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Research Article

Study of Aggressive Behavior of an Individual from Ratio of Index and Ring Fingers' Length

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Abstract

Background: Aggression is behavior directed toward another individual and carried out with the intent to cause harm. Males tend to be more aggressive than females. Index finger is the first finger and the second digit and ring finger is the fourth digit of the human hand. Digit ratio commonly known as 2D:4D is the ratio of the index finger (2D) to ring finger (4D). Males have shorter index finger than the ring finger but females have equal length of index and ring fingers. Therefore, 2D:4D is higher in female than in male.

Aims: To know the aggressive behavior from the length of index and ring fingers.

Materials and Methods: Subjects were recruited from Kathmandu University School of Medical Sciences, Chaukot, Nepal. Two hundred students (77 boys and 123 girls) of age 19 – 25 years with no congenital anomalies of finger were randomly selected as participants. Length was measured on ventral surface of hand from the midpoint of most proximal crease of each digit to fingertip.

Results: Physical aggression is more in male but verbal aggression, anger and hostility are more in female. Average finger length of index and ring fingers of both the hand of male are more than that of female. Digit ratio of male and female is 0.96 and 0.97 respectively.

Conclusions: Males are more aggressive than females. Males have shorter index finger than ring finger but females have equal length of index and ring fingers. Ratio of index finger and ring finger (2D:4D) is higher in female.

Keywords: Aggression, Congenital anomalies, Dimorphic trait, 2D:4D

1. Introduction

Human aggression is defined as any behavior directed toward another individual that is carried out with the proximate (immediate) intent to cause harm. In addition, the perpetrator must believe that the behavior will harm the target, and that the target is motivated to avoid the behavior[1-4]. Aggressive behavior in society is a serious social problem. Between 1998 and 1999, the number of violent offences in England and Wales rose by 6.3%, the majority of which was violence against the person (83%)[5].

The ring finger is the fourth digit of the human hand and the second most ulnar finger located between the middle finger and the little finger while the index finger is the first finger and the second digit of a human[6,7]. The index finger is located between the thumb and the middle finger and usually the most dexterous and sensitive finger of the hand[6,8]. Digit ratio commonly known as 2D:4D is the ratio of the index finger (2D) to ring finger (4D)[9]. Finger length ratio (2D:4D) is a sexually dimorphic trait. The ratio of second digit (index finger) to fourth digit (ring finger) is smaller for males than females in humans, mice and baboons[10-15]. Males develop a lower 2D:4D than the females by the end of the first trimester of gestation or by the 14th week of gestation[16-19].Thus the sexually dimorphic pattern is established around 14 weeks prenatally and is fixed from the second postnatal year or later[19-21].

After birth, 2D:4D ratios and sex differences in 2D:4D ratios are seen by the age of two and is thought to be stable, and they seem not to be affected by postnatal variations in hormone levels, including the large variations that occur at puberty[10,11,20]. The vertebrate *Hox* gene family is essential for limb and genital development[22,23]. The *Hox* gene family is organized into four clusters *Hoxa* to *Hoxd* and the posterior-most *Hoxd* and *Hoxa* genes are required for the growth and patterning of digits and the differentiation of the genital bud[24].

Males produce testosterone prenatally, particularly from around gestation week 8 to 24, and for approximately the first 6 months postnatally[25]. Female fetuses probably produce estrogens, although it is unclear how much of a contribution the fetal ovary makes to development[26]. However, it has only recently been suggested that sex differences in 2D:4D arise from in utero concentrations of sex steroids, with 2D:4D negatively related to prenatal testosterone and positively associated with prenatal oestrogen[20, 27]. Prenatal testosterone masculinises the brain, resulting, among other things, in higher spatial ability[28], higher musicality[29], proneness to immune system and heart diseases[30-32], depression and autism in men[33, 34] and it is related to sexual orientation[35-40].

All the studies mentioned above regarding digit ratio (2D:4D) have been conducted in other countries than Nepal. Therefore, the present study was intended to find associations between 2D:4D ration and aggression in the students of Kathmandu University School of Medical Sciences (KUSMS), Chaukot, Nepal.

2. Materials and Methods

2.1 Participants

Subjects for the present study were recruited from Kathmandu University School of Medical Sciences (KUSMS), Chaukot, Nepal. Two hundred students (77 boys and 123 girls) with no congenital anomalies of finger were randomly selected as participants from KUSMS, Chaukot, Nepal. Age ranged from 19 years to 25 years. The study was approved by the Institutional Review Committee of Kathmandu University School of Medical Sciences (IRC-KUSMS). On obtaining the written consent from participants after explaining the purpose of the present study, Buss and Perry Aggression Questionnaires[41] were distributed. The questionnaires were collected after completion by the participants.

