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Study of Second and Fourth Digit Lengths and Their Ratios With Physical Attributes in Nepali Population

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ABSTRACT

Introduction: The ratio of the lengths of the index and the ring finger (2D:4D ratio) is generally different between men and women. A number of studies have shown a correlation between the 2D:4D digit ratio and various physical and behavioral traits. The aim of the present study is to investigate the association of the index (2nd) and ring (4th) digit ratios with some physical traits in Nepali population. **Material & Method**: 200 students (100 males and 100 females) between ages of 18 years and above were randomly selected with exclusion of those with hand deformities. The digit lengths were measured from the basal crease to the tips using vernier calipers. The 2D:4D ratios were determined for each subject while height and weight were used to calculate the body mass index and data analyzed. The study was conducted between January 2018 to November 2018. **Result:** The result of the anthropometric study of the differences in index (2D) and ring (4D) and their ratios shows that there was a significant difference between the length of index finger (2D), ring finger (4D) and the ratios of right hand's 2D:4D in both males and females. There was a positive correlation between the second digit length and Height and weight in males and females both on right and left sides. The 2D:4D ratio for both left and right hand did not show any positive correlation with height, weight or BMI of an individual.

Key words: *2D:4D, BMI*

INTRODUCTION

The digit ratio is the ratio of the lengths of different digits typically measured from the midpoint of bottom crease (where the digit joins the hand) to the tip of the digit.[1] The ratio of second to fourth digit lengths has been highlighted as a potentially useful phenotypic marker of steroid exposure in utero in vertebrates.[2] In humans, the evidence for this hypothesis comes from studies showing that 2D:4D is sexually dimorphic with lower ratios among males than females from the end of the first trimester of fetal development and remain relatively stable across the life span.[3,4,5,6,7,8] It exhibits a sexually dimorphic pattern. It is usually measured from the midpoint of the most proximal crease (at the junction of the finger with hand) to the tip of the finger.

Various methods have been used to determine 2D:4D ratio, including X-rays photocopies and scanned images.[9,10,11] The aim of the present study is to investigate the association of the index (2nd) and ring (4th) digit ratios with some physical traits in Nepali population.

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METHOD

The population of study consisted of 100 males and 100 female students of Nepalgunj Medical College, Chisapani. The study was conducted between January 2018 to November 2018. Convenient random sampling method was used to obtain measurements of index and ring finger with the exclusion criteria that the participants do not have any physical anomalies of fingers or had any history of fracture or dislocation of index, middle and ring fingers .The middle finger was used as the standard reference. At the proximal base of index and ring fingers there were creases. In most of the participants, index finger had only one crease and ring finger a band of creases. The most proximal crease was chosen as a point. With the help Vernier Calipers the length of second and fourth digits were measured. All measurements were made carefully with the digits fully extended.

The data collected were used to obtain 2D:4D ratios by dividing 2D by 4D lengths. Data was expressed as mean ± standard deviation. Student t test was used to determine the level of significance. The relationship between the parameters studied was established using Pearson Correlation to establish the strength of relationship between the lengths of second and fourth digits (2D and 4D), the digit ratios and other anthropometric variables in both sexes.

RESULTS

The result of the anthropometric study of the differences in index (2D) and ring (4D) and their ratios shows that there was a significant difference between the length of index finger (2D), ring finger (4D) and the ratios of right hand's 2D:4D in both males and females. The mean values in males were

7.17,7.25,0.98 while in females were 6.70,6.67,1.01 for the 2D,4D lengths and ratios of right hand respectively. The mean values in males were 7.15, 7.16, and 0.99 and in females were 6.62, 6.63 and 1.00 for the 2D, 4D lengths and their ratios for left hand respectively. The mean values of lengths of index finger (2D), ring finger (4D) and R2D:R4D between males and females were statistically significant ($p<0.05$) as shown in Table I. L2D:L4D ratio was not significantly different between males and females.

Results shows that mean height of males exceeded the mean height of females and the mean weight of males exceeded the mean weight of females .Mean BMI of males also exceeded that of females (Table II).

Correlation matrix for the second and fourth digit lengths and the anthropometric variables were done to analyze any association between the digit lengths and the physical attributes. There was a positive correlation between the second digit length and Height and weight in males and females both on right and left sides (Table III).

Weight and second digit length also showed correlation in case of females. There was also a strong correlation between the second digit length and height in both in males and females bilaterally (Table III). Similarly both height and weight showed correlation with fourth digit length in males and females bilaterally (Table IV).

Table V. shows the correlation matrix of R2D:4D with the anthropometric parameters. There was no positive correlation between the R2D:4D and height, weight and BMI. Table VI shows no positive correlation between L2D:4D and height, weight and BMI.

