

## Vertical Facial Dimensions and Indices in Adult Upper Egyptians

\*Muhammad H. Muhammad and Hazem A. Sayed

Department of Human Anatomy and Embryology, Faculty of Medicine, Assiut University, Egypt

\*[Moh\\_abo\\_elaa@yahoo.com](mailto:Moh_abo_elaa@yahoo.com)

**Abstract:** Background & aim: Facial measurements have been used by numerous researchers to produce standard mean values for skeletal, dental, and soft tissue structures. This has become useful in the classification of different populations. So, the present study was permitted to establish the mean vertical facial dimensions and indices of adults in Upper Egypt represented in Assiut Governorate in Egypt. Also, this study was carried out to establish the sexual differences of some vertical facial dimensions and indices between the adult males and females in the fore- mentioned locality. Subjects and Methods: In the present study, 478 adult subjects were studied for some vertical facial dimensions and indices in Assiut Governorate of Egypt. They were between the ages of 18-69 years, divided into 9 groups ( from I- to - IX) and included 256 males and 222 females. Four parameters and three indices had been carried out in the present study. The parameters included the nasal height or upper facial height (UFH), the nasal width (NW), the lower facial height (LFH) and the total facial height (TFH). All measurements were carried out with the help of a sliding caliper. The three indices included the upper facial index (UFI), the lower facial index (LFI) and the nasal index (NI). Results: In the present study the highest value of the UFH, NW, LFH and TFH in both males and females was observed in age group V (34-to-37 years of age group) while the lowest was observed in age group IX (50 -to-69 years of age group). The UFI was ranged from 39.41 % to 40.67 % for males and from 39.4 % to 40.55% for females between group I and group IX. For LFI, the value was 59.41 % for males and 59.16 % for females in group I, while it was 60.71 % for males and 60.66% for females in group IX. The present study revealed higher values of UFH, LFH, TFH, UFI, LFI and NI for males when compared to that of females. This higher values was significant for UFH, LFH, TFH and NI ( $P=0.018, 0.05, 0.011$  &  $0.048$ ), while it was non significant for UFI and LFI. The results showed that, on the average, the UFH for adult males was found to be  $4.8 \pm 0.17$  cm and  $4.01 \pm 0.14$  for adult females. The LFH of adult males was found to be  $7.18 \pm 0.09$  cm while that of adult females was found to be  $6.81 \pm 0.07$  cm. The TFH showed mean values of  $11.98 \pm 0.41$  for males and  $11.33 \pm 0.18$  for females. The average UFI in the present study was  $40.09\% \pm 1.7$  for males and  $40.0\% \pm 1.3$  for females. Furthermore the average LFI in the present study was  $59.93\% \pm 2.1$  for males and  $59.99\% \pm 2$  for females. Statistical analysis of mean and standard deviation indicates sexual dimorphism, with significantly higher value ( $p < 0.05$ ) of the average UFH, LFH and TFH in males compared to females of the corresponding ages. Conclusion: This study has been able to establish the mean facial dimensions of adults in Upper Egypt represented in Assiut governorate. It also established that as in other populations facial parameters are sexually dimorphic among the peoples of Upper Egypt and that male facial dimensions are greater than those of females. Knowledge of vertical facial dimensions is important in evaluation of age, sex and racial differences, in clinical applications and in forensic application.

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### 1. Introduction

Studying the morphology of the human face is one of the interesting fields of anthropometric research (Krishan and Kumar, 2007).

The face is the part of the front of the head between the ears and from the chin to the hairline. It is the anterior part of the head that includes the forehead, eyes, nose, mouth and chin (Sinnatamby, 1999).

It is a well-known fact that facial features differ amongst different races and ethnic groups (Moore, and Dally, 1999). For evaluation of deviations in craniofacial morphology, standards of anthropometrical measurements should be established for a particular population (Basciftel *et*

*al.*, 2004). Facial parameters are of utmost importance in determining standards for each population. These parameters change with age and are dependent on variations in the dimensions of the skeleton, development of muscles, sex and fat content and distribution in the body which are under the influence of climate, diet, health, etc. These factors are important determinants of growth and development (Quinn, 2004). Ethnicity is a variable that affects craniofacial dimensions (Rajakshmi *et al.*, 2001). The nose is one of the best anatomical markers to racial origin (Oladipo *et al.*, 2006).

