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Nasal Height as a Parameter for Stature Estimation & Sex Differentiation in Dehradun Region

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Abstract

Introduction: Stature is one of the most important parameters in the identification of an individual, living or dead. In intact bodies, stature estimation does not pose any problem but when dismembered human body parts are involved, it is of a challenge for the forensic pathologist as these parameters are highly sex, race and age dependent.

Materials & Method: The study was conducted in Shridev Suman Subharti Medical College, Dehradun among a total of 158 healthy subjects (17-25 years), comprising 79 males and 79 females. Those with cranio-facial defects were excluded from the study. Mean stature and nasal height were obtained by direct measurement; co-relation co-efficient were obtained and regression equation formulated for estimating stature.

Observations & Result: The study showed that in males mean values are significantly higher than females for both stature as well as nasal height; stature (males, 172.3435 ± 6.48442; females, 158.9430 ± 5.64269), nasal height (males, 5.0341±.37075; females, 4.6770±.30431). 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. These values can be employed in estimation of stature using the linear regression equation Y = 155.251+ 3.395 (nasal height of Males), Y = 151.170 + 1.662 (nasal height of females). Also, accuracy in predicting sex when mean nasal height is taken as independent variable is more in females as compared to males (F=77.2%,M= 68.4%).

Conclusion: Nasal height can be used as a reliable tool in estimating stature, particularly in the males and in females it can be used for determination of sex with accuracy.

Keywords*: Nasal height, stature, identification,*

Introduction

The branch of physical anthropology that deals with measurements of different body parts is known as Anthropometry.[1] Various bones of the human skeleton have been employed for reconstruction of stature and prediction of sex by many scientists with varying degree of accuracy.[2,3,4,5] Although a wide variety of long bones have been employed for stature estimation, only few studies have utilized the cranio-facial dimensions in this regard.[3] Hence, establishment of alternative methodologies for estimation of stature still requires elaborate studies.

In archaeological procedures or in forensic examinations after mass disaster, estimation of height is done from rudiments or fragments of bones for the purpose of identification.[2] The body segments exhibit consistent ratios among themselves and also relative

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to the total body height.[6] Thus, in addition to the limb measurements, various cephalo-facial indices such as head circumference, facial length, facial width, nasal height, nasal width etc are amongst some of the clinical anthropometrical parameters that can be used for estimation of stature.[3]

Although, many formulae for stature estimation have been proposed, there is no universally applicable formulae as the ratios of the body segments and stature are dependent on age, sex and race.[6,7] This study aims to estimate stature of the study population in Dehradun region using nasal height by regression equation and to predict reliability of nasal height in sex differentiation.

Materials & Method

The study was conducted in Shridev Suman Medical College, Dehradun among healthy students of the Institute, subjects varying in age from 17 to 22 years. A total of one hundred and fifty eight (158) subjects were involved which comprised of 79 males and 79 females. Those having any cephalo-facial defects or spinal deformity (kyphosis, scoliosis) were excluded from the study. A written informed consent was duly obtained from all the willing participants; procedure and purpose of study was explained in detail. The stature was measured using an anthropometer as the vertical distance between vertex and heel touching the floor or ground surface, with the person standing erect and head in a Frankfort plane. A vernier calliper was used for measuring nasal height; the distance between nasion to nasopinale of the nose i.e from the point in midline where the frontonasal suture and the median plane intersect, taken on the frontal, to the lowest point at the start of the nasal floor. It was taken on both sides; to minimise subjective errors, all these measurements were taken twice and an average was duly noted. Mean of the stature and nasal height was obtained for both sexes, correlation co-efficient calculated and a regression equation was formulated using statistical software SPSS version 20.

Observations & Result

Table 1: Mean Stature and nasal height

Parameter		Mean	Std. Deviation	Correlation value [r]	R2	P value
Total subjects (n= 158)	Mean stature	165.6433	9.04919	.437	.191	.000
	Mean Nasal Height	4.8555	.38259			
Females (n= 79)	Mean stature	158.9430	5.64269	.090	.008	.216
	Mean Nasal Height	4.6770	.30431			
Males (n= 79)	Mean stature	172.3435	6.48442	.194	.038	.043
	Mean Nasal Height	5.0341	.37075			

In the study, it was observed that mean stature and mean nasal height was significantly higher in males as compared to females i.e in Males stature was 172.34 ± 6.48 while in females it was 158.94 ± 5.64; nasal height in males was 5.03 ± 0.37 and in females it was 4.68 ± 0.30. Also, in total subjects as well as individually in males and females, a weak positive co-relation was obtained with stature. Since P value is ≤ 0.05 in total subjects and in males, which means it is found to be statistically significant. However, in females, P value is found to be statistically insignificant. [Table 1]

