COMPARATIVE CRANIAL MORPHOLOGY IN THE NEWBORN

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While craniometric studies have been conducted on nearly every major race, the literature is strangely deficient in accurate investigations on the newborn infant's unmoulded head. Variations in the different anthropometric cranial and facial indices have been shown to exist between different racial groups, but the same differences have never been scientifically proved to exist in the newborn of these same groups. The assumption that these differences are present at birth in some degree is untenable, because it is known that the face and skull undergo extensive postnatal development.

There is an extensive literature on the dimensions of the newborn infant's head. Most investigators, while appreciating the extent to which the birth process modifies the cranial dimensions, have made some effort to avoid inaccurate results by selecting for study only those heads in which moulding was not detectable. Nonetheless their cases were delivered vaginally so that the possibility of some distortion by labour was always present. The occipito-frontal diameter is particularly influenced by the course of labour, but there appears to be a lack of unanimity of opinion with regard to the exact way in which it is altered.

The comparison of human skulls of different races is greatly facilitated by the computation of different indices, of which the cephalic index reflects on the ratio of length to breadth. The cephalometric studies reported here were conducted on Bantu (Xhosa) newborn infants. The (southern) Xhosa people and the (northern) Zulus are essentially one people in speech, physique, social organization, etc. Their physical features are too well known to bear repetition here, but in this context it should be pointed out that their heads are long and narrow, the cephalic index[2] being 72·5. Keen[3] gives an index of 71·6. According to a table compiled by Deniker this must be regarded as representing extreme dolichocephaly.

Two standards were determined for comparing the results of my own investigations. The first was the calculation of the cephalic index in the foetus at term based on empirical formulae and developed by graphic methods — the method of averages and the method of least squares. The second standard represented the mean as computed from the work of numerous workers in the past 13 decades, selecting only those authors who exercised care in choosing their material for study.

SELECTION OF CASES

In order to arrive as nearly as possible at the exact size and proportions of the foetal skull *in utero* and at term, Scammon and Calkins[4] made a special series of head measurements of newborn infants in whom, they say, moulding was eliminated. They selected two types of cases for their purpose. Firstly, infants born by caesarean section without the prior occurrence of labour pains, and secondly, infants born by breech extraction where this extraction was quickly and easily performed. In connection with the breech infants they state that considerable care in the selection of this group is necessary since moderate moulding in some breech-born infants can often be observed. It is of considerable interest to analyse the work of these two authors because, as will be shown, our acceptance of their statement that moulding was eliminated, and the selection of cases for future studies, should be influenced by the conclusions reached from such analyses.

Scammon and Calkins[4] studied 33 infants. The measurements were taken on the first day of postnatal life. Of these 33 infants 5 were premature, according to the menstrual history and body length. One was postmature. Their cases can be divided conveniently into 4 groups:[5]

Group 1. Palpable moulding (recorded by them as slight or very slight) was present in 15 cases. All were breech deliveries. The cephalic index for the group was 80·008.

Group 2. The cephalic index of 2 premature infants in whom moulding was discernible, was 76·7.

Group 3. No moulding was present in 15 full-term infants and 3 premature infants. The cephalic index for this group was 79·7.

Group 4. The cephalic index of the unmoulded premature group was 79·8.

The conclusion to be drawn is that, while moulding may be present in easy breech delivery, it is not of such an order as to influence the computation of the cephalic index. Also, moulding may significantly alter the cranial shape in premature breech-born infants, as indicated by the cephalic index of 76·7 in this group. The premature breech-born infant is therefore best excluded from the biometric studies.

CALCULATION OF THE CEPHALIC INDEX IN THE FOETUS AT TERM BASED ON EMPIRICAL FORMULAE DEVELOPED BY GRAPHIC METHODS — THE METHOD OF AVERAGES AND THE METHOD OF LEAST SQUARES