Also, the nose as an anatomical marker can give a clue to sexual dimorphism in the studied populations. Oladipo *et al.* (2007) studied the

values of total facial, nasal (upper facial), maxillary, mandibular and lower facial heights ( maxillary& mandibular) in a study carried out on 200 (110 males and 90 females) adult Nigerian subjects with normal facial morphology . The authors reported that facial dimensions of males were found to be significantly higher than the corresponding female values.

Erika *et al.* (2005) studied craniofacial measurements of 77 Latvians (39 males and 38 females) with normal craniofacial morphology. Comparison was made between males and females and between Latvian and non-Latvians. The study reported upper facial height and total facial height as  $5.87 \pm 0.45$ cm and  $12.41 \pm 0.41$ cm, respectively for males and that of females as upper facial height  $5.67 \pm 0.57$ cm and total facial height of  $11.76 \pm 0.62$ cm. No statistically significant differences were observed between the Latvian and non-Latvian subjects in the study group.

Cunha and van Vark (1991) and Kemkes & Gobel (2006) reported that patterns of sexual dimorphism sometimes vary significantly within local population. Furthermore, local populations also show sexually dimorphic changes in cranial size and facial shape over time spans as short as a few decades (Smith *et al.*, 1986; Jantz & Meadows Jantz, 2000; Buretic-Tomljanovic *et al.*, 2007 and Jonke *et al.*, 2007). Sexual difference is better projected as one attains adulthood ( Priyanka and Ruma, 2006) .

#### **Aim of study:**

The present study was permitted to establish the mean vertical facial dimensions and indices of adults in Upper Egypt represented in Assiut Governorate. Also, this study was carried out to establish the sexual differences of some vertical facial dimensions and indices between the adult males and females in the fore- mentioned locality.

#### **2. Material and Methods:**

Four hundred and seventy eight (478) subjects of adults in Assiut Governorate of Upper Egypt with ages ranging from 18-69 years were used in the study (256 males and 222 females) and divided into 9 groups ( from I – to- IX). All subjects were from Upper Egypt of Assiut Governorate by both parents and grandparents. The subjects were selected randomly from Assiut Governorate of Upper Egypt. All the subjects of the present study showed no facial deformity or scar.

The measurements were carried out using the method described by Didia and Dapper (2005). The landmarks in the study were defined as follows:

1. Nasion, the point on the root of the nose where the mid-sagittal plane cuts the nasofrontal suture.
2. Subnasale, the point at which the nasal septum merges with the upper cutaneous lip in the mid-sagittal plane.
3. Ganthion, the lowest point on the lower border of the mandible in the mid-sagittal plane.

The anthropometric landmarks, the nasion (n), subnasale (sn) and ganthion (gn), were pointed on the subject's face. With the help of a sliding caliper, the following measurements were taken:

1. Upper facial (Nasal) height (UFH); the distance between the nasion (root of the nose) and the anterior nasal spine.
2. Nasal width (NW); the distance between the two alar.
3. Lower facial height (TFH); the distance between and the mentum and the anterior nasal spine.
4. Total facial height (TFH); the distance between the nasion of the nose and the mentum of the mandible.
5. The upper facial index (UFI); the proportion of the UFH to the TFH. It was calculated as: 
$$UFI = \frac{UFH \times 100}{TFH}$$
6. The lower facial index (LFI); the proportion of the LFH to the TFH. It was calculated as: 
$$LFI = \frac{LFH \times 100}{TFH}$$
7. Nasal index (NI) ; it was calculated as 
$$\frac{NW \times 100}{UFH}$$

All measurements were made by one person to ensure uniformity of measurement. Measurements were made with the subjects sitting upright with the head unsupported, relaxed and breathing quietly. The obtained results were analyzed using discrete statistics and students't - test at significance level of 0.05.

#### **3. Results**

The results of the present study are shown in tables (1), (2), (3) & (4) and figures (1), (2), (3) and (4). Table (1) showed the sample size and the age groups distribution in the present study. Table (2) showed the values of upper facial height (UFH), nasal width (NW), lower facial height (LFH) and total facial height (TFH) in males and females of the corresponding ages. Regarding the UFH in the present study (Histo.1), the highest value was observed in group V (34-to-37 years of age group) while the lowest was observed in the last age group (50-to-69 years of age group). This highest and lowest value was in the same age groups for males and females. Similarly, the highest value for NW,

LFH and TFH in both males and females was observed in group V (34-to-37 years of age group) while the lowest was observed in the last age group (50 -to-69 years of age group).

