

Facial, upper facial, and orbital index in Batak, Klaten, and Flores students of Jember University

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ABSTRACT

Forensic anthropology is a neglected branch of physical anthropology in Indonesia. The role of anthropology in forensics including medical and dental forensic is identification. Anthropology could be used in identify skeleton including sex, age, height and race. The aim of this study was to know the facial index, the upper facial index and the orbital index among three different students race population of Jember University used Posteroanterior radiography. The subjects of this study were Batak, Klaten and Flores students of Jember University. The craniometric indices in this study according to the El-Najjar classification. The result showed that all the subjects facial index classified as hypereuryprosopic with the mean between 78.05–79.184. Batak population upper facial index classified as hyperueryene, while Flores and Klaten population were euryene. All the population orbital index classified as hypsiconch.

Key words: anthropology forensic, craniometric index, population, PA radiography

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INTRODUCTION

Forensic anthropology is a neglected branch of physical anthropology in Indonesia. The role of anthropology in forensics including medical and dental forensic is identification. In the police opinion, identification is an individual identification but in anthropology forensic the process to identify an individual is called identification, such as racial identification, sex and age. Anthropology could be used in identify skeleton including sex, age, height and race, or in individual identification by physiognomic reconstruction, lip print and dermatoglyphy. The role of anthropology was very strict in paternity disputed, because using the anthropometric, anthroposcopy and dermatoglyphy beside serology the reliability was very high.¹

Sometimes in disasters, whether natural, technological or man-made, there were lots of dead bodies which already mutilated or incineration. The ultimate aim of all disaster victim identification operation must invariably be to establish the identity of every victim by comparing and matching the accurate ante-mortem (AM) and post-mortem (PM) data.² In those cases the role of an anthropologist is a must. The three most vital determinations that must be made when dealing with skeletal remains are age, sex, and racial affinity. It would be nearly impossible to attempt to identify, much less reconstruct, the face of an individual without this information. There is no question that all of these factors have a significant bearing on appearance and also serve to narrow the range of possible matches.³

In the forensic context, the approach to race must be a pragmatic one. The identification of unknown individuals is one of the most important justification for maintaining biologically based racial typologies. The racial classification is also essential to facial reconstruction, where recognizability is a major aim. The skull is the best part of the skeleton to use for determination of racial affinity, both morphologically and osteometrically.³

In forensic anthropology, only three 'major' group of racial affiliation are normally encounter (at least outside the Pacific rim and Australia): Caucasian (including Europeans, Asians from the Indian subcontinent, Mediterraneans and Americans with similar ancestry); Mongoloid (Asiatics and Native Americans); and Negroid (Africans and African Americans).⁴ Indonesia belongs to Mongoloid, and Glinka *cit.* Herniyati⁵ divided Indonesia into four races and nine cluster: Deuteromelayid in the west and north side, Dayakid in the Celebes; Protomalayid in south east, and Melanesid in Irian Jaya (Papua). Physical characterize of Deuteromalayid is brachycephal head with wide face and projection of zygomatic arch as well as Dayakid, while Protomalayid and Melanesid are meso-to dolicocephal head.⁵

Distinction between the racial subgroups is best made from feature of the skull and, secondarily, from the postcranial skeleton. Traits useful in the assessment of racial affiliation include the overall morphology of the skull—its length, breadth and height—the shape of the face, the width of the zygomatic arches, the shape of the orbits, the interorbital breadth, and the size, shape and degree of guttering of the nasal aperture.⁴

It cannot be emphasized strongly that correct determination of age, sex, and race are prerequisites to all aspects of craniofacial reconstruction, superimposition, and identification. A significant error in age assignment could eliminate the actual individual in question from consideration. Diagnosing race or sex incorrectly makes identification absolutely impossible. Therefore, an experienced forensic anthropologist or skeletal biologist should always be consulted when skeletal remains are found.³

Anthropometric studies are an integral part of craniofacial surgery and syndromology. For these reasons, standards based on ethnic or racial data are desirable because these standard reflect the potentially different patterns of craniofacial growth resulting from racial, ethnic, and sexual differences.⁶

Face width is the maximum distance between directly opposite on the malar or cheek bone. Face length is measured from the nasion to the lowest point in the center line on the lower jaw (gnathion). This relation, the facial index, is calculated by dividing the length of the face by its width and multiplying the quotient by 100.⁶ The upper facial index is calculated by dividing the distance from nasion to prosthion (aleolare) by its width and multiplying the quotient by 100. And the orbital index is calculated by dividing the maximum orbital breadth by its maximum orbital length. These craniometric indices are the measurement of the skull, included in osteometry.⁷

Many disaster cases leaved several dead bodies unidentified because of the mutilation of the bodies or the incineration. The JW Marriot bombing 2003 leaved only a head of the dead body, the Situbondo tragedy 2003 killed 55 incineration students, and the Kuta bombing 2005 leaved three head without body. In all these cases identification of the body was very difficult because there was no AM data. The role of an anthropologists in those cases was determining sex, age and race from the skull. That's why we need some method and measurement of the skull.

