Open Access Library Journal
2026, Volume 13, e14712
ISSN Online: 2333-9721
ISSN Print: 2333-9705

Cephalometric Standards in Two Sub-Saharan Populations Residents in Morocco: Hausa and Somali

Sanaa Alami, Asmaa El Mabrak, Zineb Safi-Eddine, Mahamadou Abdoulaye, Zineb Serhier, Farid Bourzgui

Orthodontics Department, Faculty of Dentistry, University Hassan II, Casablanca, Morocco
Email: safieddine.zineb@gmail.com

How to cite this paper: Alami, S., El Mabrak, A., Safi-Eddine, Z., Abdoulaye, M., Serhier, Z. and Bourzgui, F. (2026) Cephalometric Standards in Two Sub-Saharan Populations Residents in Morocco: Haussa and Somali. *Open Access Library Journal*, **13**: e14712.
https://doi.org/10.4236/oalib.1114712

Received: December 5, 2025
Accepted: March 23, 2026
Published: March 26, 2026

Abstract

Objective: The purpose of this study was to investigate cephalometric norms for two Sub-Saharan populations residing in Morocco the Hausa and Somali, and to compare these norms with those of Steiner and Tweed. **Method:** A total of 40 lateral cephalometric radiographs from Hausa and Somali students in Casablanca area, aged 18 to 32 years, with Class I dental occlusion and facial harmony, were analyzed. Twenty cephalometric variables, comprising 14 angular and 6 linear measurements, were calculated and compared with reference norms, as well as those of other Arab, Asian, and European populations, using the Z-test for statistical evaluation. **Results:** The Hausa population exhibited an advanced sagittal position of both the maxillary and mandibular skeletal bases, an increased vertical dimension, and a more pronounced vestibular version of the incisors compared to the reference norms. In contrast, the Somali population demonstrated a more retruded sagittal position of the maxillary and mandibular bases, an increased vertical dimension, and a greater buccal version of the incisors. **Conclusion:** These findings emphasize the distinct cephalometric features of the Hausa and Somali populations, which should be considered in orthodontic treatment planning to ensure more accurate and population-specific care.

Subject Areas

Dentistry

Keywords

Orthodontics, Craniofacial Morphology, Cephalometry, Hausa, Somali, Sub-Saharan Populations, Morocco, Reference Norms

1. Introduction

Cephalometric analysis is a method employed for the schematization, measurement, and examination of cephalic structures through radiographic reports [1]. Its applications are vast, spanning clinical and research contexts [2]. This method allows for the measurement and study of both normal and pathological variations in craniofacial development, often using reference values derived from populations of European, North American, and Australian descent [1] [3]. However, the validity of these reference norms for populations with different ethnic backgrounds, particularly African Sub-Saharan populations, has raised concerns [3]. The core issue lies in the use of "average values" that may not reflect the craniofacial diversity found in regions such as Sub-Saharan Africa, where unique ethnic and geographical factors influence craniofacial characteristics [4] [5].

The significance of this issue is highlighted by its direct influence on orthodontic diagnosis, treatment planning, and outcomes [1]. Cephalometric analysis is essential for diagnosing craniofacial abnormalities and evaluating the progress of orthodontic treatments [1] [2]. However, when orthodontic practitioners use Western reference norms for patients from diverse ethnic backgrounds, there is a risk of misdiagnosis, improper treatment planning, and subpar results [3]. This is especially concerning for Sub-Saharan populations, which possess distinct craniofacial features shaped by factors such as historical migration, ethnic diversity, and environmental influences [4]. The application of Caucasian-derived norms to these populations can lead to less effective care and treatment outcomes. Therefore, developing population-specific cephalometric norms for Sub-Saharan communities is critical for enhancing diagnostic accuracy and optimizing treatment approaches to better meet the needs of these populations.

Many researches have examined the limitations of using Caucasian-derived cephalometric norms for non-Caucasian populations [5]-[7]: They highlighted the discrepancies between the craniofacial characteristics of Sub-Saharan populations and the reference values commonly applied in clinical practice, and concluded that the direct transposition of Western norms to African populations, particularly those in Sub-Saharan Africa, is fraught with challenges. Despite these findings, the use of standardized Western norms persists among many orthodontists, suggesting a gap in the application of population-specific data in clinical practice. This ongoing reliance on generalized norms underscores the need for further research to develop accurate, region-specific reference values that can improve orthodontic diagnosis and treatment planning for Sub-Saharan populations.