Table (3) showed the proportion of the upper facial height to the total facial height (UFI) and lower facial height to the total facial height (LFI) in males and females of the corresponding ages. The UFI was ranged from 39.41 % to 40.67 % for males and from 39.4 % to 40.55% for females between group I (18-to-21 years of age group) and group IX (50 to-69 years of age group). For LFI, the value was 59.41 % for males and 59.16 % for females in group I, while it was 60.71 % for males and 60.66%

for females in group IX.

Table (4) showed the means and standard deviations of the upper facial (UFH) , lower facial (LFH) and total facial (TFH) heights by cm , upper facial index (UFI) , lower facial index (LFI) and nasal index (NI) of Assiut adults. Analysis of this table revealed higher values of UFH, LFH, TFH, UFI, LFI and NI for males when compared to that of females. This higher values was significant for UFH, LFH, TFH and NI ( $P= 0.018, 0.05, 0.011 \& 0.048$ ). On the other hand, these higher values in males was non significant for UFI and LFI when compared to females.

**Table (1): Shows the Age and sex distribution of the studied subjects.**

Age groups	Age in years	Number of male subjects	Number of female subjects	Total
I	18-21	59	55	109
II	22-25	26	23	49
III	26-29	18	15	33
IV	30-33	35	31	66
V	34-37	15	14	26
VI	38-41	24	23	47
VII	42-45	33	23	22
VIII	46-49	27	21	26
IX	50 to 69	19	17	29
	a&above above			
<b>Total number</b>	<b>256</b>	<b>222</b>	<b>22</b>	<b>478</b>

**Table (2): Shows the mean values of upper facial height (UFH), Nasal width (NW), Lower facial height (LFH) and Total facial height (TFH) by cm in males and females of the corresponding ages.**

Age groups (9)	UFH		NW		LFH		TFH	
	Males (n=256)	Females (n=222)	Males (n=256)	Females (n=222)	Males (n=256)	Females (n=222)	Males (n=256)	Females (n=222)
I	4.75	4.37	3.73	3.09	7.29	6.72	12.05	11.09
II	4.79	4.39	3.77	3.11	7.35	6.75	12.12	11.14
III	4.83	4.44	3.79	3.12	7.36	6.77	12.19	11.21
IV	4.87	4.49	3.8	3.13	7.38	6.81	12.23	11.3
V	4.89	4.53	3.88	3.17	7.49	6.93	12.38	11.46
VI	4.84	4.49	3.83	3.15	7.43	6.85	12.28	11.34
VII	4.81	4.40	3.81	3.16	7.40	6.79	12.22	11.21
VIII	4.75	4.33	3.78	3.11	7.34	6.77	12.09	11.16
IX	4.71	4.29	3.70	3.03	6.88	6.23	11.58	10.53

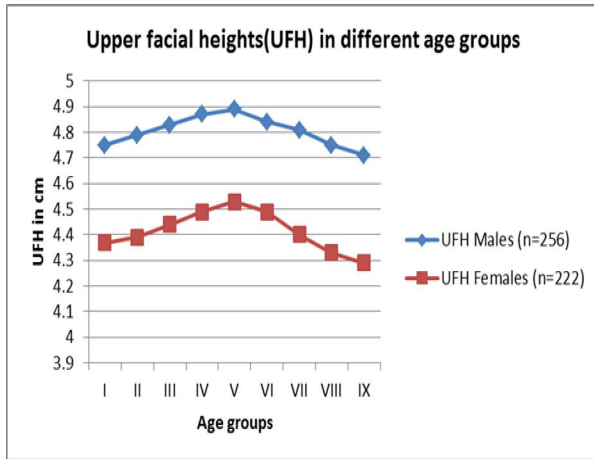


Fig. (1): Shows two distance curves for the mean values of the upper facial heights (UFH) for different age groups in males and females.

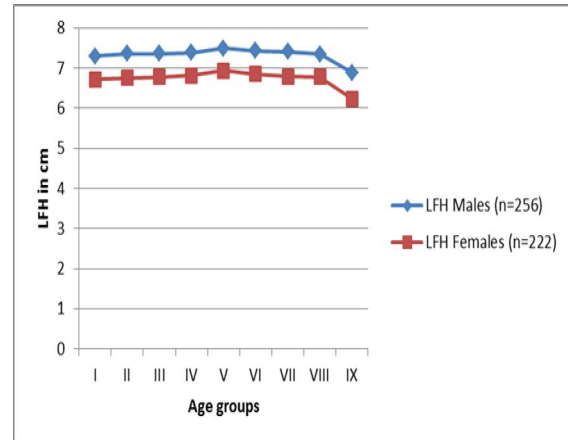


Fig. (3): Shows two distance curves for the mean values of the lower facial heights (LFH) for different age groups in males and females.

