The Stature (Height) & All Metacarpal Lengths Ratios As Markers Of Sex And Stature Determination. A Radiological Study on Population of Haryana

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ABSTRACT

Backgrond: The purpose of this study was to compare and identify potential variations between the left and right metacarpal length (MCL) and all metacarpal length ratios in female and male subjects from the Haryanvi Population. **Material and methods:** After obtaining ethical approval for study from the department of Anatomy, Santosh Medical College, Ghaziabad Utter Pradesh & Radiology department of ChaudharyLekh Raj hospital of Yamuna Institute of Dental Sciences and Research (YIDSR),Gadholi, Yamuna Nagar, Haryana, India. **Results:** It was found that the values of all Metacarpal lengths were found to be higher in men and their difference was found to be statistically highly significant, value 0.0001. So, data is having sufficient evidences to prove sexual dimorphism on the bases of metacarpal lengths and height among the individual of Haryana. **Conclusion:** Outcome of study impressed upon the relation of all metacarpal lengths (BH/MTCL) of both the hands of male and female individuals with their height or stature in population of Haryana. More over it, it was came out of after analyzing the data of male & females (All MTCLs) there were differences in the lengths & which were highly significant.

Keywords: Hand Sexual dimorphism Left -hand Right-hand metacarpal lengths Metacarpal length ratios

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Introdction

Man uses the hand as a tool, as a symbol and a weapon. The hand has a lot of significance. The hand acts as an organ of performance it serves as eyes for both the blind and the mute talk with it, and it have regarded as a symbol of salutation and condemnation. The hand also has played a significant role in the creative aspect of man's life it is known as symbol of the whole person in the field of art and drama.

Anthropometry deals with the measurements of different body parts and hands of the individuals which help in assessing if the person is suffering from any diseases. Over the period of time it can be observed that there are changes in anthropometric measurements related to hand. Many researchers feel that the hand is the most neglected part of the human body. The primary reason for this is mainly due to the scarcity of fossilized primate hand this can be due to the fact the bones are small and fragile and they can be easily destroyed by the forces of nature. Abdel-Malek et al.,[1] (1990) assessed the relationship between stature and hand measurements in 166 normal adult males and females. The study indicated close similarity of relationship between stature and hand measurements in both the sexes & in both the sides. A multiple regression equation S=34.5+5.77HL+2.7HB+- 5.1 was designed to

estimate stature from values of hand length and hand breadth regardless of the sex and or side. Faurie et al.,[2] (2005) explored the associations between socioeconomic status and handedness, analyzing data from two large cohorts of adult men and women. And result showed that left-handers have socioeconomic status advantage, countervailing the health issue.

Telkka et al.,[3] (1950) there are differences in the population of different places according to anthropological studies and they need to be studied separately. Similarly, Okunribido et al.,[4] (2000); Davies et al.,[4] (1980) observed that different ethnic groups shows different variations in the hand groups. Malina et al.,[5] (1994) stated that different ethnic groups show variations in hand measurements this is mainly due to difference in nutrition levels. AbdolazizHaghnegahdar et al[6](2019), came out with 2 major methods for bone age assessment by using left hand radiography and Tanner and Whitehouse for the purpose of evaluating relationship between skeletal age and bone size and joint space among 304 subjects (155 females and 149 males). Study concluded with findings of metacarpo-phalangeal joint length, metacarpal bone length, metacarpophalangeal joint width and metacarpal bone with shown significant relationship with bone age respectively

P. ReeshmaRethnam& Maria Priscilla David[7]., Worked with the objective to assess the reliability of metacarpal length and hand length in a cross sectional X-ray study of wrist hand of left hand of 100 subject south Indian subjects found that 2nd and 3rd metacarpal length and hand length found to reliable that are 78.15mm, 75.56mm, 224.63mm respectively. And their mean differences were significant and stature for the personal identification in forensic science

