45	11
		Percentage	65	28.1	6.9
	Female	Number	119	14	7
		Percentage	85	10	5
DG Khan	Male	Number	125	53	3
		Percentage	69.1	29.2	1.7
	Female	Number	154	18	3
		Percentage	88	10.3	1.7

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er, this value was smaller than that in Albanian males from Kosovo (13.60 cm) (2). In Qazvini males, the mean facial breadth was lower than the corresponding values in males from DG Khan Pakistan, Malaysia and Egypt. However, the afore-mentioned value was greater than that in males of Haryanvi and Gujarat Indian populations [7, 12, 13].

The mean facial height was slightly higher in Qazvini females than DG Khan females (11.98±0.93 cm versus 11.15±0.78 cm). This variable in Japanese women (11.44±0.54 cm) was lower than that in Qazvini women but higher than that in DG Khan women [14]. However, the mean facial height in females residing in DG Khan was slightly greater than that in females of Qazvin but lower than that in Japanese (13.84±0.50 cm) and Egyptian (13.08±0.07) females [11, 14]. The mean facial height in Qazvini females was found to be higher than that in females of Malaysian and Haryanvi and Gujarat Indian populations [7, 12, 13].

The mean facial height in Qazvini males was significantly greater than that in DG Khan males (102.88±10.28 cm versus 90.55±7.6 cm, P<0.005). The mentioned value in Qazvini males was also higher than that in males residing in North Nigeria (99.39%), Serbia (93.86%), Egypt (92.86%) and Iraq [5, 11, 15, 16]. However, this value in DG Khan males was lower than that in males of the afore-mentioned countries and higher than that in males of Gujarat India, China, Malaysia and Yoruba and Ibo, South Nigeria [12, 13, 17, 18]. The mean total facial index in Qazvini females was significantly higher than that in DG Khan females (96.69±7.67% versus 87.87±5.8%, P<0.005). However, the mean total facial index in females of Qazvin and DG Khan was lower than that in females residing in North Nigeria (97.54%) [16] and higher than that in females of Malaysia, Gujarat India, China, Egypt and Ibo and Yoruba in South Nigeria [11-13, 17, 18].

Jahanshahi et al. in their study in Gorgan (Northern Iran) on Torkaman and Fars ethnic populations showed that the mean total facial index in Fars men and women was higher than that in Torkaman males and females but lower than that in Qazvin and DG Khan males and females [1].

Another study on women of Sistan and Baluchistan in South East Iran reported that the total facial index in Baluch women was higher than that in Sistani women and the values in both groups were lower than that in females of Qazvin and DG Khan [19]. But this index was almost similar in Baluchi and Fars women [19].

According to the total facial index, the dominant facial type was hyperleptoprosopic in Qavini males and females; whereas, leptoprosopic face was dominant in DG Khan males similar to Serbian, Iraqi, North-Eastern Nigerian and Egyptian males [5, 11, 15, 16]. In DG Khan females, mesoprosopic face was the dominant type similar to Indian, Malaysian, Chinese and Japanese females [13, 14, 17]. The above-mentioned studies reveal that similarity of the dominant facial type in males or females of different countries cannot predict the dominant facial type in the other sex in the same countries.

Hypereuryprosopic face was rare in DG Khan men as in Torkaman and North-Eastern Nigerian men [1, 16] and this facial type was not seen in Qazvin at all. The rare facial type in Qazvin was euryprosopic face as in Iraqi men [15]. In a study on Fars and Torkaman ethnic groups in North of Iran, the dominant facial type in males of both races was found to be mesoprosopic (44% in Fars and 38.4% in Torkaman populations). The rare facial type was hyperleptoprosopic and hypereuryprosopic in Fars males and hypereuryprosopic in Torkaman males. In Torkaman and Fars females, the dominant facial type was euryprosopic (37.7% in Fars and 51.7% in Torkaman populations). The

rare facial form was hyperleptoprosopic in Fars females and leptoprosopic in Torkaman females [1]. In Baluchi and Sistani females residing in South Eastern Iran, the dominant facial type was euriprosopic (50.8% in Sistani and 37% in Baluchi populations) while the rare type was reported to be hyperleptoprosopic face [19].