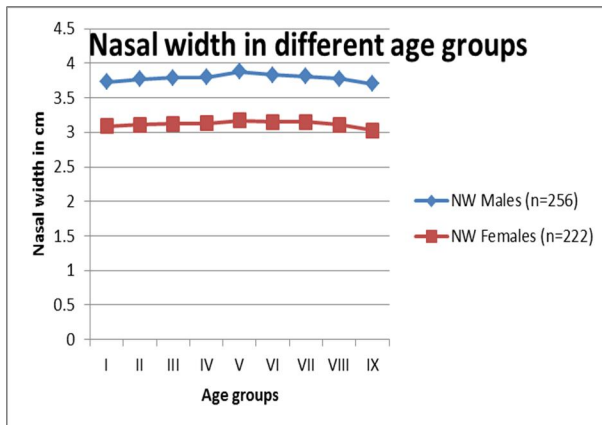


Fig. (2): Shows two distance curves for the mean values of the nasal width (NW) for different age groups in males and females.

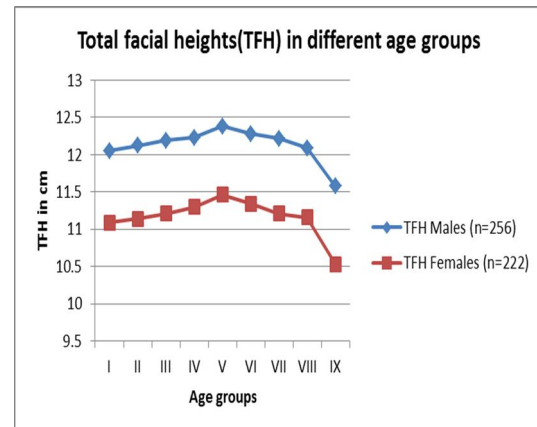


Fig. (4): Shows two distance curves for the mean values of the total facial heights (TFH) for different age groups in males and females.

Table (3): Shows the upper facial index (UFI) and lower facial index (LFI) in males and females of the corresponding ages.

Age groups	UFI		LFI	
	Males (n=256)	Females (n=222)	Males (n=256)	Females (n=222)
I	39.41	39.4	60.49	60.61
II	39.75	39.42	60.47	60.59
III	39.52	39.6	60.37	60.39
IV	39.82	39.73	60.34	60.26
V	39.5	39.52	60.5	60.47
VI	39.41	39.59	60.5	60.4
VII	39.36	39.25	60.55	60.57
VIII	39.28	39.06	60.71	60.66
IX	40.67	40.55	59.41	59.16

n= number of subjects.

**Table (4): Shows means ( $\bar{X}$ )  $\pm$  standard deviations (SD) of the upper facial height (UFH) , lower facial height (LFH) and total facial height (TFH) , upper facial index (UFI) , lower facial index (LFI) and nasal index (NI).**

Parameter	Males (n=256) $\bar{X} \pm SD$	Females (n=222) $\bar{X} \pm SD$	P
UFH	4.81 $\pm$ 0.17	4.01 $\pm$ 0.14	0.044*
LFH	7.32 $\pm$ 0.09	6.72 $\pm$ 0.07	0.005*
TFH	12.11 $\pm$ 0.41	11.15 $\pm$ 0.68	0.011*
UFI	39.64 $\pm$ 1.7	39.56 $\pm$ 1.3	N.S
LFI	60.37 $\pm$ 2.1	60.35 $\pm$ 2	N.S
NI	79.89 $\pm$ 0.13	69.27 $\pm$ 0.52	0.048*

\* Significant, P (Probability value), N.S ; Non Significant and n= number of subjects.

## Discussion

In the present study, the facial dimensions were confined to the vertical dimensions and indices of Upper Egyptians represented of Assiut adults. Farkas *et al.*, (1989), on a study of Vertical and horizontal proportions of the face in adult North American Caucasians, reported that the absolute differences were greater between the vertical facial profile sections and smaller between the horizontally oriented facial proportions. They concluded that the vertical facial dimensions are more representative parameters for sexual and racial differences. In the present study, the ages ranged from 18 -69 years. The choice of the study population was deliberate since the age of 18 years is the age of physical maturation and majority (Abigail, 2006). On the hand, the age of 69 years old is the end of middle - aged adults (Cohen *et al.*, 1996). They divided adult's subjects into four age groups, 18-44 years (young), 45-69 years (middle-aged), 70-79 (old), and 80-89 (elderly). Zankl *et al.*, (2002) reported that reference data for anthropometric characteristics of normal, healthy individuals should be provided in age ranges as wide as possible. The set of data offered by present study probably covers the largest age range with a considerable number of subjects in each sex and age group.