Material & methods

After obtaining ethical approval for study from the department of Anatomy, Santosh Medical College, Ghaziabad Utter Pradesh & Radiology department of ChaudharyLekh Raj hospital of Yamuna Institute of Dental Sciences and Research (YIDSR),Gadholi, Yamuna Nagar, Haryana, India. Data pertaining to demography was analyzed in 143 respondents study subjects from state of Haryana (71 males and 72 females) Prior informed consent for the study was obtained from subjects, in writing, both in English and Vernacular local (Hindi).General, socio-demographic information and disorder related details were obtained using a structured interview based questionnaire method. Individuals of age group of 20 to 50 years were included and measurements were done in mms. The instruments used were

- 500 Milli Ampere Allengers (X-ray machine) with a stage and adjustable source of X-ray beam.
- Care-stream Direct View Vita CR (Computerized radiographic system for producing radiograph on X-ray film.
- Radiographic film. (X-ray film) & cassettes with 24x30cm sized for keeping the X-ray film while taking the radiograph from machine.
- Konika 2006 MERGE eMED program is used to obtain anthropometric measurements which were taken from the X-rays exported to a computer using with a feature, which allow the anthropometric measurements of hand skeleton of subjects in

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millimetric precision on radiogram.

Anthropometric measurement results according to Martin technique on the radiograms taken in radio diagnostic position of both the hands are listed below. **The Height** is measured with measuring anthropometric rod by asking the subject to stand in upright position, with hands beside the body and looking straight forward at horizon, on the platform of the anthropometric height measuring rod as shown in figure.[8].**Metacarpal Lengths:** distance between midpoints of the base of metacarpal to its apex. **Metacarpal length/ body height ratio**: ratio of metacarpal length / Body heightis the ratio of hand length& height of the subject.

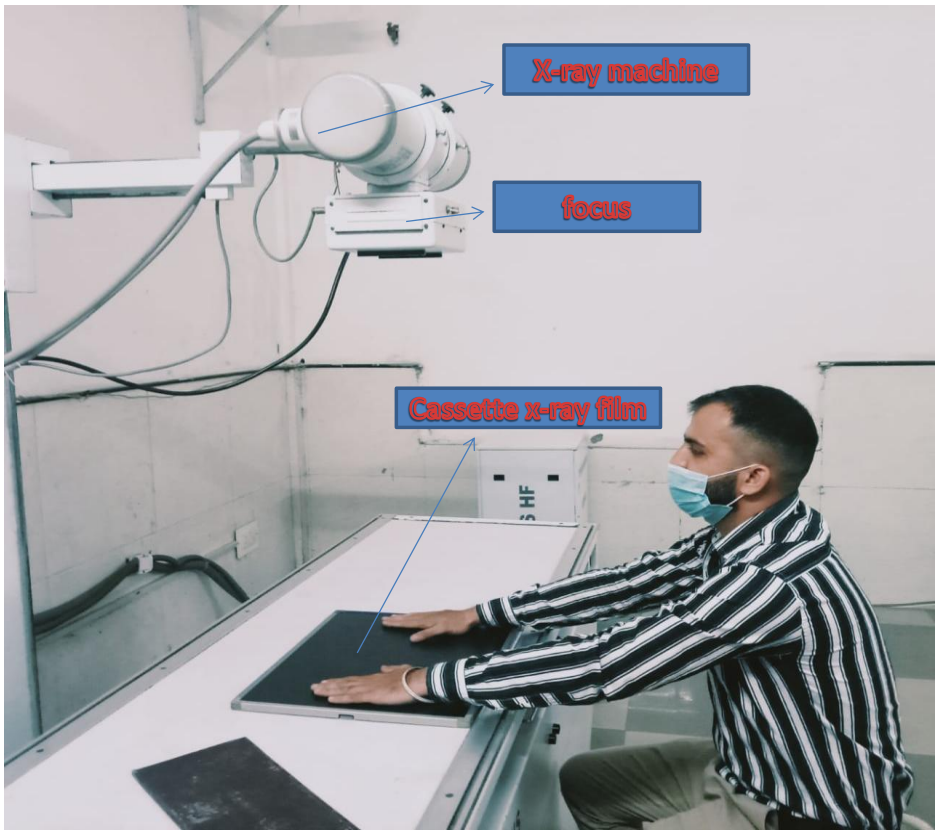

Figure.1 500Milli Ampere Allengers, (The X-ray machine).focusing on dorsum of hand (P/A VIEW)

