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Sexual Dimorphism from Hand Measurement: A Comparative approach

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Abstract:

Sexual dimorphism is considered as the foremost and significant criteria for establishing the identity of an individual such as in the cases of mass disaster for the identification of mutilated bodies, any medico legal practices. It can be realized that the measurement of hand with the help of anthropometric measurement was used as a tool for sex determination. Hence there are various research work which is being in process for assessing the sex, stature, race etc. of an individual with the help of the anthropometric measurement. The anthropometric measurement of hand, foot, ear etc. are useful in the determination of sex of an individual.

The present study is based on the hand dimensions which is helpful in discriminating the male and female so as to investigate and predict the sex of an individual. This research work is useful in the investigation of various criminal cases, or the case related with any disaster where the determination of sex is difficult.

Key Words: *Sexual Dimorphism, Anthropometric measurement, Hand dimensions, Medico-legal practice*

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Introduction

Sexual dimorphism is defined as the difference between the males and females on the basis of the appearance within the same species like change in the shape, color, size, structure etc. hence it is the systematic divergence in the form between individuals of different sex. According to Dey and Kapoor, 2015, sex determination is considered as one of the significant and best criteria for the establishment of the identity of an individual. It is also very important in revealing and very much required in various medico-legal practice.

The anthropometric measurement plays a very vital role in the identification of the sex of any individual. Anthropometry is known as the earliest and best known method for the measurement of various body parts for the purpose of identification which is also considered and called as the Bertillon system for the investigation and identification of an individual or any criminal identification. In the present time there are various cases related with dismembered body parts which are happened because of various mass disaster or any natural disaster caused by the man or in case of any murder where identification of the body is very difficult.

For the measurement of hand various anthropometric landmarks are considered for the analysis of hand length and hand breadth. The landmarks of hands used for the dimension of hand length and breadth.

- Stylion- is a defined as the lowest point on the styloid process of the radius if the arm hangs sidewise. For locating the exact point, one has to palpate the entire lateral margin of the radius with the thumb-tip.
- Dactylion-It is defined as the lowest point on the anterior curved top of the middle finger, provided arm hangs sidewise.
- Metacarpale radiale- it is the most medially placed point on the head of the fifth metacarpal bone (on the stretched palm).
- Metacarpale ulnare- it is defined as the most laterally placed point on the head of fifth metacarpal bone, on the stretched palm.

The present study has been concluded so as to co relate and found the determination of sex with the help of the hand measurement. The objective of the present study is to investigate and identify the sexual polymorphism with the help of the Hand length, Hand breadth and the Hand index. The basis motive is to study the variables which can more firmly predict the sex of an individual.

Material and Methodology -

The present research work was based on the sample size of 100 subjects. The 100 subjects include 50 males and 50 females. The entire subjects are free from any deformity, injury or any kind of fracture or surgical issue. The age group which is considered for the measurement of the hand were between the ranges of 18 to 40 because at this particular age group the development of hand became stable and the maximum growth of the hand was attained.

The material used for the measurement of hand length and breadth are:

- Sliding Caliper
- Sheet
- Pencil

The measurement of hand was done by measuring the hand length and hand breadth of an individual.

Hand length- measured as straight distance from interstylion to dactylion of the middle finger.

Hand breadth- measured as the straight distance between the metacarpal radialis to metacarpal ulnare.

Hand index- the hand is measure as the variation between the hand breadth and hand length.

The subject was requested to wash their hand and was made to sit in relaxed state. Now they were asked to straight their hand on a flat surface so as to take the measurement. The measurement of hand length and hand breadth was taken with the help of the measuring instrument sliding calliper. The measurement from both the hand i.e. right hand and left hand. Hence wuth the help of the hand length and hand breadth the hand index was calculated.

The value of hand index is important as it is also helpful in describing the shape of the hand. Also on the basis of the shape of the hand there is the variation is seen in the hand of the individual which is helpful in the sexual determination between the male and the female.

Figure 1: Measuring of Hand Length by Sliding Caliper

According to Martin and Saller (1957) classification system of hand, the hand is divided into five types on the basis of the measurement of the hand index.

The types of hand classified depends on the value of the hand index are:

- Hyperdolichocheir- the hand having very long fingers and narrow smaller palm
- Dolichocheir- the hand having long fingers and narrow small palm
- Mesocheir- the hand having long fingers but short small palm
- Brachycheir- the hand having short fingers and long large palm
- Hyperbrachycheir- the hand is having short fingers with the comparatively larger broader palm.