The results of the present study indicated that adult and old males had higher values than adult females. The highest value for UFH, NW, LFH and TFH was observed in the 34- to-37 years of age group. Similarly, the highest value for UFH, NW, LFH and TFH was observed in the 34-to-37 years of age group in adult and old females. The mean values of UFH computed in the present subjects were lesser in females than in males for all age groups. The observed differences were statistically significant for UFH, LFH, TFH and NI (P= 0.018, 0.05, 0.011 & 0.048) when compared to the female group (Table 4). The results of this study agree with many other studies that compare anthropometric characteristics of males and females. Most of such authors have concluded the presence of sexual dimorphism in their

studied sample. Oladipo *et al.* (2007) on the facial measurements among major ethnic group in Nigeria where sexual dimorphism was observed in all the ethnic groups studied with males having significantly higher facial indices than females.

Rabanus (2003) stated that the lower facial height is related to the upper facial height as 1.618:1.000 and that each ratio differs by 1.618. Knowledge of facial proportion values are employed in facial aesthetics. If the facial height for example is increased relatively to the upper two-thirds, it may be possible to restore an aesthetic proportion to the overall face by surgical alteration of the patient's alveolar height and or vertical dimensions (McLaren and Rifkin, 2002).

Similarly, decreased facial height at the vertical dimension can often be restored at an improved vertical to improve facial aesthetics (Mohindra and Bulman, 2002). Current concepts in diagnosis and treatment planning focus on the balance and harmony of various facial features (Reidel, 1950; Gonzalez-Ulloa and Steven, 1961; Merrifield, 1966 and Holdaway, 1983). No report exists on the vertical facial dimensions of the mature Upper Egyptians in Assiut governorate, hence the need for this study. Furthermore, this study will provide the anatomical data on heights of Egyptians represented in Assiut governorate which could be used as anthropometric reference values, in clinical practices ( plastic surgery and orthodontics) and in forensic medicine and also set the base for further investigation.

Farkas (1993) in his study of Canadians of Northern European origin found that LFH constitutes 59.5% of the TFH. . In another study, Farkas *et al.* (2002) found a lower face/ total face height ratio of 59.2%  $\pm$  2.7% in male and 58.6%  $\pm$  2.9% in female subjects. In the present study, the upper facial height and lower facial height to total facial height agree with the findings of Farkas *et al.*'s study.

**Table 5: Comparison between the measurements of the upper facial, lower facial and total facial heights in the present study and some other populations.**

Author /year	Population	UFH	NI	LFH	TFH
Farkas <i>et al.</i> (1989)	Caucasians	5.61	69.9	6.68	12.09
Didia and Dapper(2005)	Nigerians	4.5	-	7.44	12.02
Oladipo <i>et al.</i> (2009b)			94.1		
Erika <i>et al.</i> (2006)	Latvians	5.77	70.9	7.47	12.08
Herskovites (1937)	African Negroes	4.0	92.2	6.84	10.84
Niswander <i>et al.</i> (1967)	Brazilian Indians	5.55	72.3	7.01	12.57
Present study	Upper Egyptians	4.6	74	7.02	11.63

Comparing the measurements mentioned in Table 5 with that of the present study could not reflect that the populations of Upper Egypt is belonging to African origin or any of the fore-mentioned ethnic groups but may be considered as separate ethnic group.

### Conclusion

The present study has been able to establish the vertical facial dimensions of adults in Upper Egypt represented in Assiut governorate. It also established that as in other populations facial parameters are sexually dimorphic among the peoples Upper Egypt represented in Assiut governorate and that male facial dimensions are greater than those of females ( $p < 0.05$ ). Knowledge of mean facial dimensions is important in evaluation of age, sex and racial differences, in clinical applications and in forensic application.

### Corresponding author

Muhammad H. Muhammad  
Department of Human Anatomy and Embryology,  
Faculty of Medicine, Assiut University, Egypt  
[moh\\_abo\\_elaa@yahoo.com](mailto:moh_abo_elaa@yahoo.com)

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