Cephalofacial characteristics of the Akan people in the Assin Districts in Central Region of Ghana: Anthropometric studies

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Introduction

Modern humans exhibit great diversity of physical differences because of some factors such as sexual dimorphism, topography, climate, geographical location, and diet.1–2 These physical differences account for different races, tribes, and ethnicities.3 It also has very important influence on the health and identification of an individual; therefore, becomes very necessary to establish baseline for health and physical identification of humans for each population.4–11

Physical anthropology relies mainly on external measurements (Anthropometry) and descriptions (Morphology) of the human body. Such measurements are useful in the analysis and classification of fossil remains as well as study of living population. Anthropometry comes from a Greek word “Anthropos” which means human and “metron” which means measure. It is a non-invasive technique to measure the dimensions of the human body and skeleton.1–4 Anthropometry has become essential tool of biological anthropology that involves a series of standardized measuring techniques that express quantitatively, the dimensions of human body. Cephalic and facial indexes are very important anthropometric index used in describing head and facial dimensions and morphology, respectively.5–9

Cephalic index (CI) is very useful in racial, ethnic, and gender identification of individuals. It is defined as the ratio of maximum cephalic width to maximum cephalic length multiplied by hundred percent. Based on the value of CI, there are six different types of heads.10–11 Facial index (Prospic index), on the other hand, is used to describe the facial proportion, prognosis of orthodontic treatments as well as indicating the direction of growth of craniofacial complex. The facial index is also defined as the ratio of morphological facial height to the ratio of facial width (bizygomatic width) multiplied by hundred percent. There are five different types of face based on facial index.10,11

The facial and cephalic indices of an individual are determined by growth and developmental pattern. According to Virchow’s law of parallel and perpendicular bone expansion, patency of the metopic and sagittal sutures are responsible for the adequate growth of cranial vault in the anterior–posterior while that of coronal and lambdoid sutures account for the growth in the transverse directions.12 The fusion of metopic suture occurs between 3 and 9 months while the others fuse between 22 and 39 months.13 Premature fusion of the sagittal suture may result an increase the entire length of the head in the anterior–posterior direction but in early fusion of metopic suture, only the anterior length is reduced.13

Although a high amount of report on cephalic and facial indices exist among various tribes and ethnic groups but there are little or no published data of such kind exist for the Akan people in Ghana. This study therefore aims at establishing for the first time, the baseline of cephalic and facial indices among the Akan people of Ghana.

Materials and methods

A total of 100 (50 males and 50 females) Akan volunteer adults between the age of 20 and 58 years (mean age of 29.7 years for males and 30.7 years for females) were recruited for the study. These volunteers were randomly selected from teachers and students of ObiriYeboah SHS and College of Distant Education, UCC (ObiriYeboah SHS Center) as well as inhabitants of AssinFosu and the neighboring towns within the
Assin Districts. Subjects with history of craniofacial injury or trauma and obstructive hairstyle were excluded from the study. Verbal informed consent was obtained from each participant.

The Hrdlicka’s method was used in assessing the cephalo-facial parameters. The cephalic width (CW) was also measured as the maximum transverse diameter between two fixed points of the head (euryon), above the mastoid prominence (Fig. 1A). The cephalic length (CL) was measured with the help of spreading calipers, from glabella to mid-point of external occipital protuberance (Fig. 1B). Then the CI was calculated and the head type determined for each subject.

Table 1 illustrates the types of heads and their designated values of cephalic indices. CI was calculated using the following formula (No. 1):  

$$CI = \frac{CW}{CB} \times 100$$  

As well, total facial height (TFH) was measured from the nasion to mental tubercle (Fig 1. C), and facial ( bizygomatic) width (FW) was measured as a distance between the right and left zygion (Fig. 1D). Additionally, facial index (FI) was calculated and face type was determined for each case.

Table 2 illustrates the types of faces and their designated values of cephalic indices. FI was calculated using the following formula (No. 2):  

$$FI = \frac{FL}{FW} \times 100$$

All the measurements were taken with the subject sitting in relaxed condition and head in anatomical position. To reduce the technical error of the measurements, each dimension was taken twice and the average recorded. All measurements were taken to the nearest 1.0 cm.

The following give descriptions of the measured parameters:

- **Cephalic length (CL):** Glabella to inion
- **Cephalic width (CW):** Distance between parietal eminences (zygion)
- **Total facial length (TFL):** Nasion to gnathion
- **Facial width (CW):** Distance between zygomatic arches.

The data obtained were statistically analyzed using IBM-SPSS version 22 and Microsoft Excel 2016 for Windows. Basic descriptive statistics and independent sample t-test were performed at 95% confident interval. The p-value of less than 0.05 was considered statistically significant.

