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Original Research Article

ANTHROPOMETRICAL STUDY OF THE SECOND AND FOURTH DIGIT RATIO AND OTHER DIGIT RATIO IN COASTAL REGION OF ANDHRA PRADESH IN INDIA

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ABSTRACT

Background: It has been hypothesised that the ratio between the length of the 2nd and 4th digits (2D:4D) is a correlate of prenatal sex steroids, and this relationship is strongest for the right hand. Furthermore, it has been suggested that 2D:4D is sexually dimorphic, the dimorphism is determined early, and 2D:4D among children is stable with growth.The present study aim to study 2D:4D and other digit ratio to show sexual dimorphism in coastal region of Andhra Pradesh, India.

Materials and Methods: Our study includes 200 (96 males and 104 females) subject between ages of 18 to 25 years were recruited randomly excluding those with hand deformities from Coastal regions of Andhra Pradesh. Their digit lengths were measured from the basal crease to the tips usinga Vernier calipermeasuring to 0.01cm minor reading. The 2D:4D and other digit ratiowere then calculated for each subject on both hands. Descriptive statistics and ANOVA were used to analyze the data.

Results: The study showed no significant sexual dimorphism in 2D:4D between males and females whereassignificant sexual dimorphism in other finger ratios.

Conclusion: These observations indicate that, not only 2D:4D, but the other digit ratios have their role in sex identity. In conclusion, our study has provided the first data from coastal region of AndhraPradeshdemonstrating the sexual dimorphism in the3D:4D and3D:5Ddigit ratio. This information is useful in forensic science and anthropology.

KEY WORDS: Digit ratio, 2D:4D, Sexual dimorphism, Coastal regions of Andhra Pradesh.

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INTRODUCTION

Digit ratio-is the ratio of the lengths of different digits. The ratio of index finger length to ring finger length is called the "2D:4D digit ratio," or more simply, the "digit ratio." Specifically, it is the ratio of the length of the index finger (digit 2, or "2D") and the ring finger (digit 4, or "4D") i.e. 2D:4D ratio that is sexually dimorphic. Generally, males have a ring finger that is longer than their index finger i.e. the index finger is generally about 96 percent of the length of the ring finger, which gives an average digit ratio 0.96 (<1) they have what is termed a "low digit ratio."Females typically have index and ring

fingers of about the same length which gives digit ratio of 1.00 or slightly longer than the fourth which gives digit ratio greater than 1.00 they have what is termed a "high digit ratio" [1-4]. As per the observations of various studies, the sexual dimorphism in 2D:4D is influenced by prenatal secretion of testosterone and estrogen. The higher level of testosterone during the critical development stage, the latter part of the first trimester facilitates the growth of the ring finger, while higher levels of estrogen facilitate the growth of the index finger and thus testosterone negatively correlates with 2D:4D while estrogen correlates positively with 2D:4D. Thus 2D:4D ratio provides an indication of the relative exposure to prenatal testosterone and estrogen. Low 2D:4D ratios provide indication of greater exposure to prenatal testosterone and might therefore be considered a measure of masculinity. Similarly, high 2D:4D ratios result from greater exposure to estrogen and therefore might be thought of as a measure of femininity [2-5].

An early origin of the sexual dimorphism in 2D:4D is indicated by reports that, Adult ratios of finger lengths are established *in utero* by about week 14 and Children as young as 2 years show the sex difference and there seems little change in 2D:4D at puberty [6].

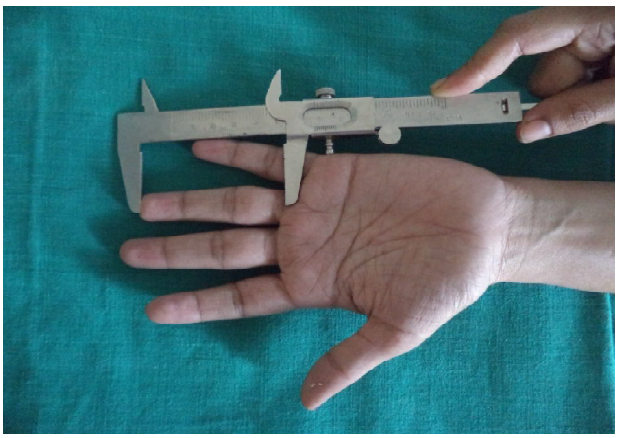
Variation in finger length ratio is thought to reflect the influence of prenatal testosterone during development. While this correlation is somewhat conjectural, non-exclusive causes have been posited. The vertebrate Hox gene family is essential for development for limb and genital development. This observation has led to the suggestion that patterns of digit formation may relate to gonads. In humans, a mutation within *Hoxa* is known to result in thecondition hand-foot-genital syndrome, which is characterized by anatomical defects in digits and genitalia [7].

Other finger ratios: Links between the developmental control of the urinogenital system, and patterns of finger growth may influence digits other than 2D and 4D. In addition to 2D:4D, there are five possible finger ratios: 2D:3D, 2D:5D, 3D:4D, 3D:5D, and 4D: 5D. (We have excluded the 1st digit or thumb because reliable measurement landmarks aredifficult to establish). In humans, sexual dimorphism hasbeen reported for 2D:5D and 3D:4D and for 2D:3D and 2D:5D[8]. The present study aim to study 2D:4D and other digit ratio to show sexual dimorphism which is useful in forensic science and anthropology.