This study aimed to contribute to exploring cephalometric norms for two Sub-Saharan populations residing in Morocco—the Hausa and Somali—and to compare these values with the standard norms defined in Steiner and Tweed analyses.

2. Methods

A cross-sectional study was performed in the dentofacial orthopedics and dental radiology department of the dental consultation and treatment center (CTDD) of Ibn Rochd University Hospital in Casablanca. We examined Hausa and Somali students enrolled in various public and private universities and schools in Casablanca area. The study population comprised 40 students selected from a total of approximately 100 surveyed, with 20 students from each ethnic group: 2 Hausa females and 18 Hausa males, as well as 10 Somali females and 10 Somali males, all aged between 18 and 32 years.

The participants were selected based on specific criteria and were recruited from multiple educational institutions in Casablanca. All radiographic examinations were carried out by the same technician at the dental radiology department of the Dental Treatment and Consultation Center of Casablanca (CCTD), using a Planmeca ProMax 3D Mid CBCT device, which allows the acquisition of 3D images, panoramic images, and digital cephalometric 2D and 3D photographs.

Eligibility Criteria

Inclusion criteria

- Students from the Hausa and Somali populations exhibiting facial harmony
- Students with a Class I canine and molar relationship
- Students with all permanent teeth present
- Students with dental crowding not exceeding 6 mm

Exclusion criteria

- Students wearing orthodontic appliances
- Students with a history of orthodontic treatment

For each participant, clinical examinations and radiographic imaging, including lateral cephalometric and panoramic X-rays, were performed. The radiographic images were systematically identified by placing tracing paper over the images and labeling them with the participant's unique identification number. Following this, cephalometric tracings were performed on a light box by a single experienced operator. The profile was consistently oriented to the right side of the operator. Using a mechanical pencil, the contours of the skeletal, dental, and soft tissue structures were traced as accurately as possible, ensuring a continuous, regular line. For bilateral structures that appeared doubled, the operator traced the structures with the least distortion, typically the left side. After the tracings were completed, notable points were identified, and the necessary lines, planes, and angles were drawn to facilitate analysis.

Data necessary for the study were collected using an evaluation form, which was divided into four sections: The first section facilitated patient identification via their administrative file number; the second section recorded the patient's gender, age, ethnic background, and country of origin; the third section documented the clinical examination findings; and the last section included the cephalometric analysis results, following the Steiner and Tweed analysis. 20 variables which involved the measurement of by a single experienced operator, including 14 angular and 6 linear parameters:

- <u>Skeletal Variables</u>: The quantitative variables included the SNA angle, SNB angle, ANB angle, SND angle, Occ/SN angle, GoGn/SN angle, and distances AoBo, Pog/NB, SE, and SL.

- Dento-alveolar Variables: These included the angle and distance I/NA, the angle and distance I/NB, and the I/i inclination angle.
- Soft Tissue Variables: The relationship of the lips to the S-line as defined by Steiner.
- Skeletal Variables: These included the FMA angle and the Occ/Fr angle.
- Dento-alveolar Variables: These included the FMIA angle and the IMPA angle.
- Soft Tissue Variables: The Z angle as defined by Tweed.

Informed consent was obtained from all selected participants for their involvement in the study and for the acquisition of radiographic images. Access to department was granted by the head of the department. The subject was submitted to and accepted by the commission of the College of Departments of the Faculty of Dentistry at Hassan II University in Casablanca, which acts as the ethics committee.

The statistical analysis was performed using the EPI Info 3.5.3.0 Fr software. To compare the means, the "Z test" was conducted. The difference between the two means was considered significant if the "Z" value exceeded 1.96 (with an estimated error risk α of 5%), and the level of significance was set at $p < 0.05$. The Fisher's Exact Test was used to determine the level of significance due to the chi-square value (χ^2) being less than 5. Fisher's Exact Test is appropriate when the sample size is small or when the expected frequency in any of the cells of a contingency table is less than 5, ensuring accurate results when the chi-square test conditions are not met.