The increase of the external dimensions of the body in the foetal period bears a rectilinear relationship to the body length. The relation of these dimensions may be expressed as:

$$D = aL + b$$

where D represents the dimensions, a the total crown-heel length of the body, and b the second constant. The formulae for the dimensions of the head are characterized by a positive 'b' constant. 'a' represents the absolute rate of growth in the dimensions with regard to growth in body length in the period under consideration, and it may be determined by the expression:

$$\frac{D_2 - D_1}{L_2 - L_1}$$

where L is given successive crown-heel lengths and D is the value for any given dimension at these lengths. The relationship between the magnitude of the various external bodily dimensions and age or time in the early foetal period have been represented by curves and figures based upon analytic convention expressing the relation of the total body length to foetal age. The total body length with regard to time or age in the foetal period is represented by the parabola:

$$L = 28\sqrt{T - 0{\cdot}74} - 35$$

$$\text{or } T = 2{\cdot}3 + \frac{2{\cdot}5L}{28} + \frac{L^2}{784}$$

$$\text{or } T = \left(\frac{L}{28} + 1{\cdot}25\right)^2 + 0{\cdot}74$$

Where T is the age in foetal or lunar months, and L is the total crown-heel length of the body.

The accuracy of these empirical formulae is best demonstrated by comparing the computed values for the occipito-frontal and biparietal diameters with the observed results of workers who have exercised care in their selection of material for study. For this purpose the measurements of Scammon and Calkins[4] have been selected. The calculated values for the biparietal and occipito-frontal dimensions show very small deviations from the corresponding observed averages. The most significant observation to be made from Tables I and II is that the deviations are increased in the last part of the distribution, where birth moulding becomes an important factor. Both dimensions are much decreased by head moulding between 35 and 55 centimetres crown-heel length.

The assertion of Scammon and Calkins[4] that birth moulding was eliminated in their studies, is not correct for, as can be seen from these tables, the deviations for the observed values for the occipito-frontal and biparietal diameters become increasingly great as the size of the foetus increases. It is concluded that moulding was present though not detectable by inspection and palpation, yet of an order sufficiently great to be manifest as a significant deviation by this method of analysis.

Since the caesarean sections were all elective, we are left to conclude that even easy breech deliveries may be associated with a degree of moulding which significantly influences cephalometric studies.

Using the values as determined by the formulae established by graphic methods, the cephalic indices at different crown-heel lengths are as follows:

Crown-heel length	*Cephalic index*
5 Centimeters	72·8
25 Centimeters	78·8
50 Centimeters	79·8

The accuracy of the calculated cephalic index is brought out by the comparison. The slight and very slight moulding which was present in 15 cases of the Scammon and

TABLE I. A COMPARISON OF THE COMPUTED AND ACTUAL VALUES FOR THE BIPARIETAL DIAMETER (369 CASES)

Crown-heel length (mm.)		*Crown-rump length (mm.)*	*Biparietal observed*			*Calculated mean*	*Difference between (a) and (b)*		*No. of cases*	*Calculated values at 5 cm. C-H length*		
Range	*Mean*		*max.*	*min.*	*mean (a)*	*(b)*	*mm.*	*%*		*CH*	*Value*	*% increment*
200–250	225·3	152·3	54	35	45·3	44·8	−0·5	−1·1	52	25	49·5	24
250–300	273·1	183·9	66	43	53·9	55·9	0·0	0·0	46	30	59·0	19
300–350	323·9	223·7	77	52	62·5	63·5	+1·0	+1·6	36	35	68·5	16
350–400	376·6	248·2	78	58	69·6	72·4	+2·8	+4·0	36	46	78·0	14
400–450	423·2	287·9	84	66	77·3	82·4	+5·1	+6·6	29	45	87·5	12
450–500	471·4	318·5	99	70	87·0	91·6	+4·6	+5·3	24	50	97·0	11
500–550	523·4	358·1	102	85	94	101·4	+7·4	+7·9	27	55	106·5	16

TABLE II. A COMPARISON OF THE COMPUTED AND ACTUAL VALUES FOR THE OCCIPITO-FRONTAL DIAMETER (369 CASES)

Crown-heel length (mm.)		*Crown-rump length (mm.)*	*Occipito-frontal observed*			*Calculated mean*	*Difference between (a) and (b)*		*No. of cases*	*Calculated values at 5 cm. C-H length*		
Range	*Mean*		*max.*	*min.*	*mean (a)*	*(b)*	*mm.*	*%*		*CH*	*Value*	*% increment*
200–250	225·3	152·3	68	48	57·9	56·9	−1·0	−1·7	52	25	62·75	23
250–300	272·1	183·9	78	60	69·2	68·6	−0·6	−0·9	46	30	74·50	19
300–350	323·9	223·7	90	71	80	80·1	+0·1	+0·1	36	35	86·25	16
350–400	370·6	248·2	101	79	88·8	91·1	+2·3	+2·6	36	40	98·00	13
400–450	423·6	287·9	115	87	99·9	103·5	+3·6	+3·6	29	45	109·75	12
450–500	471·4	318·5	123	99	105·2	114·8	+5·6	+5·1	24	50	122·50	10
500–550	523·3	358·1	129	165	117·2	127·2	+9·8	+8·4	27	55	134·75	0

Calkins[4] series, do not materially affect the computation of the index, for the effect of moulding is to reduce both dimensions so that the error is correspondingly minimized.

