

## STUDY ON NORTHERN AND SOUTHERN INDIA VARIATIONS OF HUMAN SKULL- A SECONDARY RESEARCH

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### ABSTRACT

#### BACKGROUND

Identity of a human being with regard to sex, race, age etc. can be revealed if the skull is suitably examined. The general concept of ethnic and geographic variations being reflected in the body as variations in size, shape, etc. can be checked for in the case of skeleton also. This article is formed out of a term paper study submitted by myself in 2016 to the Yenepoya University, Mangalore, Karnataka, as part of the postgraduate diploma course in Forensic Anthropology. The research was based on a question whether there is a significant difference between human skulls from North and South India. The aims/objectives were bi-fold: to analyse the difference in male and female skull from North Indian and South Indian regions from review of scholarly literature and to explore the possibility identification of individuals from cranial features unique to North and South India.

#### MATERIALS AND METHODS

The original articles available on this type of work were extensively reviewed to recognise any traits that differentiated the skulls with regard to their regional variation.

#### RESULTS

At the end of the scrutiny of such papers, a summary of the features that distinguished skulls as belonging to northern or southern parts of India was tried. The Indian cranial series, though varied widely in shape, the absence of any statistically significant difference between them made it unreliable to predict skull as male or female by morphometric estimation. The studies by different scholars did not propose for a uniform distinctiveness between north and south Indian skulls.

#### CONCLUSION

It was concluded that analysing a single specimen to be of a distinct geographic origin should be done more cautiously when compared to a setting of series analysis where variability might be there of course.

#### KEYWORDS

Human Skull, Morphometrics, North or South India origin, Variations.

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#### BACKGROUND

Careful, skilled examination of body remnants can put forward valuable information that may help in the identification of a person. It is the effort of the expert that is immensely useful in medicolegal cases. The skull is a part of skeleton that is very suitable for examinations with regard to identification. The remainder of the skull when the mandible is left out of account constitutes the cranium.<sup>1</sup> Establishment of such factors as sex, race, age and stature from the available human remains may contribute towards an approximation of identity and the consequent report accepted as evidence in court of law subject to testifying its

veracity. Cephalic index formed one of the frequently employed parameters in physical anthropology to identify the race.<sup>2</sup>

It is a general concept that geographic or ethnic variations are reflected in the skeletal constitution of body in the form of variations in size, shape, etc. Stated on anthropological basis, the evolutionary, adaptive variations of humankind against the background of genetics, culture and civilisation and nutrition can have bearing on the features of skeleton including the cranium.<sup>3</sup> Race designates the existence of a person as who belongs to a particular ethnic group. The examination of skull may provide a set of valuable information for unfolding the story behind in a reasonably reliable way. Craniometric methods have a special usefulness in forensic practice where cranial remains can be compared with existing photographic and radiographic records in making an identification.<sup>4</sup> One of the exhaustive studies is by Pathmanathan Raghavan et al (2013)<sup>5</sup> using the crania lodged in various medical education institutions in the country to probe into the ancestry of Indian populations with variable results. Craniometric studies in this regard are scientifically such relevant that they

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share the aspects of measurement and reproducibility and hence can avoid the risk of subjective errors. Metrical variability within the Indian series of adult skulls was subjected to analysis for differences between northern and southern Indians. The differences noted were many including narrower orbits and less pronounced medial protrusion of the orbits seen in north Indian skull.

The differentiation between skulls has added significance especially in this period when lots of northern states people have been known migrated to South India in the trend of job alliances. The present effort consists of extensive study of scholarly articles on study of skulls from India in order to have a better appreciation on differentiating a south Indian skull from a north Indian one. The information gathered had thus led me to compile a secondary report based on them and the comparison among them under proper acknowledgment.

### **MATERIALS AND METHODS**

The study was a secondary research into the existing scholarly literature of Indian population regarding the craniological distinctiveness between the north and south Indians.

For the term paper study, I utilised the means of searching for articles in the scientific field of concern. The Google search was conducted into the collection of scholarly articles that mentioned of original works carried out for identifying any features if that had differentiated North Indian and South Indian skulls. Also, I sought an access to the e-library attached to the Mahatma Gandhi University, Kottayam, Kerala on 20-01-2016.

The distinction of Indian states to be as belonging to North and South was derived by referring to the latest revised official notifications.

