Stature estimation from arm span in living people of Terdal region

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Abstract

Introduction: Identification of a person is the important part of investigation and estimation of stature is important part for identification for medico-legal expert. Estimation of stature from body part is key factor in identification during mass disaster like railway accident, earthquake, building collapse and fire etc. With increasing incidence of above events stature estimation from fragmented body parts become needful.

Materials and Methods: The study was carried out over 198 living subjects aged between 10 to 60 years from both rural and urban area of Terdal region. The measurement of arm span was done by calibrated measuring tape between the tips of middle fingers of maximally outstretched hands. The data was analyzed by using Microsoft Excel and statistical programme for social science (SPSS) version 17.

Result: In the study mean stature and arm span for male for male subjects are 165.01 and 167.72 respectively and for female subjects it is 154.65 and 156.48 respectively. Mean difference between arm span and stature is more in male 2.71 than female 1.83. And multiplication factor for estimation of stature from arm span is 0.989.

Conclusion: Regression equation derived for male sex for stature is 4.042 + (0.960 × AS) with standard error of 2.637 cm and strength of association 0.945. While regression equation derived for female sex for stature is 10.028 + (0.924 × AS) with standard error of 3.295 cm and strength of association 0.881.

Keywords: Terdal region, Identification.

Introduction

Identification of a person is the important part of investigation and estimation of stature is important part for identification for medico-legal expert.[1] Stature estimation from fragmented body parts has more significance in modern era due to increased event of mass disasters like railway accident, earthquake, building collapse, cyclone and fire etc. in which chances of fragmented body parts remains high.[1,2] Stature estimation of any person from skeletal remain and fragmented body has obvious importance in case of murders as the mutilation of dead body is done by criminal who tries to destroy all traces of identification and facilitate the disposal of dead body.[3] With increasing the incidence of above mentioned disasters in modern era, need of this type of study is always remain for identification of person. It is established fact that stature bears a direct relation to length of various bone. However, intact long bones may not found in each case for stature estimation. In such case measurement of various remains of body parts plays important role to estimate stature. In India, due to increasing population and struggle for existence and competition among the members of society, the crimes are expected to increase. The modus of operandi of crime would become more scientific and complex today than as is evident during last few decades.[4] With this view this research is carried out to evaluate anthropometric relationship between length of left foot sole and stature of study population of Terdal region.

Materials and Methods

The present study was conducted in the department of Agadtantra, SDM Trust's Danigond Post Graduate Center, Terdal during the period of October 2017 to March 2018. The study was conducted on 198 living subjects who were examined in the department of agadtantra at SDM Trust's Danigond Post Graduate Center, Terdal after taking necessary consent. Measurement of the living subjects were done during day time between 10:00 am to 4:00 pm. The living subjects were taken from the age group of 10 to 60 years of Terdal region (both rural and urban). The subjects having injury or deformity were excluded from the study. The information regarding the age, sex, dietary habits or any other disorder was noted. The height of the subjects were measured with barefoot, standing erect, the feet pointed outwards at the angle of 60 degree and head oriented straight. Arm span was measured by using calibrated measuring tape between the tips of middle fingers of maximally outstretched hands. The measurement was taken in unit of centimeters. The data was recorded in the proforma and analyzed statistically to find out the mean and standard deviation. The data was analyzed by using Microsoft Excel and statistical programme for social science (SPSS) version 17. To access correlation between stature and arm span, Pearson's correlation coefficient was calculated and its significance was tested. P value less than 0.5 was considered significant.

Results

The demographic and clinical data of the Table 1 is showing descriptive statistics of all the cases. Highest number of total subjects were found in age group of 21 to 30 years and minimum numbers of subjects were found in age group of 41 to 50 years.

Table 1: Age and sex wise distribution of subjects

Age (Years)	Number of Subjects		
	Male (%)	Female (%)	Total (%)
11-20	21 (10.60%)	25 (12.62%)	46 (23.23%)
21-30	32 (16.16%)	21 (10.60%)	53 (26.76%)
31-40	17 (8.58%)	20 (10.10%)	37 (18.68%)
41-50	15 (7.57%)	15 (7.57%)	30 (15.15%)
51-60	15 (7.57%)	17 (8.58%)	32 (16.16%)
Total	100 (50.50%)	98 (49.50%)	198 (100%)

It is evident from table no 2 that highest number of total subjects were found in stature range of 161 to 170 cm (i.e.41.41%) while lowest number of total subjects were found in stature range of 131 to 140 cm (i.e. 2.52%).

