



ISSN: 0976-3031

Available Online at <http://www.recentscientific.com>

CODEN: IJRSFP (USA)

*International Journal of Recent Scientific Research*  
Vol. 9, Issue, 3(L), pp. 25477-25480, March, 2018

**International Journal of  
Recent Scientific  
Research**

DOI: 10.24327/IJRSR

## Research Article

# DETERMINATION OF STATURE AND GENDER PERCEPTION FROM THE LENGTH OF MIDDLE FINGER OF NORTH INDIAN POPULATION IN AGE GROUP OF 20-30 YEARS

**Kangana Aggarwal., Amit Chauhan\* and Shukla S K**

Amity Institute of Forensic Sciences, Amity University sec-125 (Noida)- Uttar Pradesh,  
INDIA-201313

DOI: <http://dx.doi.org/10.24327/ijrsr.2018.0903.1865>

### ARTICLE INFO

#### Article History:

Received 15<sup>th</sup> December, 2017

Received in revised form 25<sup>th</sup>

January, 2018

Accepted 23<sup>rd</sup> February, 2018

Published online 28<sup>th</sup> March, 2018

#### Key Words:

Age group, gender determination,  
population, finger length, estimation etc.

### ABSTRACT

In present time of advancement, the traditional methods of identification have become out of the analytical process yet so many times, these methods have proven their significance level during the investigation. At scene of occurrence, evidences are recovered in several forms such as physical, chemical, biological, distorted, Skelton remains etc are recovered. A very small amount of any evidence or minutiae detail can help to solve any type of case during investigation. It is a necessity to establish certain methods or techniques or to follow any existing method/technique to solve cases involving dead bodies. Among all the interested field, anthropology has taken up the vast interest of experts, researchers and scientists has led to practice traditional analytical methods. These methods have proven their significance over traditional methods over modern ones. Even the remains of dead bodies can give significant clues to interpret and solve the case. In this present study, we used the method to determine the stature of an individual and gender perception from the length of middle finger conducted in the Northern population India in age group of 20-30 years. From this study, we were able to conclude the suspect/culprit stature on the basis of the of their middle finger which will help in conviction through legal proceedings.

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### INTRODUCTION

In today's modern era where the technology is advancing at high pace, people are using the technologies for new research, inventions or investigation. New emerging fields have been facilitated by these inventions or advancement. Among these emerging fields, forensic science has also been updated with advance technology from time to time and help to investigate the criminals involved in any crime. Even a few of the methods are able to determine the modus operandi or to identify the victims in terms of age, sex, height/stature, etc. During an investigation, uncountenanced of dead bodies are very common at crime scene. The dead bodies are recovered in many cases such as homicide, murder, suicide, accidents and mass disasters like fire cases, plane crash, natural disasters, explosions etc. In cases of mass disasters usually remnants of dead bodies are recovered. It has become a tedious job for the experts to identify the people who were directly or indirectly; were the part of crime. Forensic Anthropologist is called upon to collect the remnants or the cadaver from the crime scene. During the investigation of such crime, usually cranial bones, ribs, sternum, tarsals, carpals, pelvis, patella, sacrum and others are recovered.

Bones or the remains of bones plays a significant part in forensic investigation as it helps in estimation of age, gender and stature/height of the victim. Anthropologists use many methods and formula to determine various characteristic elements. For instance, long bones can be determined on the basis of medullary index from tibia, humerus, ulna and radius. Determination of gender can be done with Washburn/Ischiopubic index, Sciatic notch index, Sternal index, Corporobasal index, Sacral index, Kimura's Base-wing index and Chilitic line. Accuracy of determination of gender from adult skeletal remains such as skull, mandibular bone, pelvis and long bones is above 90%. Age can be determined with all possible age-related attributes such as dental eruption, epiphyseal unions, pubic symphyseal morphology, cranial suture closures, mandibular and sacral changes. Some of the methodology used for age estimation are cortical bone histology, Harris lines, phase changes in sternal bone and bone marrow.

Stature dimensions varies throughout our life time, such as after 30 years of age, the natural process of senile degeneration causes gradual decrease in stature by 0.6 mm per year on average. After death the body lengthens by about 2cm, due to

\*Corresponding author: **Amit Chauhan**

Amity Institute of Forensic Sciences, Amity University sec-125 (Noida)- Uttar Pradesh, INDIA-201313

complete loss of muscle tone, relaxation of large joints and loss of tensioning effect of paraspinal muscles on intervertebral discs. The methods in use to determine the stature are i.e. least squares regression equations and other regression principles such as Perason's regression formula, Breitingger, Telkka, Duppertius and Hadden, Trotter and Gleser, and Munoz. These methods are used for bone length ratios and skeleton height and adjustment for missing of soft tissues.

Many Anthropologists and researchers have tried to come up with methods of stature estimation in a certain population. In this present study, we try to determine the gender and perception of age from the length of middle finger of northern Indian population of age group 20-30 years. As there are gradual changes in environment which causes the group selection of people on the basis of genetics inhabiting in that area. Therefore, this study will help in forensic investigators in solving cases related to skelton remains for various populations in different regions of the India.

