A Comparative Study of Oro -Facial Measurements of Thalassemia Major adult Patients in Basrah

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ABSTRACT

Introduction: β Thalassemia is one of the most common hereditary diseases in Iraq. Patients usually have severe anemia due to defective haemoglobin synthesis which result in expansion of the bone marrow and distortion of the bones of skull and face. The purpose of the present study is to calculate the anthropometric measurements of the face of adult β thalassemia patients and to identify changes by comparing them with the control group and relevant studies. **Material and Methods:** Sixty β thalassemia patients and equivalent number of control were enrolled in this study. The age ranged between 20-40 years. The facial variables include sixteen parameters of face, eyes, ears, nose and mouth were calculated. Data analysis was performed by using SPSS version 20 and Chi Square tests. **Results:** The body mass index (BMI) in β thalassemia patient showed high statistical difference compared to control ($P<0.00$). Regarding facial parameters, in female the maxillary depth, the upper lip height and the ear length all had significant variations ($P<0.05$) in thalassemia patients .In male, nasal tip protrusion and Inter canthal distance of the eyes showed significant differences, the length of palpebral fissure in both gender showed significance in thalassemia patients compared with control) . **Discussion and conclusion:** This study evaluates the facial variations of β thalassemia patients with deformity of the mid face, saddle shape nose and mal-occlusion of teeth could be detected and gender variations were noticed.

Keywords: Beta thalassemia, Oro-facial, measurements, Basrah

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INTRODUCTION

Thalassemia major disease, “Cooley’s anemia” or “Mediterranean anemia” first designated by Thomas Cooley in 1925 .It is the most frequent single gene disorder with severe public health problems in worldwide population affecting almost all countries of the Mediterranean Basin [1].

Beta-thalassemia is characterized by reduced or absent synthesis of beta globin chains of hemoglobin which result in progressive hemolytic anemia (hypo chromic microcytic anemia) and often accompanied with variable degree of craniofacial anomalies. Individuals with β thalassemia major or homozygous type manifested with severe transfusion-

dependent anemia and obvious craniofacial deformities, while those with β thalassemia minor or heterozygous type presented with mild asymptomatic anemia [2].

The clinical manifestations appear clearly towards the end of the first year, usually the child presented with pallor and severe progressive hemolytic anemia, caused by defective erythrocyte production [3]. The over production of erythrocytes will result in hypertrophy of the bone marrow up to thirty times and expansion of the extra medullary region[4], this is especially noticed in patients received insufficient blood transfusion [5]. The changes are time related and frequently associated with variable degree of skeletal anomalies [6].The development of such deformities depend on many factors, like patients age, duration of symptoms, degree of anemia, timing of splenectomy and age at the onset of transfusion therapy [7].

The facial features of thalassemia are secondary to the changes of the facial bones and increase of bone marrow activity. The expansion in the size of the facial bones, will result in distortion, the deformities of the hard tissue will subsequently affect the soft tissue. Thalassemia patients had enlarged upper jaw bone growth and reduced growth of the lower jaw, which ultimately leads to malocclusion of upper incisors teeth [8]. The skull x rays show thinning of the facial bones, widening of the diploic space, commonly in the frontal region with prominent frontal and parietal bones, bulging of malar eminences, the maxillary sinus is partially obliterated resulting in larger cheekbones. [9]

In Iraq generally and city of Basrah southern of Iraq especially, a high prevalence of thalassemia was detected among population. 4.6% of populations are carriers of the gene with frequency of 0.023[10].

Aim:

This study aimed to evaluate the oro-facial measurements in β thalassemia patients in Basrah city and to estimate the differences by comparing them with control group and similar studies of relevant countries. We hope that understanding the oro-facial anatomy will support the dentists and surgeons for their surgical intervention.

MATERIALS AND METHODS:

This study was conducted during the period from Aug 2019 to February 2020. A total number of 60 adult β thalassemia major patients (34 female and 26male) were randomly selected from a large group of patients attended the thalassemia center for Hereditary Blood diseases at Basrah Maternity and Child Hospital irrespective to their social or educational backgrounds. Age ranged between 20- 40 years. Patient's data, including age, sex, weight (in kg), length (in cm), were tabulated and evaluated. All patients were under treatment including regular blood transfusion.

All controls contributed in this study had to meet the following criteria, having the same number of individuals (with comparable age and sex), between 20-40 years old and had no history of facial deformities, or any maxillofacial, plastic or reconstructive surgery and finely no history of major trauma.

