

CEPHALOMETRIC STUDY OF MOUTH MORPHOLOGY AMONG MAJOR NIGERIAN TRIBES

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ABSTRACT

We tested the hypothesis that Nigerians of the three major tribes of Yoruba, Hausa and Igbo are of similar cephalometric parameters (morphological patterns) of the lips and mouth. 300 subjects were selected from each of Hausa, Igbo or Yoruba tribe. A total of nine hundred (900) randomly selected volunteered subjects aged 18 – 30 years (450 males and 450 females) who were of Hausa, Igbo or Yoruba tribe by both parent and grandparents were, therefore, used in the study. Cephalometric parameters measured include: width of the philtrum, width of the mouth (length of the labial fissure), height of the upper lip, height of the cutaneous upper lip, height of the cutaneous lower lip, height of the lower lip, depth of the body of mandible and the vermilion heights of upper and lower lips. The statistical significance of the differences between the tribes was determined by using the student's t-test at $p \leq 0.05$. No statistically significant differences exist between the cephalometric parameters of the tribes studied. Our findings are, therefore, consistent with the stated hypothesis.

Key words: Mouth, Morphology, Anthropometry

INTRODUCTION

The introduction of anthropometric methods into clinical practice to quantify changes in the craniofacial framework led to the discovery of features distinguishing various ethnic groups and races. Normative facial data are, therefore, indispensable tools for the precise determination of the degree of deviations from the normal; and for facial surgical reconstructions, evolutionary analyses, facial aesthetics, design of safety eyes equipment and correctional tools, civil and criminal identification purposes. (Farkas, 1994; Farkas et al., 2005; Akinlolu et al., 2010)

Nigeria according to the official records of her National Population Commission (NPC) has a population of over one hundred and forty million in 2006 (National Population Commission, 2006) and a projected population of the country was one hundred and sixty eight million in 2012. Nigeria is the most populous black nation in the world; and studies carried out using Nigerian subjects will be of great relevance to academic,

security and healthcare personnel across the world.

The mouth is a major component of the face, which is the best feature that distinguishes an individual. Cephalometric measurements of the mouth have, therefore, been established to be of great relevance to the identification of gender and population differences. (Porter and Olson, 2001; Kyle et al., 2004; Porter, 2004; Farkas et al., 2005; Ngeow and Aljunid, 2009; Zhuang et al., 2010). We are not aware through literature review of any previous study which evaluated mouth morphometry in Nigerians of the three major tribes of Hausa, Igbo and Yoruba. We, therefore, tested the hypothesis that Nigerians sexes of the three major tribes of Hausa, Igbo and Yoruba are of similar cephalometric parameters (morphological patterns) of the lips and mouth in order to identify gender and population differences in Nigerians.

METHODOLOGY

The purposive technique or judgement sampling method of research (Bachetti et al., 2011) was used in this study. A reliability study was first conducted by the administration of the vernier caliper (Tresna Limited, Tokyo, Japan) to a representative sample comprising of 20 individuals of Sango Area in Ilorin, who did not form part of the final respondents. The data collected on four different occasions were analyzed item by item (and correlated by means of Pearson product moment correlation) to eliminate ambiguity. Having obtained satisfactory results, the vernier caliper was certified as the instrument for the study.

Thereafter, 300 subjects aged 18 – 30 years (150 males and 150 females) were randomly selected from each of the tribes of Hausa, Igbo and Yoruba. All subjects were of any of the three major tribes of Nigeria (Hausa, Igbo, and Yoruba) by both parent and grandparents. Furthermore, all subjects were students of tertiary institutions of Nigeria viz: the University of Ilorin, Ilorin, Kwara State; Kwara State Polytechnic, Ilorin, Kwara State; Kwara State College of Education, Ilorin, Kwara State and Lagos State University, Lagos State. Ethical approval was obtained from the Faculty of Basic Sciences, University of Ilorin and the study was conducted ethically in accordance with global standards. Informed written consent of each individual used in the study was sought and received before initiating the process of taking measurements.

