

Content available at: <https://www.ipinnovative.com/open-access-journals>

IP Indian Journal of Anatomy and Surgery of Head, Neck and Brain

Journal homepage: <https://www.ijashnb.org/>

## Original Research Article

# To find 2D:4D ratio of fingers and its correlation with hypertension and its implications for risk factors in cardiovascular diseases in north Indian population

Sunil Kumar<sup>1\*</sup>, Sadakat Ali<sup>1</sup><sup>1</sup>Dept. of Anatomy, Sri Guru Ram Rai Institute of Medical Sciences & Research, Dehradun, Uttarakhand, India

## ARTICLE INFO

## Article history:

Received 10-06-2024

Accepted 15-07-2024

Available online 01-08-2024

## Keywords:

Finger Length Ratio

2D:4D

HTN

BMI

## ABSTRACT

Hypertension is a chronic condition of concern due to its role in the causation of other non-communicable diseases like coronary heart disease, stroke and other vascular complications. In the era of socio-economic and epidemiological transition of population, it is the commonest cardiovascular disorder and emerged as major public health problem. It is one of the major risk factors for cardiovascular mortality, in case of human being's index finger (2D), to ring finger(4D), commonly called as 2D:4D ratio find a great interest for researcher because they exhibit sexual di-morphism and are also linked to several individualities.

This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](#), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: [reprint@ipinnovative.com](mailto:reprint@ipinnovative.com)

## 1. Introduction

Hypertension is a chronic condition of concern due to its role in the causation of other non-communicable diseases like coronary artery diseases, stroke and other vascular complications. In the era of socio-economic and epidemiological transition of population, it is the commonest cardiovascular disorder and emerged as major public health problem. It is one of the major risk factors for cardiovascular mortality, in case of human being's index finger (2D), to ring finger(4D), commonly called as 2D:4D ratio find a great interest for researcher because they exhibit sexual di-morphism and are also linked to several individualities.<sup>1</sup>

Hypertension alone accounts for 20-50 per cent of all deaths. High blood pressure is considered both a disease and a risk factor, especially for cardiovascular diseases, and is one of the most serious public health problems.<sup>2</sup> Today, 25% of the world's population suffers from this disease and it has been estimated that this figure will have risen by 60% by 2025, reaching a prevalence of 40%.

\* Corresponding author.

E-mail address: [drkanatomy@gmail.com](mailto:drkanatomy@gmail.com) (S. Kumar).

In addition to deaths due to circulatory system diseases, the socioeconomic burden of hypertension is high, with productive lives cut short through temporary or permanent disability.<sup>3</sup>

Various factors might have contributed to this rising trend and among others, consequences of urbanization such as change in life style pattern, diet and stress, increased population and shrinking employment have been implicated.<sup>4</sup>

Understanding and estimating the prenatal parameters helps to estimate various diseases to which particular individual are more prone for. One such parameter is assessment of ratio of 2<sup>nd</sup> and 4<sup>th</sup> finger length. It is called as 2D:4D ratio, which is attracting the interest of researchers as it is being correlated with not only with anthropometric data but also with psychological and clinical parameters.<sup>5</sup>

Analysis has always intrigued humans throughout history. In recent times two aspects of human hand have drawn attention for observation and analysis including dermatoglyphic ridge pattern and secondly, finger lengths and their ratios. Besides the lengths of the fingers such as index finger length and ring finger length, finger ratios have also been used for predicting sex of an individual. The

finger ratio is an established sexually dimorphic biometric population marker.<sup>6</sup>

Present study, is intended to find 2nd to 4th digit ratio (2D:4D) in relation to hypertension in North Indian population and its possible implications for risk factors in cardiovascular disease.

## 2. Materials and Methods

### 2.1. Inclusion criteria

The study was conducted in the Department of Anatomy, Shri Guru Ram Rai Medical College Dehradun, Uttarakhand, India.

Total Subjects were 200 males (100 with hypertension and 100 without hypertension).