Ethical approval was obtained from the ethical Committee of Al Zahraa Medical College / University of Basrah, and the center for Human Development of Basrah health Authority, Ministry of health (Ref. No. 261 at 13/5/2019).All subjects were informed about anthropometric measurements and a verbal consent was obtained from all participant enrolled in this study.

The standard instruments used were calipers, measuring tape and vernier, Fig.1.

Surface landmarks were marked on the face before taking the standard anthropometric measurement

.The head orientation was achieved by positioning the head in Frankfurt horizontal plane aligned parallel to the floor. According to Farkas method [11]. Three anatomical landmarks determined the facial midline: the nasion, the sub nasal, and the gnathion.

Fourteen linear and two angular measurements were taken, these are:

1. Face: Face width (zy- zy), Face height (n- gn), Upper face height (n- sto), Maxillary depth (t- sn), and Mandibular depth (t- gn).
2. Nose: Nose width (al- al), Nose height (n- sn), Nasal tip protrusion (sn- prn).
3. Eyes: Biorbital width (ex-ex), Intercanthal distance (en- en), Palpebral fissure length (en- ex).
4. Mouth: Mouth width (ch- ch), Lower lip height (sto- ls), Upper lip height (sn- sto).
5. Ears: Ear width (par- pa), Ear length (sa- sba).

N: All facial measurements were taken in millimeters

A comprehensive data analysis was achieved by using Chi square test and SPSS version 20

Fig. 1: The Vernier and measuring tape

RESULTS

Sixty adult β thalassemia patient with corresponding number of control were enrolled in this study. Sex and age distribution were similar in both groups. Females to males' ratio is 1.3:1. Both groups were divided into two age groups, 20-30 years group, which form nearly 61%, and 31- 40 years age group which form nearly 38.3%. Table 1

Table 1: Distribution of gender and age group in thalassemia and control

		Control		Thalassemia	
		N= 60	%	N= 60	%
Sex	Female	34	56.7%	34	56.7%
	Male	26	43.3%	26	43.3%
Age Group	20-30(yrs)	37	61.7%	37	61.7%
	31-40(yrs)	23	38.3%	23	38.3%

The body weight, height and body mass index (BMI), were compared between thalassemia patients and control. There is a difference of 21.7 Kg in weight less in female patients and 26 kg in male patients compared to control group. The height of thalassemia patients were less than the control,

16.6 cm in females and 15.6 in male patients. The BMI also are less in thalassemia patients being

5.8 Kg/ sqm in females and 5.3 Kg/sqm in males. P value in all three parameters show significant differences (P<0.05). Table 2.

Table 2: Comparison of body weight, height and body mass index (BMI) between Thalassemia and control.

Measurements	Female		P value	Male		P value
	Thalassemia	Contr.		Thalassemia	Contr.	
Weight (Kg)	45±8	66.7±14	0.000	47±10	73±13	0.000
Height (cm)	150.6±9.6	161.2±7.8	0.000	157.4±13.5	173±9.8	0.001
BMI (Kg/sqm)	19.8±2.6	25.6±4.7	0.000	19±3	24.3±3.5	0.000

P< 0.05:

Five facial measurements were taken for comparison between the two groups.

The face width (zy-zy) was larger in patients by 1.5 mm in females and 2.4 mm in males. While all other facial measurements are less in thalassemia patients in both females and males. The face height is 1.6 and 1.8mm in males and females. The upper face height is 2.1 and 1.1mm respectively. The maxillary depth is 5.9 and 2.4mm. The mandibular depth is 4.7 mm in both sexes. The P value for all the parameters is insignificant with the exception of maxillary depth in females (P = 0.014). Table 3.

Table 3: Comparison of facial measurement between thalassemia and control

Measurements	Female		P value	Male		P value
	Thalas.ia	Contr.		Thalas	Contr.	
Face width (zy-zy)	96.6±9	95.1±6	0.413	98.4±6	96±12.9	0.377
Face height (n-gn)	106.1±8.9	107.7±6.8	0.412	109.3±12.1	111.1±14.5	0.566
Upper face height (n-sto)	69.1±8.7	71.2±5.8	0.247	71.7±7.2	72.8±10.8	0.626
Maxillary depth (t- sn)	115.4±10.9	121.3±8.1	0.014	121.1±7.2	123.5±9.7	0.274
Mandibular depth (t-gn)	129.1±14.3	133.8±8.5	0.104	133.5±9.9	138.2±13.6	0.111

P < 0.05

Three nasal measurements were taken for comparison. The nasal width (al-al). Is wider in thalassemia female s by 3.2 mm than control, while it is 0.7 mm smaller in male patients compare to control. All other nasal parameters were less in patients than in control. P value show no significant differences, except for nasal protrusion in males (P 0.001). Table 4.