Heads of subjects were brought into the Frankfurt horizontal plane, which passes through the two orbital points and poria. (Farkas, 1994; Keith and Arthur, 1999; Farkas et al., 2005) Subjects stood upright while looking into the far distance and their heads were ensured to be at resting positions (in a relaxed comfortable condition and in anatomical position) while measurements on the head were taken. The measured cephalometric parameters are as detailed below:

Cephalometric Parameters Measured on the Horizontal Plane:

1. Width of the philtrum or crista philtri (cph – cph): The distance above the vermilion line between the elevated margins of the philtrum.

(Figure 1). (Farkas, 1994; Porter, 2004; Farkas et al., 2005).

2. Width of the mouth or length of the labial fissure (ch - ch). The distance between the cheilions of the closed mouth. (Figure 2). (Farkas, 1994; Porter, 2004; Farkas et al., 2005).

Cephalometric Parameters Measured on the Perpendicular Plane:

3. Height of upper lip (sn - sto): The height of the upper lip between the subnasale and the stomion. (Figure 3). (Farkas, 1994; Porter, 2004; Farkas et al., 2005).
4. Height of cutaneous upper lip (sn – ls): The length of the cutaneous area between the subnasale and the labiale superius. (Figure 3). (Farkas, 1994; Porter, 2004; Farkas et al., 2005).
5. Height of cutaneous lower lip (li – sl): The height of the skin portion of the lower lip between the labiale inferius and the sublabiale. (Figure 3). (Farkas, 1994; Porter, 2004; Farkas et al., 2005).
6. Height of the lower lip (sto-sl.): The distance between the stomion and the sublabiale. (Figure 3). (Farkas, 1994; Porter, 2004; Farkas et al., 2005).
7. Vermillion Height of upper lip (ls-sto): The thickness of the vermilion in the facial midline between the labiale superius and the stomion. (Figure 4). (Farkas, 1994; Porter, 2004; Farkas et al., 2005).
8. Vermillion Height of lower lip (sto-li): The thickness of the vermilion in the facial midline between the stomion and the labiale inferius. (Figure 4). (Farkas, 1994; Porter, 2004; Farkas et al., 2005).
9. Depth of the body of mandible (go-gn): The distance between the gonion and the gnathion. (Figure 5). (Farkas, 1994; Porter, 2004; Farkas et al., 2005).

Statistical Analyses:

Data collected from all respondents were computed and analyzed using the statistical software program SPSS 15. Comparison of means was made using students' t- test method and the alpha value (α) for the test of significance was set at $p < 0.05$.¹

RESULTS

Comparisons of the mean values of cephalometric parameters between males and females of each of Yoruba, Hausa and Igbo tribes.

Statistical comparisons of mean values of measured parameters in Yorubas viz: the width of the mandible (go-gn) (11.48 in males and 11.05 in females), width of the mouth (ch-ch) (53.00 in males and 49.90 in females), width of the philtrum (cph-cph) (8.80 in males and 6.30 in females), height of the upper lip (sn-sto) (21.90 in males and 19.40 in females), vermilion height of the upper lip (ls-sto) (9.80 in males and 8.20 in females), height of the lower lip (sto-sl) (10.60 in males and 9.20 in females), height of the cutaneous upper lip (sn-ls) (11.10 in males and 9.20 in females) and height of the cutaneous lower lip (li-sl) (2.40 in males and 1.90 in females) showed non-significant higher mean values ($p > 0.05$) in males when compared to their female counterparts. However, non-statistically significant lower mean value ($p > 0.05$) of vermilion height of the lower lip (sto-li) (8.60 in males and 11.00 in females) was observed in Yoruba males when compared to the females. (Tables 1 and 2).

Comparative analyses of the mean values of the width of the philtrum (cph-cph) (60.0 in males and 49.80 in females) showed a statistically significant higher mean value ($p < 0.05$) in Hausa males when compared to females. Evaluations of mean values of measured parameters in Hausas viz: the width of the mandible (go-gn) (11.27 in males and 11.04 in females), height of the upper lip (sn-sto) (21.20 in males and 19.60 in females), height of the lower lip (sto-sl) (10.60 in males and 9.30 in females), height of the cutaneous upper lip (sn-ls) (11.00 in males and 8.80 in females) and height of the cutaneous lower lip (li-sl) (1.80 in males and 1.70 in females) showed non-significant higher mean values ($p > 0.05$) in males when compared to females. However, non-statistically significant lower mean values ($p > 0.05$) of width of the mouth (ch-ch) (49.50 in males and 49.80 in females), vermilion height of the upper lip (ls-sto) (8.10 in males and 9.30 in females) and vermilion height of the lower lip

(sto-li) (9.10 in males and 10.30 in females) were observed in Hausa males when compared to the females. (Tables 1 and 2).