Age group 18-50 years was chosen from North Indian Population.

Prior informed consent for the study was taken both in English and vernacular languages from the subjects.

### 2.2. Exclusion criteria

1. The subjects with any apparent physical hand anomalies, inflammation, trauma, or deformities, and those who had undergone a recent major surgery were excluded because of their unsuitability for the present investigation.
2. Subjects having any genetic, psychological, neurological or chronic diseases affecting the hand parameters
3. Individuals with any history of recent drug intake
4. Subjects who were wheelchair bound or had difficulty in standing

### 2.3. Measurement of blood pressure

Blood Pressure was measured by latest standard guidelines (National Heart Centre/ Saudi Heart Association 2023 guidelines on the Management of Hypertension).

It was measured with a sphygmomanometer and stethoscope. Individuals were allowed to sit for at least for five minutes on chair. Two readings were taken, 5 minutes apart the average of two readings were entered in the record. Patient of hypertension were identified on the basis of blood pressure measurement, Medical history and Medical record.<sup>7</sup>

1. *Normal*: Systolic and diastolic =120/80.
2. *Elevated*: systolic 121/80 – 129/80
3. *Stage-I Hypertensives*: systolic 130-139 or diastolic 80-89 mm of Hg
4. *Stage-II Hypertensives*: systolic  $\geq$ 140 or diastolic  $\geq$ 90 mm of Hg
5. *Hypertensive Crisis* > 180/120

1. *2D:4D ratio*: It is defined as the ratio of the length of second digit (index finger) to the length of the fourth digit (ring finger). The measurement was taken from both hands with an electronic sliding Digital Calliper from the palmar side with the digits fully stretched and touching on a hard-flat surface, with the second to fifth digits abducted and the thumb slightly extended (Figure1).
2. *Body weight*: Body weight was measured (to the nearest 0.5 kg) with the subject standing motionless on a weighing scale (Figure 2).(18)
3. *Height*: Height was measured (to the nearest 0.5 cm) with the subject standing in an erect position against a vertical scale of portable with the head positioned so that the top of the external auditory meatus was in level with the inferior margin of the bony orbit (Figure 3)
4. *Body mass index*: The BMI was calculated as weight in kilograms divided by the squared height in meters (weight in kg/height in m<sup>2</sup>).

The data entry was analysed by using Microsoft Office Excel worksheet. Data was correlated statistically by mean  $\pm$  standard deviation, independent t- test was used to calculate significant level, Pearson correlation, were used to find out the relationship between 2D:4D ratio of control and case groups.



Figure 1: Measurement of 2D,4D length, measurement of weight

## 3. Results

By doing the study we rectified, that a significant difference of 2D:4D ratio exists among control and hypertensive groups. Comparatively

Mean & standard deviation values of both hands were higher in Hypertensive group as compared to control groups. P-Value was showing a significant correlation between two groups. (Table 1).

Mean and standard deviation of Age, Height, Weight & BMI was found more in hypertensive group. p value was



**Figure 2:** Height measurement in cm

**Table 1:** Mean and standard deviation of various parameters

Parameter	Control (n=100) mean±sd	Hypertensive (n=100) mean±sd	p- Value
Rt. 2D	5.97 ± 0.53	6.38 ± 0.66	<0.0001***
Rt. 4D	6.03 ± 0.54	6.40 ± 0.63	<0.0001***
Lt. 2D	6.02 ± 0.52	6.42 ± 0.64	<0.0001***
Lt. 4D	6.00 ± 0.54	6.45 ± 0.60	<0.0001***
Rt. 2D:4D ratio	0.99 ± 0.05	1.00 ± 0.04	<0.0054**
Lt. 2D:4D ratio	0.99 ± 0.04	1.00 ± 0.04	<0.0054**

**Table 2:** Mean & standard Deviation of others parameters used

Parameter	Control (n=100) mean±sd	Hypertensive (n=100) mean±sd	p- Value
Age	40.09±8.15	44.66±5.92	<0.0001***
Height	173.78±6.50	173.26±7.63	0.6045 (insignificant)
Weight	74.33±7.08	78.18±7.56	<0.0003***
BMI	24.70 ± 0.84	25.83. ± 2.38	<0.0001***

statistically significant except p value of Height which is showing insignificant values.

