

## Facial Dimensions in Infants

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### Summary

**Omotade OO, Kayode CM and Adeyemo AA. Facial Dimensions in Infants.** *Nigerian Journal of Paediatrics* 1994; 21: 101. Anthropometric measurements of facial dimensions were studied in randomly selected 290 infants. Values were obtained and reference curves for inner canthal, outer canthal, palpebral fissure lengths, and canthal indices were constructed. The inner canthal distances did not differ from those obtained for Caucasian infants, but the outer canthal and palpebral fissure lengths were longer in our infants than those of Caucasian children. It is concluded that it would be inaccurate to use Caucasian standards for our infants in delimiting and defining congenital malformation syndromes with facial features.

### Introduction

ABNORMAL facial features are often present in many malformation syndromes.<sup>1</sup> Since accurate measurements are required to define some of these features, the work of Pryor,<sup>1</sup> Feingold and Bossert,<sup>2</sup> Laestadius, Aase and Smith<sup>3</sup> in providing reference values for facial dimensions have been very valuable. In the absence of such well-established reference values for Nigerian children, Caucasian standards have, in the past, been used in the study of trisomies 13 and 18.<sup>4</sup> A number

of workers have recently reported reference values for facial dimensions in Nigerian neonates.<sup>5-7</sup> In a previous communication, values for inner and outer canthal distances, palpebral fissure lengths and canthal index in Nigerian neonates were compared with those of Caucasian neonates in Wales, UK.<sup>7</sup> In view of the fact that over 70 percent of children with major congenital malformations and malformation syndromes seen in our centre, present within the first year of life,<sup>8</sup> the present study of facial measurements in normal infants was therefore, undertaken in order to provide reference values for this age group.

### Subjects and Methods

The study, undertaken at the Institute of Child Health, University College Hospital (UCH), Ibadan, involved healthy,

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normal infants attending the well-baby clinic between 1991 and 1992. A one-in-five systematic random sampling procedure was used to select the subjects, whose weights-for-age were between the third and 97th percentile of the local growth chart.<sup>9</sup> All measurements were carried out by two of the authors (OOO and CMK) after they had exhibited a 1 mm or less inter-observer variation in 95 percent of the measurements taken in a test group consisting of 40 children. The ear measurements were carried out with the technique described by Feingold and Bossert,<sup>3</sup> using a modification of their instrument as earlier described by Omotade.<sup>7</sup> All measurements were taken twice to the nearest millimetre (mm) with the child relaxed, not crying, smiling nor grimacing and with the eyes open and the mean values recorded. The means, standard deviations (SD) and ranges of each dimension were computed for each two-month age interval. The canthal index was calculated as inner canthal distance/outer canthal distance  $\times$  100 and the inner canthal (IC)/occipito-frontal circumference (OFC) index by IC/OFC  $\times$  100. Reference curves were obtained by fitting simple linear regression lines by the method of least squares to the means of each dimensions; fitted means did not differ significantly from the estimated means. The third and 97th percentiles were obtained from the fitted means as the mean  $\pm$  1.88 SD, since the distribution of each dimension was approximately Gaussian.

## Results

The 290 infants who were studied com-

prised 149 (51.4 percent) male and 141 (48.6 percent) female children. Table I contains the means, standard deviations and ranges of facial dimensions in the 290 infants. As can be observed, the outer canthal distance ranged from 6.4 and 8.5 cm (mean, 7.4 cm) in the first two months of life to 8.0 and 9.2 cm (mean, 8.5 cm) in the 11-12-month old infants. The inner canthal distance ranged from 1.9 and 3.0 cm (mean, 2.3 cm) in the first two months of life to 2.4 to 3.0 cm (mean, 2.7 cm) in the 11-12 month old infants. The palpebral fissure lengths measured between 2.2 and 3.0 cm (mean, 2.9 cm) in the 11-12 month old infants, the nasolabial distance ranged from 0.8 cm in the first month to 1.6 cm in the 11-12-month old infants. While the growth of the inner canthal distance, palpebral fissure lengths and nasolabial distances maintained a steady rate throughout infancy, accelerated facial development in infancy (as measured by outer canthal distance between-interval differences) occurred within the first four and the last four months of infancy. The canthal index and inner canthal/OFC ratio are summarized in Table II. The values for the canthal index and inner canthal/OFC ratio percent remained constant throughout infancy, suggesting a relatively uniform growth and development of the facial features. In situations where there are inequalities in the growth of facial components, these values would change depending on the components involved. Figures I to IV show the 3rd, 50th and 97th percentiles of the outer canthal, inner canthal distance, palpebral fissure lengths and the nasolabial distance from birth to age one year, obtained by fitting simple linear regression lines by the method of