In Igbos, statistical comparisons of mean values of measured parameters viz: width of the mouth (ch-ch), width of the mandible (go-gn) (11.46 in males and 10.94 in females), width of the philtrum (cph-cph) (8.80 in males and 6.60 in females), height of the lower lip (sto-sl) (10.80 in males and 8.90 in females) and height of the cutaneous upper lip (sn-ls) (10.90 in males and 9.50 in females) showed non-significant higher mean values ($p > 0.05$) in males when compared to their female counterparts. Furthermore, comparisons of mean values of the height of the upper lip (sn-sto) (21.80 in males and 13.70 in females) and height of the cutaneous lower lip (li-sl) (2.20 in males and 1.60 in females) showed statistically significant higher mean values ($p < 0.05$) in males when compared to females. However, non-statistically significant lower mean values ($p > 0.05$) of vermilion height of the upper lip (ls-sto) (8.20 in males and 9.20 in females) and vermilion height of the lower lip (sto-li) (8.90 in males and 11.40 in females) were observed in Igbo males when compared to the females. (Tables 1 and 2).

Comparisons of the mean values of cephalometric parameters of males in Yoruba, Hausa and Igbo tribes.

Yoruba males had statistically non-significant higher mean values ($p > 0.05$) of the width of the mandible (go-gn) (11.48 in Yorubas and 11.27 in Hausas), width of the mouth (ch-ch) (53.00 in Yorubas and 49.50 in Hausas), width of the philtrum (cph-cph) (8.80 in Yorubas and 6.00 in Hausas), height of the upper lip (sn-sto) (21.90 in Yorubas and 21.20 in Hausas), vermilion height of the upper lip (ls-sto) (9.20 in Yorubas and 8.10 in Hausas), height of the lower lip (sto-sl) (10.60 in Yorubas and 10.20 in Hausas) and height of the cutaneous lower lip (li-sl) (2.40 in Yorubas and 1.80 in Hausas); non-statistically significant lower mean value ($p > 0.05$) of the vermilion height of the lower lip (sto-li) (8.60 in Yorubas and 9.10 in Hausas); and no statistically significant differences of the mean values

($p > 0.05$) of the height of the cutaneous upper lip (sn-ls) (11.10 in Yorubas and 11.00 in Hausas) when compared to Hausa males. (Tables 1 and 2).

Furthermore, Yoruba males had non-statistically significant higher mean values ($p > 0.05$) of the vermilion height of the upper lip (ls-sto) (9.20 in Yorubas and 8.20 in Igbos), height of the cutaneous upper lip (sn-ls) (11.10 in Yorubas and 10.90 in Igbos) and height of the cutaneous lower lip (li-sl) (2.40 in Yorubas and 2.20 in Igbos); non-statistically significant lower mean values ($p > 0.05$) of the width of the mouth (ch-ch) (53.00 in Yorubas and 54.00 in Igbos), vermilion height of the lower lip (sto-li) (8.60 in Yorubas and 8.90 in Igbos) and height of the lower lip (sto-sl) (10.60 in Yorubas and 10.80 in Igbos); no statistically significant differences of mean values ($p > 0.05$) of the width of the philtrum (cph-cph) (8.80 in Yorubas and 8.80 in Igbos), width of the mandible (go-gn) (11.48 in Yorubas and 11.46 in Igbos) and height of the upper lip (sn-sto) (21.90 in Yorubas and 21.80 in Igbos) when compared to Igbo males. (Tables 1 and 2).

