

Normal values of medial and lateral canthal distances in 3 to 18 year- old Nigerians.

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Summary

Background: This study was carried out on male and female Nigerians whose age ranged from 3 to 18 years in order to provide a database of canthal measurements for a predominantly black population and compare them with Caucasians.

Study design: All the healthy pupils and students were randomly selected. The ages of the children, adolescents and young adults were approximated to their nearest birthdays. Two different researchers measured each parameter and the mean values were recorded.

Setting: Nursery, primary, secondary schools and the University of Benin, in Benin City, Nigeria.

Results: Four hundred and sixty eight males (53.4%) and 408 (46.6%) females making up a total of 876 subjects were studied. The mean values for medial canthal distance for male Nigerians are slightly higher than those established for male Caucasians and these differences are significant ($p>0.05$). There was no significant difference in the lateral canthal distance between the two groups ($p<0.05$). Nigerian and Caucasian females have significant difference ($p>0.05$) in mean values for medial canthal distances but not in lateral canthal distance ($p<0.05$). The difference in these distances between Nigerian males and females are not significant. Weight and lateral canthal distance showed a covariance of 6.980 while age and lateral canthal distance, age and medial canthal distance showed a covariance of 2.970 and 1.140 respectively. There was no correlation between age, height, weight and the distances measured.

Conclusion: Medial canthal distances between male and female Nigerians compared to males and female Caucasians show significant variations but not in the lateral canthal distances.

Keywords: Medial, Lateral, Canthal distances, Nigerians.

Résumé

Introduction: Cette étude a été effectuée chez les hommes et femmes nigériens dont groupe d'âge est de 3 à 18 ans afin de donner la base de données des mesures canthales pour une population d'une manière prédominante noire et les comparer avec les caucasiens.

Plan d'étude: Tous les écoliers et les étudiants en très

bonne santé ont été choisis au hasard. L'âge des enfants, adolescents et jeune adultes se sont rapprochés vers leurs jours de naissance approximativement. Deux chercheurs bien différents ont mesuré chaque paramètre et on avait noté les valeurs moyennes.

Cadre: École maternelle, primaire, secondaire, et l'Université de Benin, à Benin city, au Nigeria.

Résultats: Quatre cents soixante huit hommes soit 53,4% et 408 soit 46,6% femmes dans l'ensemble un nombre total de 876 sujets ont été étudiés. Valeurs moyennes pour la distance canthale médiale pour des hommes nigériens sont légèrement plus élevés que celles recensées pour des hommes caucasiens et ces écarts sont importants ($P>0,05$). Il n'y a aucune différence importante par rapport à la distance canthale latérale entre les deux groupes ($P<0,05$). Les Nigériens et les Caucasiens ont une différence importante ($P>0,5$) en matière des valeurs moyennes en ce qui est des distances médiale canthale mais pas de différence en ce qui est de la distance canthale latérale. ($P<0,05$). La différence dans ces distances entre les Nigériens et les Nigériennes n'est pas importante. Les poids et la distance canthale latérale ont indiqué un codesaccord de 6,980 tandis que l'âge et distance canthale latérale, âge et distance canthale médiale ont indiqué un codesaccord de 2,970 et 1,140 respectivement. Il n'y a aucune corrélation entre l'âge, taille, poids, et les distances mesurées.

Conclusion: Les distances canthales médiales entre hommes et femmes nigériens par rapport aux hommes et femmes caucasiens ont indiqué une variation importante mais pas en ce qui est de distances canthales latérales.

Introduction

Previous studies have documented normal distances between the medial and lateral canthal distances in Caucasians,¹ North American Whites,² North American Blacks³, Mexicans and Japanese ancestry.⁴ Accurate and mere clinical estimation of hypertelorism are sometimes difficult without reference to standard values. Accurate values of these distances are essential guide to both reconstructive surgery and orthodontic treatment especially as it affects the black population because illusory hypertelorism may occur in individuals with flat nasal bridge, epicanthal folds, exotropia, widely spaced eyebrows, narrow palpebral fissure and dystopia canthorum.⁵

There are obvious differences in facial features be-

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tween blacks and whites and we considered that normal values of one group would not necessarily apply to the other group. Standard values of these distances, which are largely applicable to Caucasians and non-blacks are sometimes used in our environment for clinical assessment of patients before treatment because of the non-availability of normal values for the predominantly black race.

This study intends to document these distances in a predominantly black African population between the ages of 3 to 18 years. We were also interested in comparing these distances with what has been documented for the Caucasian population.