3. Results

The average age of the entire study population was 23.2 ± 3.1962 years. Specifically, the average age of the Hausa population was 22.95 ± 3.2359 years, while the average age of the Somali population was 23.45 ± 3.2196 years. Among the 40 subjects participating in the study, the Hausa ethnic group consisted of 10% females and 90% males, whereas the Somali ethnic group was evenly distributed with 50% females and 50% males. The overall sample was composed of 30% females. Regarding the country of origin, our results revealed that 50% of the participants were from Niger, and 50% were from Djibouti.

The ethnic composition showed that, within the Hausa group, 15% were hyperdivergent, while 85% were normodivergent. Meanwhile, the Somali ethnic group included 55% hyperdivergent individuals and 45% normodivergent individuals.

As for the profile type according to Steiner's Esthetic S-Line, our study showed that 90% of the Ethnicity Hausa have a convex profile and 10% have a flat profile, while 95% of the Somali ethnic group have a convex profile and 5% have a flat profile (Table 1).

Table 2 presents the cephalometric characteristics of the Hausa and Somali ethnic groups, highlighting key skeletal, dentoalveolar, and soft tissue measurements.

Table 1. Demographic characteristics, and comparison of facial typology and profile type according to Steiner's esthetic s-line.

Ethnicity	Average age (years) M (SD)	Gender distribution	%	Hyperdivergent	Normodivergent	Convexe profile	Flat profile
Hausa (n = 20)	22.95 (3.2359)	2 Female 18 Male	10% 90%	3 (15%)	17 (85%)	18 (90%)	2 (10%)
Somali (n = 20)	23.45 (3.2196)	10 Female 10 Male	50% 50%	11 (55%)	9 (45%)	19 (95%)	1 (5%)
Total (N = 40)	23.2 (3.1962)	12 Female 28 Male	30% 70%	14 (35%)	26 (65%)	37 (92.5%)	3 (7.5%)

Table 2. Cephalometric chart of the Hausa and Somali ethnic group: Mean skeletal, dentoalveolar, and soft tissue measurements.

	Total (N = 40)	
Variables	Hausa (n = 20)	Somali (n = 20)
Sagittal Skeletal Measurements	M (SD)	M (SD)
SNA (˚)	86.2 (3.7)	79.7 (4)
SNB (˚)	82.1 (4.06)	77.2 (3.6)
SND (˚)	78.35 (3.8)	74.1 (3.5)
ANB (˚)	4.1 (1.8)	2.5 (2)
AoBo (mm)	2.1 (1.3)	2.7 (1.8)
Pog-Nb (mm)	1.1(1.1)	1 (0.9)
SL (mm)	40.7 (5.6)	33.9 (7.04)
SE (mm)	16.2 (2.4)	17.2 (3.4)
Vertical Skeletal Measurements	M (SD)	M (SD)
GoGn/SN (˚)	30.6 (5.5)	38.2 (8.1)
FMA (˚)	27.4 (7.2)	30.9 (7.5)
Dentoalveolar Measurements	M (SD)	M (SD)
I to I (˚)	114.1 (7.02)	109.7 (6.6)
I/Na (˚)	27.4 (4.8)	34.6 (5.03)
I/Na (mm)	4.5 (1.6)	7 (2.3)
I/NB (˚)	35.6 (4.6)	33.1 (5.2)
I/NB (mm)	6.2 (1.7)	6.7 (1.5)
Occ/SN (˚)	15.6 (6.3)	21.1 (4.1)
FMIA (˚)	53.4 (5.9)	52.7 (7)
IMPA (˚)	100.4 (5.05)	96.3 (5)
Occ/Fr (˚)	8.3 (3.4)	12.8 (6.5)
Soft Tissue Measurements	M (SD)	M (SD)
Angle Z (˚)	64.5 (6.9)	65.05 (7.6)

M. Mean; D. Standard deviation.

The Z test value, was used to compare the norms obtained from our study with the accepted norms of the Steiner analysis [8] [9]. For the Somali population, the difference between the means and Steiner's norms was not significant for the Pog/NB distance but was significant for the other variables (**Table 3**). The difference between the means of both the Hausa population and the Somali population with Tweed's norms [10] was significant for all variables (**Table 4**).

