

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Association Of 2D:4D Ratio With Depression, Anxiety And Stress In Second Year Female Dental Students.

Tejaswini Santhoshi Bandaru<sup>1\*</sup>, Kumar Sai Sailesh<sup>2</sup>, and Ravikanth Manyam<sup>3</sup>.

<sup>1</sup>Second year BDS student, Vishnu Dental College, Vishnupur, Bhimavaram, West Godavari District, Andhra Pradesh, India.

<sup>2</sup>Department of Physiology, Vishnu Dental College, Vishnupur, Bhimavaram, West Godavari District, Andhra Pradesh, India.

<sup>3</sup>Department of Oral Pathology, Vishnu Dental College, Vishnupur, Bhimavaram, West Godavari District, Andhra Pradesh, India.

### ABSTRACT

According to World Health Organization, 500 million people are affected by mental health disorders worldwide and among these a majority of them are affected with depression, anxiety and stress. In India 10-20 persons out of every 1000 have been reported to be suffering from mental illness. Earlier studies reported that the 2D:4D correlates with the depression, anxiety and stress. The present study was undertaken to observe the association of 2D:4D ratio with depression, anxiety and stress in second year female dental students. 30 apparently healthy second year female students were included in the study after obtaining the written informed consent. 2D:4D ratio was ratio of the length of second and fourth digits. The length of each digit was measured from the mid-point of bottom crease where the fingers join the hands to the tip of the fingers. The value of R is -0.0696 for association of 2D:4D ratio (right) and depression. This indicates a negative correlation, between the variables. The value of R is -0.2073 for association of 2D:4D ratio (right) and anxiety. This indicates a negative correlation between the variables. The value of R is -0.3231 for association of 2D:4D ratio (right) and stress. This indicates a negative correlation between the variables. The value of R is 0.0599 for association of 2D:4D ratio (left) and depression. This indicates a positive correlation between the variables. The value of R is 0.1916 for association of 2D:4D ratio (left) and anxiety. This indicates a positive correlation, between the variables. The value of R is 0.2169 for association of 2D:4D ratio (left) and stress. This indicates a positive correlation between the variables. Right hand 2D:4D ratio has negative correlation with depression, anxiety and stress whereas left hand 2D:4D ratio has positive correlation with depression, anxiety and stress. We recommend further detailed studies to understand the association.

**Keywords:** Digit ratio, Stress, Depression.

*\*Corresponding author*

## INTRODUCTION

According to World Health Organization, 500 million people are affected by mental health disorders worldwide and among these a majority of them are affected with depression, anxiety and stress. In India 10-20 persons out of every 1000 have been reported to be suffering from mental illness. Earlier studies reported that the 2D:4D correlates with the depression, anxiety and stress. The length of the index finger is considered as 2D and length of the ring finger is considered as 4D. The ratio between these two lengths is called as 2D:4D ratio [1,2]. It was reported that there was negative correlation between 2D:4D ratio with prenatal testosterone levels [3]. In fact, the ratio of 2D and 4D represents the ratio of testosterone and estrogen in the fetal life [4]. The ratio was lower in males when compared with females [5]. It was reported that the ratio of 2D and 4D was associated with depression, anxiety and stress [6]. However, there are limited studies in this area. Hence, the present study was undertaken to observe the association of 2D:4D ratio with depression, anxiety and stress in second year female dental students.

## MATERIALS AND METHODS

**Study design:** Cross-sectional study

**Study setting:** The present study was conducted at Department of Physiology, Vishnu Dental College, Bhimavaram, Andhra Pradesh.

**Study participants:** 30 apparently healthy second year female participants within the age group of 18-24 years were included in the study after obtaining the written informed consent. Participants with any serious diseases and those under any treatment and unwilling participants were excluded from the study.

**Measurement of 2D:4D ratio:** 2D:4D ratio was ratio of the length of second and fourth digits. The length of each digit was measured from the mid-point of bottom crease where the fingers join the hands to the tip of the fingers [7, 8].

**Ethical considerations:** The present study was approved by institutional research committee of Vishnu Dental College, Bhimavaram.

**Data analysis:** Data was analyzed by SPSS 20.0. Data was represented as mean and SEM. Pearson correlation coefficient was applied to observe the association between the variables.