TABLE I

Means, Standard Deviations and Ranges of Facial Dimensions in Infants

Age (months)	Dimension (cm)							
	Outer Canthal		Inner Canthal		Palpebral Fissure		Nasolabial	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range
1-2	7.6(0.4)	6.4-8.5	2.3(0.2)	1.9-3.0	2.7(0.2)	2.2-3.0	1.2(0.2)	0.8-1.6
3-4	7.9(0.5)	5.0-9.0	2.4(0.2)	2.0-3.0	2.7(0.2)	1.4-3.2	1.3(0.2)	0.8-1.8
5-6	8.0(0.4)	6.8-9.2	2.4(0.3)	1.4-3.0	2.8(0.2)	2.3-3.4	1.4(0.2)	1.0-1.6
7-8	8.0(0.7)	7.0-9.3	2.5(0.3)	2.2-3.0	2.8(0.3)	2.3-3.2	1.3(0.1)	1.2-1.6
9-10	8.2(0.4)	7.6-9.4	2.6(0.3)	2.0-3.6	2.8(0.2)	2.2-3.4	1.3(0.2)	0.8-1.6
11-12	8.5(0.4)	8.0-9.2	2.7(0.3)	2.4-3.0	2.9(0.2)	2.6-3.3	1.4(0.1)	1.2-1.6

Figures in parenthesis represent standard deviation

TABLE II

Canthal index and Inner Canthal/OFC Ratio in Infants

Age (months)	Canthal Index (percent)		IC/OFC ratio (percent)	
	Mean	Range	Mean	Range
1-2	30(2)	25 - 38	5.9(0.5)	4.9 - 6.9
3-4	31(2)	26 - 44	5.9(0.6)	5.0 - 7.7
5-6	30(4)	17 - 38	5.8(0.9)	3.3 - 7.4
7-8	31(2)	28 - 34	5.8(0.5)	5.0 - 6.9
9-10	34(4)	24 - 45	5.8(0.7)	4.6 - 7.8
11-12	32(3)	28 - 35	5.8(0.4)	5.2 - 6.7

Figures in parenthesis represent standard deviation

least squares to the means of each measurement. It is evident that the percentiles of these measurements showed a uniform rate of growth during infancy.

### Discussion

The selected parameters in the present study were those that are usually measured in clinical dysmorphology; hence, the results are likely to be of immense value to paediatricians and other health workers who see children with malformation syndromes. The 3rd, 50th and 97th percentiles for the inner canthal distance obtained in the study did not differ much from those of Feingold and Bossert<sup>2</sup> (the difference did not exceed 0.2 cm for any of the percentiles at a given age). However, the outer canthal distances exceeded those of Feingold and Bossert;<sup>2</sup> the 3rd, 50th and 97th percentiles at the same ages also exceeded those of Feingold and Bossert<sup>2</sup> by as much as 1.0 - 1.2 cm. Similarly, when comparing the means of the inner canthal and outer canthal distances with those obtained by Pryor,<sup>1</sup> the mean inner canthal distance during the first year of life, differed by only 0.1 cm, but the mean outer canthal distance in the present study was higher by 1.6 - 1.8cm. It is thus, evident that the Nigerian infant has a greater outer canthal distance than the Caucasian, but both have similar inner canthal distances. This same pattern had been reported by Ejiwunmi, Okanlawon and Ojo<sup>6</sup> and Omotade<sup>7</sup> in neonates.