Fortunately, there is only little information of the measurement of Indonesian. The aim of this study is to know the facial, upper facial, and orbital index among three different students population of Jember University used PA radiography and we hope that this measurement could be used in identification the skull in incineration and mutilation cases, or in superimpose technique and facial reconstruction.

MATERIALS AND METHODS

The subjects of this cross sectional study were students from Jember University that belongs to three different population according from their hometown: Batak, Klaten and Flores. Using purposive sampling technique with sample criteria: male, age between 18-27, there is no mix-marriage to other population up to two generation, no malocclusion, no dental restoration and prosthetic, and good

key of occlusion; we found 10 samples for Klaten, 10 samples for Flores, and 11 samples for Batak population.

All the samples used PA radiography and we calculated the facial, upper facial, and orbital index according to the craniometric indices from El-Najjar⁷ as follows:

$$\text{Facial index} = \frac{\text{Nasion - Gnathion Height} \times 100}{\text{Bizygomatic Breadth}}$$

Hypereuryprosopic	X-79,9
Euryprosopic	80,0-84,9
Mesoprosopic	85,0-89,9
Leptoprosopic	90,0-94,9
Hyperleptoprosopic	95,0-X

$$\text{Upper facial index} = \frac{\text{Nasion - Prosthion Height} \times 100}{\text{Bizygomatic Breadth}}$$

Hypereuryene	X-44,9
Euryene	45,0-49,9
Mesene	50,0-54,9
Leptene	55,0-59,9
Hyperleptene	60,0-X

$$\text{Orbital index} = \frac{\text{Max. Orbital Breadth} \times 100}{\text{Max. Orbital Length}}$$

Chamaeconch	X-75,9
Mesoconch	76,0-84,9
Hypsiconch	85,0-X

RESULTS

We studied 31 students of Jember University that belongs to three different population according to their hometown. Both Flores and Klaten population classified as hyperueryprosopoc (50%), euryprosopic (40%) and mesoprosopic (10%); while Batak population classified as hypereuryprosopic (64%), mesoprosopic (27%) and euryprosopic (9%) as shown in table 1. The mean of facial index of these population between 78.76-79.184 and classified as hyperueryprosopic (Table 4).

Table 1. Facial Index classification on Flores, Batak and Klaten population of Jember University

Population	N	Facial index classification				
		A	B	C	D	E
Flores	10	5 (50%)	4 (40%)	1 (10%)	0	0
Batak	11	7 (64%)	1 (9%)	3 (27%)	0	0
Klaten	10	5 (50%)	4 (40%)	1 (10%)	0	0

A. Hypereuryprosopic,
 B. Euryprosopic,
 C. Mesoprosopic,
 D. Leptoprosopic,
 E. Hyperleproprosopic

Upper facial index of Flores population was so variety as shown in table 2. 50% of this population classified as euryene, 20% classified as hypereuryene and mesene, while 10% classified as lepene. 64% of Batak population classified as hypereuryene, and 18% classified as euryene and mesene. 50% of Klaten population classified as euryene, 30% as mesene and 20% as hypereuryene. The mean of upper facial index of these population between 43.46–47.8 (Table 4) and classified as hypereuryene and euryene.

Table 2. Upper facial index classification on Flores, Batak and Klaten population of Jember University

Population	n	Upper Facial index classification				
		A	B	C	D	E
Flores	10	2 (20%)	5 (50%)	2 (20%)	1 (10%)	0
Batak	11	7 (64%)	2 (18%)	2 (18%)	0	0
Klaten	10	2 (20%)	5 (50%)	3 (30%)	0	0

A. Hypereuryene, B. Euryene, C. Mesene, D. Lepene, E. Hyperlepene

All of these population orbital index classified as hypsiconch (100%) as shown in Table 3 with the mean of orbital index between 99.26 – 106.63 (Table 4).

