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Original Research Article

SEXUAL DIMORPHISM IN NORTH INDIAN INDIVIDUALS ACCORDING TO ALL HAND DIGIT LENGTH RATIOS

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ABSTRACT

Aim: To compare and detect possible differences between the digit length and digit length ratios in left - and right-hands of female and male individuals. One of the cerebral hemispheres is dominant over the other. Knowing a person's dominant hemisphere can be a useful guide in some personal activities.

Materials and Methods: Digit lengths (D) of the students were measured, followed by calculating the ratio of each digit to the others (1D:2D, 1D:3D, 1D:4D, 1D:5D, 2D:3D, 2D:4D, 2D:5D, 3D:4D, 3D:5D, and 4D:5D). after obtaing the X-ray of both the hands.

Results: It is concluded that male and females of north Indian population have difference digit lengths for their both the hands, hence dimorphism is established.

From table 2 & 3. All the digits can arranged according to their mean digit lengths in increasing order there to obtain formulae i.e D1(50.03) < D5(65.83) < D2(77.46) < D4(83.97) < D3(88.97) & D1(49.58) < D5(65.39) < D2(77.07) < D4(83.51) < D3(87.84) for right and left hands of north Indian females respectively. D1(55.64) < D5(72.54) < D2(84.34) < D4(91.72) < D3(96.01) & D1(55.07) < D5(72.81) < D2(84.21) < D4(92.10) < D3(95.86) for right and left hands of north Indian males respectively.

Conclusion: Digit length is known to enhance potential, particularly in sporting activities. It is especially necessary to measure digit length of the hand for practical reasons. In handball and basketball, the longer the digit length, the better the accuracy of the shot or throw. A longer fi ft h digit may help stabilize the second digit when throwing objects, and this would increase throwing accuracy. In turn, this would give more of an advantage in sporting activities.

KEY WORDS: Hand, sex, left -handed, right-handed, digit length ratios.

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INTRODUCTION

All human beings occupying this globe belong to the same species i.e. Homo sapiens. No two individuals are exactly alike in their measurable traits; even genetically identical twins (monozygotic) differ in some respects. These traits tend to undergo change in varying degrees from birth to death, in health and disease, and since skeletal development is influenced by a number of factors producing differences in skeletal proportions between different geographical areas [1],

The personal identification from extremities becomes more important in cases of mass disasters, where there is a likelihood of recovering feet (often enclosed in shoes) and hands separated from the body. With regard to personal identification of dismembered hand and foot, somatometry of hand and foot, and its osteologic and radiologic examination can help in the determination of primary indicators of identification, such as sex, age and stature [2].

Right and left-handers have co existed at least since the upper Paleolithic[2] and lefthanders are in minority in all the populations [3]. The universal expression of right-handedness in humans has led many to postulate a genetic basis for its expression. From the genetic point of view, it has been established that the members of the TGF- β gene family are expressed asymmetrically in the bulbus during the formation of the asymmetry [4]. The fact that the same gene plays a role in the development and modeling supports the idea that there is an intimate relationship- between hand preference, which is an indirect indicator of brain asymmetry, and hand dimensions [5]. Anthropometric studies have revealed that, in comparison of two halves of the body, the values belonging to the right half are different than those of left half. This is due to effect of directionality and degree of handed preference, a functional property of hand, on anthropometric measurement of hand in healthy individuals [6,7]. Environmental factors such as hand activity, hormones, and brain asymmetry may play a role in effect of hand preference on hand anthropometric measurements [8]. Information about the normal development of human-being and the various phases of hand finger dimensions from the fetal period is necessary for the evaluation of hand dimensions in various pathological conditions. The measurement of prenatal hand dimensions is based on the measurement of hand length and third digit length and width. These parameters and their relative proportional relationships form the basis for hand measurements not only during the intrauterine period, but in all periods of life [9].