The palpebral fissure lengths were higher than those reported by Chouke<sup>10</sup> and Fox;<sup>11</sup> they were however, similar to the findings of increased palpebral fis-

sure lengths in Negro neonates compared with Caucasians.<sup>7, 12</sup> It seems that increased outer canthal distance and apparent telecanthus of African infants may be attributed to increased palpebral fissure lengths compared to those of Caucasian infants. Thus, it would be inaccurate to use Caucasian reference graphs to classify outer canthal distances and palpebral fissure lengths in Nigerian infants. The mean nasolabial distance of 1.4cm at one year of age was slightly shorter than the 1.6cm reported by Hajnis.<sup>13</sup>

Measurements of facial features are very important in the accurate description of syndromes that have facial involvement. The eyes may be far apart as in Apert, Crouzon, Robinson and the foetal-hydantoin syndromes, or close together as in holoprosencephaly sequence, Meckel-Gruber and trisomy-13 syndromes.<sup>14</sup> The palpebral fissure is often short in the Dubowitz, Williams and the foetal-alcohol syndromes.<sup>14</sup> The nasolabial distance (philtrum) is often short in DiGeorge sequence,<sup>14</sup> the Cohen and orofacial-digital syndromes<sup>14</sup> and is long in Weaver, Williams and Freeman-Sheldon syndromes.<sup>14</sup> Therefore, these reference values and graphs underline their importance to the paediatrician and other health workers dealing with infants who have malformation syndromes.

The present study has demonstrated that our infants have greater outer canthal distances and palpebral fissure lengths and shorter nasolabial distances than Caucasian infants.<sup>12</sup> It is evident that these differences are present at birth and persist until the end of the first year. In the light of these findings, it is unjusti-