Table 4: Comparison of nasal measurement between thalassemia and control

Measurements	Female		P value	Male		P value
	Thalas.	Contr.		Thalas.	Contr.	
Nose width (al-al)	38.7±22.7	35.5±3.9	0.427	36.3±3.7	37±4.2	0.420
Nose height (n-sn)	48.5±8.3	50.4±8	0.356	50.4±5.3	51±7.3	0.707
Nasal tip protrusion (sn- prn)	16.3±8	17.2±2.8	0.523	15±1.6	17.1±2.9	0.001

P < 0.05

Regarding eye measurements, the Biorbital width (ex-ex) in the control group showed longer distance in both sexes, its 3.3 mm in females and 1 mm in males. The Palpebral fissure length (en- ex) in the control showed higher figures also, it is 2.4mm less in females and 1.7mm less in male patients. While the Intercanthal distance (en-en) is longer in thalassemia patients by 2.6 mm and 2.4mm respectively in females and males. The P value is significant in both sexes for Palpebral fissure length (P 0.013), (P 0.039) &for males in Intercanthal distance (p 0.000).Table 5.

Table 5: Comparison of eye measurement between thalassemia and control

Measurements	Female		P value	Male		P value
	Thalas	Contr.		Thalas	Contr.	
Biorbital width(ex-ex)	89.9±18.3	93.2±12.3	0.387	92.5±5.6	93.5±10.1	0.655
Intercanthal distance (en-en)	34±10	31.4±2.7	0.139	34.3±2.4	31.9±2.9	0.000
Palpebral fissure length (en-ex)	30.8±4.2	33.2±3.6	0.013	31.3±1.9	33±3.7	0.039

P < 0.05

To compare mouth measurements between the thalassemia and control groups, three parameters were taken. The mouth width is larger in control group in both sexes; it is 1.4 and 2.1 mm in females and males. While both lip height are more in thalassemia patients. The differences in lower lips are
0.5 and 3.9 mm in females and males, while in upper lip its 2.1 and 0.4 mm in females and males. None of these figures is significant only for upper lip height in females (P 0.011). Table 6.

Table 6: Comparison of mouth measurement between thalassemia and control

Measurements	Female		P value	Male		P value
	Thalas	Contr.		Thalas	Contr.	
Mouth width (ch- ch)	43.3±5.6	44.7±4.5	0.292	44.5±4.7	46.6±8.5	0.241
Lower lip height (sto- sl)	11.4±1.7	10.9±1.6	0.201	15.3±16.6	11.4±1.8	0.071
Upper lip height (sn- sto)	11.7±5.1	9.6±1.9	0.034	10.1±4.7	9.7±2	0.622

P < 0.05

The size of the ear show differences between the two groups in favor of the control group. The ear width (pra- pa) is 4.4 and 5 mm less in females and males of thalassemia patients, while the ear length (sa-sba) is 7.7and 4.5mm less in females and males of thalassemia patients. The only P value significant is the ear length in females (P 0.011). Table 7.

Table 7: Comparison of ear measurement between thalassemia & control

Measurements	Female		P value	Male		P value
	Thala	Contr.		Thala	Contr.	
Ear width (pra- pa)	37.2±7.5	41.6±16.4	0.162	36.3±2.9	41.313.1	0.061
Ear length (sa- sba)	53.8±7.2	61.5±15.5	0.011	57.9±4	62.4±12.2	0.068

P < 0.05

DISCUSSION:

Oro facial measurements have always been an inspiring subject for anatomists anthropologists, forensic documentary and plastic surgeons [12]. Many factors such as age, sex, race and several chronic and hereditary diseases such as β thalassemia major affect the craniofacial development and growth [13, 14].

The severity of the facial changes in β thalassemia patients would increase with the decrease in general health and in neglected children [15]. All patients in the current study underwent blood transfusions at an early age; therefore, the prevalence of the deformities would be expected to be reduced in those patients. The results obtained increase our knowledge a bout orofacial changes in thalassemia patients and allow us to obtain quantitative beneficial results needed .