## RESULTS

Results are presented in table no 1 and 2. The value of R is -0.0696 for association of 2D:4D ratio (right) and depression. This indicates a negative correlation, between the variables. The value of  $R^2$ , the coefficient of determination, is 0.0048. The value of R is -0.2073 for association of 2D:4D ratio (right) and anxiety. This indicates a negative correlation between the variables. The value of  $R^2$  is 0.043. The value of R is -0.3231 for association of 2D:4D ratio (right) and stress. This indicates a negative correlation between the variables. The value of  $R^2$  is 0.1044 (table no 1). The value of R is 0.0599 for association of 2D:4D ratio (left) and depression. This indicates a positive correlation between the variables. The value of  $R^2$  is 0.0036. The value of R is 0.1916 for association of 2D:4D ratio (left) and anxiety. This indicates a positive correlation, between the variables. The value of  $R^2$  is 0.0367. The value of R is 0.2169 for association of 2D:4D ratio (left) and stress. This indicates a positive correlation between the variables. The value of  $R^2$ , the coefficient of determination, is 0.047 (table no 2).

**Table 1: Association of 2D:4D ratio of right hand with depression, anxiety and stress.**

Parameter	Mean and SEM	2D:4D ratio (right)	R	R <sup>2</sup>
Depression	4.03± 0.61	0.92±0.009	-0.0696	0.0048
Anxiety	5.63±0.69		-0.2073	0.043
Stress	5.83±0.65		-0.3231	0.1044

(Data was presented as Mean and SEM)

**Table 2: Association of 2D:4D ratio of left hand with depression, anxiety and stress.**

Parameter	Mean and SEM	2D:4D ratio (right)	R	R <sup>2</sup>
Depression	4.03± 0.61	1.04±0.01	0.0599	0.0036
Anxiety	5.63±0.69		0.0036	0.0367
Stress	5.83±0.65		0.2169	0.047

(Data was presented as Mean and SEM)

### DISCUSSION

The ratio of the digits was measured from the midpoint to the bottom crease where the finger joins the hand to the tip of the finger [9-11]. Earlier studies reported that there was correlation between the 2D and 4D ratio with gender and testosterone levels [12]. The length of the second digit was longer in females when compared to the fourth digit. This was reverse in case of males [13]. It was reported that the ratio of 2D:4D ratio was associated with poor physical and psychological health outcomes in males whereas in females it was not associated with health outcomes. There were mixed results in case of digit ratio. In males lower ratio of 2D and 4D indicates higher levels of depression, anxiety and stress [14]. Anti-social behavior was observed in the individuals with lower 2D and 4D digit ratio. It was reported that, the testosterone levels in the prenatal life determine the 2D and 4D digit ratio [15]. In contrast another study reported that there was no association between the 2D and 4D digit ratios with testosterone as well as antisocial behavior [16]. Right hand 2D:4D ratio has negative correlation with depression, anxiety and stress whereas left hand 2D:4D ratio has positive correlation with depression, anxiety and stress. It was reported that handedness has an effect on the digit ratio. Left-handed people have a lower digit ratio when compared to right-handed males [17]. Other study reported that there was no difference in males. However, in females, there is a difference which is significant statistically. This difference in females was reported due to the influence of estrogen [18-20]. The difference in the correlation observed in the present study may be due to the presence of asymmetry in the length of the digits of right and left hands as reported in earlier studies [20]. The second metacarpal was reported to be larger in the right hand among the right and left handers [21, 22].

**Limitations:** The present study sample size was lower. The study was conducted at one center, so the results may not be generalized.

### CONCLUSION

Right hand 2D:4D ratio has negative correlation with depression, anxiety and stress whereas left hand 2D:4D ratio has positive correlation with depression, anxiety and stress. We recommend further detailed studies including both genders to understand the association which may help as simple indicators for assessment of psychological disorders.

### ACKNOWLEDGEMENT

We sincerely thank Dr. M. C. Suresh Sajjan, Principal and Dr. Venkata Rama Raju. A, Vice Principal, Vishnu Dental College, for their support and cooperation throughout the study. Our special thanks to the management of Vishnu Dental College for providing necessary facilities for the study.