Hausa males had statistically significant higher mean value ($p < 0.05$) of the width of the mouth (ch-ch) (54.30 in Hausas and 49.50 in Igbos); non-significant higher mean value ($p > 0.05$) of the vermilion height of the lower lip (sto-li) (9.10 in Hausas and 8.90 in Igbos), non-statistically significant lower mean values ($p > 0.05$) of the width of the mandible (go-gn) (11.27 in Yorubas and 11.46 in Igbos), width of the philtrum (cph-cph) (6.00 in Hausas and 8.80 in Igbos), height of the upper lip (sn-sto) (21.80 in Hausas and 21.90 in Igbos), height of the lower lip (sto-sl) (10.80 in Hausas and 10.90 in Igbos) and height of the cutaneous lower lip (li-sl) (1.80 in Hausas and 2.20 in Igbos); and no statistically significant differences of mean values ($p > 0.05$) of the vermilion height of the upper lip (ls-sto) (8.10 in Hausas and 8.20 in Igbos) and height of the cutaneous upper lip (sn-ls) (11.00 in Hausas and 10.90 in Igbos) when compared to Igbo males. (Tables 1 and 2).

Comparisons of the mean values of cephalometric parameters of females in Yoruba, Hausa and Igbo tribes.

Yoruba females had statistically non-significant higher mean values ($p > 0.05$) of the width of the philtrum (cph-cph) (6.30 in Yorubas and 6.10 in Hausas), vermilion height of the lower lip (sto-li) (11.00 in Yorubas and 10.30 in Hausas) and height of the cutaneous lower lip (li-sl) (1.90 in Yorubas and 1.70 in Hausas); non-statistically significant lower mean values ($p > 0.05$) of the height of the upper lip (sn-sto) (19.40 in Yorubas and 19.60 in Hausas) and vermilion height of the upper lip (ls-sto) (8.90 in Yorubas and 9.30 in Hausas); and no statistically significant differences of mean values ($p > 0.05$) of the width of the mandible (go-gn) (11.05 in Yorubas and 11.04 in Hausas), width of the mouth (ch-ch) (49.90 in Yorubas and 49.80 in Hausas), height of the lower lip (sto-sl) (9.20 in Yorubas and 9.30 in Hausas) and height of the cutaneous upper lip (sn-ls) (8.80 in Yorubas and 8.80 in Hausas) when compared to Hausa females. (Tables 1 and 2).

In addition, Yoruba females had statistically significant higher mean value ($p < 0.05$) of the height of the upper lip (sn-sto) (19.40 in Yorubas and 13.70 in Igbos); non-statistically significant higher mean values ($p > 0.05$) of the width of the mandible (go-gn) (11.05 in Yorubas and 10.94 in Igbos), height of the lower lip (sto-sl) (9.20 in Yorubas and 8.90 in Igbos) and height of the cutaneous lower lip (li-sl) (1.90 in Yorubas and 1.60 in Igbos); and statistically non-significant lower mean values ($p > 0.05$) of the vermilion height of the upper lip (ls-sto) (8.90 in Yorubas and 9.20 in Igbos), width of the mouth (ch-ch) (49.90 in Yorubas and 50.50 in Igbos), vermilion height of the lower lip (sto-li) (11.00 in Yorubas and 11.40 in Igbos) width of the philtrum (cph-cph) (6.30 in Yorubas and 6.60 in Igbos) and height of the cutaneous upper lip (sn-ls) (8.80 in Yorubas and 9.50 in Igbos) when compared to Igbo females. (Tables 1 and 2).

Hausa females had statistically significant higher mean value ($p < 0.05$) of the height of the upper lip (sn-sto) (19.60 in Hausas and 13.70 in Igbos); statistically non-significant higher mean values ($p > 0.05$) of the width of the mandible (go-gn) (11.04 in Hausas and 10.94 in Igbos) and height of the lower lip (sto-sl) (9.30 in Hausas and 8.90 in Igbos); non-statistically significant

lower mean values ($p>0.05$) of the width of the mouth (ch-ch) (49.80 in Hausas and 50.50 in Igbos), width of the philtrum (cph-cph) (6.10 in Hausas and 6.60 in Igbos), vermilion height of the lower lip (sto-li) (10.30 in Hausas and 11.40 in Igbos) and height of the cutaneous upper lip (sn-ls) (8.80 in Hausas and 9.50 in Igbos); and

no statistically significant differences of mean values ($p>0.05$) of the vermilion height of the upper lip (ls-sto) (9.30 in Hausas and 9.20 in Igbos) and height of the cutaneous lower lip (li-sl) (1.70 in Hausas and 1.60 in Igbos) when compared to Igbo females. (Tables 1 and 2).

