

A cephalometric study of antero-posterior skeletal jaw relationship in Nigerian Hausa-Fulani children

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Summary

Objective: To determine the antero-posterior skeletal jaw relationship in Hausa-Fulani children in Nigeria.

Setting: This study was carried out in 1998 at the Maxillo-facial unit of the Ahmadu Bello University Teaching Hospital, Kaduna, Nigeria.

Materials and methods: 100 subjects aged 11–13 years of Hausa-Fulani ancestry with no previous orthodontic treatment were selected for the study. Lateral cephalometric radiographs were traced and analysed to produce values for SNA, SNB and ANB.

Results: The mean SNA was 82.4° , mean SNB 80.3° and mean ANB 2.1° . The normal range of ANB values was $0.5^\circ - 4^\circ$.

Conclusion: The values obtained differ from those of other population groups and should be used as guidelines in the orthodontic treatment of the ethnic group studied.

Keywords: Cephalometry, Hausa-Fulani, Norms, Skeletal

Résumé

Introduction: Déterminer le rapport antéro-postérieur machoire squelettique chez des enfants Hausa-Fulani au Nigeria.

Etablissement: Cette étude hospitalier universitaire d'Ahmadu Bello, Kaduna, Nigeria.

Matériel et méthode: 100 sujets âgés de 11–13 ans d'ascendance Hausa-Fulani sans aucun traitement orthodontique précédent ont été choisis pour cette étude. La radiographie latérale céphalométrique a été remontée et analysée afin de fournir des valeurs pour SNA, SNB, et ANB.

Résultats: Le moyen SNB était 82.4° , moyen SNB 80.3° , et moyen ANB 2.1° . La tranche normale de valeurs ANB était $0.5^\circ - 4^\circ$.

Conclusion: Les valeurs obtenues sont différentes de celles des autres groupes de la population et devront être utilisées comme directive en matière du traitement orthodontique du groupe ethnique étudié.

Introduction

The use of the cephalometric radiograph in the clinical practice of orthodontics is well established. Clinically, it is of value in diagnosis and treatment. Since the advent of the cephalometric radiograph, several methods

of analyses have been used to show the normality of skeletal and dentofacial patterns.¹⁻³ An accurate evaluation of any orthodontic patient involves a comparison of the individual's cephalometric values with the norms of his or her own ethnic group. This is because cephalometric standards vary widely between ethnic groups.^{4,5} A large number of studies have been conducted to determine the skeletal and dentofacial relationships of Caucasians, black Americans, black Africans and other ethnic groups.^{1-3,6-11} However, in the literature, there is very little information on the antero-posterior skeletal relationships of Nigerians. The only sources of information are the works of Isiekwe,^{12,13} Durosinmi-Etti,¹⁴ and Ajayi.¹⁵ These studies of Nigerians were primarily on ethnic groups in the Southern part of Nigeria, a populous country with as many as 250 ethnic groups.

Nigeria, the most populous nation in black Africa, has an estimated population of 120 million people. Nigeria's ethnic populations have possible variations in their cephalometric values. These ethnic populations can broadly be classified along lines of majority groups; the Ibos in the South-East, Yoruba in the South-West, Hausa-Fulanis in the North and the minorities. The facial structures of members of these ethnic nationalities probably vary because of their historical antecedents. For example, the Fulanis who conquered the Hausas and became integrated with them into what is now referred to as the Hausa-Fulani tribe migrated from the North West of Africa (today's Senegal). This region had been inhabited by Berbers with Caucasian antecedent from the Mediterranean region. It is believed that a long period of intermarriage with these Berber traders is responsible for the more Caucasian facial structure among the Hausa-Fulani.¹⁶

The importance of establishing the skeletal jaw relationship, which this study sought, is heightened by the high prevalence of malocclusion among Hausa-Fulani children. daCosta¹⁷ reported that 87.8% of children in Northern Nigeria have one form of malocclusion or the other. It is, therefore, important that the prevailing skeletal pattern of the Hausa-Fulani tribe in Nigeria be determined in order to assist in diagnosis, treatment and teaching. This study was, therefore, designed to determine the distribution of the antero-posterior skeletal jaw relationship of Nigerian Hausa-Fulani children and to establish normal values for this study population. This investigation also compared the cephalometric values of the Hausa-

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Fulani children with those of the British (Eastman Standards) and other major Nigerian ethnic groups.

