Original Article

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Estimation of Stature from Nasal Height and Nasal Breadth for Population in and Around Rajkot Region of Gujarat

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Abstract

Determination of stature from fragmented human remains is vital part of forensic investigation for thepurpose of identification. Determination of stature from dismembered body parts can play vital role for identification of person. Present study was done to derive regression formula and multiplication factor to estimate stature from Nasal dimensions mainly Nasal Height and Nasal Breadth for population in and around Rajkot region of Gujarat. Total 100male cases and 100 female cases randomly selected from cadavers brought for post-mortem examination at mortuary of P.D.U. Govt. Medical College and Hospital, Rajkot. Stature was measured with measuring tape and Nasal dimensions were measured by Spreading caliper after breaking Rigor mortis, if developed. Collected data were statistically analysed using software like Epi info 7 and Microsoft excel. Mean stature as well as mean Nasal dimensions were significantly higher for male than for female ($p<0.05$). Regression formula and multiplication factor derived in present study are useful to estimate stature from nasal dimensions for population in and around Rajkot region of Gujarat.

Keywords: Identification; Stature; Nasal Height; Nasal Breadth.

Introduction

During legal investigations, especially in crimes resulting in fatalities or when unknown human remains are recovered by investigatingagencies, the forensic pathologist is often required to give an opinionregarding personal identification of the deceased. Stature or bodyheight is one of the most important parameters to determine thephysical identity of an individual. There is a definite biological relationshipof stature with the all body parts such as extremities, head, trunk, vertebral column, etc. Many studies have been conducted onthe determination of stature from percutaneous measurements ofvarious body parts including arms, legs, feet, hands, etc. Nose is the important physiognomic feature in humans. Nasal dimensions are among the most important cephalometric parameters used in the descriptions of human morphology, identification of individuals and classification of sex and races. However, different population exhibits variation in their body proportions as they are affected by race, diet, genetics of a person, geographical location and climatic conditions [4]. Due to which, results of a study conducted on one population cannot be applied on other population. Even results of a study conducted on one generation of a population cannot be applied on next generation as they are affected by secular changes in physical growth. With this view, present study was carried out to derive regression formula and multiplication factor to determine stature from Nasal dimensions for population in and around Rajkot region.

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Material and Method

This study was carried out on 100 male cases and 100 female cases randomly selected from cadavers brought for post-mortem examination at mortuary of P.D.U. Govt. Medical College and Hospital, Rajkot during the period of January 2015 to May 2016. Age group selected for the study was 21 years and above. The cadavers with any injury, disease or anomaly that affects Facial dimensions were excluded from the study. The bodies that were decomposed, charred or mutilated were also excluded from the study.

Measurements were taken up to nearest 0.1 cm as below after breaking rigor mortis, if developed.

Stature

The body was placed in supine position on a flat, hard surfaced autopsy table. Head was fixed in such way that Frankfort plane remains at right angle to autopsy table. Frankfort plane is defined as plane adjoining the upper margin of the ear openings and lower margin of the orbit of the eyes. Knee and hip joints were kept extended, and the neck and feet were kept in neutral position. If rigor mortis was present, it was broken down. Stature (Total Body Length) was measured between the vertex of the head and the heel using a measuring tape up to nearest of 0.1 cm.

Nasal Height

It was measured as straight distance between nasion and subnasale (In the midline, the point where nasal septum merges with the upper lip). It was measured by spreading caliper with scale as follows: one tip of the calliper was placed at subject's nasion and the movable part was moved and placed on subnasale.

Nasal Breadth

It was measured as straight distance at right angle to the Nasal Height from ala to ala (lateral surface of external nose) by spreading caliper.

Statistical Analysis

All the measurements were statistically analysed using software like Epi info 7 and Microsoft Office Excel 2007.The data was analysed for male and female cases separately as well as for total cases i.e. both sexes together. Result of data analysed for total cases can be applied to determine stature from Nasal dimensions, when sex is unknown. Pearson correlation coefficient (r) was calculated to assess the correlation of stature with Nasal dimensions. Independent samples T-test was applied to determine statistical significance of gender differences in stature and Nasal dimensions. P-value of less than 0.05 was considered significant. Regression formula and multiplication factors were derived to estimate stature from Nasal dimensions.

Observation

Table 1 is showing descriptive statistics of all the cases. It is evident from the table that mean of stature and nasal dimensionsare higher for male than for female.Genderdifference in stature and Nasal dimensionsarestatistically confirmed by applying t-test as shown in Table 2 ($p < 0.001$).

Table 3 is showingcorrelation of Nasal dimensions with stature. Nasal Height and Nasal Breadthare showing positive and significant correlation with stature in male as well as female cases.

Table 1: Descriptive statistics (Mean ± SD)

Parameter	Male	Female	Total Cases
Stature	167.59±4.47	151.39±4.55	159.49±9.28
Nasal Height	4.34±0.24	3.93±0.26	4.15±0.33
Nasal Breadth	3.75±0.24	3.46±0.24	3.60±0.28

* All measurements are in centimeters.

Table 2: Comparison for gender difference in stature and nasal dimensions

Parameter	Mean		T Value	P Value*
	Male	Female		
Stature	167.59	151.39	25.391	0.000 (S)
Nasal Height	4.37	3.93	12.564	0.000 (S)
Nasal Breadth	3.75	3.46	8.674	0.000 (S)

* S=Significant

*p Value<0.05 is significant and p Value<0.001 is highly significant.