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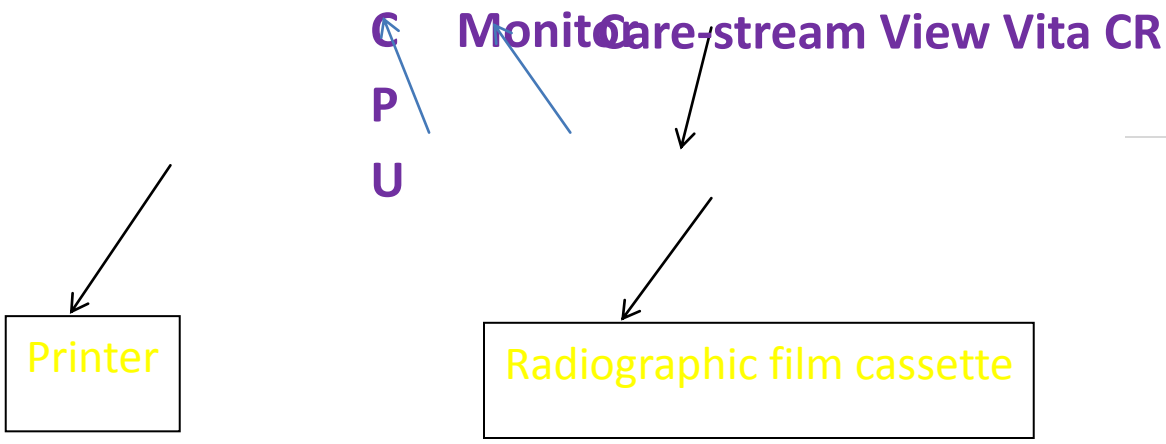

Figure 2. Care-stream Direct View Vita CR (Computerized Radiographic System)

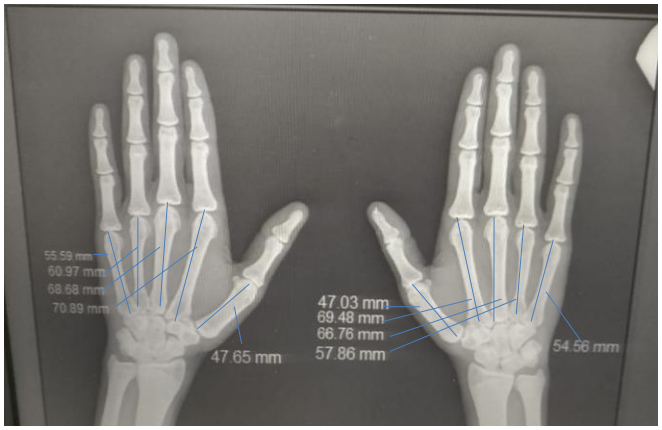

Figure 3. X-ray radiograph of with anthropometric parameters of both hands

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The distance between source (x-ray tube) of rays and dorsum of hands will be 100cm to obtain acceptable focus to skin distance. The Postero-anterior view of both the hand was obtain on the X-ray film by positioning the hand as shown in figure 3.4

The measurements of anthropometric parameters of hands from the radiographic film were performed by a single researcher, Statistical analysis: The data so obtained was recorded in MS-Excel® and subsequently analyzed. The results for continuous variables were recorded as mean ± SD. The difference between mean values of two groups was performed using unpaired t-test and the difference between two values of same group was performed using paired-t tests. A p-value of less than 0.05 was considered statistically significant. Data was recorded and tabulated and subjected to statistical analysis using SPSS 13 software.

Results

Different factors such as body height and metacarpal lengths and ratios of body height and metacarpal lengths were found out to identify the correlation among the metacarpal lengths of male & female respondents of both the populations

Results that and all Metacarpal lengths were more in the right hand and the difference was statistically insignificant.