Here, I selected a few indexed and peer reviewed articles that revealed research works focused on the incidence of differentiating features between Northern and Southern Indian skulls. After going through them and assimilating the subject matter, I had attempted summarising the distinguishing features or trends between them.

### **Working Definitions**

The term North India officially refers to the states of Punjab, Jammu and Kashmir, Haryana, Himachal Pradesh, Uttar Pradesh, Uttarakhand and the Union Territories of Delhi and Chandigarh. The states of Rajasthan, Bihar and Madhya Pradesh are also considered as in the Northern group.

The term South India encompasses the states of Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Union Territories of Andaman Nicobar, Lakshadweep and Puducherry.

### **RESULTS**

The different articles here reviewed belonged to the works of Indian as well as abroad scholars. The results of their works in general depended on the analysis pertained to morphometric and epicranial features, whichever they had concentrated on. By the term morphometric, the general

impression created was on the features in shape or form that attracted the possibility of a race or regional variation. The latter term sounded more or less explanatory in itself as variations that might exist in foramina or cranial sutures were explored into on the basis of comparable localisation. The multiple set of analysis consequent to the study in "Indian Craniometric Variability and Affinities" led by Pathmanathan Raghavan (2013) resulted in extensive derivations, which were described as below. The former three ones out of his six original analyses were considered as relevant in the subject of present concern.

The Indian cranial series had shown wide and ubiquitous shape variations. The cranial index, vault length-height index, upper facial index, orbital index and nasal index varied with extreme and minimum levels in the same series. Quantitative way of predicting the skull as male or female by making use of proportionate relationship between the male and female mean measurement values became unreliable as no statistically significant difference could be made out with them.

Despite the considerably overlapped craniometric values and indices that had made the differentiation between northern and southern Indian skulls to be difficult to discern, there existed some statistically significant differences between northern and southern Indians in their craniometrics provided the comparisons were those for males with males and females with females. They included larger supraorbital projection for northern Indians than southern Indians, narrower orbits among northern Indians than southern Indians and facial flatness for northern Indians compared to projecting facies of southern Indians. Northern Indians had a lower vault length-height index than southern Indians. Northern Indian male frontals tended to be narrower than southern Indian male frontals. North Indian skull in particular had affinity to resemble Caucasoid populations. Demonstration of a distinctive South Asian craniometric profile and the intermediate status of northern Indians between southern Indians and populations northwest of India confirmed the predominantly indigenous ancestry of northern and especially southern Indians.

With regard to the work of Tracy Lea Rogers<sup>6</sup> in 1999, he demonstrated that the seven measurements and one index including the frontal process width, zygomatic process of the frontal breadth, interorbital breadth, basion-prosthion, maximum alveolar breadth, maximum alveolar length, mastoid length and upper facial index had no significant difference between any of the Indian population divisions with the exception of bizygomatic breadth. In this research, it had been pointed out that the Indian nasal shape did not always fit into one of the three prescribed categories-Quanset, tent and tower. Unlike this, the nasal skeleton in European sample was characteristically tower shaped. In view of bias, in collection of samples, the conclusion arrived at no significant divisional difference in Indian skull samples. The anthropometric patterns that reflected in the study carried out by S. Bharati et al in 2005 were on variations among northern, southern and eastern regions of India. The details were that the northern region and to an extent, the

southern region showed taller stature, broad facial index and longer nose; the eastern region people comparatively were of short stature and broad headed.

Summarised from numerous anthropometric analyses in India, Bhasin and colleagues<sup>7</sup> in 1994 have observed that there is a tendency for people of North India to form a cluster distinct from the rest of India.

The results of studies by Pathmanathan Raghavan and Tracy Lea Rogers showed significant differences with regard to the distinctiveness of northern Indian skulls from southern Indian ones. Both when compared, the older study could not recognise regional distinctive features in the three divisions, the recent one suggested north-south cranial differentiation possible by way of wide set of analyses.

In contrast to the above two, the study by S. Bharati et al in 2005 had worked out in a somatometric method for racial differentiation. Moreover, there were limitations too as reported in it from having been done on previous data, the accuracy of analysis thus might err.

