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Original Article

ESTIMATION OF STATURE FROM NASAL HEIGHT IN MALE AND FEMALE STUDENTS IN UDAIPUR

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ABSTRACT

Objective: Stature refers to a person's height when standing upright. It is a vital measure of physical identity. In archaeological operations or forensic exams following a mass disaster, height is estimated using rudiments or bone pieces for identification. In order to determine stature, separate regression formulae should be developed for each population group.

Methods: This cross-sectional study was conducted at Department of Anatomy, Pacific Institute of Medical Sciences, Umarda, and Udaipur. A total of 110 students (55 males and 55 females) aged between 18 to 25 y, participated in this study. Those with craniofacial defects were excluded from study. Height was measured from vertex to floor by stadiometer.

Results: The study showed that in males mean values are significantly higher than females for both nasal height as well as stature; nasal height in (males 48.54±3.584 mm; females 46.75±3.763 mm) and stature in (male 170.3±7.902 cm; female 159.61±5.383 cm). In total student's as well as in males and females, nasal height had a weak positive linear relationship with stature; r=0.283 in total students, r=0.222 for male and r=0.123 for female. The regression equation for stature and nasal height was found to be Y=134.053+0.648× nasal height for total students, Y=146.487+0.491×nasal height for males, Y=151.328+0.177× nasal height for females.

Conclusion: The observed correlation is statistically significant in total students (p value<0.05) but not significant in males and females (p value>0.05). Overall nasal height had a weak positive linear correlation with stature.

Keywords: Stature, linear regression, Nasal height

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INTRODUCTION

Anthropometry is the area of physical anthropology concerned with measuring various body parts [1]. In archaeological operations or forensic exams following a mass disaster, height is estimated using rudiments or bone pieces for identification [2]. Personal identification means determining a person's individuality. It can be entire (absolute) or partial. Complete identification implies an absolute emphasis on a person's personality. Partial identification suggests that just some facts regarding a person's identity have been determined, while others remain unknown. The key factors of identification include age, gender, and size [3]. Stature refers to a person's height when standing upright. It is a vital measure of physical identity. The identification of a person from mutilated, decomposed, and amputated body fragments has become a crucial requirement in recent times because of man-made and natural disasters such as bomb blasts, wars, terror attacks, cyclones, floods, and earthquakes. It is significant from an ethical and legal standpoint. The four pillars of an individual's identity are generally described as age, gender, stature, and race, with gender and stature being the two most significant [4]. There is a clear biological connection between stature and all body parts [5]. Many studies have been undertaken to estimate stature using various body parts such as the hands, trunk, entire spinal column, upper and lower limbs, individual long and short bones, feet, and footprints [6]. In addition to limb measures, different cephalo-facial indices such as head circumference, facial length, facial breadth, nasal height, nasal width, and so on are examples of clinical anthropometrical characteristics that can be used to estimate stature [7]. But, only a few studies have been conducted on an estimation of stature from nasal dimensions with respect to gender. In order to determine stature separate regression formulae should be developed for each population group. The present study was conducted to derive regression equations for estimation of stature from nasal height of medical students.

Aim and objectives

The aim of study was to derive regression equations for estimation of stature from nasal height of medical students in Udaipur.

- To find out correlation of stature with nasal height of male and female students.
- To estimate stature from nasal height of male and female students.

MATERIALS AND METHODS

Source of data and sample size

This cross-sectional study was conducted at Department of Anatomy, Pacific Institute of Medical Sciences, Umarda, Udaipur, from September 2021-August 2023. Study was conducted after getting permission from the Research review board and Institutional Ethic committee. A total of 110 students (55 males and 55 females) aged between 18 to 25 y, participated in this study. Prior to enrolment in the study, participants were instructed on the research's objectives, and written informed consent was taken from all the participants.

Inclusion criteria

- Students between 18 to 25 y age of both sex.
- Students who are willing to participate in the study.

Exclusion Criteria

- Students with history of trauma or surgery of the face and nose, with developmental anomalies of face and nose such as cleft lip cleft palate also excluded.
- Those having any cephalo-facial defects or spinal deformity (kyphosis, scoliosis) and feet deformity was excluded from the study.

Material for the study

- Stainless steel digital vernier caliper
- Stadiometer
- Measuring tape

Methodology for data collection

Nasal height was measured with the participants sitting comfortably on a chair in anatomical position or Frankfurt's horizontal plane. It ensured that the caliper was adjusted correctly and that precise readings were taken. Additionally, it was guaranteed that participants did not alter their facial expressions or smile during the measuring process. After carefully identifying the relevant nasal surface landmarks on the students, a black marker was applied to the nose.