## METHODOLOGY

This study was conducted to determine the stature estimation and perception of gender from the length of middle finger of the population of north India. All the samples were collected from the North-East district of Uttar Pradesh i.e. Delhi, Barout, Ramala, Sarurpur of Distrcit Baghpat. The aim of this study was to establish the degree of reliability for the purpose of identification from remains.

## MATERIAL & METHOD

For this study, total 100 individuals i.e. 50 males and 50 females of age group 20-30 years were selected. Sample selection was done randomly and the consent of the subjects were taken prior by explaining the purpose of this study. The subjects included in the present study were healthy and had no history of any sort of deformity of the hand, metabolic disorders and any issue of developmental process. To avoid any kind of diurnal variation, all the measurements were taken during day time interval. All the measurements were taken with the help of anthropometric board. Measurements of stature were taken as vertical distance from the vertex to the foot.

To measure the stature, all the subjects were asked to stand barefoot on the platform of stadiometer with the upper back, and heels pressed against the wall thus ensuring their upright position, while head was positioned in the Frankfurt horizontal plane. During the measurement of middle finger length, all the subjects were asked to turn inverse their palm & fingers horizontally towards the stand following by the Frankfurt plane<sup>20</sup>. The movable rod of stadiometer was brought in contact with vertex in the mid-sagittal plane. All the measurements of thumb were measured with the help of a sliding calliper, when the subjects placed their hands supine on a flat horizontal surface with the fingers extended<sup>21</sup>. The measurement of middle finger length was obtained up to the place of one decimal and any kind of error was avoided, moreover, all the measurements were taken twice and the average of both of measures were considered for the further analysis. To avoid any kind of instrumental error or variation, all the instruments were verified at significance level and a variation of  $\pm 0.01$ cm was observed.

## Statistical Analysis

The data was tabulated, analyzed and subjected to statistical analysis by using SPSS software (latest version, 11.0).

## RESULT AND DISCUSSION

To determine the estimated stature/height of an individual, long bones are preferably used due to their higher correlation coefficient and small error. However, it becomes difficult in those circumstances where only the remains or fragmented parts of body are available for the purpose of medical examination and its further analysis. Hence, forensic investigators are exploring new parameters and are establishing new methods or techniques to estimate stature and gender perception by the measurements of head, foot, face, lengths of finger, etc.

As described earlier, to conduct this study a data of hundred subjects (including male & female) were collected by taking their respective measurements. These measurements are given below (table no.-1)-

**Table no 1** data of both genders according to age and the measurements of right-hand and left-hand middle fingers.

S. No.	Age	Right hand	Left Hand	Age	Right Hand	Left Hand Middle
		middle finger	Middle Finger		Middle Finger	Finger
		measurement	Measurement	Measurement		Measurement
Female subject's data				Male subject's data		
1	28	10.2	9.7	20	9.6	9.5
2	24	10.6	10.4	24	9.1	9.8
3	23	10.5	10.4	24	10.2	10.2
4	22	10.1	10.2	24	9.7	9.7
5	22	10.3	10.3	22	9.5	9.4
6	24	11.2	11.1	25	10	9.8
7	26	10.8	10.5	24	9.5	10.5
8	23	10.6	10.6	23	9.2	9.9
9	23	11.3	11.4	25	10	10
10	24	10.6	10.5	25	9.8	9.8
11	23	11	11	26	10.7	10.3
12	23	11.2	11.2	26	10	9.8
13	24	10.3	10.3	26	11	10.8
14	21	11	10.8	21	9.8	9.5
15	21	11.6	11.4	23	9.4	9.1
16	23	10.3	10.4	24	10.1	10.3
17	24	11	11	25	9.9	9.4
18	30	10.8	10.8	24	10.2	10.3
19	25	11.7	12.1	23	9.9	10.1
20	27	10.4	10.3	24	10.6	10.3
21	25	10.1	10	24	10.1	9.8
22	24	11.1	11	25	10.1	10.1
23	25	10.8	10.6	28	10.1	10.3
24	25	11	11	25	10.8	10.9
25	24	11.5	11.6	25	9.8	9.6
26	23	11	11	30	10.2	10.2
27	23	10.2	10.3	24	10.2	10.3
28	24	11	11.1	24	10.3	10.1
29	24	11	11	24	9.2	9.1
30	24	11	10.8	23	9.2	9.4
31	25	11.5	11.4	25	10.1	10
32	25	10.5	10.6	25	10.2	10.1
33	24	11	10.9	24	10.4	10.3
34	28	11	11	23	10.4	10.4
35	24	11	11.1	24	10.5	10.3
36	25	11.2	11	24	9.7	9.7
37	23	11.2	11.2	23	9.6	9.5
38	24	11	10.8	24	11	10.6
39	24	11	11	28	9.6	9.2
40	23	11.5	11.6	24	9.6	9.5
41	23	11.2	11	23	11	10.6
42	22	11.2	11.2	24	9.6	9.2
43	23	11	10.8	24	10.6	10.6
44	23	11.8	11.5	24	10.5	10.4
45	23	11.6	11.5	24	10.1	10.1
46	25	11.7	11.8	23	9.8	9.5
47	25	11	11	23	11.1	11
48	25	11.8	12	28	9.9	9.5
49	26	11.8	11.3	24	10.2	10
50	25	11.2	11.2	26	10.2	10.3