Table No.1 Hand classification on the basis of the Hand Index Value

S. No.	Hand Index	Hand Classification
1	equal and less than 40.9	Hyperdolichocheir
2	41.0 - 43.9	Dolichocheir
3	44.0 – 46.9	Mesocheir
4	47.0 – 49.9	Brachycheir
5	equal and greater 50	Hyperbrachycheir

Result-

The collected sample are utilized and helpful in giving the new information for the analysis of hand for the sexual determination between the male and female.

The analysis of hand length and hand breadth was done by the measurement and the following data was collected.

Hand length

The average range of hand length varied from 17.5cm to 21.5cm in males and 16.4cm to 18.3 in females. And it was observed that the hand length was comparatively larger in males as compare to females. (Table No. 2)

The statistical analysis was done on the basis of the maximum and minimum length the mean and standard deviation was calculated. (Table 2)

Table 2: Hand length (in cm) of both Males and Females

Variables	Minimum Length	Maximum Length	Mean	Standard Deviation
Males				
Hand Length	17.8	21.5	19.65	2.616
Females				
Hand Length	16.4	18.3	17.35	1.343

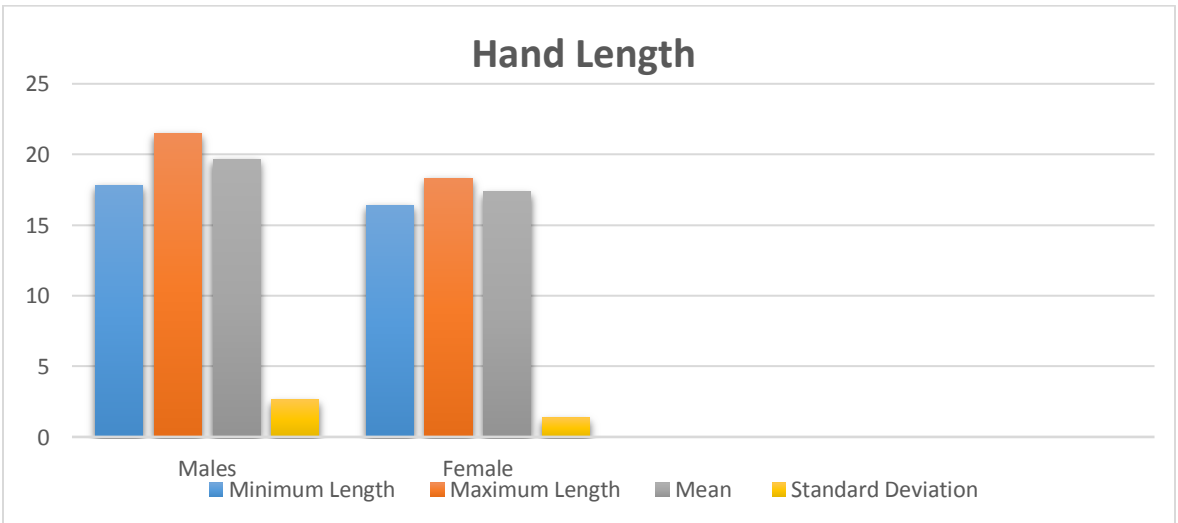

Figure No. 2 Graphical representation of Hand Length both Male and Female

Hand breadth-

Hence similar observation is done for the hand breadth analysis, the average variation of hand breadth is 7.4cm to 9.2 cm in males and 7.0cm to 8.6cm in females. It is observed that hand breadth is significantly larger in males as compare to females. (Table No.3)

Hence through the data the mean and standard deviation analysis was also calculated at which also reveals the same variation in males and females i.e. more in male and les in females. (Table 3)

Table 3: Hand Breadth (in cm) of both Males and Females

Variables	Minimum Breadth	Maximum Breadth	Mean	Standard Deviation
Males				
Hand Breadth	7.4	9.2	8.3	1.272
Females				
Hand Breadth	7.0	8.6	7.8	1.313

