

# A study of 2nd to 4th digit ratio (2D:4D) in relation to hypertension in north Indian males and its implications for risk factors in coronary heart disease

Ravinder Kumar Yadav<sup>1</sup>, Manju Bala<sup>2,\*</sup>

<sup>1</sup>Lecturer, Department of Anatomy, Shri Sukhmani Dental College and Hospital, Dera Bassi, Mohali, Punjab, India

<sup>2</sup>Associate Professor, Department of Anatomy, Medical College, MMIMSR, Mullana, Ambala, Haryana, India.

**\*Corresponding Author:**

E-mail: drmanju14@yahoo.in

## Abstract

The index finger to ring finger ratio (2D:4D) of the hands are affected by prenatal sex steroids. Furthermore, 2D:4D ratio is related to myocardial infarction and coronary artery diseases, however no research has reported the relationship between the 2D:4D ratio and hypertension in Indian male. In this study, we examined 2D:4D finger length ratio in 100 Indian male with history of hypertension and 100 controls without history of hypertension. The 2D:4D ratio was more in hypertensive group and p value was statistically significant in control & hypertensive group. It was higher in left hand among both the groups. This finding supports the suggestion of 2D:4D ratio to serve as a predictor for hypertension which is the major risk factor for cardiovascular diseases.

**Keywords:** Hypertension, 2D:4D, coronary artery disease

Access this article online	
Quick Response Code:	Website: www.innovativepublication.com
	DOI: 10.5958/2394-2126.2016.00007.4

## Introduction

Hypertension is one of the serious issue of medical and public health and its burden is remarkably increases throughout the regions of world both in developed and developing countries<sup>1,2</sup>. Hypertension is important risk factor for predicting cardiovascular diseases, chronic kidney diseases as well stroke<sup>3</sup>. In India with a population estimated at 1.1 billion, the prevalence of hypertension has been estimated to be 3%-34.5% in males and 5.8%-33.5% in females<sup>4-7</sup>.

Various epidemiological evidence and studies shows the significant association of anthropometric measurements and indices like BMI (body mass index), WhtR (weight height ratio), WC(waist circumference) with hypertension as well cardiovascular disorders<sup>8</sup>.

Recently, the 2D:4D ratio has received great attention to the researchers and they had found the relationship between 2D:4D ratio with traits like coronary heart diseases. 2D:4D is sexually dimorphic, such that it is more prevalent in males. Studies have reported that men have lower 2D:4D ratio than women<sup>9,10,11</sup>. In human urogenital system and appendicular skelton are under the control of HOX genes. This common control of digit and gonad differentiation raises the possibility that digit formation may relate to spermatogenesis and hormonal concentration. Testosterone affects the development of digit including 2D:4D ratio and digit dermatoglyphics.

As a result adult testicular activity is correlated with 2D:4D ratio<sup>10</sup>. Manning et al<sup>11</sup> reported 2D:4D ratio as a marker for testosterone and oestrogen in first trimester of pregnancy. Their study shows negative relationship between 2D:4D ratio and age of first MI, that is men with low 2D:4D ratio have tendency for first MI later in life than men with high 2D:4D ratio. Whereas Xing li wu et al<sup>12</sup> suggested the positive correlation between 2D:4D and coronary heart diseases in males. Similarly Fink et al<sup>13</sup> also reported positive correlation between 2D:4D and neck circumference for men after assessing body mass index than women. With best of our knowledge the effects of 2D:4D ratio on cardiovascular system have been shown in means of myocardial infarction, neck circumference and atherosclerotic formation, the association between 2D:4D ratio and hypertension have not been shown in the literature yet which is one of the important risk factor for CAD. So present study aimed to find out the association between 2D:4D ratio and hypertension in north Indian males.

## Material and Method

The present study was conducted in the Department of Anatomy, Maharishi Markandeshwar Institute of Medical Sciences & Research, Mullana, (Ambala) on 200 adult male subjects:- 100 with known case of hypertension and 100 without any history of hypertension after given informed consent. The male subjects were above age of 18 yrs - 50 yrs. Ethical approval was granted by the institutional committee. Subjects with apparent anomalies, inflammation, trauma, deformities and surgery of hand (if any) were excluded.

### Measurement of Digit Length: 2D:4D = Index finger length: Ring finger length

The subject was asked to place their hands in supine position on a table with fingers extended. The index finger and ring finger lengths was measured on the palmer surface of hands from the middle of the proximal crease to the tip of digit in the both hands by using sliding callipers measuring to 0.01 mm. Each finger was measured twice.