Table 1: Mean, standard error of mean, variance and standard deviation of cephalometric parameters of the lips and mouth in males of Yoruba, Hausa and Igbo in centimetres.

C.P	Yoruba				Hausa				Igbo			
	X	SEM	Varia	S.D	X	SEM	Varia	S.D	X	SEM	Varia	S.D.
go-gn	*11.48	0.03	0.15	0.38	*11.27	0.02	0.09	0.30	*11.46	0.03	0.16	0.40
ch-ch	*53.00	0.13	2.54	1.59	*49.50	0.04	0.20	0.44	*54.30	0.20	0.06	0.25
cph-cph	*8.80	0.18	0.01	0.10	*6.00	0.07	0.07	0.08	*8.80	0.01	0.02	0.13
sn-sto	*21.90	0.01	0.01	0.12	*21.20	0.08	0.09	0.10	*21.80	0.01	0.01	0.10
ls-sto	*9.20	0.02	0.06	0.24	*8.10	0.06	0.047	0.07	*8.20	0.06	0.01	0.08
sto-li	*8.60	0.05	0.04	0.06	*9.10	0.06	0.05	0.07	*8.90	0.07	0.01	0.09
sto-sl	*10.60	0.07	0.07	0.09	*10.20	0.02	0.02	1.12	*10.8	0.07	0.01	0.09
sn-ls	*11.10	0.07	0.09	1.10	*11.00	1.01	1.02	1.12	*10.90	0.01	0.03	0.16
li-sl	*2.40	0.05	0.06	0.18	*1.80	0.06	0.05	0.07	*2.20	0.04	0.03	0.05

$p<0.05$ = student's t-test, C.P. = Cephalometric parameters, X = Mean, Varia = Variance, SEM = Standard Error of Mean of 150 determinations, S.D. = Standard Deviations.

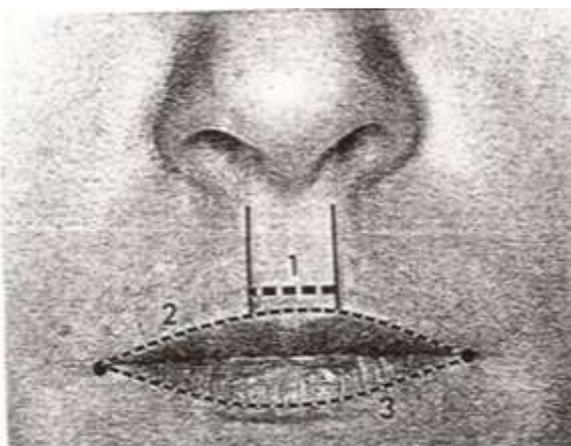


Figure 1: 1 = width of the philtrum (cph-cph). (Farkas, 1994; Porter, 2004; Farkas et al., 2005).

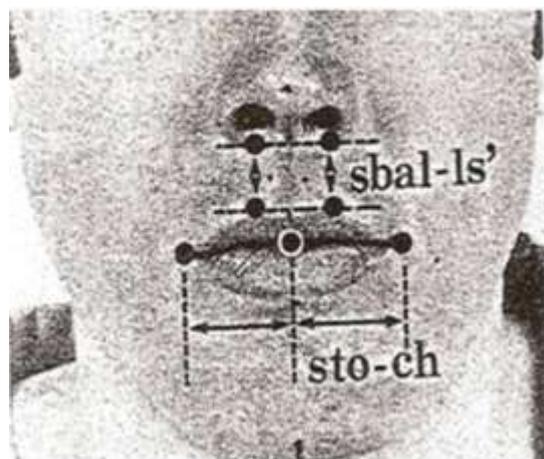


Figure 2: Width of the mouth (ch-ch); half of the labial fissure (ch-sto); and the lateral upper lip height (sbal-ls). (Farkas, 1994; Porter, 2004; Farkas et al., 2005). ch-ch was measured in this study.