2.2 Measurement of 2D:4D Ratio:

The dorsum of the both hand was kept on smooth surfaced table with fingers fully extended. Then length of index finger (2D) and ring finger (4D) of both hands was measured on ventral surface of hand from the midpoint of most proximal crease of each digit to fingertip [8, 9], using digital vernier calipers. The length was taken in millimeter (mm) and ratio was calculated by dividing index finger length by ring finger length. Mean of right and left hand ratio was taken as mean 2D:4D ratio for each participant.

2.3 Statistical Analysis

Data was analyzed using SPSS version 17.00 and Microsoft Office Excel 2010. The analysis was performed to derive mean, median, mode, standard deviation, minimum and maximum values. Two sample *t* -test was done for average digit ratio and different aggressions. *P* value of less than 0.01 was considered as significant.

3. Results

TABLE 1: Statistical Measurement of Questionnaire Scores

Sex		PhysicalAggression	VerbalAggression	Anger	Hostility	Total
M	N	77	77	77	77	77
	Mean	**26.70**	15.23	17.85	23.74	**83.52**
	Median	26.00	15.00	17.00	24.00	82.00
	Mode	28.00	13.00	15.00	19.00	75.00
	SD	7.54	3.81	5.48	6.27	23.10
	Minimum	14	8	7	10	39
	Maximum	65	24	31	37	157
F	N	123	123	123	123	123
	Mean	24.07	**15.33**	**19.73**	**24.10**	83.23
	Median	24.00	15.00	19.00	24.00	82.00
	Mode	21.00	13.00	19.00	21.00	74.00
	SD	4.96	4.28	5.40	5.50	20.54
	Minimum	13	6	8	11	38
	Maximum	37	29	32	39	137

The present study shows physical aggression more in male than in female while verbal aggression, anger and hostility are more in female than in male. But total aggression of male (83.52) is more than that of female (80.23) {Table 1}.

Figure 1: Bar diagram comparing male and female in average fingers length of both right and left hands

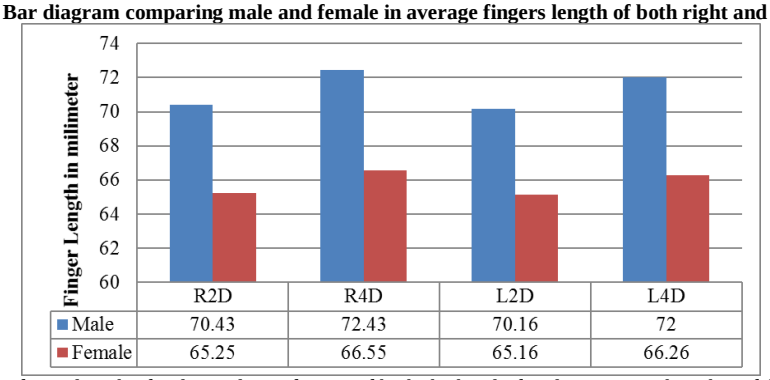
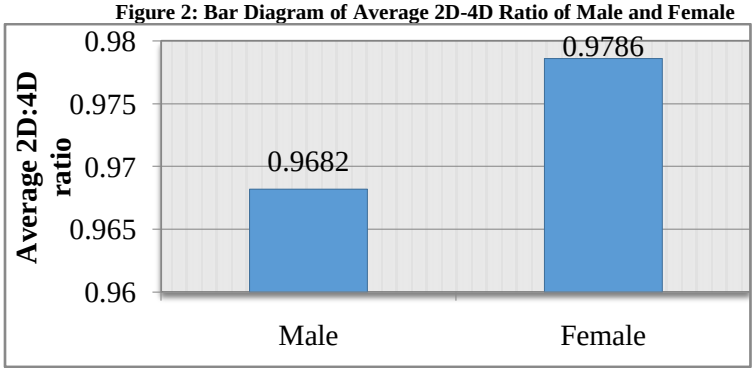


Figure1 shows average finger length of index and ring fingers of both the hand of male are more than that of female. But both male and female shows average finger length of index and ring fingers of right hand more than that of left hand.

Figure 2: Bar Diagram of Average 2D-4D Ratio of Male and Female



Average ratio of 2D:4D of male and female are 0.9682 and 0.9786 respectively (figure2).

Table 2: Statistical measurement of average 2D-4D Ratio of Male and Female

	N	Mean	Median	Mode	SD	Minimum	Maximum
Male	77	0.9682	0.9700	0.96	0.02848	0.89	1.04
Female	123	0.9786	0.9850	1.00	0.02756	0.88	1.05

Minimum average 2D-4D ratio of male (0.89) is more than that of female (0.88). But maximum average 2D-4D ratio of female (1.05) is more than that of male (1.04) {Table 2}.

Table 3: Correlations between Average 2D-4D Ratio of Male and Female

		Average Ratio Male	Average Ratio Female
Average Ratio Male	Pearson Correlation	1	0.205
	Sig. (2-tailed)		**0.073**
Average Ratio Female	Pearson Correlation	0.205	1
	Sig. (2-tailed)	**0.073**	

P value = 0.073

Pearson correlation between average 2D-4D ratio of male and female is 0.073 which is not statistically significant (table 3).

