

2D:4D digit ratios in males and females and its correlation with simple reaction time: A cross sectional Study at Combined Military Hospital (CMH), Lahore, Pakistan

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Abstract

A cross-sectional study was conducted on 86 medical students between the ages of 18 to 25 years studying at the Combined Military Hospital (CMH) in Lahore, Pakistan. They were assessed for height, weight, digit length of the 2nd and 4th fingers of both hands and reaction time (response time to auditory stimulus as measured by BIOPAC). Of the 86 students, 42 (49%) were male and 44 (51%) were female, with a mean age of 19.55 ± 1.017 and 19.86 ± 0.905 years, respectively. There was a significant difference in the height, weight and Body Mass Index (BMI) of the students. The mean 2D:4D ratio for males on the left hand was 0.958 ± 0.029 and for females it was 0.979 ± 0.363 ($p=0.004$). The ratio for the right hand for males was 0.958 ± 0.031 and for the females it was 0.977 ± 0.035 ($p=0.011$). There was a significant correlation between the 2D:4D ratio in the left hand with the reaction time in the dominant hand at random intervals ($r=-0.240$, $p=0.027$) and with reaction time in the non-dominant hand at fixed intervals ($r=-0.232$, $p=0.03$). Our results concluded that there is a negative correlation between the digit ratio and the reaction time. Those individuals who had lower digit ratios had faster reaction times than those who had higher digit ratios.

Keywords: 2D:4D digit ratios, simple reaction time, anthropometry. **doi:** 10.5455/JPMA.294659.

Introduction

2D to 4D ratio is defined as the measurement and comparison in length of the second digit (index finger) with the fourth digit (ring finger) of the same hand.¹ The ratio of the length of the two fingers (ring and index) is used as a clinical marker to assess the balance between foetal testosterone and foetal oestrogen level of a person.² The amount of testosterone present in the body has been linked with many traits.³ In recent studies it has been

found that 2D:4D ratio has been negatively correlated in cognitive abilities especially those involving impulsive thinking.⁴ Some studies found no significant correlation and concluded the 2D:4D ratio as an inconclusive test in determining talent.⁵ Some of the disciplines tested demonstrated a significant correlation with performance and 2D:4D, such as rugby and surfing.^{6,7} Our objective was to determine whether there was any correlation between reaction time in relation to the 2D:4D ratio differences between males and females in a sample population taken from our college students.

Methods and Results

Research was initiated after obtaining approval from the ethical review committee (73/ERC/CMHLMC). After informing the students about the purpose of our research and obtaining their consent, students filled out a structured questionnaire regarding their bio-data, hand dominance and were ensured about confidentiality. A hand scan was done using HP scanner, the students were asked to place their hands flat on the scanner and all foreign objects were asked to be removed (watch, ring, gloves etc). The digit length was measured from the basal crease to the tip of the finger (Figure 1), digit length was measured using ruler tool in Adobe Photoshop CS. The parameters calculated were: length of left index finger (LI), left ring finger (LR), right index finger (RI) and right

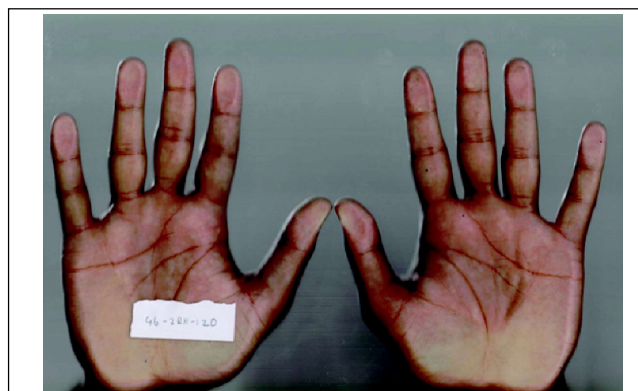


Figure: Hand scan used for digit measurement in Adobe Photoshop using ruler tool.

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Table-1: Anthropometric measurements of the study groups.

		n	Mean±SD	p-value
Age (years)	Males	42	19.55±1.017	0.131
	Females	44	19.86±0.905	
Height (m)	Males	42	1.78±0.062	0.001*
	Females	44	1.63±0.053	
Weight (Kg)	Males	42	71.6±11.33	0.001*
	Females	44	55.1±8.75	
BMI(kg/m ²)	Males	42	22.5±2.755	0.01*
	Females	44	20.8±3.225	

*p-value < 0.05 is statistically significant, Independent sample t-test was used to compare group means

Table-2: Comparison of digit length parameters among the study subjects.