The landmarks were

1. Vertex: The highest point of the head in the mid-sagittal plane when the head is held erectly or in Frankfurt plane.

2. Nasion: The point on the root of the nose where the mid-sagittal plane cuts the naso-frontal suture.

3. Subnasale: The point at which the nasal septum merges with the upper cutaneous lip in the mid-sagittal plane.

Measurements

Stature

Height was measured from vertex to floor by a stadiometer. Subject standing erect on an even floor, barefoot with heels together and weight evenly distributed between both feet and head in the Frankfurt plane. The distance was measured from the highest point on the subject head to the ground with the help of a stadiometer.

Nasal height

It was the distance measured from the nasion to the subnasale.

Statistical analysis

Data was collected and entered in Microsoft Excel sheet and analysed by using standard statistical software (Statistical Package for Social Sciences/SPSS version 26).

The mean, standard deviation, minimum, maximum, standard error of estimation, Karl Pearson's correlation coefficient calculated, and a regression equation was formulated.

Fig. 1: Measurement of stature using a stadiometer

Fig. 2: Measurement of nasal height

Table 1: Descriptive statistic of stature and nasal height in total students

Parameters	Mean	SD	Minimum	Maximum
Nasal height	47.64	3.767	38.22	58.91
Stature	164.97	8.615	150	186

Table 1 Shows mean nasal height in total students was 46.64±3.767 mm and mean of stature was 64.97±8.615 cm.

Table 2: Comparison of stature and nasal height between male and female students

Parameters	Male			Female			P-value
	mean±SD	Min.	Max.	mean±SD	Min.	Max.	
Nasal height	48.54±3.584	41.03	58.91	46.75±3.763	38.22	55.82	0.0119
Stature	170.3±7.902	150	186	159.61±5.383	150	175	<0.0001

Table 2 shows the mean nasal height in male and female was 48.54±3.584 mm and 46.75±3.763 mm, respectively. The result showed that there was a significant difference in nasal height between male and female ($p<0.05$). The mean stature in male and female was 170.3±7.902 cm and 159.61±5.383 cm, respectively. The result showed that there was an extremely statistically significant difference in stature between male and female ($p<0.05$).

Table 3: Pearson correlation coefficient between stature and nasal height of male and female students

Parameters	Male		Female		Total	
	(r)	P-value	(r)	P-value	(r)	P-value
Stature v/s Nasal height	0.222	0.103	0.123	0.367	0.283	0.002

Table 3 shows that in total student's nasal height had a weak positive linear relationship with stature; r=0.283. The observed correlation is statistically significant (p value<0.05). Both in male and female nasal height had a weak positive correlation with stature; r=0.222 for males and r=0.123 for females. The observed correlation is not statistically significant (p value>0.05).

Table 4: Regression equations for estimation of stature from nasal height in male and female students

Parameters	Sex	Regression equation (Y= a+bx)	R^2	(±SEE)
Stature v/s Nasal height	Total	Y=134.053+0.648×Nasal height	0.0805	±8.299
	Male	Y=146.487+0.491×Nasal height	0.0491	±7.776
	Female	Y=151.328+0.177×Nasal height	0.0153	±5.392

Table 4 Shows regression equations to calculate stature from nasal height in both sex and in total students. The hypothetical regression equation is represented as Y= a+bx, where 'Y' is dependent variable (stature), 'x' is independent variables (nasal height), 'a' is the regression coefficient of dependent variable (intercept) and 'b' is regression coefficient of independent variable (slope). The regression equation for stature and nasal height was found to be Y=134.053+0.648× nasal height for total students, Y=146.487+0.491×nasal height for males, Y=151.328+0.177× nasal height for females. This regression equation can be used for calculating the estimated stature of that particular person once nasal height is known.