Table 3. Comparison of the mean values between Hausa and Somali populations and Steiner's norms.

Variables	Steiner (n = 20)	Hausa (n = 20)			Somali (n = 20)		
Sagittal Skeletal Measurements	M (SD)	M (SD)	Test Z	p value	M (SD)	Test Z	p value
SNA (˚)	82 (3.9)	86.2 (3.7)	5.08	$<10^{-4}$*	79.7 (4)	2.571	0.0187*
SNB (˚)	80 (3.6)	82.1 (4.06)	2.31	0.032*	77.2 (3.6)	3.478	0.0025*
SND (˚)	79	78.35 (3.8)	−0.76	0.457	74.1 (3.5)	6.261	$<10^{-4}$*
ANB (˚)	2 (1.8)	4.1 (1.8)	5.22	$<10^{-4}$*	2.5 (2)	1.565	0.1340
Pog-Nb (mm)	1.3 (1.5)	1.1(1.1)	−0.81	$<10^{-4}$*	1 (0.9)	1.491	0.1525
SL (mm)	51	40.7 (5.6)	−8.23	$<10^{-4}$*	33.9 (7.04)	10.863	$<10^{-4}$*
SE (mm)	22	16.2 (2.4)	−10.81	$<10^{-4}$*	17.2 (3.4)	6.314	$<10^{-4}$*
Vertical Skeletal Measurements	M (SD)	M (SD)	Test Z	p value	M (SD)	Test Z	p value
GoGn/SN (˚)	32 (4)	30.6 (5.5)	−1.14	0.268	38.2 (8.1)	3.423	0.0029*
Dentoalveolar Measurements		M (SD)	Test Z	p value	M (SD)	Test Z	p value
I to I (˚)	127 (10)	114.1 (7.02)	−8.22	$<10^{-4}$*	109.7 (6.6)	11.722	$<10^{-4}$*
I/Na (˚)	22	27.4 (4.8)	5.03	$<10^{-4}$*	34.6 (5.03)	11.203	$<10^{-4}$*
I/Na (mm)	4 (2.5)	4.5 (1.6)	1.40	0.178	7 (2.3)	5.833	$<10^{-4}$*
I/NB (˚)	25	35.6 (4.6)	10.31	$<10^{-4}$*	33.1 (5.2)	6.966	$<10^{-4}$*
I/NB (mm)	4 (2.5)	6.2 (1.7)	5.79	$<10^{-4}$*	6.7 (1.5)	8.050	$<10^{-4}$*
Occ/SN (˚)	14	15.6 (6.3)	1.14	0.27	21.1 (4.1)	7.744	$<10^{-4}$*

M. Mean; SD. Standard deviation; *Statistically significant.

Table 4. Comparison of the mean values between Hausa and Somali populations and tweed's norms.

Variables	Tweed (n = 45)	Hausa (n = 20)			Somali (n = 20)		
Sagittal Skeletal Measurements	M (SD)	M (SD)	Test Z	p value	M (SD)	Test Z	p value
AoBo (mm)	2	2.1 (1.3)	0.34	0.735	2.7 (1.8)	1.739	0.0982
Vertical Skeletal Measurements	M (SD)	M (SD)	Test Z	p value	M (SD)	Test Z	p value
FMA (˚)	25 (3)	27.4 (7.2)	1.491	0.152	30.9 (7.5)	3.518	0.002*
Dentoalveolar Measurements	M (SD)	M (SD)	Test Z	p value	M (SD)	Test Z	p value
FMIA (˚)	67 (3)	53.4 (5.9)	10.309	$<10^{-4}$*	52.7 (7)	9.136	$<10^{-4}$*
IMPA (˚)	88 (3)	100.4 (5.05)	10.981	$<10^{-4}$*	96.3 (5)	7.424	$<10^{-4}$*
Occ/Fr (˚)	10 (2)	8.3 (3.4)	2.236	0.038	12.8 (6.5)	1.926	0.069
Soft Tissue Measurements	M (SD)	M (SD)	Test Z	p value	M (SD)	Test Z	p value
Angle Z (˚)	75 (5)	64.5 (6.9)	6.805	$<10^{-4}$*	65.05 (7.6)	5.855	$<10^{-4}$*

M. Mean; SD. Standard deviation; *Statistically significant.

The difference between the mean values of the Somali and Hausa populations according to the Steiner variables is non-significant for the Pog/NB distance and the SE distance, while it is significant for the remaining variables.