MATERIALS AND METHODS

A cross sectional study was conducted by the department of anatomy, Narayana medical college, Nellore. This study includes 200 subjects (96 males, 104 females) from Coastal regions of Andhra Pradesh with age group of 18 to 25 years and Subjects with any abnormality in the digits were excluded from the study. The institutional ethical clearance was obtained before commencement of the study. Digit lengths was measured on the ventral surface of the hand from the most proximal crease of the digit to the tip of the second, third, fourth, fifth digits in both right and left hand using Vernier caliper. Measurement is taken from proximal crease of the digit because this is the most proximal between finger and palm. It appear around ninth week of gestation and is one of the primary or regular crease of the hand. It is deep and permanent crease developing independently of finger movements between digits and volar pads [9]. Descriptive statistics and ANOVAwere used to analyze the data collected.

Fig. 1: Shows the measurement of digit length using vernier caliper.



RESULTS

The results were presented in Table 1 and 2; Table 1 shows there was a significant difference in digit length between male and female study subjects at p<.0001. Table 2 shows significant difference in digit ratio between males and

females are right 3D:4D, left 3D:4D and left 3D:5D at p<.05 where as other digit ratios are not statically significant.

Table 1: Comparison of Means between Males and Females for Digit Length.

Variables		Males (n=96) Mean ± S.D	Females (n=104) Mean ± S.D	t	P
DIGIT LENGTH RIGHT SIDE	2D	7.47± .49	6.88± .54	16.09	<.000
	3D	8.20 ±.51	7.61± .55	15.52	<.000
	4D	7.62± .49	6.96 ±.519	18.33	<.000
	5D	6.16 ± .47	5.86± .57	15.98	<.000
DIGIT LENGTH LEFT SIDE	2D	7.44 ±.52	6.83± .51	16.21	<.000
	3D	8.22± .529	7.64± .555	15.09	<.000
	4D	7.66 ±.461	7.00± .55	18.49	<.000
	5D	6.21± .426	5.62± .49	17.91	<.000

Table 2: Comparison of Digit Ratio between Males and Females of Age Group 18 - 25 Years.

S. No	Digit ratio	Digit side	Males (n=96) Mean ± S.D	Females (n=104) Mean ± S.D	t	P
1	2D:3D	Right	.911 ± .032	.903 ± .032	1.633	0.104
		Left	.905 ± .032	.899 ± .048	1.009	0.314
2	2D:4D	Right	.981 ± .042	.989 ± .044	-1.373	0.171
		Left	.973 ± .044	1.038 ± .554	-1.138	0.256
3	2D:5D	Right	1.216 ± .073	1.225 ± .110	-721	0.472
		Left	1.198 ±.067	1.214 ±.078	-1.48	0.141
4	3D:4D	Right	1.077 ±.043	1.091 ±.041	-2.27	**0.024**
		Left	1.072 ±.038	1.089 ±.051	-2.722	**0.007**
5	3D:5D	Right	1.335 ±.083	1.350 ±.125	-978	0.329
		Left	1.324 ±.069	1.363 ±.079	-3.7	**0**
6	4D:5D	Right	1.240 ±.072	1.237 ±.104	0.204	0.838
		Left	1.235 ±.057	1.243 ±.078	0.838	0.403

DISCUSSION

In the present study, the digit lengths (2D, 3D, 4D, 5D) in males are higher than female and are significant. It was observed from this study that, in male's second digit length was shorter than fourth digit length hand significantly different as compared with thefemales. This agrees with the reports of Gwunireama IUet al [3], George [10], who reported that seconddigits in males tend to be shorter than fourth digits. These digits lengths are influenced by testosterone and estrogen in utero. In femalessecond andfourth digit lengths are approximately the same which is similar to observations of Gwunireama IUet al [3].

DIGIT RATIOS

2D:4D ratio: The present study shows no significant sexual dimorphism in 2D:4D ratio i.e. though the mean 2D:4D ratio in males is less than female it is not statistically significant.

This finding correlates with the study of DongenSV [11]. These findings were not consistent with prior expectations underthe assumption that 2D:4D ratios reflect foetal hormone exposure as well as serve as a proxy for hormone levels later in life and/or their effects ondevelopment, behavior and life and life history.

Literature in the digit ratio concerned primarily on the 2D:4D ratio, its association with the prenatal testosterone levels, which determines the digit length as well as on sexual dimorphism

Other digit ratio: Few studies opined that the sexual dimorphism is associated with other digit ratios. In the present study, the significant associations of sexual dimorphism with other digit ratio were also observed.In humans, sexual dimorphism has been reported for 2D:5D and 3D:4D McFadden and Shubel [9], for 2D:3D and 2D:5D Manning et al [13] and 2D:3D,2D:5D, and 3D:5D Robert Trivers [8]. In mice, there is evidence that 2D:3D is dimorphic. This may mean that a number of thefinger ratios could be correlates of sex-dependent traits suchas developmental disorders and susceptibility to disease (e.g. 2D:3D, 2D:4D, and 2D:5D for myocardial infarction. The stability of these ratios is therefore of interest [8]. The present study show the sexual dimorphism was significant for right and left 3D:4D, left 3D:5D digit ratio.

CONCLUSION

The observations of the study were not only limited to 2D:4D ratio, but also to the other digit ratio.These observations indicate that, not only 2D:4D, but the other digit ratios have their role in sex identity. In conclusion, our study has provided the first data from coastal region of AndhraPradeshdemonstrating the sexual dimorphism in the3D:4D and3D:5Ddigit ratio. This information is useful in forensic science and anthropology.

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Conflicts of Interests: None

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