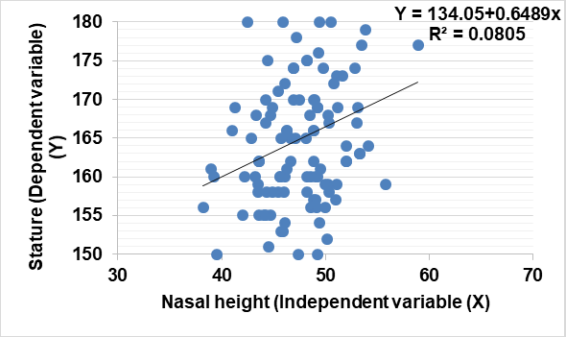

Fig. 3: Correlation between stature and nasal height in total students

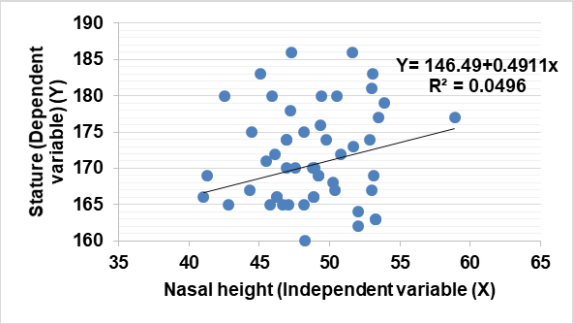

Fig. 4: Correlation between stature and nasal height in males

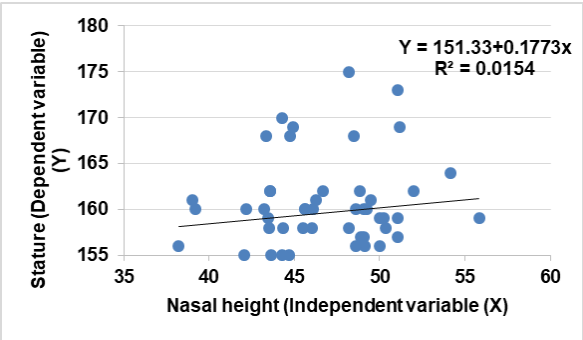

Fig. 5: Correlation between stature and nasal height in females

DISCUSSION

The main objective of this study is to find out correlation between stature and nasal height and to use of this study in the forensic examination for the identification of unknown, highly decomposed fragmentary and mutilated human remains. Various authors have estimated stature from cephalo-facial dimensions and found that it had a partial positive correlation with total facial height, considering facial height as a better parameter [8-11]. In this study, nasal height was used as a single parameter for estimation of stature.

Shrestha RN *et al.* conducted a study on 214 healthy adults (110 males and 104 females) aged between 25 to 35 y. They noted that in both male and female nasal height had partial positive correlation with stature; r=0.18 for male and r=0.19 for female [12]. These findings were similar to our study.

Jyoti Barwa *et al.* conducted a research study in Shridev Suman Subharti Medical College, Dehradun, among a total of 158 subjects (17-25y), comprising 79 males and 79 females. The study showed that in males mean values are significantly higher than females for both stature as well as nasal height; stature (males, 172.34±6.48; females, 158.94±5.642), nasal height (males, 5.03±0.3707; females, 4.67±0.304). Nasal height in total subjects and individually in males is significantly ($p<0.05$) and positively correlated with stature. However, in females it is found to be statistically insignificant [13]. These finding was differ from present study.

Agnihotri *et al.* had done a research study on the Indo-Mauritian population in 2011 and estimated stature from cephalo-facial dimensions and found that stature had partial positive correlation with total facial height (r=0.32 in male and r=0.16 in female) and with nasal height (r=0.19 in male and r=0.15 in female) [5].

Kharyal *et al.* in 2008 did a study on Brahmins of Himachal Pradesh and calculated estimation of stature from maxilla-facial height parameters and observed that stature had a positive partial correlation with total facial height (r=0.39 in male and r=0.35 in female) and with nasal height (r=0.36 in male and r=0.22 I female) [14].

In the present study it had been observed that in total student's nasal height had a weak positive linear relationship with stature; r=0.283 and in male and female nasal height also had a weak positive correlation with stature; r=0.222 for male and r=0.123 for female.

Regression analysis is considered to be the most effective method for estimating stature, although stature can also be evaluated by using the regression equation or by multiplying the parameter by the determined multiplication factor [7, 14, 5, 15].

However, in this study, the value of regression analysis is not found to be statistically significant in males and females; when all the subjects are considered together, the value is statistically significant.

CONCLUSION

This study observed that in total student's nasal height had a weak positive linear relationship with stature; r=0.283. The observed correlation is statistically significant (p value<0.05).

Both in male and female nasal height had a weak positive correlation with stature; r=0.222 for male and r=0.123 for female. The observed correlation is not statistically significant (p value>0.05).

The regression equation for stature and nasal height was found to be Y=134.053+0.648× nasal height for total students, Y=146.487+0.491×nasal height for males, Y=151.328+0.177× nasal height for females.

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AUTHORS CONTRIBUTIONS

All the authors have contributed equally

CONFLICT OF INTERESTS

Declared none

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