CEPHALOMETRIC SURVEY

In the light of the conclusions reached from the detailed and critical analysis of this large series of cases by 2 thorough and careful workers, I used only infants born by elective caesarean section in my own survey. No infant born by caesarean section even a few hours after the onset of labour, as for example in cases of prolapse of the cord early in parturition, was included in the series. One series of cases was measured by radiological methods, and in order to determine whether moulding had occurred, it may have been necessary to repeat X-rays in the early puerperium to detect any rapid restoration to the unmoulded proportions. The cumulative effects of several X-rays on the newborn infant's head may have been responsible for effects not predictable at the time.

Initially I used cases of easy breech delivery in multipara as well as the breech-born second of twins. In several infants moulding was overtly present and the use of this type of case was discontinued.

The material used in this study was as follows:

1. *Bantu Infants — 50 Cases*
   - (*i*) Elective caesarean section for disproportion — 21 cases
   - (*ii*) Caesarean section after the 38th week of gestation for fulminating pre-eclamptic toxaemia — 7 cases
   - (*iii*) Caesarean section for placenta praevia (not in labour) — 17 cases
   - (*iv*) All other indications (vaginal abnormality, repeated stillbirths, patient with an ileal bladder, prolapse of the cord, pelvic tumour) — 5 cases
2. *Cape Coloured Infants — 50 Cases*
   - (*i*) Elective caesarean section for disproportion — 24 cases
   - (*ii*) Caesarean section after the 38th week of gestation for fulminating pre-eclamptic toxaemia — 10 cases
   - (*iii*) Caesarean section for placenta praevia (not in labour) — 11 cases
   - (*iv*) Other indications including vaginal abnormality, uterus didelphys, pelvic tumour, diabetes mellitus, and accidental haemorrhage — 5 cases

METHOD OF INVESTIGATION

Two methods of investigation were employed. The 100 cases referred to above were all measured directly using an engineer's caliper with a vernier scale (cephalometry). In addition, measurements were made on the cranium by the method of triangulation radiography employing stereoscopic methods. Anthropologists distinguish between cephalometry and measurements made on the cranium itself; they use the term craniometry in connection with the latter type of measurement. Forty-seven craniometries were conducted in this manner. The material can be classified as follows:

Bantu cases (13)

1.	Multiparous breeches	9 cases
2.	Breech-born infants (the second of twins)	3 cases
3.	Caesarean infants	1 case

Coloured cases (18)

1.	Multiparous breeches	12 cases
2.	Breech-born infants (the second of twins)	4 cases
3.	Caesarean infants	2 cases

Sixteen films were found to be unsuitable. This represents a high percentage of failure. Radiological craniometry, performed by the method I adopted, thus left much to be desired. The method was costly and 1 out of every 3 films proved unsatisfactory for use. There was another reason why this method was discontinued shortly after the commencement of the study, namely, the accuracy with which direct measurement could be carried out as well as the ease with which the identification of the anterior end-point could be made — a procedure which was often difficult on the X-ray film.

RESULTS AND COMPARISON

Method of Analysis

The frequency distribution of each measurement was tabulated, after choosing a suitable class interval. The arithmetic mean (a) and the standard deviation (σ) were then calculated. In order to compare the data obtained in the 2 groups, calculations were made to determine the critical ratio between the 2 means of each index. This calculation involves first of all the determination of the standard error of the mean (σ_a) according to the formula

$$\sigma_a = \frac{\sigma}{n} \qquad (n = \text{number of observations}).$$

The standard error of the mean for the Bantu group may be written as $\sigma_a 1$, for the Coloured group as $\sigma_a 2$, and for the Scammon and Calkins series as $\sigma_a 3$. The next step was the calculation of the standard error of the difference (σ diff.) using the formula:

$$\sigma \text{ diff.} = \sigma_a 1 + \sigma_a 2.$$

Having obtained the standard error of the difference, the critical ratio is determined by the formula:

$$\text{critical ratio} = \frac{\text{actual difference between means}}{\sigma \text{ diff.}}$$