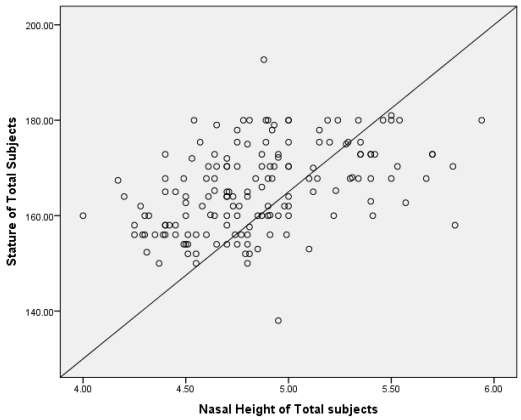

Fig 1: correlation between stature and nasal height of total subjects

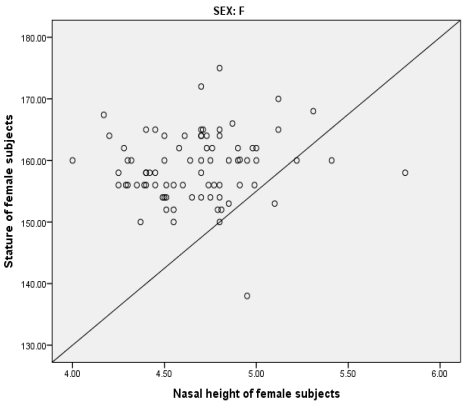

Fig 2: Correlation between stature and nasal height in females

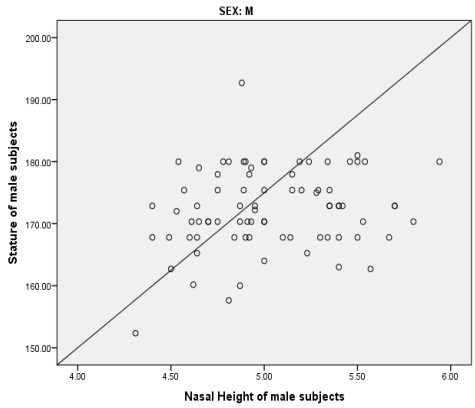

Fig 3: Correlation between stature and nasal height in males.

Regression equation was formulated for total subjects as well as individually for males and females which can be used for calculating the estimated stature of that particular person once nasal height is known. [Table 2]

Table 2: Regression analysis for predicting stature (dependable variable) considering nasal height as independent variable

Parameter	Regression equation for stature
Total subjects (n= 158)	Y = 115.480 + 10.331 (nasal height of subjects)
Females (n= 79)	Y = 151.170 + 1.662 (nasal height of females)
Males (n= 79)	Y = 155.251+ 3.395 (nasal height of Males)

Considering nasal height of the subjects alone as an independent variable, sex can be differentiated as P value is ≤ 0.005, which is statistically highly significant. This shows that statistically, sexual dimorphism exists among the study population having a percentage of 8.5%. It was also observed that the findings are more accurate in females as compared to males i.e 77.2% and 68.4 % in females and males respectively [Table 3 & 4]

Table 3: Independent t test: for sex differentiation from Nasal Height

Parameter	Sex	Mean ± SD	T value	P value	Significance level	% of sexual dimorphism
Nasal Height	M	172.3435 ± 6.48442	6.617	0.000	Statistically Highly significance	$\frac{X_m - X_f}{X_f} \times 100 = 8.5\ \%$
	F	158.9430 ± 5.64269				
Xm = mean of male nasal heights, Xf = mean of female nasal height						

Table 4: % age accuracy to predict sex from nasal height using differential functional analysis

Parameter	% age Accuracy
Total subjects	72.8%
Females	77.2%
Males	68.4%

Discussion

Various authors have estimated stature from cephalo-facial dimensions and found that it had partial positive correlation with total facial height, considering facial height as a better parameter.[8,3,9,10,11] In this study, nasal height was used as a single parameter for estimation of stature. Except Shrestha RN et al[12] which has used solely, most of the authors [13,14,15,16,17,18,19,20] have used nasal height in conjunction with other cephalo-facial parameters and similar findings of a positive correlation consistent with the present study have been obtained; the values being higher in males as compared to females. Though, few of the authors[18,19,20] found nasal height to be un-reliable in stature estimation.

It is known that stature can be estimated either by multiplying the parameter with the derived multiplication factor or can be measured by employing regression equation, but most of the researchers considered that regression analysis is the best for stature estimation.[3,13,14,21] However, in this study, the value of regression analysis is not found to be statistically significant in females but in males as well as when all the subjects are considered together, the value is significant. This disparity could be due to lesser number of subjects being studied and thereby research needs to be extended to a larger population.

In a study by Sagar S and Nath S [22] nasal height is not considered to be a reliable parameter for sex differentiation but findings by E O Ewunonu[23] is consistent with the present study. The accuracy in predicting sex when mean nasal height is taken as independent variable is more in females as compared to males (F=77.2%,M= 68.4%) with percentage of sexual dimorphism being 8.5%; no author has commented in this regard.

Since, this study was conducted with intact soft tissue over the face, it is possible that the parameters may have insignificant correlation with bare bone measurements. These results can be of significance only in mutilated body with presence of some intact tissue or when isolated facial structure is brought for forensic examination. The regression equation thus obtained could prove to be beneficial in mass disasters as individuals that fall outside those limits can be easily excluded.