### Measurement of Blood Pressure

Blood pressure was measured by following standard guidelines. The individual was made comfortable and sit at least for five minutes on chair. It was measured with a mercury sphygmomanometer and stethoscope. Two readings were taken, 5 minutes apart the average of two readings were entered in the record. Patient of hypertension was identified on the basis of blood pressure measurement, medical history and medical record.

**Normal:** Systolic and diastolic <120/80

**Prehypertension:** systolic 120-139 or diastolic 80-89 mm of Hg

**Stage-I Hypertensives:** systolic 140-159 or diastolic 90-99 mm of Hg

**Stage-II Hypertensives:** systolic  $\geq 160$  or diastolic  $\geq 100$  mm of Hg<sup>14</sup>

The data entry was carried using Microsoft Office Excel worksheet. Data was analysed statistically by mean  $\pm$  standard deviation, independent t- test was used to calculate significant level, pearson correlation, were used to investigate the relationship between 2D:4D ratio and study groups.

### Results

Considering the measurements studied, the results indicate a significant difference of 2D:4D among control and hypertensive groups. And the ratio was higher in both hands in hypertensive group as compared to control. Furthermore ratio was higher in left hand of hypertensive group (Table 1).

**Table 1: Baseline characteristics of study population in control and hypertensive groups**

Variables	Control (n=100)	Hypertensive (N=100)	p value
	mean $\pm$ sd	mean $\pm$ sd	
AGE	24.62 $\pm$ 2.59	45.77 $\pm$ 4.21	0.00*
Rt. 2D	7.18 $\pm$ 0.50	7.21 $\pm$ 0.37	0.58
Lt. 2D	7.36 $\pm$ 0.50	7.35 $\pm$ 0.39	0.94
Rt. 4D	7.60 $\pm$ 0.53	7.57 $\pm$ 0.38	0.61
Lt. 4D	7.71 $\pm$ 0.53	7.63 $\pm$ 0.42	0.24
Rt. 2D : 4D	0.945 $\pm$ 0.02	0.954 $\pm$ 0.02	0.00*
Lt. 2D : 4D	0.955 $\pm$ 0.02	0.964 $\pm$ 0.02	0.00*

\*P value <0.05 significant

### Discussion

The present study has revealed a novel relation between the hypertension and index finger to ring finger length ratio(2D:4D). Hypertension is a major health problem in India and other developing countries. Prevalence of hypertension is found to be highest among the north Indian states.<sup>15</sup>The relative lengths of the 2nd and 4th digits (2D:4D) may provide an easily measurable and stable anthropometric index of prenatal androgen exposure.<sup>16</sup>It has become widely used as a means to study the effects of prenatal androgenisation in humans. There was no evidence of a change in the 2D:4D ratio with age <sup>10</sup>. The mechanisms of the link between 2D:4D and hypertension are not clear, while the prenatal sex hormones may affect the development of a number of organ systems including the cardiovascular system, so the unbalanced prenatal sex hormones exposure may be the main aetiology.<sup>17</sup> This was supported by Phillips who reported that free testosterone was significantly related to CAD in postmenopausal women.<sup>18</sup>

Previous studies reported that the 2D:4D ratio is a predictor for coronary heart diseases<sup>11,12</sup>. Our results confirmed these earlier studies which demonstrated the higher index finger to ring finger length ratio in hypertensive group. Furthermore 2D:4D ratio was found more in stage II hypertensive group and p value was statistically significant for both Rt. & Lt. Hands.[table 2].

In the present study, we found that the 2D:4D ratio of Rt. and Lt. hand in hypertensive group was found to be statistically higher than control group(table 1). Similar result was obtained by Wu Xing et al.<sup>12</sup> they found high 2D:4D ratio in coronary artery diseases in Chinese men and Fink B et al<sup>13</sup> which found positive correlations between 2D:4D ratio and neck circumference in men suggest a possible predisposition towards CHD.