Table 1 **Showing Comparison between body height & metacarpal lengths of both hands of Male and Females of Haryanvi Population.**

PARAMETERS (in mm)		Sex Of Individuals		Differences in males & females	p value
		Males	Females		
Height/stature		1775.8±42.8	1653.10±12.95	121.8	0.0001***
1st Metacarpal length	Right	49.77±3.05	45.65±2.94	4.12	0.0001***
	Left	49.40±3.20	45.42±2.83	3.80	0.0001***
2nd Metacarpal length	Right	72.46±2.31	66.60±4.73	6.86	0.0001***
	Left	72.31±2.90	66.21±4.21	6.10	0.0001***
3rd Metacarpal length	Right	69.74±2.93	64.26±6.47	5.48	0.0001***
	Left	68.33±2.79	63.25±4.01	5.80	0.0001***
4th Metacarpal length	Right	61.67±2.79	56.47±3.64	5.20	0.0001***
	Left	61.32±2.38	56.09±3.85	5.21	0.0001***
5th Metacarpal length	Right	57.21±2.49	51.81±3.55	5.40	0.0001***
	Left	57.21±4.90	51.26±3.66	5.86	0.0001***

*Source: Primary Data (P>0.05 Insignificant, P≤0.05 Significant, P≤0.01 Very significant, P≤0.001 Highly significant)

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From data collected. It was found that the values of all Metacarpal lengths were found to be higher in men and their difference was found to be statistically highly significant, value 0.0001. So data is having sufficient evidences to prove sexual dimorphism on the bases of metacarpal lengths and height among the individual of Haryana.

Graphical comparison of metacarpal length of both the sexes of Haryana region

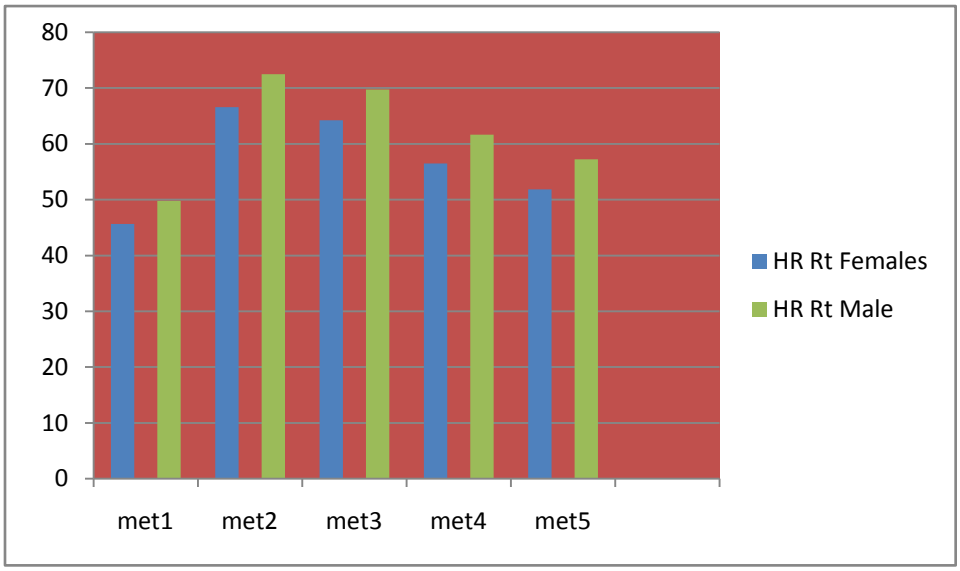

Fig4. Showing right metacarpals length in Male and Females of Haryana.

From the graphical illustration, it can be observed that metacarpal length hands of right males are slightly higher than the right females of Haryana region.