The dossier of measured subjects right hand and left- hand middle finger length is described in the given table according to their respective age. The correlation coefficient of the stature and age of females are given below in table no-2-

**Table no.2** Pearson correlation coefficient of middle finger measurements with stature and p value in females

Middle Finger	Right hand		Left hand	
	Correlation coefficient	P value	Correlation coefficient	P value
	0.7892	<0.0001	0.573	<0.0001

Since p is greater than 0. 0001, hence, the obtained results are significant. The correlation coefficient in the measurement of right hand middle finger was  $p < 0.0001$  at significant level while in left hand, it is given below in table no-3-

**Table no 3** Pearson correlation coefficient of thumb measurements with stature and p value in males

Middle Finger	Right hand		Left hand	
	Correlation coefficient	P value	Correlation coefficient	P value
	0.586	<0.0001	0.270	<0.0001

The regression equation for stature estimation was applied in both of gender (male as well as female). The stature estimation of females is shown in table no.-4 below while the male stature estimation regression equation is shown in table no.-5 below.

**Table no.4** Regression equation for estimation of stature in females.

Right hand		Left hand	
Middle Finger	Height =93.67+5.98	Middle Finger	Height =89.87+7.43

**Table no 5** Regression equation for estimation of stature in males

Right hand		Left hand	
Middle Finger	Height =84.150+6.189	Middle Finger	Height =88.380+7.919

The regression coefficient estimation for females is given below (table no.-6)

**Table no.6** Regression coefficient estimation for females

Fingers	Constant In cm (b <sub>0</sub> )	Regression Coefficient In cm (b <sub>1</sub> )
Right Middle Finger	134.78	3.63
Left Middle Finger	124.86	3.57

The regression coefficient estimation for male's subjects are given below (table no.-7)-

**Table no7** Regression coefficient estimation for males

Fingers	Constant In cm (b <sub>0</sub> )	Regression Coefficient In cm (b <sub>1</sub> )
Right Middle Finger	89.38	7.19
LEFT Middle Finger	86.15	7.68

For correlation coefficient for right hand middle finger in females we used the regression coefficient  $y=(b_0 +b_1) x$ . For right -hand middle finger measurements in male.

$y=B_0+B_1x$   
 $y=B_0+B_1x$   
 $B_0=104.22$

$B_1=9.43$   
 $x=7$   
 $y=104.22+57.98= 162.2$   
 Measured height=163.1cm.

To estimate the stature, linear regression equation derived from the middle finger length shows a significant statistically ( $p < 0.001$ ) relationship between them. During this study, a significant correlation was observed between the ring finger and the stature which is highly encouraging for investigation purpose. The correlation between the ring finger and stature in female was higher in comparison of male. From the regression models derived in the present study the standard error of estimate in the predicted stature was more in males than the females. According to our study, height and length of the hand were more significant in males than females. There was no bilateral variation of right and left middle fingers length.

In other words, the accuracy of stature estimation in females is more than males. The multiplication factor is a manual tool that play a vital role in such conditions where the gender perception and stature is estimated. The findings of this study can be useful to increase the forensic significance, even, when it is compared with another exists study at various populations. During such studies, it may be an interesting fact to observe the effect of geographical area over different population. So as, to evaluate the effect of area/region over population or to study the gender perception whether it exists or not?

### CONCLUSION

From past many decades, stature estimation and gender perception from the skeleton remains have been used for the identification of an individual but a very less work exists regarding the gender perception and stature estimation from the length of middle finger. As a resultant of this study, it was observed that middle finger length is a good and reliable method for gender discrimination and stature estimation which has raised hopes that even a skeleton remains of middle finger can help in concluding the identity of suspect or victim. Every year around 2,22,446 dead bodies are recovered and among them only 5% are found in appropriate condition while rest are found in decomposed, putrefied or skeleton form. In such cases, when the identity of actual person is not possible then stature estimation along with gender perception and age determination helps to solve the case. This study will help the investigators from all over the world to collect information about victim around the particular area which will reduce the time duration of investigation. It could be proved as a milestone for justice system in the northern population of India.

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**How to cite this article:**

Kangana Aggarwal et al. 2018, Determination of Stature And Gender Perception From The Length of Middle Finger of North Indian Population In Age Group of 20-30 Years. *Int J Recent Sci Res.* 9(3), pp. 25477-25480.  
DOI: <http://dx.doi.org/10.24327/ijrsr.2018.0903.1865>

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