**Table 2: Comparison of 2D:4D ratio among groups divided according to Hypertension**

Hypertension	Systolic BP (mean ± sd)		Diastolic BP (mean ± sd)		P value	
	Rt.(2D:4D)	Lt.(2D:4D)	Rt.(2D:4D)	Lt.(2D:4D)	Rt.(2D:4D)	Lt.(2D:4D)
STAGE I	0.952±0.025	0.963±0.025	0.952±0.025	0.963±0.025	0.00*	0.00*
STAGE II	0.958±0.018	0.967±0.022	0.959±0.015	0.968±0.020	0.00*	0.00*

Mean and SD of 2D:4D ratio was found more in stage II hypertensive group and p value was statistically significant for both Rt. & Lt. 2D:4D ratio in stage I & stage II hypertensive group.

### Conclusion

The preliminary results of the present study revealed the association of 2D:4D and hypertension in males and can be predictor for cardiovascular heart diseases in the link to prenatal sex hormones. However, more studies are suggestive to verify these preliminary results.

**Conflict of Interest:** None

**Source of Support:** Nil

### References:

- Murray CJ, Lopez AD. Mortality by cause for eight regions of the world: global burden of disease study. *Lancet* 1997; 349(9061):1269–76.
- Murray CJ, Lauer JA, Hutubessy RC, Niessen L, Tomijima N, Rodgers A et al. Effectiveness and costs of interventions to lower systolic blood pressure and cholesterol: a global and regional analysis on reduction of cardiovascular-disease risk. *Lancet* 2003; 361(9359):717–25.
- The sixth report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. *Arch Intern Med* 1997; 157(21):2413–46.
- Malhotra P, Kumari S, Kumar R, Jain S, Sharma BK. Prevalence and determinants of hypertension in an un-industrialised rural population of north India. *J Hum Hypertens* 1999; 13(7):467–72.
- Gupta R, Sharma AK. Prevalence of hypertension and subtypes in an Indian rural population: clinical and electrocardiographic correlates. *J Hum Hypertens* 1994; 8(11):823–9.
- Gupta R, Gupta S, Gupta VP, Prakash H. Prevalence and determinants of hypertension in the urban population of Jaipur in western India. *J Hypertens* 1995; 13(10):1193–1200.
- Das SK, Sanyal K, Basu A. Study of urban community survey in India: growing trend of high prevalence of hypertension in a developing country. *Int J Med Sci* 2005; 2(2):70–8.
- Dalton M, Cameron AJ, Zimmet PZ, Shaw JE, Jolley D, Dunstan DW et al. Waist circumference, waist-hip ratio and BMI and their correlation with cardiovascular risk factors in Australian adults. *Journal of internal medicine* 2003; 254(6): 555–63.
- George R. Human finger types. *Anat Rec.* 1930; 46: 199–204.
- Manning JT, Scutt D, Wilson J, Lewis-Jones DI. The ratio of 2nd–4th digit length: a predictor of sperm numbers and levels of testosterone, LH and oestrogen. *Hum Reprod.* 1998; 13: 3000–4.
- Manning JT, Bundred PE. The ratio of 2nd–4th digit length: a new predictor of disease predisposition?. *Med Hypotheses.* 2000; 54(5): 855–7.
- Wu XL, Yang DY, Chai WH, Jin MI, Zhou XC, Peng L, et al. The Ratio of Second to Fourth Digit Length (2D:4D) and Coronary Artery Disease in a Han Chinese Population. *Int J Med Sci* 2013; 10: 1584–8
- Fink B, Manning JT, Neave N. The 2nd–4th digit ratio (2D:4D) and neck circumference: implications for risk factors in coronary heart disease. *Int J Obes.* 2006; 30: 711–4.
- Chobanian AV, Bakris LG, Black HR. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: The JNC 7 Report. *JAMA* 2003; 289(19):2560–71.
- National family health survey. International institute for population sciences (IIPS) and ORC Macro, 1998–99; Mumbai IIPS, NFHS-2, 2000.
- Knickmeyer RC, Woolson S, Hamer RM, Konneker T, Gilmore JH. 2D:4D ratios in the first 2 years of life: stability and relation to testosterone exposure and sensitivity. *Horm Behav* 2011; 60(3):256–63.
- Buck JJ, Williams RM, Hughes IA, Acerini CL. In-utero androgen exposure and 2nd to 4th digit length ratio: comparisons between healthy controls and females with classical congenital adrenal hyperplasia. *Hum Reprod* 2003; 18:976–9.
- Phillips GB, Pinkernell BH, Jing TY. Relationship between serum sex hormones and coronary artery disease in postmenopausal women. *Arterioscler Thromb Vasc Biol.* 1997; 17:695–701.