Materials and methods

The sample consisted of 100 volunteer Hausa-Fulani children attending secondary school in Kaduna, Nigeria. There were 65 females (65%) and 35 males (35%) and their ages ranged from 11-13 years. None of the subjects had received any orthodontic treatment and they were all Nigerians of Hausa-Fulani ancestry.

Before the study was conducted, ethical approval was sought and obtained from the Medical Advisory Committee of the Ahmadu Bello University Teaching Hospital, Kaduna. Standardized lateral cephalometric radiographs of all individuals were taken with a cephalostat at the Ahmadu Bello University Teaching Hospital, Kaduna, Nigeria. The cephalograms were then traced on matte finish acetate paper by identifying certain anatomic landmarks. From these tracings, the appropriate angles were measured. The anatomical landmarks traced are shown in figure 1 and defined thus: NASION (N) - The most anterior part of the frontonasal suture.

SELLA (S) - The centre of the sella turcica.

POINT A (A) - The deepest point in the midline between the anterior nasal spine and the alveolar crest.

POINT B (B) - The deepest point in the midline between the alveolar crest of the mandible and the mental process

Statistical analysis

The error analysis was carried out by tracing 25 of the cephalometric radiographs twice within an interval of 4 weeks. The method error was determined by applying Dahlberg's formula¹⁸:

$$\bar{O} = \sum d^2 / 2n$$

Where \bar{d} = Difference between the 1st and 2nd tracing, and n = sample size.

The method error for SNA was 1.28°, SNB 1.30° and ANB 0.69°. The systematic error of the replicate measurements was assessed using paired *t*-tests. There was no significant difference in the measurements.

EPI INFO 6 version 6 statistical software¹⁹ was used for data entry, editing and analysis. The Student's *T*-test was used for comparison of the mean cephalometric values for boys and girls. When comparing the results of the present study with those of previous ones, the Analysis of Variance Test (ANOVA) was used and the 'F' evaluated. Statistically significant difference was said to exist when the *P*-value was less than 0.05 (*P* < 0.05).

Results

The mean values for each measurement are illustrated according to gender in Table 1. There was no statistically significant difference between the males and females and this therefore allowed the combined data to be considered. The mean SNA, SNB and ANB for both sexes are 82.4°, 80.3°, and 2.1° respectively. These pooled means

Table 1 Comparison between Hausa - Fulani boys and girls.

Parameter	Boys (n=35)		Girls (n=65)		t	p-value
	Mean	SD	Mean	SD		
SNA (°)	81.9	3.35	82.6	3.60	0.94	0.34
SNB (°)	79.8	3.64	80.6	3.04	1.17	0.24
ANB (°)	2.3	2.66	2.0	2.97	0.50	0.62

Table 2 Comparison of cephalometric values of the British, Hausa - Fulanis, Yorubas and Ibos.

Parameter	Hausa-Fulanis		Eastman Standards		Yorubas		Ibos		F	p-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
SNA (°)	82.4	3.5	81	3	88.9	4.2	85.5	4.3	65.5	<0.001
SNB (°)	80.3	3.3	78	3	84.5	3.7	81.2	4.0	36.1	<0.001
ANB (°)	2.1	2.9	3	2	4.4	2.3	4.3	2.5	25.4	<0.001

Table 3 The frequency distribution of ANB values for Hausa-Fulani children.