Materials and methods

This study was carried out in nursery, primary and secondary schools and the University of Benin, Benin City, Nigeria. Permission for participation in this study was obtained from the heads of the schools and the parents of the children where necessary. Consent was also obtained from the participants.

All the participants were randomly selected. Information on gender, age, height and weight were obtained from all the participants in a data form. The ages of the children were approximated to the nearest birthday of the pupils and students. Premature infants and adults, mixed races, adults with ocular diseases and subjects who have had fracture involving the bridge of the nose were excluded.

The medial and lateral canthal distances were measured using a calliper graduated in centimetres. The standard points of measurement for the medial canthal distance were the medial angles of the palpebral fissure while the lateral canthal distance was measured from the outer-

most edge of the bony orbit.⁴ The height was measured in centimetres while the weight was measured in kilograms using the bathroom scale. Two different researchers took each measurement twice and the mean values were recorded. The instruments were sterilised and subsequently disinfected on site for use in between subjects using hibitane in spirit.

Statistical analysis

Both comparative and descriptive statistics were used to analyse the results. The mean, range, standard deviation, correlation and covariance were calculated. The comparative test was conducted using the paired student's t-test to demonstrate any statistically significant difference in the medial and lateral canthal distances between male and female Nigerians and between them and Caucasians. At 95% confidence level or $P < 0.05$, was regarded as not significant.

Results

Altogether, 876 subjects comprising 468 (53.4%) males and 408 (46.6%) females of age range 3-18 years were studied. Table 1 shows the results of the medial canthal and lateral canthal distances (MCD, and LCD respectively) for males. Table 2 shows the figures of MCD and LCD for females.

Tables 3 shows the statistical comparisons of MCD of Nigerians and Caucasians while table 4 shows the comparison of LCD for Nigerians and Caucasians. Figure 1 shows the graphic representation of MCD for male Nigerians and Caucasians. The graphic comparison of LCD between male Nigerians and Caucasians are shown in figure 2. Similar graphic comparisons were carried out for MCD and LCD for female Nigerians and Caucasians in

Table 1 Medial and lateral canthal distances in centimetres for male Nigerians

Medial canthal distances					Lateral canthal distances		
Age (years)	No of subjects	Range	Mean	SD	Range	Mean	SD
3	12	2.5-3.2	2.80	0.22	8.7-10.8	9.55	0.65
4	17	1.1-3.3	2.75	0.46	7.8-10.8	9.72	0.79
5	17	2.5-3.4	2.90	0.59	7.8-10.6	9.58	0.73
6	20	2.6-3.4	2.98	0.25	9.0-10.6	9.82	0.46
7	51	2.6-3.4	2.99	0.23	7.4-11.4	9.97	0.65
8	33	2.9-3.5	3.19	0.20	9.9-11.4	10.50	0.42
9	92	2.6-4.0	3.17	0.25	9.0-12.0	10.50	0.55
10	69	2.7-3.8	3.18	0.25	9.4-11.6	10.57	0.55
11	48	2.6-3.8	3.22	0.28	9.1-11.9	10.50	0.69
12	18	1.7-4.1	3.08	0.51	9.6-11.9	10.57	0.72
13	9	2.7-4.0	3.25	0.38	10.1-11.4	10.57	0.50
14	13	2.9-3.9	3.45	0.25	10.3-11.7	10.80	0.52
15	19	3.0-4.2	3.59	0.37	10.8-12.4	11.54	0.40
16	33	2.9-4.2	3.59	0.35	10.4-14.6	11.56	0.83
17	10	3.1-3.8	3.48	0.27	10.9-12.2	11.47	0.44
18	7	2.7-4.1	3.59	0.39	9.7-12.6	10.96	0.91
Total=468							

Table 2. Medial and lateral canthal distances in centimetres for female Nigerians