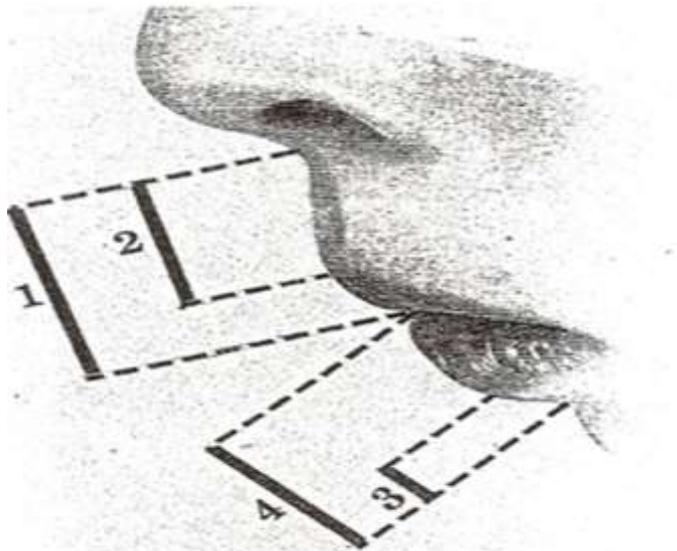


Figure 3: Perpendicular measurements of the lips: 1 = upper lip height (sn-sto); 2 = height of the skin of the portion of the upper lip (sn-ls); 3 = height of the skin of the portion of the lower lip (li-sl); 4 = lower lip height (sto-sl). (Farkas, 1994; Porter, 2004; Farkas et al., 2005; Akinlolu et al., 2010).

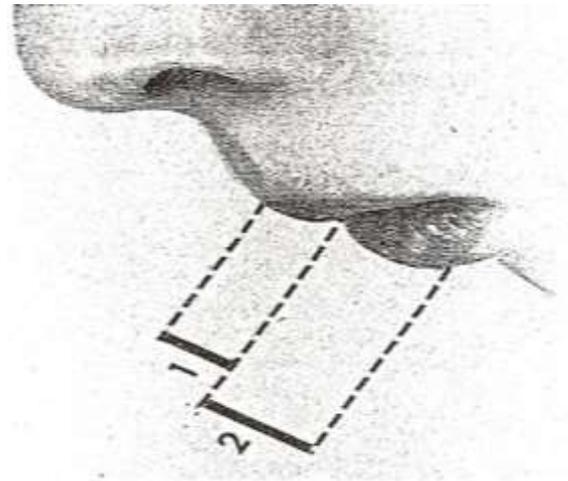


Figure 4: Vermilion heights: 1 = of the upper of the lip (ls-sto); 2 = of the lower lip (sto-li). (Farkas, 1994; Porter, 2004; Farkas et al., 2005).

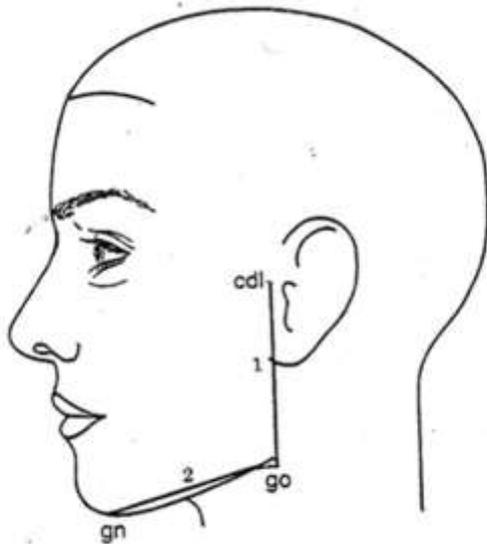


Figure 5: Measurements of the mandible: height of the ramus (go-cdl); 2. depth of the mandible (go-gn). (Farkas, 1994; Porter, 2004; Farkas et al., 2005). go-gn was measured in this study.

Table 2: Mean, standard error of mean, variance and standard deviation of cephalometric parameters of the lips and mouth in females of Yoruba, Hausa and Igbo in centimetres.