The difference between the mean values of the Somali and Hausa populations according to the Tweed variables is non-significant for the Z angle, while it is significant for the other variables (Table 5).

Table 5. Comparison of mean cephalometric values between the Somali and Hausa populations.

Variables	Hausa (n = 20)	Somali (n = 20)		
Sagittal Skeletal Measurements	M (SD)	M (SD)	Test Z	p value
SNA (˚)	86.2 (3.7)	79.7 (4)	5.18	0
SNB (˚)	82.1 (4.06)	77.2 (3.6)	3.95	0.0003*
SND (˚)	78.35 (3.8)	74.1 (3.5)	3.66	0.0007*
ANB (˚)	4.1 (1.8)	2.5 (2)	2.29	0.027*
AoBo (mm)	2.1 (1.3)	2.7 (1.8)	1.28	0.2
Pog-Nb (mm)	1.1(1.1)	1 (0.9)	0.3	0.75
SL (mm)	40.7 (5.6)	33.9 (7.04)	3.37	0.0017*
SE (mm)	16.2 (2.4)	17.2 (3.4)	1	0.32
Vertical Skeletal Measurements	M (SD)	M (SD)	Test Z	p value
GoGn/SN (˚)	30.6 (5.5)	38.2 (8.1)	3.47	0.0013*
FMA (˚)	27.4 (7.2)	30.9 (7.5)	1.49	0.14
Dentoalveolar Measurements	M (SD)	M (SD)	Test Z	p value
I to I (˚)	114.1 (7.02)	109.7 (6.6)	2.01	0.05
I/Na (˚)	27.4 (4.8)	34.6 (5.03)	4.62	0
I/Na (mm)	4.5 (1.6)	7 (2.3)	3.86	0.0004
I/NB (˚)	35.6 (4.6)	33.1 (5.2)	1.58	0.12
I/NB (mm)	6.2 (1.7)	6.7 (1.5)	1.05	0.29
Occ/SN (˚)	15.6 (6.3)	21.1 (4.1)	3.21	0.002
FMIA (˚)	53.4 (5.9)	52.7 (7)	0.31	0.75
IMPA (˚)	100.4 (5.05)	96.3 (5)	2.58	0.013
Occ/Fr (˚)	8.3 (3.4)	12.8 (6.5)	8.06	0.004
Soft Tissue Measurements	M (SD)	M (SD)	Test Z	p value
Angle Z (˚)	64.5 (6.9)	65.05 (7.6)	0.21	0.82

M. Mean; SD. Standard deviation; *Statistically significant.

4. Discussion

The purpose of this study was to establish a set of normative reference values for two Sub-Saharan populations—the Hausa and Somali—residing in Morocco. By analyzing skeletal, dentoalveolar, and soft tissue measurements using the Steiner and Tweed methods, we aimed to identify the specific cephalometric characteristics of each group. This approach allowed us to develop a population-specific cephalometric chart that reflects the anatomical norms of the studied sample and may serve as a valuable diagnostic tool for clinicians working with individuals from these ethnic backgrounds.

In light of this study, it became apparent that applying cephalometric norms established for Caucasian populations to the Hausa and Somali populations was not appropriate. Several significant differences were found between the average values of the two populations and the Steiner and Tweed norms.

When comparing the two populations, the differences between the Somali and Hausa populations were generally insignificant for the Pog/NB and SE distances according to Steiner variables, and for the Z angle according to Tweed variables. However, differences for other variables were significant. Additionally, the study revealed notable differences in skeletal measurements: the Somali population exhibited a more retrusive maxillary position and a more sagittally retrusive mandibular position compared to the Hausa population, which had a more advanced maxillary and protruded mandibular position.