In this study, the age ranged between 20-40yrs with female to male ratio equal to 1.3: 1 in both thalassemia and control with significant difference in body mass index (BMI) of both sexes between thalassemia and control group ($P<0.05$). Many articles mentioned that younger age group with thalassemia major usually suffer from growth retardation, a low body mass index and impaired immune function which is due to repeated blood transfusion result in secondary hemochromatosis affecting most organs of the body [16, 17, 18]. Vlychou et al [19] studied 62 thalassemia patients (35 female &27 male) from Greece with height, weight and BMI higher than current study, differences could be due sample type (ages were up to 50 and more,) or they might have better nutritional background. Naimi et al 2017 have the average BMI as 20.12, which is similar to this study. Hattab et al found that the BMI is 10% less in 37.2% of patients over 10 years [20]. In this study, we found that there is 20% decrease of BMI in overall cases, but no much difference between female and male patients regarding BMI, all are significant when compared to control. Toman et al. [21] from Malaysia found a relationship of craniofacial deformities with the clinical picture, 19 out of 43 β thalassemia patients (44.2%) have a craniofacial deformity. With weight and height as well as BMI are less in β thalassemia patients than control. Girinath et al from India found the oral and maxillofacial changes were observed in 84% of the patients. They proposed that the prevalence of oral and maxillofacial changes would decrease in patients who undergo blood transfusions at a young age which match with our results. Sixteen facial measurements were taken, these parameters are; 5 from the face, 3 from the nose, 3 from the eyes, 3 from the mouth and 2 from the ears.

In the present study, the facial data show that face width (zy-zy) is slightly more in β thalassemia patients in both sexes, but with no significant difference ($P <0.05$). Karakas et al had been reported larger face width of 106 mm, while Naimi et al reported much larger figure of 148.1mm. The increase of face width approved also by Alavi and Eshagh and Dr Amini [21, 22]. The rest of facial data, which are, Face height (n-gn), Upper face height (n-sto), Maxillary depth (t-sn), Mandibular depth (t- gn), show that the male patients have larger sizes than female patients especially in maxillary depth, which reach up to 6 mm difference. The control have higher figures than the patients do. The maxillary and the mandibular depth are less than control in both sexes, which means that the maxilla is retracted and the teeth had mal occlusion, which agree with Takriti et al [25] studies. Karakas et al reported figures that are similar, while Naimi et al reported higher figures. Present study show that both maxilla and mandible in thalassemia patients are receding, with more incidence in female.

In studying the nose width (al- al) in female patients are large than control and even larger than male. The nose width (al- al) in male, nose length (n- sn) and nasal tip protrusion (sn- prn) are smaller than control. The nasal width is slightly

narrower in both Karakas & Naimi studies, nearly equal nasal length, but the nasal tip protrusion is smaller than Karakas and larger than Naimi et al. The combination of low nasal height in thalassemia patients with decrease nasal tip protrusion; and receding maxilla, give the squirrel like appearance, compatible with Pakshir and Mina [26].

The eye measurements showed that the Biorbital width (ex-ex) is less in patients than control in both sexes, but it is not significant. The same for palpebral fissure length but it shows significance and less than Karakas and Naimi [1]. The Intercanthal distance (en-en) is wider in thalassemia patients and only significant in males, and higher than Naimi et al and Karakas et al.

The mouth width (ch- ch) is less than control, but it is not significant. Karakas S et al found lower mouth width than control. Naimi et al have higher figures but no significant difference than control (because of racial and geographical differences in Iran). Gupta et al. [27] show significant difference lower than control. The upper lip height (sn- sto) is longer in thalassemia patients, it is significant in females only, and females have a longer upper lip than male. Which agree with Naimi and Karakas with higher figures. The lower lip height (sto-ls), is longer than control and longer in male patients, but all are insignificant. Naimi et al [1], report less in control, but higher than present result

The ears width and ear length are less in β thalassemia patients. The ear width (pra- pa) is equal to Karakas et al series but the ear length (sa- sba) is much smaller than Karakas et al and Naimi et al. In the present study, we found that the males have longer ear, but females have wider ear. The variability of these craniofacial measures worldwide are multifactorial and may be due to race, ethnicity or geographical distribution, etc.

CONCLUSION:

Beta thalassemia show high prevalence in Basrah governorate, fortunately there is an early recognition of cases, and treatment started early in specialized center, with frequent blood transfusions. Early recognition decrease the stress on bone marrow with less hypertrophy of hematopoietic centers and less or mild deformity of facial bone complex.

The study showed facial variations when compared with normal, these quantitative changes of facial anatomy can offer a solid and helpful base for concerned doctors to interfere and manage thalassemia cases. The result of this study might be different from nearby countries like Turkey and Iran, due to racial and social, environmental differences between these different populations.

Conflicts of interest:

No conflict of interest

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