

# A Novel Method to Estimate Height of an Individual with Facial Index

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## Abstract

**Objective:** Face is the most important part of the body. Cranial anthropometry is well known determinant of good and important aspects of treatment in the field of medicine, dentistry, plastic surgery, aesthetics. There are studies on the facial index determination and classification of faces. There are very few studies on the estimation of height of an individual from facial index as a parameter. Here in this study, we have aimed to estimate height of an individual from facial index derived from his/her 2D photograph. Therefore, here in this study we have attempt to estimate height from the facial index of an individual.

**Materials and Methods:** Study population were randomly selected 105 samples to measure the facial parameters using digital vernier calipers manually, and also height with the help of stadiometer. Then the facial index was determined from the postcard size photograph of an individual, then classified based on Bannister classification and formula was derived to estimate the height of an individual from it.

**Result and Conclusion:** We observe a correlation existing between the facial index and the height of an individual. This study will be of great utility for the forensic application for estimation of height from the 2D photograph of an individual.

**Key words:** Facial index, height, 2D photograph

## Introduction

Craniofacial anthropometry plays a vital role in the identification, in treatment planning, evaluation, and outcome assessment in several health disciplines like anatomy, forensic medicine, plastic surgery, aesthetics, maxillofacial surgeries, etc.<sup>[1]</sup> Face is the main part of the body which is given high importance in revealing identity of a person. There are many research work

done to correlate the facial parameters with height of an individual<sup>[7]</sup>. Here in this study, based on facial index derived from a 2D photograph, we are able to estimate the height of an individual. The study will be of great utility while receiving a complaint on missing person with a photograph to estimate probable height. It is a novel method to estimate height of an individual.

## Materials and Methods

**Materials:** The study is a cross sectional study with a sample size of 105 Indians with the mean age of 20 years, female 76 and male 29. The study was approved by the Institutional ethical Committee. The participants were given information sheet, then informed consent was obtained after explaining about the queries if they have any. All participants never underwent any plastic

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surgeries, reconstruction surgeries on the face. Any facial palsy, any other face related dysmorphology participants were not included in the study.

**Methods**

After collecting preliminary details, the participants were made to sit erect on a chair with face facing forwards [Frankfurt plane]. They were photographed with a web-camera Logitech C920HD connected to a computer. The photograph obtained was made into a postcard size positive hard copy. On the Postcard size 2D photographs obtained, we marked land mark points of our interest-Nasion [Na], Gnathion[Gn], and Zygoma[Zy] -Zygoma[Zy]. Then using a measuring scale and divider, we measured distances between these points namely Nasion to Gnathion length and Bi-zygomatic width in centimeters. All the measurements were noted down. Each parameter was measured twice to keep it error free. Then facial index was calculated using the formula **Facial Index=Facial length[Na-Gn]\*100/ Bi Zygomatic Width[Zy-Zy]**.

The obtained facial indices were arranged according to Bannister classification of Facial indices into hyper euryprosopic, Euryprosopic, Mesoprosopic, Leptoprosopic and Hyperleptoprosopic groups. Then we multiplied the facial index group with the factor. The factor value decreases with the facial index increasing. Thus, by multiplying the facial index obtained from a 2D postcard size photograph with the Factor, we could estimate the height of an individual.

Each participant was also requested and subjected for physical original measurements with the help of calibrated digital vernier calipers. Original facial parameters Nasion to Gnathion length [Na-Gn] and Zygoma to zygoma width [Zy-Zy] was measured in millimeters. The values were measured twice to reduce error. Then subject height was measured using calibrated stadiometer in centimeters. Subject was requested to stand with head, buttocks, heels touch the wall; head straight and eyes looking forwards. All these physical original measurements from participants obtained were used only for confirming the height estimate obtained from 2D photograph.

**Results**

The study had participants from different parts of India- belonging to aryan and dravidian races. The facial indices were classified according to Bannister’s Classification [7]. We had 11 participants with hypereuryprosopic; 26 with euryprosopic, 39 with mesoprosopic face, 17 with leptoprosopic face, 12 with leptoprosopic face. Total of 105 participants.