Table 3. Orbital index classification on Flores, Batak and Klaten population of Jember University

Population	n	Orbital Facial index classification		
		A	B	C
Flores	10	0	0	10 (100%)
Batak	11	0	0	10 (100%)
Klaten	10	0	0	10 (100%)

A. Chamaconch, B. Mesoconch, C. Hypsiconch

Table 4. Mean of facial, upper facial, and orbital index on Flores, Batak and Klaten Population of Jember University

Population	n	Mean of facial index	Mean of upper facial index	Mean of orbital index
Flores	10	79.184 ± 4.96	47.43 ± 4.75	106.63 ± 7.63
Batak	11	78.05 ± 7.04	43.46 ± 5.43	99.26 ± 6.99
Klaten	10	78.76 ± 4.4	47.8 ± 3.03	102.73 ± 5.77

A. Chamaconch, B. Mesoconch, C. Hypsiconch

DISCUSSION

The skull is the bony structure of the head which includes the cranium, skeleton of the face, and the mandible or lower jaw. Skull bones vary in thickness, size, and shape in relation to each other and between different individuals. They may be flat (parietal and temporal), irregular (sphenoid), or curved (frontal).⁷

The frontal bone is a saucer-shaped bone which forms the forehead and the upper part of the orbital cavities. The frontal bone articulates with the two parietal bones at the coronal suture, laterally with the great wing of the sphenoid and the frontal process of the zygomatic bone, and below with the ethmoid, lacrimal, maxillary and nasal bones posteroanteriorly.⁷

The zygomatic or malar bone supports the cheek. It articulates medially with the maxilla, above with the frontal bone, laterally with the temporal bone, and behind with the greater wing of the sphenoid. The posterior projection forms the anterior portion of the zygomatic arch, and the upward projection completes the outer wall of the orbit.⁷

Anatomically modern the human show considerable geographical variation in the form of the facial skeleton. During growth the facial skeleton changes dramatically in shape as well as in size. It comprises several interdependent bones that grow and develop under the influence of various local and systemic factors. Although different bones and/or different parts of the same bone may grow independently to some degree under the influence of localized factors, the facial skeleton remains a functional whole throughout the course of development. It well known that adult modern human populations show significant differences in both facial size and shape.⁸

Klaten (central Java) belongs to Deuteromalayid while Batak and Flores are Protomalayid, and in the dendogram of Indonesian population by Glinka *cit.* Herniyati⁵ they all at the D group.⁵ It supported this present study that the facial index of the three population were similar classified as hypereuryprosopic (Table 1) with the mean of the facial index between 78.05–79.184 (Table 4). In contrast, Cakirer *et al.*⁹ showed that leptoprosopic facial types were more often associated with dolicocephalic head forms, and euryprosopic facial forms were more often associated with brachycephalic head forms.

The different classification of the upper facial index, Batak was hypereuryene (mean 43.46) but Klaten and Flores were euryene (Table 2) with the mean of the upper facial index respectively 47.8; 47.43 caused by Batak and Tapanuli were in the same group (D), while east Flores at the C group and Bama (east Flores) at the C group. Some of east Java are in the D group but some of them in the F group. The different result could be made by the different aspect of view. We analyzed the indices through the PA radiography and compared it by the classification of physical anthropology because PA radiography is the most useful tools in identification the skull of death body. In the superimpose technique where we compared the victim photograph and skull found in the scene, the used of the PA radiography is a must.

Radiography studies play an important part in the forensic autopsy and are particularly relevant in the cases where identity of the deceased is unknown. Comparison of the post mortem radiographs with clinical radiographs taken in life can result in identity being established with a very high degree of certainty.¹⁰ Ante mortem X-ray

photographs of the head and oro-dental region are excellent evidence for identification purposes. The size, shape and dimensions of many structures are very stable in the skeleton of the head. Post mortem radiographs of skulls can, however, be taken under conditions identical to those which were employed during life, allowing superimposition comparisons to be made.¹¹

The orbital index of all population classified as hypsiconch (Table 3). It was hard to measure the orbital breadth and length due to the quality of the PA radiogram. Various factors have been proposed to influence the adult form of the facial skeleton. Although the basic structure is determined in accordance with genetically regulated blueprint while in utero this is modified pre- and postnatally through functional matrices responding to environmental and epigenetic influence such as climate, activity patterns and masticatory function.⁸

Metric traits are continuous morphological variables dealing with the size and dimension of the skull and postcranial skeleton. The inheritance of these traits depends on the combined influence of many gene.⁷ There are certain universal traits of the skull that influence appearance, regardless of geographic or racial differences.³ Many traits in radiographs, which suggest that a familial study may be possible using films now stored in hospitals and other repositories.⁷

Selection, gene flow, and genetic drift may have acted singly or in combination at the same time or at different time levels to produce the observed similarities or differences in the skeletal material. Similar diets and environment conditions under which the groups lived may have also been responsible for the observed similarities or differences in their skull.⁷ The similar classification of facial and orbital index and the different classification of the upper facial index in those three population maybe caused by the economic and transportation factors that lead to the same condition on diet.

In conclusion, this study showed that there was no different of facial and orbital index on Batak, Klaten and Flores population of Jember University, but there was different classification of upper facial index among these populations. We haven't found any relation of facial and upper facial index yet, maybe because the variety of the

result and the little number of samples used in this study. We suggest more samples in the future study and more study of craniometric indices on Indonesian population because Indonesia has lots of island with different kind of population in order to make a special Indonesian facial measurement.

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