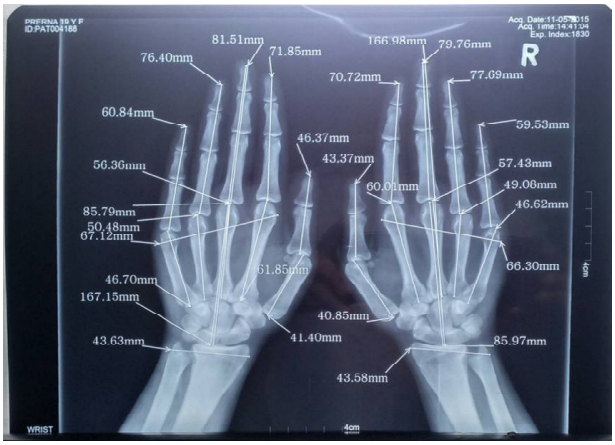
MATERIALS AND METHODS

After obtaining approval from the ethics committee of our university, this study was carried out with a total of 106 subjects from north india, aged between 18 and 45 years, at radiology deptt of Yamuna Instt of Dental Sciences (Ch Lekh Raj Multispeciality Hospital, Gadholi Yamuna Nagar Haryana). There were 54 females, and 52 males, (Table 1).

Fig 1: Showing the Computerized radiographic system (Care-stream Direct View Vita CR).

Fig. 2: Showing the X-ray machine, 500 Milli Ampere Allengers.

Fig. 3: Showing X-ray radiograph of both hands with anthropometric parameters hands.



Procedure For Obtaining X-ray: A Computerized radiographic system with (CPU) and X-ray machine, 500 milli ampare(as shown in fig. 2 and 3, will be used for all the anthropometric measurements except for the body height. X-ray radiograph of both the hands will be done by placing palm & the digits fully stretched touching on flat hard surface of radiographic plate and 2nd to 5th digits adducted and thumb slightly extended. The source of rays on the dorsum of hands at 100cm distance to obtain P/A view of hands.

Measurements from X- ray exported to a computer using Konika 2006 MERGE eMED program which will allow us to obtain anthropometric measurements of normal skeleton of hands.

Digit Lengths: the distance between midpoints of base of proximal phalanges to the apices of distal phalanges (as shown in fig 3).

Subsequently, the ratio of each digit length to the others (1D:2D, 1D:3D, 1D:4D, 1D:5D, 2D:3D, 2D:4D, 2D:5D, 3D:4D, 3D:5D, and 4D:5D) was calculated [7,8]. The measurements were performed by a single researcher, Statistical analysis: The data 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.

Table 1: Shows total number of subjects.

Female	Male	total
54	52	106

Table 2: Mean values of male digit lengths (mm).

	Number	Minimum	Maximum	Mean	Std. dev.
1D left	52	46.32	62.23	55.07	3.60
2D left	52	74.53	94.43	84.21	4.6
3D left	52	83.65	107.32	95.86	5.07
4D left	52	81.59	103.43	92.10	5.16
5D left	52	64.02	82.23	72.81	4.14
1D right	52	48.2	74.74	55.64	5.04
2D right	52	73.88	94.10	84.34	4.09
3D right	52	86.26	107.12	96.01	5.02
4D right	52	82.61	102.1	91.72	4.99
5D right	52	53.67	82.21	72.54	4.22

Above table shows that males have large 1st ,2nd and 5th digit value which more on opposite 4rth digit in north Indian male population

Table 3: Mean values of Female digit lengths (mm).

DIGITS	Number	Minimum	Maximum	Mean	Std.dev.
1D left	54	40.65	57.62	49.58	3.62
2D left	54	68.07	87.73	77.07	5.15
3D left	54	77.51	101.49	87.84	5.76
4D left	54	72.27	94.69	83.51	5.40
5D left	54	56.51	74.54	65.39	4.20
1D right	54	42.21	76.99	50.03	5.10
2D right	54	67.84	87.11	77.46	5.04
3D right	54	77.60	102.54	88.17	5.47
4D right	54	72.59	94.73	83.93	5.16
5D right	54	57.48	64.59	65.83	4.10

In the table it was found that north Indian female population having larger digit length values for right hand.

Table 4: Differences between male and female digit lengths on north Indian individuals.