Medial canthal distances					Lateral canthal distances		
Age (years)	No of subjects	Range	Mean	SD	Range	Mean	SD
3	7	2.5-2.9	2.7	0.15	9.2-10.3	9.57	0.4
4	9	2.4-3.2	2.9	0.23	8.7-10.2	9.48	0.4
5	12	2.7-3.1	2.96	0.12	9.2-10.6	9.88	0.39
6	14	2.6-3.2	2.94	0.22	1.6-10.9	9.34	0.30
7	25	2.5-3.7	3.04	0.31	9.2-10.4	10.02	0.37
8	35	2.7-3.8	3.15	0.28	9.3-11.2	10.26	0.44
9	85	2.4-4.1	3.19	0.26	9.6-11.5	10.54	0.50
10	89	2.7-4.1	3.25	0.31	9.2-11.9	10.43	0.56
11	60	2.7-3.9	3.28	0.26	9.5-11.9	10.57	0.66
12	23	2.0-3.9	3.24	0.40	9.7-11.9	10.86	0.66
13	3	3.2-3.2	3.2	0.0	11.0-11.0	11.0	0.00
14	9	2.9-3.6	3.49	0.23	10.5-11.7	11.14	0.50
15	13	2.6-3.9	3.25	0.39	10.3-11.8	10.99	0.45
16	15	2.6-3.9	3.25	0.35	10.3-11.8	11.05	0.42
17	5	3.6-3.9	3.64	0.15	11.3-12.2	11.56	0.37
18	4	2.9-3.5	3.13	0.26	10.0-11.8	10.95	0.74
Total=408							

Table 3. Comparison of medial canthal distances of Nigerians and Caucasians

Groups	Pooled Mean	Calculated	Tabulated	Remarks (at 95% confidence level or P< 0.05)
Nigerian male vs Caucasian males	3.19 vs 2.93	3.03	2.04	Significant
Nigerian males vs Nigerian females	3.19 vs 3.16	0.35	2.04	Not significant
Nigerian males vs Caucasian females	3.19 vs 2.88	3.92	2.04	Significant
Nigerian females vs Caucasian females	3.16 vs 2.88	3.73	2.04	Significant
Nigerian females vs Caucasian males	3.16 vs 2.93	2.19	2.04	Significant
Caucasian males vs Caucasian females	2.93 vs 2.88	0.67	2.04	Not Significant

Table 4. Comparison of lateral canthal distances of Nigerians and Caucasians

Groups	Pooled mean	Calculated	Tabulated	Remarks (at 95% confidence level or P< 0.05)
Nigerian males vs Caucasian males	10.52 vs 10.53	0.04	2.04	Not significant
Nigerian males vs Nigerian females	10.52 vs 10.48	0.17	2.04	Not significant
Nigerian males vs Caucasian females	10.52 vs 10.39	0.53	2.04	Not significant
Nigerian females vs Caucasian females	10.48 vs 10.39	0.37	2.04	Not significant
Nigerian females vs Caucasian males	10.48 vs 10.43	0.19	2.04	Not significant
Caucasian males vs Caucasian females	10.53 vs 10.39	0.52	2.04	Not significant

figures 3 and 4 respectively. Figures 5 and 6 show medial and lateral canthal distances being measured by one of the researchers. The correlation and covariance between height, weight, age, medial and lateral canthal distances of Nigerians were determined. The correlation between MCD and LCD (0.610) and weight and LCD (0.580) were higher than the other parameters compared although these were not significant. There was a covariance between

weight and LCD (6.980), age and LCD (2.970), age and MCD (1.140). The other parameters compared did not show any significant variation and these were height and MCD whose correlation was 0.042 and covariance of 0.063. The covariance and correlation for height and LCD, weight and MCD were 0.036, 0.130, 0.450 and 2.290 respectively. Age, MCD and LCD showed a correlation of 0.430 and 0.480 respectively.

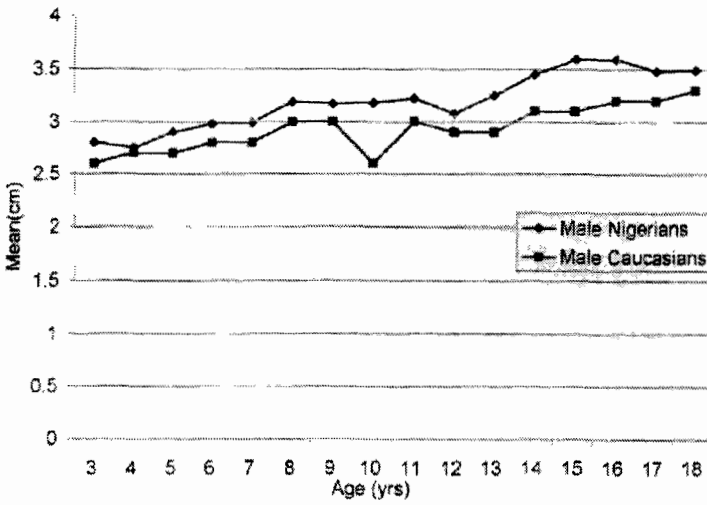


Fig. 1 Comparison of medial canthal distances between male Nigerians and male Caucasians. Note the slightly higher values for Nigerians. The mean values for Caucasians were derived from 158 normal male Caucasians. Data by Laestadius et al 4