**Prevalence Study on Epicranial Foramina/Sutures**

Gupta T<sup>8</sup> in 2008 had found that the incidence of parietal foramen was highest in south Indian male (113.9%) and

female (112.2%) crania out of the 1189 dried crania from north and south India. Incidence of parietal foramen in north Indian male was (104%) and female (90.46%) crania.<sup>9</sup>

The study conducted by Aswini et al<sup>10</sup> in 2012 on 83 adult skulls from southern India found that the supraorbital notch (69.87%) was found more frequently than the supraorbital foramen (28.91%). The supraorbital notch/foramen measured approximately 22 mm from the midline.

Study conducted in 1967 by Berry and Berry<sup>11</sup> reported markedly low frequency of supraorbital foramen (12.3%) in north Indian skulls. They noted that the average distance between supraorbital foramen/supraorbital notch and the midline was 24 mm.

Prevalence of metopic suture was more in South Indian crania of both sexes compared to North India. Its prevalence was more in male crania of North India and South India when compared to female crania of both North and South India.<sup>12</sup>

Research	Trait	North Indian	South Indian
Pathmanathan Raghavan et al 2013	1. S. O. projection 2. Orbit 3. Interorbital breadth 4. Facial skeleton 5. Vault length-height index 6. Male frontal bone	Larger Narrow Large Facial flatness Lower Narrower	Large Wide Smaller Projecting facies Low Wide
Tracy Lea Rogers 1999	-	-	-
S. Bharati et al 2005	Somatometric Features	Taller Broad faced Longer nose	Taller Broad faced Longer nose
1. Gupta. T 2008 2. Makandar 2013	Parietal Foramen Incidence	Lower	Higher
1. Aswini et al 2012 2. Berry and Berry 1967	S. O. Foramen/Notch Incidence	Lower	More frequent
Makandar et al 2015	Metopic Suture Prevalence	Less	More
<b>Research Comparison Study of North and South Indian Skull</b>			

**S. O.-** Supraorbital.

Tracy Lea Rogers research did not show characteristic differential features for the divisions.

**DISCUSSION**

Having gone through the research articles and then compared them, it was found that there had been an expansion in the anthropological approach and analyses in the differentiation and ancestry studies. This could be attributed to improved methods of analysis and research techniques.

Pathmanathan Raghavan et al 2013 had noted the difficulty in discerning consistent differences between northern and southern Indians from most cranial measurements and indices as their mean values overlapped considerably. However, they found out some differences between northern and southern Indians in their

craniometrics, comparing males with males and females with females to a degree of statistical significance. They observed that the average supraorbital projection was larger for northern Indians than southern Indians. Further, the orbits were on average narrower among north Indians than south Indians. As a result of this, the interorbital breadth tended to be larger in northern Indian samples than the southern Indian ones.

There were subtle differences in Pathmanathan Raghavan’s study from other literatures. Despite the wide variability in measurements on the crania, he had demonstrated that there existed some differences between the northern and southern regions of India in the skeletal

features of orbit, extent of facial flatness and vault length-height index. Differences, if any that would exist between north and south Indians could not be arrived at from research by S. Bharati et al 2005 since the northerners and southerners shared the same features; the east Indian features, however, different. Even though, this research done on data collected from living subjects, it was quoted here in consideration of its support for a multivariate factor origin in evolution.

Tracy Lea Roger 1967, however, cautioned that cranial dimensions might also be influenced by nutritional and environmental stress. This should be taken care of when referring to the applicability of research studies in medicolegal as well as anthropological examinations of materials. The probability of correctly assigning an individual to one among two populations was proportioned as 50%. The guidelines established by Hair and associates<sup>13</sup> in 1987 necessitated the probability to exceed 62.5% for meaningful differences in population trait expression.

The studies by different scholars when surveyed did not contribute for a uniform proposal of distinctive features between north and south Indian skulls. This strengthens the concept that skeletal development is multifactorial and influenced, besides other things by nutrition, hereditary factors and environment.

The studies of epicranial foramina and metopic suture cited had significance in their assessment of the prevalence among different regions.

### CONCLUSION

The craniofacial traits claimed in series metrical study tend to demonstrate significant differences between north and south Indian skull. One should take due caution on what outcome would it be when analysing a single specimen whereas series analysis could prefer for variability. More studies with larger sample size are required focusing on skull measurement variation in north, south, east, west parts of India, which may help localise victims in mass disasters.

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