According to the laws of probability the significance of the numeral values obtained for the critical ratio is as follows: If the critical ratio is 2·5, a difference between the two means, equal to or greater than the observed difference, is not likely to be found in more than 6 out of 1,000 comparisons of groups drawn from similar population groups. Hence we are justified in concluding that the observed differences are almost certainly due to systematic and not to chance factors; in other words that the observed differences are significant. This conclusion is all the more justified if the more critical ratio exceeds 2·5, the significance becoming more and more important as the critical ratio increases.

Comparison

The results of the cephalometric studies are recorded in Tables III and IV. The average biparietal diameter for the Bantu series was found to be 91.54 millimeters, which is appreciably lower than that of obstetric teaching. Scammon and Calkins[7] cited 35 series from authors who published means for this dimension. The average for the biparietal diameter, based on the findings of the work of all these authors, is 85·4 (Fasbender) to 100 0 millimeters (Lizarzlik and Webster). The mean obtained by Meigs (Philadelphia, 1943) is not included in these calculations, for this author obtained a value of 137·6 millimeters for the biparietal diameter and 122·8 for the occipito-frontal measurement. The mean for the biparietal diameter based on the work of 35 authors is 93·61 millimeters. In only 8 series are the means smaller than that of the Bantu newborn infants; in the remaining 27 series the value is greater. It may be stated, therefore, that the biparietal diameter in the full-term Bantu foetus is in the lower limits of the range for this measurement. It is of interest to note that such workers as De Lee (92·5), Williams (92·5), Jonner (92·5), and Hector (92·2) obtained values lower than the average (93·61 millimeters) for all workers.

TABLE III. MEASUREMENTS ON UNMOULDED HEADS OF NEWBORN CAPE COLOURED INFANTS

Number	*Sex*	*Age in hours*	*Crown-heel length (mm.)*	*Biparietal diameter (mm.)*	*Occipito-frontal diameter (mm.)*
1	F	10	495	92	114
2	M	2	500	94	116
3	M	7	515	95	117
4	F	4½	500	92	114
5	M	15	505	92	114
6	F	16	495	93	118
7	F	2	490	92	116
8	M	7	500	93	117
9	F	1½	515	94	118
10	M	5	500	93	116
11	F	9	490	92	115
12	M	6	500	93	117
13	F	15	495	92	116
14	M	17	485	91	115
15	M	2	480	92	117
16	F	22	495	92	114
17	M	1½	510	93	116
18	F	17	495	92	114
19	F	5	490	90	112
20	M	4	495	92	114
21	F	9	485	91	112
22	M	21	500	92	113
23	F	4	480	89	113
24	F	7½	510	93	116
25	M	11	485	90	111
26	M	22½	490	91	113
27	F	1	485	89	112
28	M	7	495	92	115
29	F	9	495	92	115
30	F	8	490	91	114
31	M	3½	500	92	112
32	M	6	515	93	115
33	F	15	495	90	112
34	M	7	505	93	113
35	M	4	495	92	113
36	F	1	490	89	114
37	M	7	495	91	116
38	M	8	490	92	117
39	F	15	495	91	116
40	F	9	495	92	117
41	M	22½	515	94	118
42	F	11	500	92	117
43	F	23	510	93	116
44	F	17	500	94	118
45	M	17	495	92	116
46	F	9	495	92	112
47	F	7	505	93	114
48	M	4	485	91	112
49	M	9	500	92	113
50	M	2	495	92	114