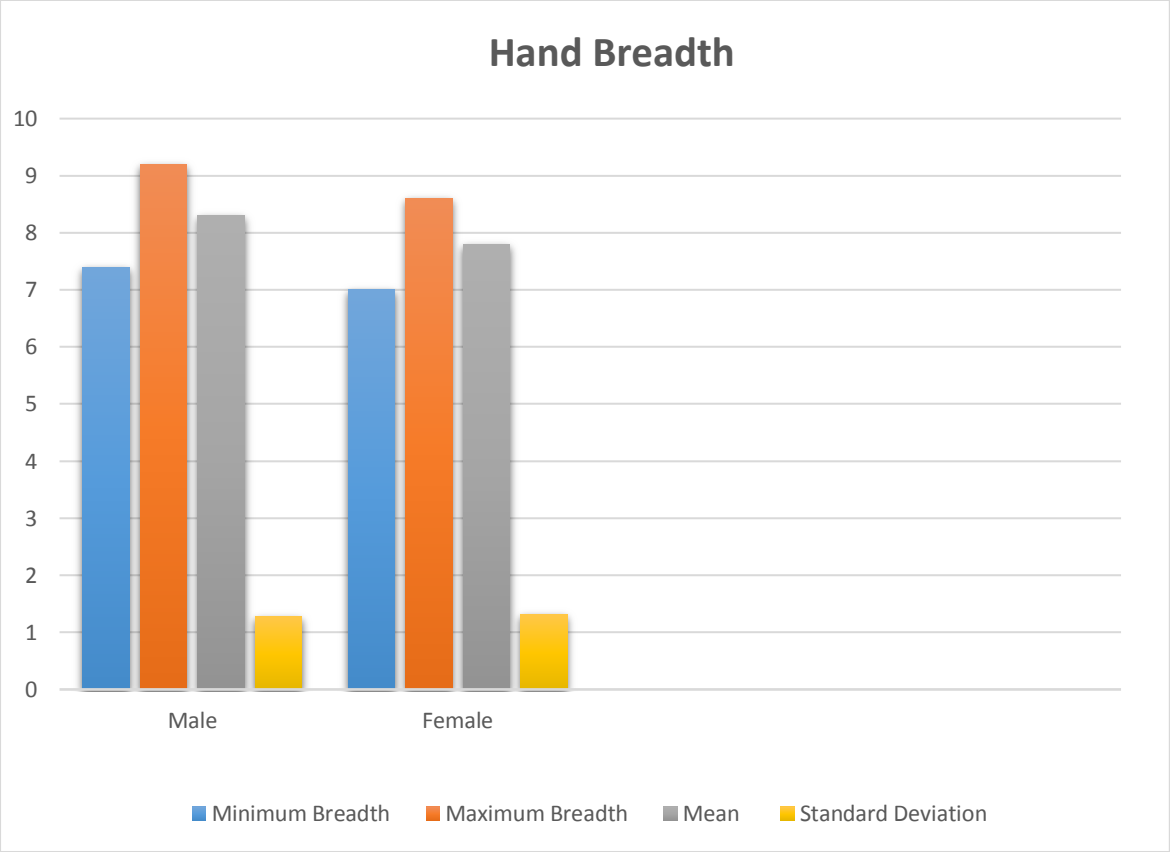

Figure 3 Graphical Representation of Hand Breadth of both Male and Female

Hand Index-

The descriptive analysis of hand index was also calculated for the classification of hand on the basis of the five categories mentioned above.

Hand index also gave variation between the male and female sample which are helpful in differentiating the male with the female. (Table 4)

Table 4: Hand Index of Male and Female

Sample	Male Hand Index	Female Hand Index
1	47.02	44.11
2	41.11	40
3	48.42	45.45
4	43.34	46.28
5	42	44.57
6	41.91	45.71
7	43.78	42.04
8	42.63	40.98
9	45.94	43.93
10	42.15	42.85
11	41.74	42.94
12	48.91	47.05
13	45.94	50
14	43.07	43.97
15	41.87	44.11
16	45.98	40.46
17	42.78	44.84
18	46.92	47.05
19	43.78	45.78
20	40.88	44.11
21	46.48	43.60
22	43.06	42.60
23	45.98	43.35
24	41.62	44.97
25	42.34	41.75
26	47.48	42.61
27	41.29	43.52
28	43.58	41.53
29	40.88	43.35
30	46.48	41.52
31	42.93	42.85
32	43.06	41.81
33	42.42	50
34	48.36	42.28
35	41.87	43.93
36	48.14	42.07
37	41.53	42.10
38	43.52	40.98
39	41.46	42.77

40	41.83	41.75
41	43.06	43.60
42	47.64	43.19
43	47.19	46.02
44	42.32	45.45
45	46.48	44.31
46	46.92	47.05
47	47.02	43.37
48	42.78	40.35
49	40.98	44.11
50	48.36	42.85

The analysis of hand index was helpful in differentiating the male and female samples and also it is later observed that the female are having the Dolichocheir type of hand more as compare to male.