Table 3: Correlation of nasal dimensions with stature

Parameter	Pearson Correlation Coefficient (R)*	
		Female
Nasal Height	0.240	0.196
Nasal Breadth	0.188	0.124

*p Value is less than 0.05 for all.

Simple regression formula when sex is known

For Male

1. From Nasal Height
   STATURE= 148.039 + 4.470 x Nasal Height
2. From Nasal Bredth
   Stature= 154.305 + 3.544 x Nasal Breadth

For Female

1. From Nasal Height
   Stature= 137.803 + 3.456 x Nasal Height
2. From Nasal Breadth
   Stature= 143.265 + 2.351 x Nasal Breadth

Simple Regression Formula When Sex is Unknown

1. From Nasal Height
   Stature= 83.052 + 18.408 x Nasal Height
2. From Nasal Breadth
   Stature= 96.966+ 17.356 x Nasal Breadth

Mean Multiplication Factor when Sex Is Known

For Male

1. From Nasal Height
   STATURE= **38.42** X NASAL HEIGHT
2. From Nasal Breadth
   Stature= **44.87**X Nasal Breadth

For Female

1. From Nasal Height
   Stature=**38.66** X Nasal Height
2. From Nasal Breadth
   Stature= **44.00** X Nasal Breadth

Mean multiplication factor when sex is unknown

1. From nasal height
   Stature=**38.53** X Nasal Height
2. From Nasal Breadth
   Stature = **44.43** X Nasal Bradth

Table 4: Comparison of stature estimated by regression formula and by mean multiplication factor (Mean ± SD)

Parameter	Male	Female	Total Cases
Measured Stature	167.59±4.47	151.39±4.55	159.49±9.28
Stature Estimated By Regression Formula			
Nasal Height	167.59±1.74	151.39±0.89	159.49±6.13
Nasal Breadth	167.59±0.84	151.39±0.56	159.49±4.85
Stature Estimated By Mean Multiplication Factor			
Nasal Height	168.05±9.22	151.97±9.98	160.00±12.85
Nasal Breadth	168.21±10.66	152.06±10.56	160.06±12.43

SD=Standard Deviation

Table 4 is showing comparison of stature estimated by regression formula with stature estimated by mean multiplication factor.Standard deviation (SD) measures amount of dispersion from mean value.

From Table 4, it is evident that mean stature estimated by regression formula as well as multiplication factor are very nearer to mean measured stature.

However, SD of stature estimated by mean multiplication factor are higher than SD of stature estimated by regression formula, which means stature estimated by mean multiplication factor is showing more dispersion from its mean value. So, regression formula measures stature more precisely than mean multiplication factor.

Discussion

The main objective of this study is to find out correlation between Nasal dimensions with stature and to use result of this study as a basis for developing stature estimation standards specifically for population in and around Rajkot region of Gujarat.Several such studies have been carried out in past for different population of India.

Agnihotri AK et al [5] studied 150 Indo-Mauritian adults (75 males and 75 females) of age group between 20 to 28 years to establish anthropometric relationship between stature and nasal dimensions. Comparative statistical analysis among both gender clearly revealed that Nasal breadth emerged as a major predictors for stature estimation among males.

But none of nasal parameters worked to estimate stature of females.

Sagar S et al [6] studied 300 Jatvas (100 males and 200 females) aged between 17 to 40 years of Delhi region. They measured Stature, Nasal height, Nasal breadth, Head length, Head breadth and Ear length. They concluded that Jatvas Males exhibit greater dimensions for Nasal Breadth and females exhibit greater dimensions for Nasal height.

From comparison of these studies, it is evident that all the studies have found positive correlation between Nasal dimensions and stature, which means Nasal Height and Nasal Breadth are useful parameter to estimate stature. All the studies show significant gender difference mean stature as well as Nasal Height and Nasal Breadth. Table 5 shows comparison of mean stature and mean nasal height and mean nasal breadth with other similar studies. It is evident from the table that all the studies have found different mean stature as well as mean nasal height and mean nasal breadth. This finding substantiate well known fact that different population shows difference in stature as well as in body proportions, so population and sex specific regression formula and multiplication factor are required for accurate stature reconstruction from nasal dimensions.

Table 5: Comparison of present study with other similar studies

Author	Mean Stature* (Mean ± SD)		Facial Dimensions			
			Mean Nasal Height		Mean Nasal Breadth	
	Male	Female	Male	Female	Male	Female
Agnihotri AK et al.[5]	173.40±7.70	157.36±6.17	5.27±0.33	5.20± 0.35	3.28±0.49	2.95±0.37
Sagar S et al.[6]	152.33±0.56	152.44±0.39	4.77±0.06	4.88±0.23	3.90±0.05	3.75±0.15
Present Study	167.59±4.47	151.39±4.55	4.37±0.24	3.93±0.26	3.75±0.24	3.46±0.24

Conclusion

In present study, mean stature estimated from regression formula as well as multiplication factor are similar to mean measured stature in both sexes, however, regression formula measures stature more precisely than mean multiplication factor. So, regression formula and multiplication factor derived from present study can be used to determine stature of deceased person from nasal dimensionswhen mutilated head is found.

Mean stature as well as mean nasal height and mean nasal breadth are significantly higher for male than for female, so sex specific regression formula and mean multiplication factor should be derived. Present study has derived regression formula and multiplication factors for male and female cases separately as well as for total cases i.e. both sexes together. Regression formula and multiplication factor derived for total cases can be applied to determine stature from nasaldimensions, when sex is unknown. However, sex specific regression formula and multiplication factors can estimate sex more accurately.

Asdifferent population show difference in stature as well as in body proportions, results of present study are applicable to population in and around Rajkot region.

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