		Mean±SD	p-value
LI (cm)	Males	7.602±0.36	0.001*
	Females	6.929±0.41	
LR (cm)	Males	7.944±0.48	0.001*
	Females	7.085±0.41	
RI (cm)	Males	7.596±0.41	0.001*
	Females	6.876±0.379	
RR (cm)	Males	7.936±0.513	0.001*
	Females	7.048±0.437	
Ratio L	Males	0.958±0.029	0.004*
	Females	0.979±0.363	
Ratio R	Males	0.958±0.031	0.011*
	Females	0.977±0.035	

*p-value < 0.05 is statistically significant, Independent sample t-test was used to compare group means, LI: Left Index Finger, LR: Left Ring Finger, RI: Right Index Finger, RR: Right Ring Finger.

ring finger (RR). The digit length was measured from the basal crease to the tip of the finger.⁸ After the hand scan was complete, the reaction time of the students was calculated using BIOPAC MP36 Data Acquisition unit.⁹ Upon auditory stimulus, students had to respond by pressing the clicker button on the BIOPAC apparatus and the response time was recorded. This procedure was repeated four times, twice with the dominant hand and twice with the non-dominant hand at random and fixed intervals respectively. All data was entered into and analysed by SPSS version 20. Independent sample t-test was used to compare the group means. Partial correlation coefficient was used to correlate simple reaction time with digit ratio. The level of significance was kept at 0.05. Tables 1,2,3 give the values recorded for age, weight, digit length and reaction time. Table 4 shows the correlation between digit ratio and reaction times calculated at random and fixed intervals. It is evident from our study group that there is a significant correlation between 2D:4D ratio in the left hand and reaction time in the dominant hand at random intervals (p-value=0.027) and with the non-dominant hand at fixed intervals (p-value=0.032).

Table-3: Comparison of simple reaction time among the study subjects.

		Mean±SD	p-value
RT Dominant hand fixed interval (sec)	Males	0.241±0.045	0.350
	Females	0.250±0.041	
RT Dominant hand random interval (sec)	Males	0.223±0.046	0.347
	Females	0.232±0.048	
RT Non-dominant hand fixed interval (sec)	Males	0.256±0.061	0.472
	Females	0.266±0.059	
RT Non-dominant hand random interval (sec)	Males	0.225±0.059	0.601
	Females	0.23±0.05	

*p-value < 0.05 is statistically significant, Independent sample t-test was used to compare group means, RT= reaction time

Table-4: Correlation between reaction time and 2D:4D.

	RT in DH at fixed interval	RT in DH at random Interval	RT in Non-DH at fixed interval	RT in Non-DH at random Interval
2D: 4D in left hand				
Partial correlation	-0.071	-0.240	-0.232	-0.161
p-value	0.51	0.027*	0.032*	0.142
2D: 4D in right hand				
Partial correlation	-0.109	-0.125	-0.104	-0.037
p-value	0.319	0.254	0.342	0.736

*p-value < 0.05 is statistically significant, RT= reaction time, DH= dominant hand.

Conclusion

It is concluded that there is a negative correlation of digit ratio with reaction time. Those individuals who have a lower digit ratio have faster reaction times than those who have higher digit ratios. We would also like to conclude that there is a visible difference in the 2D:4D ratio between males and females within the same age group. For more accurate results, further researches should focus on experiments outside the neutral lab environment. Digit ratio has limitless potential and needs to be researched more, as it has the potential to act as an indicator of cancer development. Low 2D:4D ratio has been associated with prostate cancer¹⁰ and a high 2D:4D ratio with breast cancer, which can help us to assess the risk factors and initiate treatment earlier.¹¹

Acknowledgements: The authors will like to thank the biostatistician Miss Bushra Amin, Department of Community Medicine, CMH Lahore Medical College and IOD, for reviewing the data and its analysis. The authors wish to thank Dr. Zeeshan Ashraf (late) for his support and guidance, and the motivation to initiate this research project.

Disclaimer: None

Conflict of Interest: None

Sources of Funding: None

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