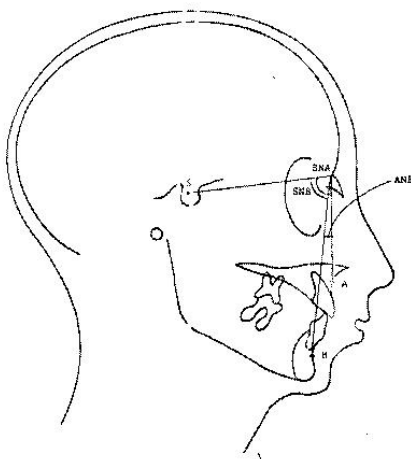
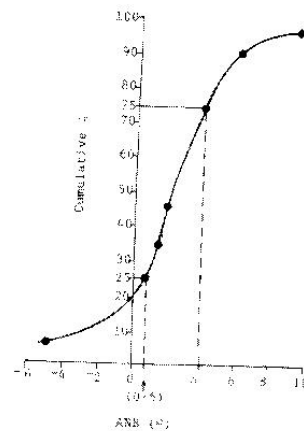
ANB ($^{\circ}$)	Frequency	Percentage Frequency	Cumulative Percentage
-5 to -3	6	6	6
-2 to 0	18	18	24
0.5 - 1	12	12	36
1.5 - 1	12	12	48
2.5 - 3	14	14	62
3.5 - 4	14	14	76
4.5 - 6	19	19	95
6.5 - 10	5	5	100
Total	100	100	

are illustrated in Table 2 and are compared with the British, Yoruba and Ibo norms.

The ANB values obtained are shown in Table 3 on cumulative frequency distribution tabulation and plotted in figure 2. The quartile values i.e 25 percentile and 75 percentile are obtained from figure 2 as 0.5 $^{\circ}$ and 4 $^{\circ}$ respectively.

Discussion

Worldwide, several studies have been conducted to determine cephalometric values for different racial and ethnic groups.⁶⁻¹¹ In Nigeria, there is limited information on the cephalometric values of the different ethnic groups. This study used Hausa - Fulani ancestry with no previous orthodontic treatment as its sole criteria for patient selection, a departure from most other cephalometric studies. In most of the literature on cephalometric values, occlusal status is the most frequently used criterion during

**Fig. 1** Cephalometric landmarks**Fig. 2** Percentage Cumulative frequency distribution of ANB values.

sample selection.²⁰⁻²² Because of the diverse definitions of the occlusal status as used by many authors, an element of bias is introduced as normative data based on these samples were not objectively determined but were based on subjectively selected samples.²³

The present study showed no statistically significant differences between Hausa-Fulani males and females for any cephalometric measurement. This is similar to previous findings for other ethnic groups.^{8,24} However, the study indicates that there are statistically significant differences in the identified values for the Hausa - Fulani, Yoruba, Ibo and the British. Whereas the values for the Hausa - Fulani are larger than that of the British, they are smaller than that of the Ibo and Yoruba.

The mean SNA and SNB angles (82.4 $^{\circ}$ and 80.3 $^{\circ}$) of the Hausa-Fulani as compared to the mean SNA and SNB angles (88.9 $^{\circ}$ and 84.4 $^{\circ}$) of the Yorubas¹⁴ and that (85.5 $^{\circ}$ and 81.2 $^{\circ}$) of the Ibos¹⁵ indicate that the dental bases of the Hausa-Fulani are positioned more posteriorly in relation to the anterior cranial base than those of the population from Southern Nigeria. This is similar to the observation of daCosta¹⁷ who noted the straight facial appearance of this ethnic group as viewed in profile when compared to the more protrusive profile common to indigenes of Southern Nigeria. In addition, the mean ANB angle of this study (2.1 $^{\circ}$) as compared to that of the Ibos (4.3 $^{\circ}$) and Yorubas (4.4 $^{\circ}$) suggests that children from Southern Nigeria tend to be more in the class 2 category than Hausa-Fulani children.

In contrast, however, the SNA and SNB (81 $^{\circ}$ and 78 $^{\circ}$) of the British indicate that the dental bases of the Hausa - Fulani are positioned more anteriorly in relation to the anterior cranial base than that of the British. Furthermore, the Hausa-Fulani have a smaller ANB value than the British. There is, however, greater dissimilarity between the values for the Hausa - Fulani and the Southern Nigerian children than between the Hausa-Fulani and Brit-

ish children. The findings of the present study are however not conclusive and this creates a need for further research including a detailed evaluation of the cranio-facial dimensions of the Hausa-Fulani.

From the present study, the normal range of ANB values for Hausa-Fulani children lies between 0.5° and 4° . Clinically, this implies that for this population, pre-normality or skeletal 3 is said to be present when the ANB angle is less than 0.5° and post normality or skeletal 2 present when the ANB is greater than 4° .