**Results**

Tables 3–7 show the results of present study. Basic statistics of CL, CW, CI, TFH, FW, and FI are shown in Table 3. The mean CL and CW of males were 18.26 ± 0.85 and 14.20 ± 0.76, while those in females were 17.52 ± 0.91 and 13.88 ±0.82, respectively. As the data show, there were significant differences (p<0.05) in both mean CL and CW between male and female subjects. The means of CI were also 77.92 ± 5.37 and 79.28 ± 5.08 for males and females, respectively, but there were no significant differences between the two genders (p=0.052) (Table 4).

The mean CI of both males and females was 78.60 ± 4.66, which falls within mesocephalic (a head of medium proportions). This type together with brachycephalic (a moderately
broad and short head) were the predominant types of head (Tables 1, 3 and 5).

The Basic statistics of TFH and FW are shown in Table 3. The mean of TFH and FW were 11.58 ± 0.97 and 12.02 ± 1.12, while those in females were 11.52 ± 0.95 and 12.14 ± 1.23, respectively. There was no significant difference in both mean TFH and FW between male and female subjects (p > 0.05, Table 4).

Table 4 shows the mean facial index 97.21 ± 12.70 and 95.82 ± 12.49 for males and females respectively, and the difference was not statistically significant (p = 0.291).

The mean facial index of the studied population was 96.51 ± 12.55 (Table 3), which...
falls within hyperleptoprosopic (a very long narrow face) type of face (Table 2).

According to our data, hyperleptoprosopic is also the predominant type of face as depicted in Table 6. Furthermore, the correlation between the head width and facial width has been shown in Table 7.

Discussion

In the present study, cephalofacial anthropometric characteristics of the Akan people in the Assin Districts (Central Region of Ghana) were investigated. This study has revealed that the CI of the Akan people in the Assin Districts was 78.60 ± 4.66. This value is in agreement with the results obtained by many authors such as Basu et al. and Bhargav and Kher. However, in a study conducted by Madadi et al. among Iranian medical students, the CI of 83.51 was recorded. Anupama et al. (2009) also obtained a CI of 85.53 among Punjabi students. These results do not correlate with the result of the current study, however it confirms the fact that there are differences in the CI among different populations.

According to the results, no significant difference was observed between males and females CI. Our findings corroborated with the results of Oladipo and Paul et al. In contrast, the results of Babatunde et al. and Anupama et al. were not in accordance with our findings.

The reasons for the absence of difference in CI between male and female are not clear but may be due to the fact that the effect and interplay amongst growth, thyroid, and sex hormones seem to have the similar effect in both sexes. The dominant types of head in our study are meseocephalic and brachycephalic. The existence of more than one dominant head type with an equal percentage of distribution within the same study population is uncommon in the published literatures. However, both head types observed in the present study are among the most common head type in the African population.

The facial index of the studied population was 96.51 ± 12.55. By comparing with the results in other populations, our value showed a degree of variations. Among Fars and Turkmen of Iran, males and females showed a prosopic index of 74.3 and 81.6, respectively. As well, Jaberi et al. among Fars and Turkmen of Iran, males and females showed a prosopic index of 74.3 and 81.6, respectively. In contrast, the results of Babatunde et al. and Anupama et al. were not in accordance with our findings.

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Indigenous of Maiduguri also had prosopic indexes of 99.59 and 97.54 for males and females, respectively. Among the Qazvin people of Iran, Azizi et al. recorded a prosopic index of 102.88 in males and 96.69 in females, respectively. In this study, similar to the CI, there was no significant sexual dimorphism between males and females in the prosopic index as well. The reasons for this observation are not clear but can be the same with CI reasons. The dominant type of face in the study population was hyperleptoprosopic in both males and females. This is in the direct agreement of the face type amongst Bini People of Nigeria.

Finally, our results indicate that there are a significant positive correlation between cephalic length and cephalic width, cephalic length and total facial length as well as cephalic width and facial width. These findings agree with that of Umar et al. among Hausa and Yoruba ethnic groups of Nigeria. Obaje et al. also came to the same conclusion in their study of cephalic indices among Benue ethnic groups of Nigeria.

Conclusion

This study has revealed that the CI and facial index among the Akan people of the Assin Districts in the Central Region of Ghana are, respectively, 78.60 and 96.51. This population has both Mesoecephalic and Brachycephalic as dominant types of head. The dominant face type among them is hyperleptoprosopic. There was a positive correlation between head width and facial width among them. Data obtained from this study will serve as a baseline for forensic scientist and anthropologists, and for comparisons between the Akan people of Assin Districts and other ethnic groups within or outside Ghana.

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Conflict of Interest

There was no conflict of interest.

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Cephalofacial characteristics in Central Region of Ghana

Gordon Kyei et al.

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