C.P.	Yoruba				Hausa				Igbo			
	X	SEM	Varia	S.D	X	SEM	Varia	S.D	X	SEM	Varia	S.D
go-gn	*11.05	0.04	0.28	0.53	*11.04	0.03	0.08	0.28	*10.94	0.05	0.24	0.49
ch-ch	*49.90	0.02	0.06	0.25	*49.80	0.02	0.02	0.14	*5.05	0.02	0.04	0.21
cph-cph	*6.30	0.08	0.01	0.10	*6.10	0.01	0.01	0.10	*6.60	0.01	0.02	0.13
sn-sto	*19.40	0.01	0.02	0.13	*19.6	0.01	0.01	0.11	*13.70	0.07	0.48	0.70
ls-sto	*8.90	0.01	0.03	0.16	*9.30	0.08	0.05	0.07	*9.20	0.07	0.06	0.08
sto-li	*11.00	0.01	0.013	0.12	*10.3	0.08	0.08	0.09	*1.14	0.07	0.05	0.07
sto-sl	*9.20	0.06	0.06	0.08	*9.30	0.08	0.05	0.07	*8.90	0.08	0.06	0.08
sn-ls	*8.80	0.09	0.01	0.11	*0.88	0.13	0.14	0.12	*0.95	0.01	0.01	0.12
li-sl	*1.90	0.05	0.05	0.07	*0.17	0.07	0.04	0.06	*1.60	0.05	0.03	5.60

$p < 0.05$ = student's t-test, C.P. = Cephalometric parameters, X = Mean, Varia = Variance, SEM = Standard Error of Mean of 150 determinations, S.D. = Standard Deviations.

DISCUSSION

We investigated variations in anthropometric parameters of mouth morphology among the three major tribes in Nigeria viz: Yoruba, Hausa and Igbo. Comparative analyses showed sexual dimorphism with higher non-statistically significant mean values ($p > 0.05$) in 89% of measured parameters in males when compared with the females of each of Hausa, Igbo or Yoruba tribe. However, 11% of measured parameters (width of the philtrum) showed a statistically significant higher mean value ($p < 0.05$) in Hausa males than females. Similarly, females of Hausa, Igbo and Yoruba tribes had statistically non-significant higher mean values ($p > 0.05$) of the vermilion height of

lower lip (11% of measured parameters) than males. (Tables 1 and 2).

Our observation clearly showed that males differ from females in facial appearances and features. This finding is in agreement with previous studies which reported sexual dimorphism with higher non-statistically significant mean values ($p > 0.05$) of evaluated cephalometric parameters in males when compared to their female counterparts in Binis of South-South region of Nigeria (Omotoso et al., 2011) and in North American Whites. (Farkas et al., 2005). Furthermore, the observed lower mean values of cephalometric parameters in females when compared to males is in agreement

with established anatomical principle that females have smaller crania with shorter facial features than males. (Keith and Arthur, 1999). The lower mean values of cephalometric parameters in females have also been positively associated with improved facial beauty in females compared to males. (Raymond et al., 2006).

Results showed that Yoruba males generally had statistically non-significant higher mean values ($p > 0.05$) than their Hausa and Igbo counterparts in 22.22% of measured parameters. (Tables 1 and 2). Hausa males had the lowest statistically non-significant mean values ($p > 0.05$) in 55.55% of measured parameters when compared to Igbo and Yoruba males. (Tables 1 and 2). However, 44.44% of measured parameters (height of the cutaneous upper lip, width of the philtrum, height of the lower lip and height of the upper lip) showed no statistically significant differences ($p > 0.05$) amongst the three tribes of Hausa, Yoruba and Igbo males. (Tables 1 and 2). 88.89% of measured parameters showed statistically non-significant differences ($p > 0.05$) amongst Hausa, Igbo and Yoruba females except in the mean values of vermilion height of upper lip (11.11% of measured parameters) with the Yorubas having statistically significant higher mean values ($p < 0.05$) than Igbo females. (Tables 1 and 2). The observed similarities in mean values of measured cephalometric parameters in Hausas, Igbos and Yorubas confirmed that Nigerians belong to the Negroid classification of head shape characterized by short mesocephalic skull, receded zygomas, wide nasal apertures, broad and tall upper faces with inferiorly positioned nasal regions. (Omotoso et al., 2011).

The mean values of the Height of cutaneous upper lip, Vermilion Height of upper lip and Vermilion Height of lower lip were comparatively similar ($p > 0.05$) amongst Hausas, Igbos, Yorubas, North American Whites (Farkas et al., 2005), African-Americans (Porter and

Olson, 2001; Porter, 2004), Hispanics (Zhuang et al., 2010), Malays (Ngeow and Aljunid, 2009) and Korean-Americans (Kyle et al., 2004). This implies that these parameters cannot be used as facial fiducial points for distinguishing members of these tribes or races from one another.