Conclusion

In circumstances where decomposed or mutilated body is bought for medico-legal examination, identification can be established by estimating stature by means of regression equation using nasal height. This produces a height range and individuals that fall outside

those limits can be subsequently excluded. Prediction of sex is also possible to a greater extent which can be used as an identification tool. This method is not only reliable, relatively easy and quick to apply without involvement of any sophisticated techniques but also the anatomical landmarks measured are standard, much easier to locate and does not require difficult instrumentation.

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: Obtained from the Institutional Ethical Committee of Shridev Suman Subharti Medical College

References

1. Gould Stephen Jay. The Measurement of man. W W Norton and Co; 1993.
2. Buchner A . The identification of human remains. Int Dent J. 1985 35: 307-311.
3. Krishan K, Kumar R. Determination of stature from cephalo-facial dimensions in a North Indian population. Legal Med. 2007;9:128-133.
4. Baraw R, Barwa J, Pradhan M, Khanna SK. Width of sternum at suprasternal notch and at the level of fourth rib for determination of sex in the population of Delhi: A new & reliable tool for sex prediction. J Indian Acad Forensic Med. Jan-Mar 2017;39(1): 83-7.
5. Singh R, Barwa J, Nanda R, Mamgain S, Sabharwal S, Chadha S, Kataria S. Estimation of stature from percutaneous measurement of upper limb length by linear regression equation. Medico-Legal Update 2017; 17(2): 93-6.
6. Jantz RL. Modification of the Trotter and Gleser female stature estimation formulae. J Forensic Sci. 1992;37:1230-5.
7. Duyar I, Pelin C. Body height estimation based on tibial length in different stature groups. Am J Phys. Anthropol. 2003;122: 23-7.
8. Jibonkumar, Lilinchandra. Estimation of stature using different facial measurements among Kabui Naga of Imphal valley, Manipur. Anthropologist. 2006;8:1-3.
9. ShahT, Pate MNl, Nath S, Bhise RS, Menon SK. Estimation of Stature from Cephalo-facial dimensions by regression analysis in Gujarati population. J Indian Acad Forensic Med. 2015;37(3):253-7.
10. Eboh DE, Igbigbi PS. Stature estimation from cephalometric parameters of young adults in five Nigerian ethnic groups. Italian journal of anatomy and embryology. 2017;122(2) : 98-109.
11. Ewunonu EO. Estimation of stature from facial parameters in adult Abakaliki people of South – Eastern Nigeria. Journal of Health and Visual Sciences. 2014;16(1):13-19.
12. Shrestha RN, Banstola D, Nepal D, Baral P. Estimation of stature from nasal length. J Nepal Med Assoc 2016;55(204):76-8.
13. Kharyal A, Nath S. Estimation of stature from maxillofacial height measurements among Brahmins of Himachal Pradesh. Indian J Forensic Odont. 2008;1:9-12.
14. Agnihotri AK, Kachhwaha S, Googoolye K, Allock A. Estimation of stature from cephalo-facial dimensions by regression analysis in Indo-Mauritian population. J Forensic Leg Med. 2011;18:167-72.
15. Lukpata PU, Esomonu UG, Ogan CA, Tessy EO. Estimation of stature from some selected cephalofacial parameters among teenage Indigenes of Ogoja local government area cross river state. BJMMR. 2016;12(2): 1-7.
16. Wankhede KP, Kamdi NY, Parchand MP, Anjankar VP, Bardale RV. Estimation of stature from maxillo-facial anthropometry in a central Indian population. J Forensic Dent Sci. 2012;4(1):34-7.
17. Patil KR, Mody RN. Determination of sex by discriminant function analysis and stature by regression analysis: a lateral cephalometric study. Forensic Sci Int 2005;147(2-3):175-80.
18. Lukpata PU, Esomonu UG, Ogan CA, Tessy EO. Estimation of stature from some selected cephalofacial parameters among teenage Indigenes of Ogoja local government area Cross River State. British Journal of Medicine & Medical Research. 2016;12(2): 1-7.
19. Agnihotri AK, Kachhwaha S, Googoolye K, Allock A. Estimation of stature from cephalo-facial dimensions by regression analysis in Indo-Mauritian population. Journal of Forensic and Legal Medicine.2011;18(4):167-72.
20. Shah T, Patel MN, Nath S, Bhise RS, Menon SK. Estimation of stature from cephalo-facial dimensions by regression analysis in Gujarati population. J Indian Acad Forensic Med. July-

September 2015;37(3):253-7.

21. Iscan MY. Forensic anthropology of sex and body size. Forensic Sci Int 2005;147:107-12.
22. Sagar S, Nath S. Estimation of stature from different head and face measurements among male and female Jatavs of Delhi. IOSR Journal of Humanities and Social Science. 2014; 19(9): 52-5.
23. Ewunonu EO. Nasal mophormetric pattern of the Abakaliki ethnic group of South Eastern Nigeria. Journal of Health and Visual Sciences. 2014;16(1):7-12