## REFERENCES

- [1] Hönekopp J, Watson S. Meta-analysis of digit ratio 2D:4D shows greater sex difference in the right hand. *Am J Hum Biol* 2010;22:619–630.
- [2] Manning JT. Resolving the role of prenatal sex steroids in the development of digit ratio. *ProcNatlAcadSci U S A* 2011;108:16143–16144.
- [3] Zheng Z, Cohn MJ. Developmental basis of sexually dimorphic digit ratios. *ProcNatlAcadSci U S A* 2011;108:16289–16294.
- [4] Cornelia Sindermann, Mei Li, RaynaSariyska, Bernd Lachmann<sup>1</sup>, Éilish Duke, Andrew Cooper, Lidia Warneck and Christian Montag. The 2D:4D-Ratio and Neuroticism Revisited: Empirical Evidence from Germany and China. *Frontiers in Psychology*2016 : 7: 811.
- [5] Hönekopp, J.,andWatson,S.Meta-analysisoftherelationshipbetween digit-ratio 2D:4Dandaggression. *Pers.Individ.Dif* 2011;51: 381–386.
- [6] Manning, J.T., Scutt, D., Wilson, J., Lewis Jones, D.I. The ratio of 2nd to 4th digit length: a predictor of sperm numbers and concentrations of testosterone, luteinizing hormone and oestrogen. *Hum. Reprod*1998; 13, 3000-3004.
- [7] BolajiFataiOyeyemi, OluyinkaAjibolalyiola, AdekunleWahabOyeyemi, KokoriAuduOricha, Abass Toba Anifowoshe, and NanfizatAbiketAlamukii. Sexual dimorphism in ratio of second and fourth digits and its relationship with metabolic syndrome indices and cardiovascular risk factors. *J Res Med Sci* 2014; 19(3): 234–239.
- [8] FatihCanan,ServetKaraca,MelikeDüzgün, Ayşe MerveErdem, EsranurKaraçaylı, NurBegümTopan, Sang-Kyu Lee, Zu Wei Zhai, Murat Kuloğlu, and Marc N. Potenza. The relationship between second-to-fourth digit (2D:4D) ratios and problematic and pathological Internet use among Turkish university students. *J Behav Addict* 2017; 6(1): 30–41.
- [9] Mayhew TM, Gillam L, McDonald, R, Ebling FJ. Human 2D (index) and 4D (ring) digit lengths: Their variation and relationships during the menstrual cycle. *J Anat*2007; 211 (5): 630-638.
- [10] Fink B, Manning J, Neave N, Tan U. Second to fourth digit ratio and hand skill in Austrian children. *BiolPsychol*2004; 67 (3): 375-384.
- [11] Fink B, Manning J, Neave N, Grammer K. Second to fourth digit ratio and facial asymmetry. *Evol HumBehav*2004; 25(2): 125-132.
- [12] Manning JT, Barley L, Walton J, et al. The 2nd: 4th digit ratio, sexual dimorphism, population differences and reproductive success: Evidence for sexually antagonistic genes? *Evol HumBehav* 2000; 21(3): 163-183.
- [13] Manning JT, Scutt D, Wilson J, Lewis-Jones DI. The ratio of 2nd to 4th digit length: A predictor of sperm numbers and concentrations of testosterone, luteinizing hormone and oestrogen. *Hum Reprod*1998; 13(11): 3000-3004.
- [14] Kimberly A.Rapoza. Does life stress moderate/mediate the relationship between finger length ratio (2D4D), depression and physical health? *Personality and Individual Differences* 2017; 113:74-80.
- [15] TerburgD , Morgan B, van Honk J. The testosterone cortisolratio:ahormonalmarkerforproneisstosocialaggression. *InternationalJournalofLawandPsychiatry* 2009; 32:216–223.
- [16] JillPortnoy, AdrianRaine, AndreaL.Glenn, FrancesRChen,OliviaChoy,DouglasGranger. Digitratio(2D:4D)moderatestherelationshipbetween cortisolreactivityandself-reportedexternalizingbehaviorinyoungadolescentmales. *BiologicalPsychology* 2015; 112: 94–106.
- [17] Stoyanov Z, Marinov M, Pashalieva I. Finger length ratio (2D:4D) in left- and right-handed males. *Int J Neurosci.* 2009;119(7):1006-13.
- [18] Robinson SJ, Manning JT. Ratio of 2nd to 4th digit length and male homosexuality. *Evolution and Human Behavior* 2000; 21: 333-45
- [19] Manning JT, Henzi P, Bundred PE. The ratio of 2nd to 4th digit length: a proxy for testosterone and susceptibility to HIV and AIDS? *Medical Hypotheses* 2001; 57: 761-63.
- [20] RenginKosif, Murat Diramali. Comparison of all hand digit length ratios in left and right handed individuals. *Turk J Med Sci*2012; 42 (3): 545-552.
- [21] Purves D, White LE, Andrews TJ. Manual asymmetry and handedness. *ProcNatlAcadSci USA* 1994; 91: 5030-32.
- [22] Means LW, Walters RE. Sex, handedness and asymmetry of hand and foot length. *Neuropsychologia* 1982; 20: 715-19.