Comparisons of some measured cephalometric parameters in Hausas, Igbos and Yorubas with young adults (18 – 35 years) of North American Whites (Farkas et al., 2005), African-Americans (Porter and Olson, 2001; Porter, 2004), Hispanics (Zhuang et al., 2010), Malays (Ngeow and Aljunid, 2009) and Korean-Americans (Kyle et al., 2004) showed that the width of the mouth was wider ($p > 0.05$) in Hausas, Igbos, Yorubas, North American Whites and Korean-Americans than in males and females of Hispanics and Malays. Similarly, the mean value of the Height of upper lip was higher ($p > 0.05$) in Malays than in Hausa, Igbo and Yoruba males and females. This implies that the width of the mouth and Height of upper lip can be used as facial fiducial points for forensic analyses and for distinguishing members of these tribes or races from one another.

This study observed sexual dimorphism in mouth cephalometry of males and females of each of Hausa, Igbo and Yoruba tribes of Nigeria. However, our observations showed no statistically significant differences in most measured parameters amongst Nigerians of Hausa, Igbo and Yoruba origins which implied that Nigerians of the three tribes are of similar morphological patterns of the lip and mouth.

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REFERENCES

1. Akinlolu AA, Akinola OB, Hussein AT. 2010. Position of the ear in relation to facial midline landmarks in Nigerians. *Int J Human Anat* 2(1). URL: <http://www.ispub.com/IJHA/2/1/10497>. [Accessed April 2014].
2. Bacchetti P, Deeks SG, McCune JM. 2011. Breaking Free of Sample Size Dogma to Perform Innovative Translational Research. *Sci Transl Med* 3(87): 24. doi:10.1126/scitranslmed.3001628.
3. Farkas LG. 1994. *Anthropometry of the Head and Face*. 2nd Ed. UK: Raven Press. Pg 3- 56.
4. Farkas LG, Katic MJ, Forrest CR, Alt KW, Bagic I, Baltadjiev G et al. 2005. Anthropometric study of facial morphology in various ethnic groups/races. *J Craniofac Surg* 16 (4):615-46.
5. Keith LM, Arthur D. 1999. *Clinically Oriented Anatomy*. 4th Ed. Lippincott: Williams and Wilkins. Pg 832-851.
6. Kyle SC, Anthony PS, Jason AL, Guo-Pei Y, Thomas RIII. 2004. The Korean American Woman's Face. Anthropometric Measurements and Quantitative Analysis of Facial Aesthetics. *Arch Facial Plast Surg* 6(4):244-252.
7. Lloyd DE. 1980. *Sicher's Oral Anatomy*. 2nd Ed. London: The C. V Mosby Company. Pg 94 – 105.
8. National Population Commission, Nigeria [homepage]. 2006. Population and Housing Census of Nigeria. National Population Commission, Nigeria. URL: <http://www.population.gov.ng/index.php/censuses>. [Accessed April 2014].
9. Ngeow WC, Aljunid ST. 2009. Craniofacial anthropometric norms of Malays. *Singapore Med J* 50(5):525-528.
10. Omotoso DR, Oludiran OO, Sakpa CL. 2011. Nasofacial Anthropometry of Adult Bini Tribe in Nigeria. *Afr J Biomed Res* 14(3):219-221.
11. Porter JP, Olson KL. 2001. Anthropometric Facial Analysis of the African American Woman. *Arch Facial Plast Surg* 3(3):191-197.
12. Porter JP. 2004. The Average African American Male Face. An Anthropometric Analysis. *Arch Facial Plast Surg* 6(2):78-81.
13. Raymond E, Pragati A, David W, Darrel G. 2006. The use of anthropometric proportion indices in the measurement of facial attractiveness. *Europ J Orthod* 28(3):274–281.
14. The World Bank [homepage]. 2012. Nigeria at a Glance. The World Bank. Available from: <http://www.worldbank.org/en/country/nigeria>. [Accessed April 2014].
15. Zhuang Z, Landsittel D, Benson S, Roberge R, Shaffer R. 2010. Facial Anthropometric Differences among Gender, Ethnicity, and Age Groups. *Ann Occup Hyg* 54(4):391–402.