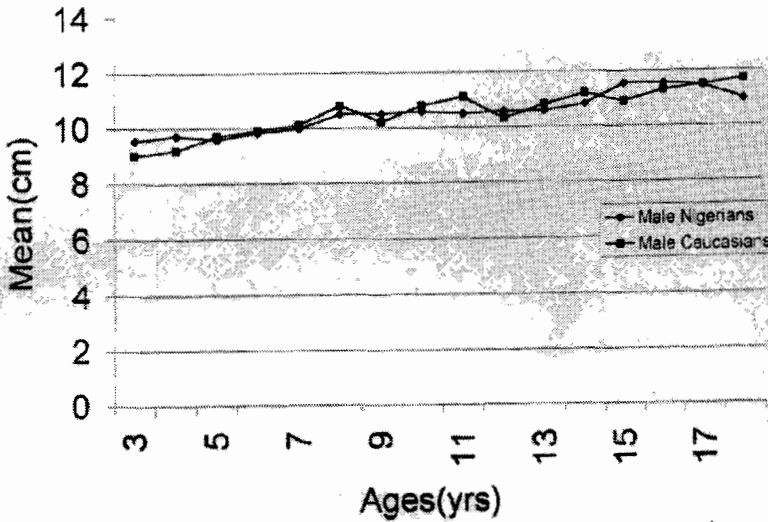


Fig. 2 Comparison of lateral canthal distances between male Nigerians and male Caucasians. Note: The mean values for Caucasians were derived from 158 normal male Caucasians. Data by Laestadius et al 4

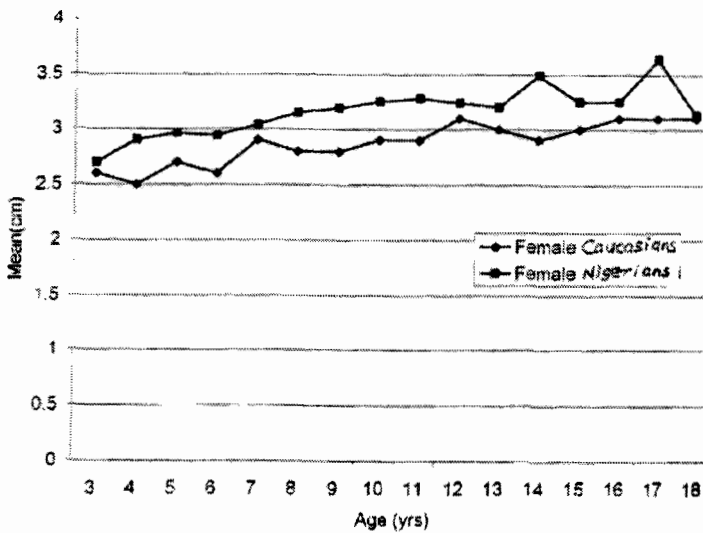


Fig. 3 Comparison of Medial canthal distances between female Nigerians and female Caucasians. Note: The mean values for Caucasians were derived from 135 normal female Caucasians. Data by Laestadius et al 4

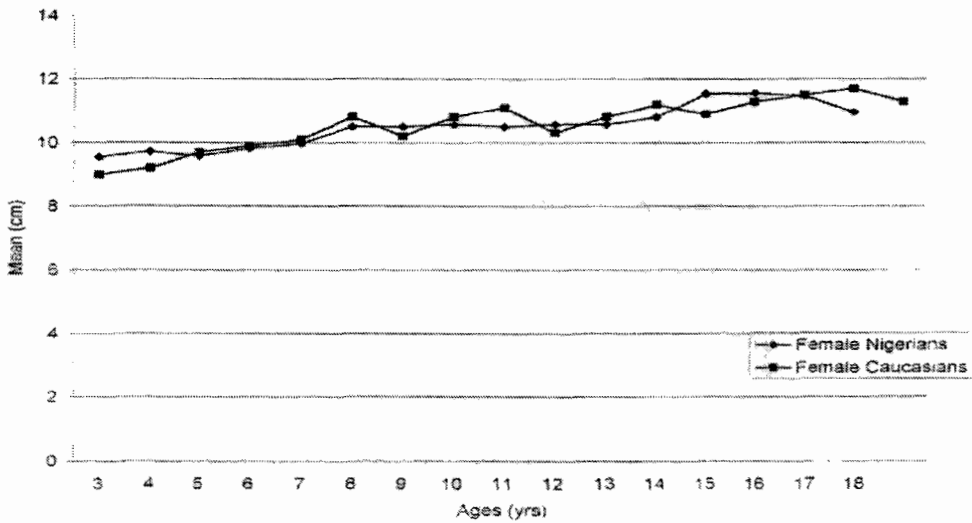


Fig. 4 Comparison of lateral canthal distances between female Nigerians and female Caucasians. Note: The mean values for Caucasians were derived from 135 normal female Caucasians. Data by Laestadius et al 4