TABLE IV. MEASUREMENTS OF UNMOULDED HEADS OF NEWBORN BANTU INFANTS

Number	*Sex*	*Age in hours*	*Crown-heel length (mm.)*	*Biparietal diameter (mm.)*	*Occipito-frontal diameter (mm.)*
1	F	2	495	90	115
2	M	7	488	89	114
3	M	4	490	89	115
4	F	8½	495	91	115
5	M	24	498	91	116
6	F	6	495	92	116
7	F	10	495	91	115
8	M	14	510	93	117
9	F	17½	500	92	116
10	F	18	495	92	116
11	M	5	505	93	118
12	M	1½	485	91	116
13	M	3	510	93	118
14	M	4	495	92	116
15	F	12½	495	92	116
16	M	22½	490	90	115
17	F	17	495	91	115
18	F	4	515	93	118
19	M	9	490	90	116
20	F	2½	495	91	116
21	F	11	485	90	114
22	M	17	498	92	117
23	F	13	500	93	117
24	M	13½	495	90	113
25	F	1½	495	91	115
26	M	7	490	90	116
27	M	10	495	91	117
28	F	14	505	93	118
29	M	11½	490	90	117
30	F	4	495	92	117
31	F	22	490	90	115
32	M	14	485	89	115
33	M	18	485	88	117
34	F	16	495	92	117
35	M	2	495	91	116
36	M	7	490	91	116
37	M	9	515	95	118
38	F	5	498	91	116
39	F	15	495	92	118
40	M	14	495	91	117
41	F	5	490	91	115
42	M	9	510	94	117
43	F	18	495	92	116
44	F	15	490	92	117
45	F	4	495	91	115
46	M	11	498	91	116
47	F	6	485	89	114
48	M	10	492	90	115
49	F	5	495	92	116
50	F	5	480	89	114

The mean for the Coloured infants in my series was 92·22 millimeters, which agrees fairly closely with the means of the authors quoted in the previous paragraph. It is only 0·68 millimeters less than the corresponding figure for the Bantu infants. No significance can be attached to the difference.

The *mean values for the dimensions studied, in millimeters,* are as follows:

Dimension	*Bantu*	*Cape Coloured*
BIP	91·54	92·22
O–F	116·0	114·7

The occipito-frontal diameter for the Bantu infants is 116·0 millimeters, whereas that for the Coloured group is only 114·7 millimeters. The range according to calculations based on 28 series of measurements is 110·0 - 120·0 millimeters. Again, Meigs' figure of 122·8 for this measurement is not included. The mean is found to be 115·7 millimeters. It may be said of the Bantu value of 116·0 millimeters that it is barely above the average and that it is in the higher reaches of the range for this dimension. Different workers have obtained widely varying results in their assessment of the occipito-frontal dimension. Thus De Lee and Williams, who obtained identical means for the biparietal diameter, found the occipito-frontal measurement to be 110·0 and 117·5 millimeters in their respective series. The figure of 114·7 for Coloured infants is slightly below the average.

In the 29 series listed by Scammon and Calkins, 12 authors obtained a smaller, and 17 a greater value.

CONCLUSION

An attempt has been made to determine the dimensions of the head in the foetus at term. It is clear that English obstetric teaching places the value for the biparietal dimension higher than the determinations of recent workers. This difference is probably because obstetric teaching is based on measurements made 4 or even 5 days after birth. While this has the advantage of being done on a head which has largely recovered from the moulding effects of parturition, it unfortunately introduces an error owing to growth. The same may be said of the occipito-frontal dimension.

The results of my investigations show that the head of the full-term Bantu foetus does not differ very markedly from that of the Caucasian. The shorter biparietal and longer occipito-frontal diameters in the South African Negro suggest that the head is slightly narrower and longer than in, for example, the Coloured group, which differs not al all from the Caucasian.

THE CEPHALIC INDEX

Computations based on the results of my cephalometric studies yield a cephalic index for Cape Coloured infants of 80·38, which is almost identical to that obtained by

Scammon and Calkins in their biometric investigations. The mean index for a series of 50 Bantu infants was 78·52. These two indices were subjected to statistical analyses, and a critical ratio of 25·90 was obtained (Table V). The conclusion is therefore justified that the observed difference (1·86) between the arithmetic means for the 2 series almost certainly arises from systematic and not chance factors; in other words, these cephalometric studies show that Bantu infants are more dolichocephalic than Cape Coloured infants at birth.