In comparison to existing literature, a study conducted by Ouédraogo *et al.* [5] aimed to establish cephalometric norms specific to an African population by using the Tweed-Merrifield craniofacial and aesthetic analysis. This retrospective cross-sectional study involved 84 lateral cephalograms, with an equal distribution of male and female participants aged between 11 and 21 years. The cephalometric measurements, including the SNA and ANB angles, were compared with the established norms for European populations. The study revealed several key characteristics distinct to the African population: the SNA angle averaged 84.94 ± 2.59, and the ANB angle was 4.88. The vertical dimension was consistent with general standards, but the mandibular incisor axis showed significant buccal tipping, with an IMPA angle of 95.97. Moreover, the study identified a closed Z angle, which is characteristic of a more prognathic profile. Both the maxilla and mandible were found to be protrusive relative to the cranial base, indicating a typical Ballard's Class II maxillary-mandibular relationship. The authors concluded that these distinct characteristics, including the pronounced alveolar biprotrusion, should be considered when planning orthodontic treatments for African populations, emphasizing the need to adjust Caucasian-derived cephalometric norms for this ethnic group.

Another study conducted by De Oliveira *et al.* [11] aimed to assess the craniofacial characteristics of African-Brazilian young adults with normal occlusion and bimaxillary protrusion, comparing these measurements to European-American standards as well as to the Steiner and Tweed norms. It included 43 African-Brazilian participants (28 males and 15 females, mean age 22.4 ± 3.4 years), and identified significant differences in dentoalveolar and cranial base measurements.

Notably, the African-Brazilian cohort demonstrated a reduced cranial base angle (SNAr = 119.87˚ ± 5.66˚), a shorter anterior cranial base length (SN-distance

= 68.63 ± 4.50 mm), and a more protruded maxilla (SNA = 88.51˚ ± 3.23˚) and mandible (SNB = 85.06˚ ± 3.24˚) in comparison to European-American cephalometric standards.

Similarly, Hashim *et al.* [6] investigated ethnic differences in Tweed's facial triangle, comparing Sudanese individuals with other major racial groups, including Caucasians, Black Africans, and East Asians. The sample consisted of 29 cephalometric radiographs from Sudanese individuals with normal occlusion, aged between 18 and 25 years. This study aimed to assess the variation in facial angles and establish whether these differences could inform more accurate orthodontic diagnoses. The results revealed significant differences in the facial angles, with the Sudanese population showing a more pronounced proclination of the lower incisors compared to other racial groups. Specifically, the study observed that Sudanese, as well as other African-descended and East Asian populations, exhibited greater incisor protrusion, a trait commonly associated with Tweed's facial triangle. These findings align with those of our study, and reinforce the importance of using ethnic-specific cephalometric norms in orthodontic practice.

To ensure the validity of our study, it was essential to minimize selection bias in the composition of our sample—an important step in establishing reliable cephalometric norms for the populations studied. For this reason, participants were selected based on well-defined, objective inclusion criteria such as the absence of previous orthodontic treatment, Class I occlusion, and no craniofacial anomalies.

Our sample focused specifically on Sub-Saharan students—namely, individuals of Hausa and Somali origin—living in Morocco and studying in Casablanca, allowing for a clearly delineated target population and meaningful ethnic comparison. All radiographic tracings and cephalometric measurements were performed by a single experienced operator following standardized procedures. This systematic and consistent approach not only reduced operator-related variability but also ensured precise identification of skeletal, dentoalveolar, and soft tissue landmarks. As a result, it enhanced the accuracy and comparability of our data, which is essential for a robust analysis of craniofacial relationships within the studied sample.

Furthermore, the use of uniform tracing techniques addressed one of the common challenges in cephalometric studies—variation in landmark identification. For example, anatomical points like the gonion can be located using differing methods, potentially impacting measurements. By maintaining a single, standardized protocol, our study avoided such inconsistencies, strengthening the reliability of the cephalometric norms established. Despite the strengths of our methodology, some limitations should be noted. The relatively small and specific sample—composed of students residing in Casablanca—may not fully represent the broader Hausa and Somali populations, potentially limiting the generalizability of our findings. Additionally, while facial harmony was evaluated clinically, it remains a subjective criterion, introducing potential examiner bias. The inherent constraints of two-dimensional radiography—such as projection errors, magnification, and overlapping structures—may also have affected measurement precision. Although landmark identification was standardized, variations in the definition of certain points like the gonion remain a common issue in cephalometric research.