Table 2: Stature and sex wise distribution of subjects

Stature (cm)	Number of Subjects		
	Male (%)	Female (%)	Total (%)
121-130	3 (1.51%)	3 (1.51%)	6 (3.03%)
131-140	3 (1.51%)	2 (1.01%)	5 (2.52%)
141-150	2 (1.01%)	21 (10.60%)	23 (11.61%)
151-160	4 (2.02%)	44 (22.22%)	48 (24.24%)
161-170	56 (28.28%)	26 (13.13%)	82 (41.41%)
171-180	32 (16.16%)	2 (1.01%)	34 (17.17%)
Total	100 (50.50%)	98 (49.50%)	198 (100%)

Table 3: Descriptive statistics of study sample

Parameters	Male			Female		
	Min.	Max.	Mean ± SD	Min.	Max.	Mean ± SD
Age (year)	11.00	60.00	32.84 ± 14.02	12.00	60.0	33.25 ± 14.78
Stature(cm)	122.60	179.00	165.01 ± 11.21	123.00	171.20	154.65 ± 9.50
AS(cm)	126.00	188.90	167.72 ± 11.35	124.30	175.50	156.48 ± 9.65
	For Both Sex					
Age (year)	11.00	60.00	33.04 ± 14.37	-	-	-
Stature(cm)	122.60	179.00	159.88 ± 11.60	-	-	-
AS(cm)	124.30	188.90	162.16 ± 11.93	-	-	-

As per table no 3 of descriptive statistics of the study shows that mean stature and mean arm span of male is higher than that of female. Mean arm span for either sex is more than mean stature.

Table 4 (mean of arm span) shows that with increase in stature, arm span also increased.

Table 4: Stature and sex wise mean of arm span

Stature (cm)	Arm Span (AS) in cm		
	Male (Mean ± SD)	Female (Mean ± SD)	Both Sex (Mean ± SD)
121-130	130.10 ± 3.80	129.47 ± 4.53	129.74 ± 3.90
131-140	136.72 ± 2.44	136.35 ± 0.92	136.60 ± 1.94
141-150	150.23 ± 0.55	148.59 ± 4.62	148.79 ± 4.36
151-160	160.90 ± 2.61	157.43 ± 4.08	157.78 ± 4.08
161-170	168.13 ± 3.68	164.93 ± 3.49	167.10 ± 3.90
171-180	176.80 ± 4.33	173.3 ± 2.91	176.51 ± 4.31
All	167.72 ± 11.35	156.48 ± 9.65	162.16 ± 11.93

Table 5: Level of significance of measurements for both sex and linear regression formula for estimation of stature

	Parameter	N	PCC	R^2	SEE	p Value	Regression Formula
Male	Arm Span	100	0.972	0.945	2.637	0.000	S = 4.042 + 0.960 × AS
Female	Arm Span	98	0.939	0.881	3.295	0.000	S = 10.028 + 0.924 × AS
Both	Arm Span	198	0.967	0.935	2.975	0.000	S = 7.494 + 0.940 × AS

Where, N is the total number of cases, PCC is Pearson's correlation coefficient and SEE is standard error of estimate.

Table 5 shows Pearson's correlation coefficient, R^2, Standard error of estimate, p value of male, female and either sex. The correlation coefficient for stature with arm span was obtained and was found significant. The correlation coefficient indicates the strength of association and it varies from -1 (negative correlation) to +1 (positive correlation). In present study, Pearson's correlation coefficient for arm span was 0.945 for male, 0.939 for female and 0.967 for either sex. The standard error of estimate is 2.637 for male, 3.295 for female and 2.975 for either sex. Mean multiplication factor for estimating stature from arm span is 0.984 for male, 0.989 for female and 0.986 for either sex. Mean multiplication factor is calculated by actual stature divided by arm span.
Mean multiplication factor = Actual Stature / Arm Span length.

Conclusion

Mean arm span in male was 167.72 cm with SD of 11.35 while that of female was 156.48 cm with SD of 9.65 and for either sex, it was 162.16 cm with SD of 11.93. Regression equation derived for either sex was stature = 7.494 + (0.940 × AS) with standard error of 2.975 cm and strength of association 0.935. Regression equation derived for male was stature = 4.042 + (0.960 × AS) with standard error of 2.637 cm and strength of association of 0.945. Regression equation derived for female was stature = 10.028 + (0.924 × AS) with standard error of 3.295 cm and strength of association of 0.881. Mean multiplication factors for estimation of stature from arm span for either sex, male and female was 0.986, 0.984 and 0.989 respectively.

Conflict of Interest: None.

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