DIGITS	Male Mean (95%CI)	Female mean (95%CI)	Differences	P value
1D left	55.07(54.07-56.07)	49.58(48.57-50.59)	5.49	p≤001
2D left	84.21(82.86-85.55)	77.07(75.63-78.50)	7.14	p≤001
3D left	95.86(94.36-97.34)	87.84(86.23-89.43)	8.02	p≤001
4D left	92.10(90.69-93.46)	83.51(82.00-85.01)	8.49	p≤001
5D left	72.81(71.67-73.96	65.39(64.18-66.59)	7.42	p≤001
1D right	55.64 (54.38-56.89)	50.03(48.61-51.45)	5.61	p≤001
2D right	84.34(82.89-85.78)	77.46(76.05-78.86)	6.88	p≤001
3D right	96.01(94.55-97.47)	88.17(86.64-89.69)	7.84	p≤001
4D right	91.72(90.30-93.13)	83.93(82.53-85.40)	7.79	p≤001
5D right	72.54(71.21-73.86)	64.59(64.68-66.97)	7.95	p≤001

Above table describe the comparison of male and female digit lengths of north Indian population where both the hand for male population showing larger values which is highly significant (pd≤001). This is the evidence of sexual dimorphism.

Table 5: Shows digit ratios of both side of male and females of north Indian population.

DIGITS Ratios	Male left(95%CI)	male right(95%CI)	Female left hand(95%CI)	Female rt hand (95%CI)
1D:2D	0.65(.64-.66)	0.66(.64-.67)	0.64(.64-.65)	0.64(.63-.64)
1D:3D	0.57(.56-.58)	0.58(.56-.59)	0.56(.56-57)	0.57(.56-.58)
1D:4D	0.60(.59-.60)	0.61(.59-.61)	0.59(.59-.60)	0.60(.58-61)
1D:5D	0.76(.74-.76)	0.77(.75-.78)	0.76(.75-.77)	0.77(.74-.77)
2D:3D	0.88(.87-.88)	0.88(.87-.88)	0.88(.87-.88)	0.88(.87-.88)
2D:4D	0.91(.91-.92)	0.92(.91-.93)	0.92(.91-.93)	0.92(..92-.93)
2D:5D	1.16(1.15-1.17)	1.16(1.14-1.19)	1.18(1.16-1.8)	0.19(1.17-1.19)
3D:4D	1.03(1.03-1.04)	1.04(1.04-1.05)	1.05(1.05-1.06)	1.05(1.04-1.06)
3D:5D	1.31(1.31-1.33)	1.32(1.30-1.35)	1.34(1.33-1.36)	1.36(1.33-1.35)
4D:5D	1.26(1.25-1.27)	1.26(1.25-1.28)	1.28(1.26-1.29)	1.30(1.27-1.29)

Digit ratios of all the digits of left and right hand for male and females given in table 5 with 95% confidence level shows that 1D:2D is large for left hand than right in case of males which is equal on both sides for their female counterpart,values of left side 1D:3D is more on left for males reverse for females.,1D:4D value are more for right in both the sexes where as 1D:5D are reverse.2D:3D shows equal values for both sexes of population.2D:4D shows left side more than right in males whereas it is same on both sides of females. 2D:5D is equal on both the hands of male and large on right side in case of females. 3d:4d is large on right for males where is same for females. 3D:5D large on right whereas females showing same trend on both side. Finally right and left sides for males shows same 4D:5D values which are greater on right hands of females.

CONCLUSION

Findings as tabulated in Table 4. It is concluded that male and females of north Indian population have difference digit lengths for their both the hands, hence dimorphism is established.

Findings as tabulated in Table 2 & 3. All the digits can arranged according to their mean digit lengths in increasing order there to obtain formulae i.e D1(50.03) < D5(65.83) < D2(77.46) < D4(83.97) < D3(88.97) & D1(49.58) < D5(65.39) < D2(77.07) < D4(83.51) < D3(87.84) for right and left hands of north Indian females respectively. D1(55.64) < D5(72.54) < D2(84.34) < D4(91.72) < D3(96.01) & D1(55.07) < D5(72.81) < D2(84.21) < D4(92.10) < D3(95.86) for right and left hands of north Indian males respectively.

The functional significance of digital and metacarpal formulas is not to seek the best hand type for certain tasks, but rather to determine which hands are relatively disadvantaged in performing those tasks.

Digit length is known to enhance potential, particularly in sporting activities. It is especially necessary to measure digit length of the hand for practical reasons. In handball and basketball, the longer the digit length, the better the accuracy of the shot or throw [10].

A longer fifth digit may help stabilize the second digit when throwing objects, and thiswould increase throwing accuracy. In turn, this would give more of an advantage in sporting activities [11].

Conflicts of Interests: None

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