Based on the results of the current study, the facial type of Qazvini women was different from that of other women residing in other parts of Iran.

The mean nasion-prosthion height in Qazvini males and females was greater than that of DG Khan males and females and this value in both locations was greater in males than in females; but this difference was not statistically significant. Accordingly, the upper facial index in Qazvini males was higher than that in DG Khan males (63.75±5.45% versus 56.04±4.22%) and this difference was statistically significant (P=0.006). This index in Chinese men (55.35±3.72%) was close to that in DG Khan men but had a lower value in Egyptian males (46.19±0.36%) [11, 17]. The mean upper facial index in Qazvini females was higher than that in DG Khan females; but this difference was not statistically significant. This value in Chinese females (56.3±2.99%) was very close to that in DG Khan females (55.92±5.37%) but was the lowest in Egyptian females [11, 17].

The dominant facial profile in males and females residing in Qazvin and DG Khan was orthognathic profile while the prognathic profile was rare in both populations. Thus, despite significant differences in facial height and breadth and total and upper facial indexes in the two populations, it appears that the proportions of these values relative to one another result in an orthognathic profile in both groups.

Similar studies have been conducted on newborns and comparison of their results with the findings of studies conducted on adults of the same region and population reveal changes in facial dimensions and type and confirm the effect of age on facial type and profile.

Golalipour et al. evaluated female newborns of Torkaman and Fars populations in Gorgan and reported the dominant facial type to be mesoprosopic in Torkaman (36.01%) and hypereuryprosopic in Fars populations (71.22%) [20]. However, in adult females of the two populations, the dominant facial type was found to be euriprosopic [1].

In a study by Bayat et al. on female newborns in Arak, Iran, the dominant facial type was reported to be hypereuryprosopic [6]. Thus, the dominant facial type in Arak was similar to that in the Fars population of Gorgan (hypereuryprosopic), which is in line with the findings of Emami Meybodi et al. [21] and Golalipour et al. in 2003 [22] but different from the results in Torkaman population (mesoprosopic). A study on male newborns in Zahedan located in South East of Iran revealed the dominant facial type to be euriprosopic [23]; which is different from the results of the above-mentioned studies but similar to the findings of a study on Indian newborns reporting the dominant facial type to be euriprosopic [4].

The total facial index in the Indian newborns (80.5%) was lower than that in newborns in Arak (94.9%) and Zahedan [4, 6, 23]. In terms of facial dimensions, the mean facial height in Torkaman newborns was higher than that in Fars newborns residing in Gorgan. This value in Arak was lower than that in Fars and Torkaman populations residing in Gorgan. The difference in facial height between Torkaman and Araki populations was significant (P<0.02).

The mean facial breadth in Fars newborns in Gorgan was higher than that in Araki newborns and the latter value was higher than that in Torkaman newborns; but this difference did not reach statistical significance [6, 20].

Alexeeva et al. stated that differences among different populations might be due to bioenvironmental factors [24]. Ferrario et al. in their study on 108 healthy adults in Italy concluded that the face was wider in males and longer in females. Globally, the male face is rather rectangular while the female face is more square-shaped. Also, specific differences exist in the lower one-third of the face among different ethnic groups and races [25]. Based on the results of the current study, the nasion-prosthion height in Qazvin residents was greater than that in other ethnic populations. The longer facial height and consequently the facial index in Qazvini males and females compared to other ethnicities may be due to the greater nasion-prosthion height in Qazvini population rather than the lower one-third of the face.

Based on the results of the current study and those of previous investigations, it may be concluded that facial type and dimensions may be influenced by age, gender, ethnicity, race and bioenvironmental factors. Based on the results of the current study, the facial index in Qazvini males and females was significantly greater than that in other populations, which may be due to the high value of the mean facial height and low facial breadth in Qazvin residents. Future studies with larger sample sizes on different geographical locations are required to draw more definite conclusions regarding the facial type and the correlations between indices and dimensions in this regard.

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