5. Conclusions

This study delineated the craniofacial characteristics of the Somali and Hausa populations residing in Morocco, revealing significant differences when compared to established Caucasian cephalometric standards, namely those of Steiner and Tweed.

The observed discrepancies highlight the limitations of applying Caucasian-derived reference values to Sub-Saharan African populations and emphasize the need for the development of specific, population-based cephalometric norms.

Our findings advocate for the incorporation of ethnic variations in the formulation of diagnostic and treatment protocols in orthodontics and craniofacial surgery. These results not only contributed to a more accurate understanding of the craniofacial morphology of these populations but also underscored the importance of personalized care.

Future studies should focus on further refining these cephalometric standards and exploring additional ethnic groups, thereby advancing the precision and efficacy of orthodontic and surgical interventions in diverse populations.

Author Contributions

All authors contributed to this research.

Informed Consent Statement/Ethics Approval

Verbal informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

Conflicts of Interest

All authors declare that they have no conflicts of interest.

References

[1] Jha, M.S. (2021) Cephalometric Evaluation Based on Steiner's Analysis on Adults of Bihar. *Journal of Pharmacy and Bioallied Sciences*, **13**, S1360-S1364. https://doi.org/10.4103/jpbs.jpbs_172_21

[2] Suhail, S., Harris, K., Sinha, G., Schmidt, M., Durgekar, S., Mehta, S., *et al.* (2022) Learning Cephalometric Landmarks for Diagnostic Features Using Regression Trees. *Bioengineering*, **9**, Article 617. https://doi.org/10.3390/bioengineering9110617

[3] Ousehal, L., Lazrak, L. and Chafii, A. (2012) Cephalometric Norms for a Moroccan Population. *International Orthodontics*, **10**, 122-134. https://doi.org/10.1016/j.ortho.2011.12.001

[4] Ajayi, E.O. (2005) Cephalometric Norms of Nigerian Children. *American Journal of Orthodontics and Dentofacial Orthopedics*, **128**, 653-656. https://doi.org/10.1016/j.ajodo.2005.07.002

[5] Ouédraogo, Y., Benyahia, H., Diouf, J.S., Camara, T., Bationo, R. and Ngom, P.I. (2019) Cephalometric Norms of a Burkina Faso Population. *International Orthodontics*, **17**, 136-142. https://doi.org/10.1016/j.ortho.2019.01.002

[6] Hashim, H.A., Gsouma, I., Ahmed, S.S. and Hashim, M.H. (2023) Cephalometric Norms in Sudanese Sample: A Pilot Study. *European Journal of Medical and Health Sciences*, **5**, 20-24. https://doi.org/10.24018/ejmed.2023.5.2.1646

[7] Salinas, C.A., Liu, A. and Sharaf, B.A. (2023) Facial Morphometrics in Black Celebrities: Contemporary Facial Analysis Using an Artificial Intelligence Platform. *Journal of Clinical Medicine*, **12**, Article 4499. https://doi.org/10.3390/jcm12134499

[8] Steiner, C.C. (1953) Cephalometrics for You and Me. *American Journal of Orthodontics*, **39**, 729-755. https://doi.org/10.1016/0002-9416(53)90082-7

[9] Steiner, C.C. (1959) Cephalometrics in Clinical Practice. *The Angle Orthodontist*, **29**, Article 1959.

[10] Tweed, C.H. (1946) The Frankfort-Mandibular Plane Angle in Orthodontic Diagnosis, Classification, Treatment Planning, and Prognosis. *American Journal of Orthodontics and Oral Surgery*, **32**, 175-230. https://doi.org/10.1016/0096-6347(46)90001-4

[11] De Oliveira, T.C.P., De Mendonça Copello, F., De Carvalho Crusoé Silva, I.M., Nojima, L.I. and Da Cunha Gonçalves Nojima, M. (2021) Dentofacial and Skeletal Pattern in African Descendants from Southeastern Brazil: Clinical Prospective Study. *Dental Press Journal of Orthodontics*, **26**, e2119288. https://doi.org/10.1590/2177-6709.26.3.e2119288.oar