Table 4: Statistical Measurement of Correlation between Different Parameters in Male

Sex			Average 2D-4D ratio	Physical aggression	Verbal aggression	Anger	Hostility
M	Average 2D-4D Ratio	Correlation	1	-0.058	-0.029	-0.004	-0.006
		Sig.		0.617	0.803	0.971	0.959
	Physical aggression	Correlation	-0.058	1	0.393**	0.463**	0.544**
		Sig.	0.617		0.000	0.000	0.000
	Verbal aggression	Correlation	-0.029	0.393**	1	0.203	0.298**
		Sig.	0.803	0.000		0.76	0.009
	Anger	Correlation	-0.004	0.463**	0.203	1	0.438**
		Sig.	0.971	0.000	0.076		0.000
	Hostility	Correlation	-0.006	0.544**	0.298**	0.438**	1
		Sig	0.959	0.000	0.009	0.000	
**. Correlation is significant at the 0.01 level (2- tailed).							

In male physical aggression is correlated with verbal aggression, anger and hostility but there is no correlation between verbal aggression and anger (table 4).

Table 5: Statistical Measurement of Correlation between Different Parameters in Female

Sex			Average 2D-4D ratio	Physical aggression	Verbal aggression	Anger	Hostility
F	Average 2D-4D Ratio	Correlation	1	0.075	0.011	0.097	-0.057
		Sig.		0.408	0.907	0.285	0.535
	Physical aggression	Correlation	0.075	1	0.312**	0.320**	0.095
		Sig.	0.408		0.000	0.000	0.296
	Verbal aggression	Correlation	0.011	0.312**	1	0.174	0.155
		Sig.	0.907	0.000		0.054	0.087
	Anger	Correlation	-0.097	0.320**	0.174	1	0.237**
		Sig.	0.285	0.000	0.054		0.008
	Hostility	Correlation	-0.057	0.095	0.155	0.237**	1
		Sig	0.535	0.296	0.087	0.008	
**. Correlation is significant at the 0.01 level (2- tailed).							

In Nepalese female population studied, physical aggression is correlated with verbal aggression and anger but it did not show correlation with hostility (table 5).

Anger significantly correlated with physical aggression and hostility both in male and female (table 4 and 5). Average 2D-4D ratio is neither correlated with any form of aggression in male nor correlated with any form of aggression in female (table 4 and 5).

4. Discussion

Human beings have emotions throughout their life. Every emotion is related to the achievement of personal goals; therefore, happiness is linked to the progress towards the goal whereas sadness is linked to the failure or non-achievement of a goal. Anger arises when a plan goes away or is blocked and anxiety emerges when a goal is threatened, and so on[42].

From the present study aggression showed a reliable sex difference with males being on average, more aggressive than females. This study agrees with the study done by Daly and Wilson[43], Bailey *et al*[44], Campbell[45], Honekopp et al[46], and Virupaxi *et al*[47].

The present study showed the aggression more in male than in female while verbal aggression, anger and hostility were more in female than in male [table 1]. These results are different than those Bailey et al and Virupaxi *et al*. In their results physical, verbal and anger were more in male; and only hostility was more in female.

We found significant correlation of anger with physical aggression and hostility in male. In the study done by Bailey *et al* anger significantly correlated with all three sub-scales of aggression (physical aggression, verbal aggression and hostility) in male. In the present study all form of aggression were correlated in female, except verbal aggression with hostility and anger. In the study of Bailey et al all form of aggression were correlated in female, except in case of verbal aggression and hostility.

We did not find any correlation between digit ratio and any form of aggression either in males or in females. These results agree with the results obtained by Virupaxi *et al*.

We found from the present study that index finger length in males was shorter than ring finger length and significantly different as compared with females. These results confirms that digit ratio (2D:4D) is sexually dimorphic. These findings show similarity with earlier findings of George[48], Phelps[49], Manning *et al*[20], Manning *et al*[9], Ibegu *et al*[50] and Virupaxi *et al*[47] who found that index fingers in males tend to be shorter than ring fingers. These fingers lengths are affected by testosterone and estrogen in intrauterine life [12].

We also found that females had higher digit ratio in comparison with males. These result agree with earlier results of Phelps, George, Manning *et al*[24], Manning *et al*[9, 12,32], Oladipo *et al*[51,52], Ibegu *et al*, Virupaxi*et al* andSrihari *et al*[53].

5. Conclusion

On average, males are more aggressive than females. The physical aggression is more in males but verbal aggression, anger and hostility are more in females. The ratio of index finger and ring finger (2D:4D) is higher in male than in female. Males have shorter index finger than the ring finger but females have equal length of index and ring fingers. This information is useful in forensic science and anthropology. Therefore, large Nepalese population in other parts of Nepal should be studied.

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