TABLE V. THE CEPHALIC INDEX

	Bantu	*Cape Col.*
Cephalic index	78·52	80·38
Standard deviation	0·2573	0·4377
Standard error of mean	0·03639	0·0691
Standard error of diff.	0·07178	
Critical ratio	25·9	

This difference between the 2 groups of infants may at first sight appear contrary to what was expected, especially in view of the fact that the Cape Coloured number among their ancestors certain Southern Negroid ethnic groups, namely, the Bushmen (cephalic index 75·8) and Hottentots (cephalic index 70·5). Moreover Bushman - Hottentot hybrids have been shown to have an index of 73·4, which is roughly an average of the 2 individual groups. Reasoning in a purely arithmetic way one would expect the index for the Cape Coloured people to be lower than its proved figure of 75·8.[8] However, the inheritance of cranial characteristics seems to be a complex affair, probably because so many independent variables are involved in the process that it cannot be expressed in terms of simple Mendelian factors.[9]

The fact that isolated inbreeding can produce a fairly stable and constant mean cephalic index, and the further fact that interbreeding between diverse stable groups introduces modifications in the descendants, indicate that hereditary transmission is a factor of some importance. The complexity of the problem of inheritance emerges from the measurements made by Sullivan[10] (1919) on the Samar united twins, of whom Lucio had a cephalic index of 80·8 and Simplicio an index of 85·5. However, while the genetics of head-form are not simply resolvable, it must be conceded that within a homogeneous group under stable conditions the cephalic index remains constant for a long time, and this must arise mainly from hereditary transmission.

There is thus no method by which the inherited cranial form of these people with their multiracial origin can be predicted. The adult index is 75·8 and in the foetus at term the index is no different from that, for example, obtained by Scammon and Calkins in their investigations. The computed index based on empiric formulae does not differ appreciably from that for Cape Coloured and American infants.

Different workers have obtained widely differing results in their studies on the full-term foetus, the exercise of insufficient care in the selection of material having been the main factor responsible for this lack of uniformity. In Table VI are recorded the indices which have been calculated from the investigations of different workers.

TABLE VI. THE CEPHALIC INDEX IN THE NEWBORN (BASED ON THE MEASUREMENTS OF DIFFERENT WORKERS)

Race	*Crown-heel range (mm.)* 450–500	500–550	*Author*
Rhenish	79·64 (106)	76·57 (79)	Caspar
German	73·72 (74)	74·99 (6)	Spondi
French	80·85 (164)	80·69 (81)	Ribemont
French	80·00 (98)	80·69 (102)	Depaul
French	80·77 (40)	80·69 (57)	Solares
French	79·82 (70)	81·19 (64)	Lafaille
Greek	82·85 (52)	79·82 (80)	Corrado
Norwegian	73·05 (1)	74·78 (1)	Kjölseth
German	80·15 (?)	80·26 (?)	Weisz

Figures in parentheses indicate the number of heads measured.

The findings of the 3 French workers show close agreement in the index, being just above 80. Indices below 75 were obtained by 2 workers, namely, Spondi (German) and Kjölseth, working in Christiana. Their series are however too small (6 and 1) to form the basis of discussion and comparison — even if the values quoted are correct. However, Caspar (Rhenish) in a series of 79 cases, obtained an index of 76·57.

Ever since its inception the cephalic index has remained the major criterion of human affinities and development. Morant, in 1918, claimed that only one character has been found which is capable of making an absolute distinction between more than one of the groups (i.e. of humans), and that is the cephalic index. Thus the value of the index is established, but it can be accepted only as a total response to a number of variable factors, some of which are probably obscure. Abbie,[11] who adopts the attitude in his 1947 paper of seeking some unifying principle under the apparent diversity of the multitude of observations, considers head-form in relation to many factors including race and individual development. He finds the term 'race' objectionable on politico-sociological grounds — an attitude for which there is much to be said, especially in view of the fact that the word is used equally for the whole human species and for sections of that species.

The cephalic index of the newborn infant falls within a very restricted range which is close to the lower limit of brachycephaly (78·82). Skull differentiation shows 4 stages, of which the first is a common human stage at birth. Common human heredity determines head-form until birth.

SUMMARY

Bantu and Cape Coloured infants were studied, special care having been taken to avoid the unpredictable alteration of cranial form introduced by head moulding. The findings show that the foetus at term, of both groups, has an index which falls within the range of what anatomists and anthropologists have come to accept as normal for the human race.

One of the features brought out by this study is the greater frequency of true dolichocephalic forms among Bantu foetuses at term. The term dolichocephaly is used here according to the index grouping suggested by Abbie: brachycephaly, over 82; and dolichocephaly, under 78. No difference in cephalic index was demonstrated between males and females of either group investigated.

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