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Full Length Article

Preliminary cephalometric study of the relationship between facial morphology and sex

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ABSTRACT

Morphology of the face depends on many factors, such as sex, ethnicity, race, climate, nutrition, genetic constitution and socio-economic status. In the developed countries, there is well established database on facial anthropometry and for the purpose of identification. In Ghana however, there is very little documented information on cephalometric indices for biometric and forensic purposes. This study therefore, aimed at establishing baseline data to assess the relationship between sex using upper, lower and total cephalometric indices. One hundred participants made up of sixty males and forty females from KNUST were recruited for the study. Linear facial anthropometry were taken using calibrated Shahe digital calipers whiles participants sat with head in natural position. The facial anthropometric measurements were generally higher in males than in females. Upper facial height, facial width, nasal width, biocular diameter, lower facial height, lip length and total facial height were statistically significant and ($p < 0.05$). The present study shows the existence of statistically significant sexual dimorphism in the study population using cephalo-facial dimensions.

1. Introduction

Anthropometry is an essential tool of biological anthropology which involves a series of standardized measuring techniques that express quantitatively the dimensions of human body. Cephalometry is one of the disciplines of anthropometry which deals with the measurement of the head and face of living human beings and cadavers. Direct facial anthropometry is considered a gold standard method in assessing facial dimensions (Farkas et al., 2005).

Cephalometry has been widely used by many researchers for sex estimation. Determination of sex is of fundamental importance both for personal identification in forensic science as well as population data studies (Stephan et al., 2005). Sex is generally inferred from facial morphology which is highly reliable. The ultimate aim of determining sex in forensic science is to help law enforcement agencies in achieving personal identity in medico-legal cases like mutilated and decomposed body parts. In many cases cephalofacial dimensions are the only means of evidence for forensic examination. Such studies are also useful in forensic and clinical medicine, plastic and oral surgery, facial reconstruction and research.

Over the last decade, there has been a rise in the occurrence of disasters such as floods, earthquakes, typhoons, fire, road traffic accidents etc. In such situations, it becomes difficult to determine the sex of the dead victims especially bodies that have decomposed. In the developed countries, facial recognition systems based on cephalometry are used in combination with dental records to identify such victims. However in developing countries such as Ghana, it appears there are no metric cephalofacial data for Ghanaians. Therefore the present study was designed to examine facial morphology and provide some baseline cephalometric indices for the study population.

2. Materials and methods

The present study was conducted at the Anatomy Department, School of Medical Sciences, Kwame Nkrumah University of Science and Technology. A total of 100 undergraduate students were recruited for the study, out of which 60 were males and 40 were females. Participants were between the ages of 17 and 34 years. Informed

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participant consent and ethical approval were sought. Participants without facial deformities or history of facial surgery were included in the study. Those with facial deformities or previous history of facial trauma or surgery were excluded from the study. Their facial dimensions were measured with calibrated Shahe digital calipers manufactured in Shanghai (China).

2.1. Sample collection

Data collected in the study included upper, lower and total facial measurements. Primary data concerning age and sex were also taken.

2.2. Measurements

The landmarks, techniques and procedures recommended by Singh and Bhasin (2004) were adopted for the study. Eight facial dimensions were taken from all the participants. All measurements were taken using standard anthropometric procedure with participant sitting in a chair in a relaxed condition and head in the natural position.

2.3. Upper facial measurements

The following dimensions were taken to the nearest millimeters using calibrated Shahe digital calipers and the results recorded into the log book:

1. Upper facial height (nasion-subnasion): The distance from the root of the nose to the deepest point of the nose (Fig. 1).
2. Facial width (zygion-zygion): The maximum distance between the most lateral points of zygomatic aches localized by palpitation.
3. Biocular diameter (ectocanthion-ectocanthion): The distance between the lateral junction points of the upper and lower eyelid of both right and left eye (Fig. 2).
4. Interocular diameter (endocanthion-endocanthion): The distance between the median junction points of the upper and lower eyelid of both right and left eye.

2.4. Lower and total facial measurements

The following dimensions were taken to the nearest millimeters using calibrated Shahe digital calipers and the results recorded into the log book:

1. Lower facial height (subnasale-gnathion): The distance from the base of the nose to the lowest median landmark on the border of the mandible.
2. Nasal width (alare-alare): The distance between the most lateral points of the right and left nostrils (Fig. 3).
3. Lip length (cheilion-cheilion): The distance between the lateral junction points of the upper and lower lips
4. Total facial height (nasion-gnathion): The distance from the root of the nose to the lowest median landmark on the border of the mandible (Fig. 4).

Fig. 1. A photograph showing measurement of upper facial height using Shahe digital calipers (X 0.5).

Fig. 2. A photograph showing measurement of biocular diameter using Shahe digital calipers (X 0.5).

Fig. 3. A photograph showing measurement of nasal width using Shahe digital calipers (X 0.5).

Fig. 4. A photograph showing measurement of total facial height using Shahe digital calipers (X 0.5).

2.5. Data analysis

The various measurements and data collected were sorted out, coded, tabulated and compiled on an excel spread sheet. The data were then analyzed statistically using IBM Statistical Package for Social

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