**Results were analysed in two different methods.**

A] First method is by obtaining facial index from post-card size 2D photograph, then multiplying it with the factor given. Results obtained were matched with true value. There was a difference of +-10 with the true value of the height.

**Table:1 Classification of face types and Factor for estimation of height:**

Face types with facial index [Banister Classification]	No. of Subjects[N=105]	Facial Index	Factor*	Formula for height
Hypereuryprosopic [x-79.9]	11	Upto 75.9	2.3	= facial Index from photo*2.3
		76- 80	2	=Facial index*2
Euryprosopic [80-84.9]	26	81- 84.9	1.9	=Facial Index*1.9
Mesoprosopic [85-89.9]	39	85 -90		
Leptoprosopic [90-94.9]	17	91-94.9	1.7	=Facial Index*1.7
Hyperleptoprosopic [95-x]	12	95-100.9		
		101-110	1.4	=Facial index*1.4

The estimated height obtained is variable upto +\_10 cms to its true value of height of subject.

### Statistical Analysis

The facial indices ranged between 69 to 116 among the 105 participants.

Mean value of the facial index was 86.88; Standard deviation+-.6.79.

Height of a person 140-189 with a mean value 161+-9.17.

The data was analyzed for correlation coefficient with Statistical software in Microsoft excel 2010, found a Standard deviation of +- 2.6; Further the facial index and height was correlated with the value being 0.21 and found it statistically not significant. Correlation coefficient was significant for mesoprosopic and leptoprosopic subjects. The height estimate was accurate with standard deviation of +-9.

B] Second method was: regression analysis, **estimated height (Y)=0.29X+136.17** where X stand for facial index derived from postcard size frontal photograph of an individual.

### Discussion

Past study by Khan N. has showed that the 2D photographs can be used for craniofacial anthropometry and provided a data set for upper facial parameters among deccan population in 2012 [2]. Jeremic D. discussed about facial index among central Serbia population and said most of the population were Leptoprosopic and have created a reference set for population of Central Serbia [4]. Ghosh A. et al study on Kolkata newborn on facial parameters and facial indices has set reference range for newborn facial parameters and facial index among Kolkata population. The article was setting reference range for the new born facial parameters. [5] A study on the facial indices among the Indian Haryanvi population has found majority of them were mesoprosopic, followed by euryprosopic. The study has focused on setting up a reference for Haryanvi population of India. [6]. Prasanna L. C., et al in 2013 have studied Indian population based of major races of India and have taken on facial index as a parameter for stature estimation among South and North Indians was conducted with n=200. In this study, they

have found a correlation between the stature and facial index statistically. They found a correlation between upper facial height and height of an individual [7]. C. Ashwini study has showed significant difference in facial types mainly Leptoprosopic, hypereuryprosopic among North and South Indian population with a sample size of 171. They found south Indians had a Lepto prosopic type as most commonest type and mesoprosopic commonest among North Indians [8]. T. Yesmin found a facial index among Malay population and found mesoprosopic type commonest type and facial types differ with gender with a sample size of 81 [9]. Another study by showed a correlation between facial width and the stature. But the sample size was only n=30. They have devised a regression equation for estimation of height from the facial width [10]. Thoudam B. D. et al discussed on facial index and upper facial height as a parameter for stature estimation among Meiti male population in Manipur [12]. A study has discussed about stature estimation from the facial height and facial width among the Iranians with a sample size of 200. The result showed facial width is better parameter for estimation of the height [13]. With our study, we have attempted a facial index from a 2D photograph of an individual and have devised factor for estimation of height of an individual from a 2D photograph.

From previous studies, where most of them have only correlated the upper facial height, Facial width as a parameter for estimation of height of an individual, we have devised a novel method to look at facial index from a 2D photograph as a parameter for estimation of height. We can use this method to estimate height from a 2D photograph derived facial index esp. in forensic cases of missing people.

Further, research community can replicate the work with more male representation in sample size, also in greater number of participants and from a digital photograph. Can also extend the work into 3D photogrammetry and facial index as a parameter for height estimation. The present work is of immense utility in the craniofacial anthropometry, forensic anthropology.

**Ethical Clearance obtained from** Institutional Ethical Committee.

**Conflict of Interest:** Nil

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