Fig. 5 Measurement of medial canthal distance

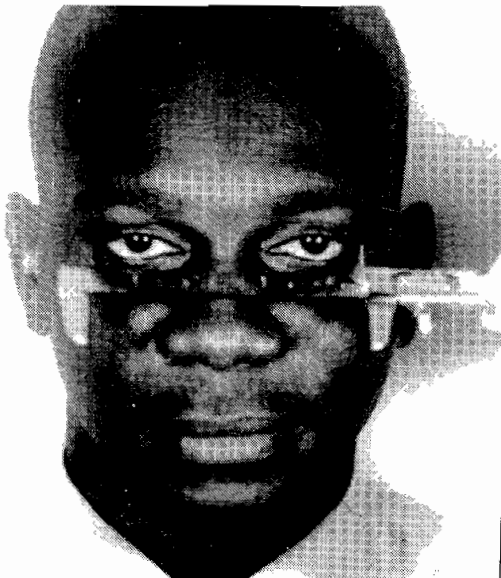


Fig. 6 Measurement of lateral canthal distance

Discussion

Normal canthal distances in a predominantly black population are not easily available for clinical reference in our environment. Available normal values are estimates which have been established for Caucasians and other ancestry. The results of this study show no significant difference in medial and lateral canthal distances between male and female Nigerians. Similarly, there was no significant difference in these distances between male and female Caucasians.⁴ However, when we compared the normal values with those already established for Caucasians of the same age range,⁴ our mean values of MCD for male Nigerians are significantly higher than those established for male Caucasians. This agrees with other works, which have compared mean values of these distances and found MCD to be significantly higher in normal black population⁶ while the values for black boys were also significantly different from those of the white boys³ in seven age groups.

However, when female Nigerians MCD were compared with female Caucasians, the former showed higher mean values which are significantly different from the latter. There appears to be a small difference in LCD for both male and female Nigerians when compared with male and female Caucasians respectively although these differences recorded were not significant. This is in contrast with previous reports.^{3,6} Similarly, differences in MCD started appearing from the age of 14 years with males exhibiting slightly higher values than females. When we determined the correlation and covariance between height, weight, age, MCD and LCD, we found no significant correlation between these parameters. However, there was covariance between weight and LCD, age and MCD, and age and LCD. The variations in height and MCD, height and LCD, MCD and LCD were not significant.

Since these values also provide information on the growth and development of this region, the clinician can easily detect a child's unusual appearance of the upper facies. Although it has been established that 78 percent

of the adult MCD has been established at 1 year of age after which the growth slows in contrast to LCD,⁴ our mean figures show some measure of growth from 3 years of age, which agrees with a similar Japanese study that showed a significant increase in MCD, LCD and pupillary distance.⁷ Some reports have questioned the reliability of MCD measurement in detecting ocular hypertelorism because an increase in MCD is known to be present in several forms of apparent or pseudohypertelorism with epicanthal folds and in Waardenburg's syndrome.⁸ Different methods of measurements have however been employed by different investigators. Some have used photogrammetry⁹ as alternative to direct measurements of facial distances for a variety of anthropometric application but was fraught with technical errors.¹⁰ However, MCD and LCD measurements even though less accurate than inter-orbital measurements,^{11,12} are the simplest to use for standard clinical workups in clinical genetics⁵ as long as racial standards values are used. MCD has been found to be a reliable predictor of maxillary central incisor width when it is multiplied by a decreasing function value of the geometric progression term and then divided by 2.¹³

In conclusion, there are significant variations in MCD between male and female Nigerians of 3-18 years old compared to male and female Caucasians but not in LCD. We recommend these mean values to maxillofacial and plastic surgeons that are engaged in facial reconstruction and orthodontists and spectacle frame and lenses manufacturers. In particular, the paediatricians and dysmorphologists may find them useful in the early identification of some craniofacial syndromes.

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