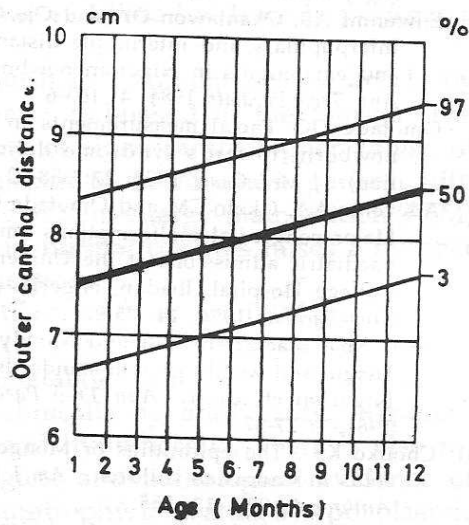


Fig. 1 Percentiles of outer canthal distances

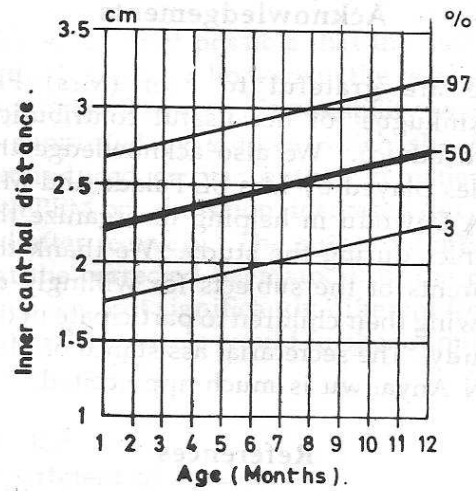


Fig. 2 Percentiles of inner canthal distances

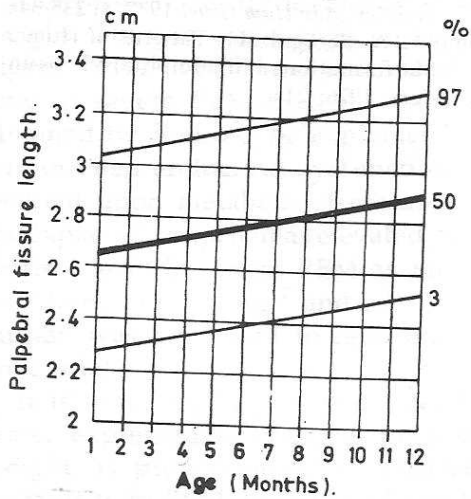


Fig. 3 Percentiles of palpebral fissure distances

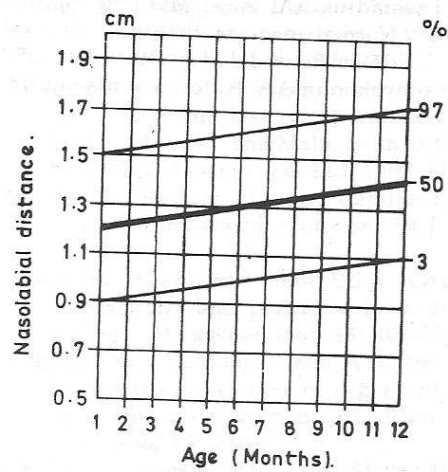


Fig. 4 Percentiles of nasolabial distances

fied to use a single standard for all races, as this may result in misclassification of facial features, particularly when the abnormalities present are subtle.

### Acknowledgements

We are grateful to Prof (Mrs) FM Akinkugbe for her useful contribution and advice. We also acknowledge the roles played by Mrs SL Falade and Mrs CA Dawodu in helping to organize the clinics during the study. We thank the parents of the subjects for willingly allowing their children to participate in the study. The secretarial assistance of Miss SN Anyanwu is much appreciated.

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## Letters to the Editor

Sir,

### *Plasma and blood volume in patients with severe protein-energy malnutrition.*

I wish to comment on the article by Renner<sup>1</sup> published in the Journal. The finding of significantly higher values of plasma and blood volume in patients with severe protein-energy-malnutrition (PEM) than in normal controls raises a number of questions.

Patients with severe PEM are reported by others<sup>2</sup> to be hypovolaemic and in a hypometabolic state which is characterized clinically by bradycardia, hypotension and hypothermia. There is also radiological and pathological evidence of cardiac atrophy, indicating a hypovolaemic and low output state in these patients.<sup>3-5</sup> This clinical evidence has been supported by animal experiments<sup>6</sup> which show progressive decline in total blood volume, red cell volume and cardiac output in proportion to the decline in body weight. The question then is, how can the higher values of plasma and blood volume in severe PEM than in controls as obtained by Renner<sup>1</sup> be explained? The author cited endocrine dysfunction, consequent upon metabolic stress as one of the explanations, whereas elevated plasma cortisol level in severe PEM as reported by Allyne and Young<sup>7</sup> and cited by the author, was attributed to reduced clearance rate.

It is however, known that total body water, expressed as a percentage of body weight, is proportionately increased in patients with PEM, but most of this fluid is in the interstitial space with consequent fall in plasma volume.<sup>8</sup> In these circum-

stances, is it not possible that the author studied patients who were in the recovery stage of the illness? This possibility would be supported by studies which showed that reduced cardiac output in patients with PEM on admission, increased during and after recovery.<sup>9</sup> The author's finding that the corrected haematocrit of the patients was not significantly different from that of the controls would further support this possibility.

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*Dr Renner replies*

Sir,

I wish to thank Dr Ibe for the comments made and questions raised in his letter on the above matter. Firstly, the data on plasma and blood volume may be explained by changes in the reference measurements, rather than in the real volumes. This simply means that, if the volumes in question, are related to surface area, for instance, no significant difference will be noticed between well-nourished and malnourished children. Furthermore, it should be realized that although the absolute volumes may be reduced, the actual body mass suffers greater reduction, thereby giving rise to a larger volume per unit mass.

It is known that by the time the malnourished child presents clinically, cer-

tain haemodynamic and metabolic compensatory mechanisms are set in motion. Were it not for these compensatory mechanisms, a substantial number of malnourished children would present in shock in the absence of fluid loss or overwhelming infection. From experience, this is not so. The malnourished patients that were studied were not in the recovery or after recovery stage, as suggested in the letter. Secondly, reasonable haematorit level does not guarantee freedom from malnutrition.

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