Table 5 Hand Classification in Males and Females

Type of Hand	Male Hand Index	Female Hand Index
Hyperdolichocheir	4	3
Dolichocheir	26	28
Mesocheir	14	10
Brachycheir	4	9
Hyperbrachycheir	2	0

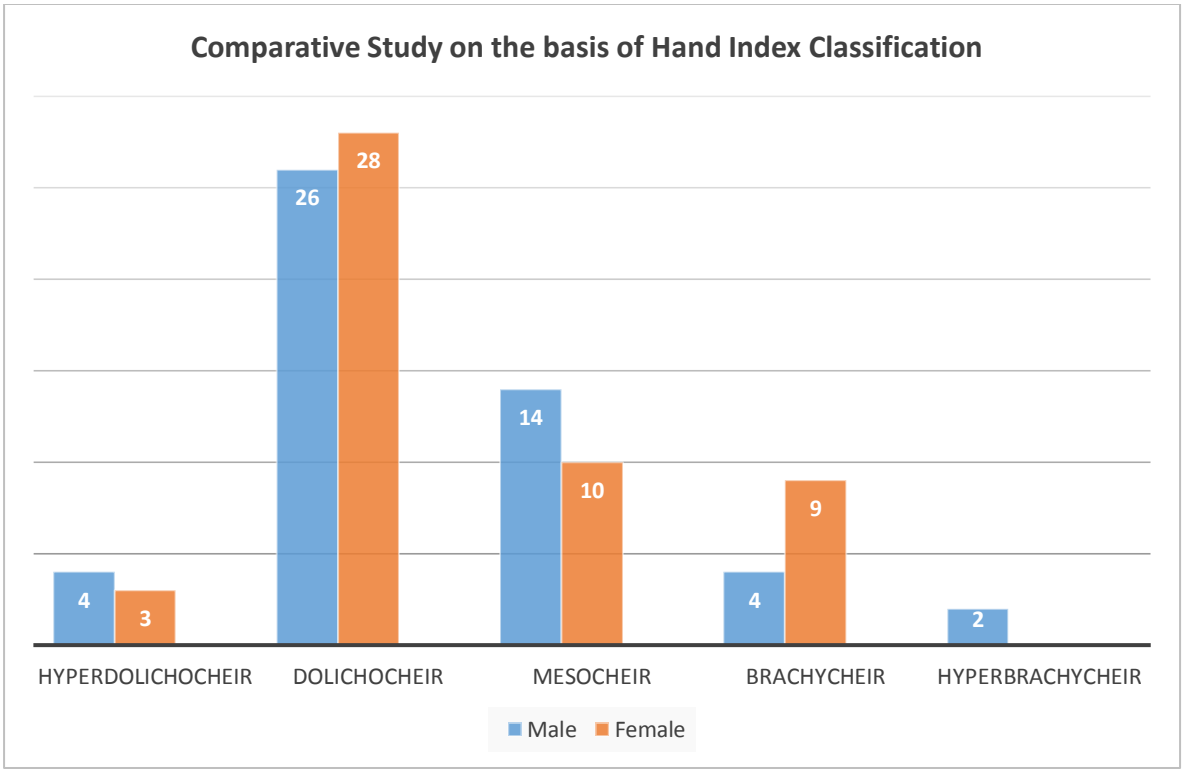

Figure 4 Graphical representation of hand index classification

Discussion

The sexual determination of an individual is such a challenging field for a forensic investigator as well as the anthropologist. Hence with the help of new methodology for the determination of sex is found a great application and is very much important in the future point of view as well. Hence the anthropometric measurement is helpful in the analysis of hand for the sexual dimorphism.

According to Dey and Kapoor in his research work use of the anthropometric measurement for the analysis of hand measurement was done. According to their study the measurement of hand length, hand breadth and hand index was used so as to differentiate the male and female sample and observed the sex determination from the hand dimensions focusing on the forensic identification. They use both the right hand and left hand dimensions for the analysis of hand and were observed that there was a bit of variation in the length of both right and left hand as well as the both left and right hand breadth whereas in the present study the sampling criteris use for the analysis was same as that of the measurement of hand length, breadth and hand index. Hence it is observed in the present study that there is no variation seen in the right and left hand dimensions, so the single hand measurement is identified in the paper which gave the same analysis. The male hand are found larger as compare to the female's ones.

Conclusion

From the present research work it is observed and concluded that the dimensions of hand can be successfully utilized and used for the determination of male and female and can be considered as the strong feature in sexual dimorphism. Among the various body parts, hand dimensions are considered as the most reliable and significant factor for the prediction of sex. Also the classification of hand type is helpful in analyzing that the females mostly belong to the dolichocheir group as compare to males. The present study is very much helpful in the detrmiantion of sex in the cases related with mass disaster, or in the cases where the body is difficult to identify. The databases is helpful in fulfilling the needs of forensic science and also as a very great evidential value in the future perspective of forensic science.

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