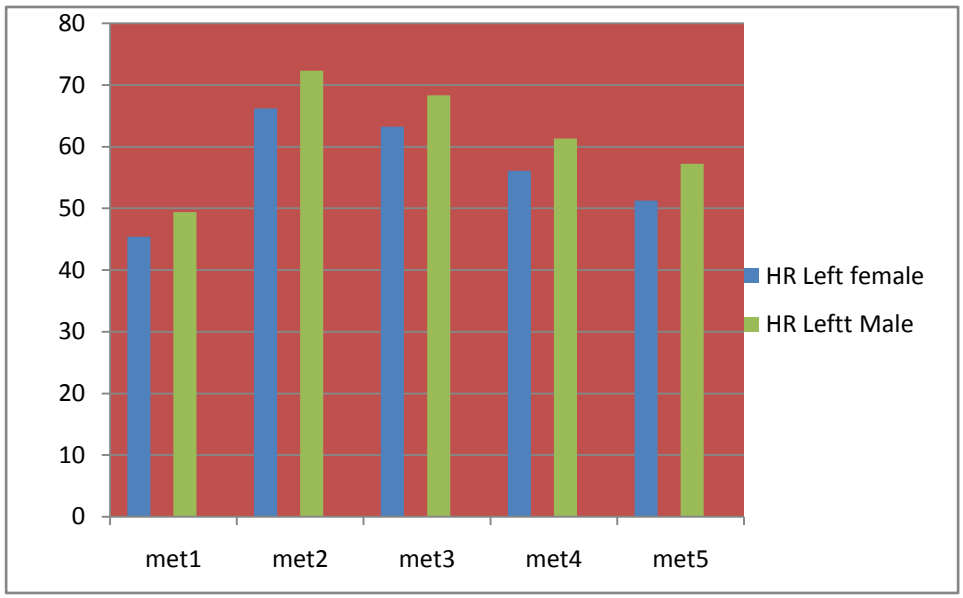

Fig5. showing left metacarpal lengths of male and females of Haryana.

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The given graphical depiction represents the comparison of metacarpal length of hand of left handed female and male of Haryana region. It can be observed that the metacarpal length of left handed male is higher than the left female of Haryana region.

Table 2 Body height and metacarpal ratios in Male Haryanvi population

HEIGHT : MTCL	RIGHT HAND	LEFT HAND
HEIGHT OR STATURE	1773.3mm	same
HEIGHT /1stMTCL	35.49	35.90
HEIGHT /2nd MTCL	24.49	24.49
HEIGHT /3rd MTCL	25.48	25.96
HEIGHT /4th MTCL	28.77	28.77
EIGHT /5th MTCL	30.99	30.87

Table 3 Body height and all metacarpal ratios in female Haryanvi population

HEIGHT : MTCL	RIGHT HAND	LEFT HAND
HEIGHT	1653.10mm	same
HEIGHT /1ST MTCL	35.72	35.75
HEIGHT /2nd MTCL	24.60	24.55
HEIGHT /3rd MTCL	25.56	25.77
HEIGHT /4th MTCL	28.98	28.96
HEIGHT /5th MTCL	31.54	31.80

Table 2 and 3 are showing relation between height and metacarpal lengths of male Haryanvi population which is producing the values for finding the height of a person from his/her metacarpal lengths. A specific number multiplied to a particular metacarpal length will approximately provide stature of a person to whom it belongs.

Discussion

So many authors have tried for determination of sex and statures of individuals or populations by studying shapes and sizes of different parameters of small portions of body, such as foot, hand, shoe, Head of femur, patella or by using long bones of upper and lower extremities of human beings.[9,10,11]

The frail cancellous layer of bone that lies above the long bone shafts causes the epiphyses to deteriorate and suffer injury. The tiny long bones, such as the metacarpals and phalanges, frequently remain intact. Consequently, a suitable choice for measuring accurately both anthropometrically and radio-osteologically. A foot or a hand, for example, are frequently brought in for postmortem investigations by anthropometry and forensic medicine. The relationships between various body components, particularly the limbs, are also used to determine the victims' sex and height. Finding out the significance of metacarpal bone lengths and their relationship to the height and gender of different populations becomes necessary as a result.

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Therefore, in this study, both populations exhibit longer metacarpals for males than for girls. Their large disparities could be utilised as an evidence of sexual dimorphism.

Conclusion

Outcome of study impressed upon the relation of all metacarpal lengths(BH/MTCL) of both the hands of male and female individuals with their height or stature in population of Haryana. More over it, it was came out of after analyzing the data of male & females (All MTCLs) there were differences in the lengths & which were highly significant. Hence, the sexual dimorphism is also established. Lastly, the x-Ray radiographs of metacarpals as well as hands had played a pivotal role as non invasive& efficient tool in finding sex as well as stature of both populations. There is forensic and anthropometric importance of these kinds of study, as it gives a data base for a population to solve medico-legal cases, where finding of the sex and statures among the carcass, skeletal remains at the place of disaster or incidentare big challenges for forensic experts, archeologists and anthropologists.

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