Conclusion

The cephalometric angular norms for the antero-posterior skeletal jaw relationship of Hausa-Fulani children in this study are SNA 82.4° , SNB 80.3° and ANB 2.1° . The normal range of ANB values are 0.5° - 4° . The findings from this study indicate that the dental bases of the Hausa – Fulani are more posteriorly positioned than those of their counterparts from Southern Nigeria. In addition, the angle ANB of the Hausa – Fulani suggests that their skeletal pattern is less in the class 2 category than that of the Southern population. In contrast, however, the dental bases of the Hausa-Fulani are more anteriorly positioned than that of the British. Therefore, orthodontic evaluation of the Hausa-Fulani should be done using their own cephalometric standards.

References

- Downs W B. Variations in facial relationship: Their significance in treatment and prognosis. *Am J Orthod* 1984; 34: 812 - 840
- Sassouni V. A roentgenographic cephalometric analysis of cephalo-facial-dental relationships. *Am J Orthod* 1955; 41:735 -764.
- Steiner C. Cephalometrics for you and me. *Am J Orthod* 1953; 39: 729 - 775
- Drummond R A. A determination of cephalometric norms for the Negro race. *Am J Orthod* 1968; 54:670 - 688.
- Richardson E R. Racial differences in the dimensional traits of the human face. *Angle Orthod* 1980; 50: 301 - 311.
- Anderson A A, Anderson A C, Hornbuckle A C, Hornbuckle K. Biologic derivation of a range of normal values for children of African-American descent (after Steiner). *Am J Orthod Dentofacial Orthop* 2000; 118, 1:90-100.
- Kapila S. Selected cephalometric angular norms in Kikuyu children. *Angle Orthod* 1989; 56, 2: 139-143.
- Chan G. A cephalometric appraisal of the Chinese (Cantonese). *Am J Orthod* 1972; 61, 3:279 -285.
- Haralabakis B, Spirou V, Kolokithas G. Dentofacial cephalometric analysis in adult Greeks with normal occlusion. *Eur J Orthod* 1983; 5: 241 -243.
- Nanda R. Nanda R. A cephalometric study of the dentofacial complex of North Indians. *Angle Orthod* 1969; 39: 22- 28.
- Hamdan A M, Rock W P. Cephalometric norms in an Arabic population *J Orthod* 2001; 28: 297 -300.
- Isiekwe M C. A distribution of antero-posterior skeletal jaw relationship in a Nigerian population. *Afri Dent J* 1987; 1: 23 -27.
- Isiekwe M C, Sowemimo G O A. Cephalometric findings in a normal Nigerian adult with unrepaired cleft. *Cleft Palate Journal* 1984; 214 -328.
- Durosinmi-Etti T. Cephalometric values of school children in Lagos. 1992, Thesis, submitted to the West African College of Surgeons.
- Ajayi E O. The cephalometric values of Ibo school children in Enugu. 2001, Thesis, submitted to the West African College of Surgeons.
- Ajayi J FA. A thousand years of West African history Ed. Espie, I: Ibadan, Nigeria., Ibadan University press, 1965, 52 -54.
- daCosta O O. An Epidemiological survey of malocclusion among children from Northern Nigeria. 1991, Thesis, submitted to the West African College of Surgeons.
- Dahlberg G. Statistical methods for medical and biological students. New York: Inter science publication, 1940.
- Dean A G, Dean J A, Coulombier D, Burton A H et al. Epi Info version 6. A word processing database and statistics program for public health on IBM - compatible micro-computers. 1995.
- Taylor W H, Hitchcock H P. The Alabama Analysis. *Am J Orthod* 1966; 52: 245 -256.
- Bishara S E. Longitudinal Cephalometric standards from 5 years to adulthood. *Am J Orthod* 1981; 79: 35 -44.
- McNamara J A Jr, Ellis E. Cephalometric analysis of untreated adults with ideal facial and occlusal relationships. *Int J Adult Orthod Orthog Surg* 1988; 3: 221 - 231.
- Hixon E H. The norm concept and cephalometrics. *Am J Orthod* 1956; 42: 898 - 906.
- Gaincity A A. Age and sex cephalometric norms. *Am J Orthod* 1970; 47: 497 -501.