Parameters	Males	Females	t-value	Sig. level
	Mean ± SD	Mean ± SD		
R2D	7.17 ± 0.42	6.70 ± 0.41	7.90	p<0.001
R4D	7.25 ± 0.40	6.67 ± 0.41	10.03	p<0.001
L2D	7.15 ± 0.35	6.62 ± 0.37	10.30	p<0.001
L4D	7.16 ± 0.39	6.63 ± 0.38	9.83	p<0.001
R2D:4D	0.98 ± 0.36	1.01 ± 0.04	2.85	p<0.05
L2D:4D	0.99 ± 0.42	1.00 ± 0.04	0.11	p>0.05

Table I: Mean ±standard deviation of 2D, 4D lengths and the ratios of 2D:4D in males and females

Parameters	Sex	Mean ± SD	Minimum	Maximum	N
Height	Male	170.84 ± 5.93	156.80	187	100
	Female	158.51 ± 7.43	139	172	100
Weight	Male	63.96 ± 11.70	41	100	100
	Female	56.50 ± 8.52	39	72	100
BMI	Male	21.83 ± 3.26	16.31	31.97	100
	Female	22.44 ± 2.66	16.56	30.30	100

Table II: General statistics of the anthropometric parameters used

Parameters	Male				Female			
	R2D	P Value	L2D	P value	R2D	P Value	L2D	P value
Height	0.543**	0	0.433**	0	0.639**	0	0.497**	0
Weight	0.380	0	0.308**	0.002	0.370**	0	0.254*	0.011
BMI	0.211*	0.035	0.176	0.080	-0.036	0.721	-0.060	0.552

** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level

Table III: Correlation matrix of second digit length with anthropometric variables

Parameters	Male				Female			
	R4D	P Value	L4D	P value	R4D	P Value	L4D	P value
Height	0.535**	0	0.483**	0	0.514**	0	0.494**	0
Weight	0.356**	0	0.311**	0.002	0.287**	0	0.215*	0.032
BMI	0.189	0.059	0.159	0.115	-0.042	0.676	-0.106	0.295

** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level

Table IV: Correlation matrix of fourth digit length with anthropometric variables

Parameters	Male (R2D:4D)		Female (R2D:4D)	
	Pearson correlation coefficient r value	P value	Pearson correlation coefficient r value	P value
Height	0.069	0.498	0.170	0.090
Weight	0.081	0.422	0.104	0.302
BMI	0.063	0.534	-0.002	0.982

Table V: Correlation matrix of R2D:4D with the anthropometric parameters used

Parameters	Male (L2D:4D)		Female (L2D:4D)	
	Pearson correlation coefficient r value	P value	Pearson correlation coefficient r value	P value
Height	-0.126	0.211	-0.011	0.915
Weight	-0.056	0.582	0.056	0.578
BMI	-0.013	0.898	0.076	0.452

Table V: Correlation matrix of R2D:4D with the anthropometric parameters used

DISCUSSION

Past studies have shown that the digit ratio values are consistently reliable in determination of sexual dimorphism. According to Brown et al, considerable proportions of normal males have low digit ratios compared to females[12]. It was also shown that men had relatively short second digits than fourth digits[13]. In our present study, females had greater 2D:4D for right hand and almost equal digit ratio for the left hand. This study has shown significant differences between male and female regarding the length of second and fourth digits in both hands. It has also shown the significant difference in case of 2D:4D ratio for right hand. The present study was also done to establish the relationship between the male and female finger length ratios (2D:4D) and to ascertain if it has any correlation with height, weight and BMI. The results showed that there was no correlation between digit ratios and anthropometric variables in both sexes. Manning et al reported that there was no significant correlation between height and weight and digit ratios for 69 men and 62 women with the exception of positive correlation between the weight and 2D:4D ratios for the right hands[14]. Present study showed a negative correlation between L2D:4D and height (-0.126, -0.011). On the other hand, Hurt and VanAnders reported a large negative correlation of -.49 between height and digit ratios after controlling the gender[15]. Jacob et al showed males to have higher 2D:4D ratio and a negative correlation between R2D:4D and height(-.27)[16].

CONCLUSION

The 2D:4D length ratio in females is greater than in males. Results obtained from the total sample of 200 participants have shown females to have higher or equal 2D:4D ratios in both right and left hands respectively. The 2D and 4D lengths between right and left hand also showed variations with p value less than 0.001. Present study showed that there was a positive correlation between second and fourth digit length and height in males and females bilaterally. There was also a significant correlation between weight and second and fourth digit lengths in both sexes. Results showed no positive correlation between the 2D:4D ratios and height, weight and BMI of the study population.

Results from the present study indicate that 2D and 4D lengths is a proxy indicator of height when it is difficult to measure height directly. Since the study is limited to certain smaller age group population, further studies are recommended to be carried out with larger population for greater utility value of 2D:4D as a indicator for physical attributes.

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