#### 4. Discussion

High blood pressure is considered both a disease as well as a risk factor, especially for cardiovascular diseases, and is one of the most serious public health problems.<sup>1</sup>

The pervasiveness of the ailment will increase even further unless broad and effective preventive measures are implemented. Epidemiological studies to assess the prevalence of hypertension are essential to plan preventive strategies and promote the health of these populations. Though several studies have been carried out among the

general population in India but very few studies have been conducted among rural population.<sup>1</sup>

Prevalence of hypertension were found to be highest among the North Indian states. It has become widely used as a means to study the effects of prenatal androgenisation in humans. 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>2</sup>

It is generally postulated by Oyeyemi B et.al that the lower the individual 2D:4D, the higher testosterone but the lower oestrogen levels experienced during foetal life. 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 foetal development and remain relatively stable across the life span.<sup>8</sup>

Ghosh et al revealed in their study that there is a variation in the life patterns in the rural India, there is a shifting in the overall pattern of cardiovascular diseases due to stress and tension intrinsic within the epidemiological shift.<sup>9</sup>

Present study of 2D:4D ratio of both hands with Hypertension publicized an innovative relation. 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>10</sup>

In the study done by Kukda N & Verma S, 2D:4D ratio was found significantly higher in males those having CAD when compared with the healthy males; a strong correlation of digit ratio to CAD exists as also confirmed through significant correlation.<sup>11</sup>

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) Yadav R, Bala M)

**Table 3:** Mean and standard deviation of various parameters of previous study by Yadav R, Bala M)

Author	Parameter	Control(n=100) mean ±sd	Hypertensive(n=100) mean ±sd	P Value
Yadav R & Bala M (2016)	Rt. 2D:4D ratio	0.945±0.02	0.954±0.02	0.00*
	Lt. 2D:4D ratio	0.955±0.02	0.964±0.02	0.00*
Kukda N and Verma SK (2021)	Parameter	Control N=50	Coronary Artery Disease N=50	P value
	2D:4D ratio (both hands)	1.005 ± 0.004	0.98 ± 0.003	<0.01

When comparison was made with the previous study done by Yadav R & Bala M, 2D:4D ratio was found higher in hypertensive group & p-value was showing a significant correlation in both groups. (Table 3)

Same study was done Kukda N & Verma SK but 2D:4D ratio was compared with coronary artery disease it was showing value of 2D:4D lower in case of disease group (Table 3).

## 5. Conclusion

In our study it was concluded that there is a strong correlation of 2D:4D ratio with Hypertension. 2D:4D ratio is also a predictive of cardiovascular diseases and may be used for assessment, diagnosis, prognosis and also for early life style changes in a population. Moreover, many more study needed to do in large no of population and in different individuals of various ethnic groups, so as to check the association of Hypertension with 2D:4D ratio.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

## References

1. Habit N, Babita P. Prevalence of hypertension among the rural population of Mehsana district of North Gujarat region, India. *Int J Community Med Public Health*. 2021;8(12):584907–58581.
2. Yadav R. 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. *Indian Journal of Clinical Anatomy and Physiology*. 2016;3(1):24–26.
3. Bwami S, Buddhiraja R, Gupta, Bansal S, Gaur N, Sharma D. Correlation between Second to Fourth Digit Ratio and Anthropometric Variables Indicative of Cardiovascular Disease. *J Morpho Sci*. 2019;36(1).
4. Toumrin Y, Ugurlu K. The Ratio of the Second Finger to the Fourth Finger (2D:4D); Can it be a Marker for Dental Anxiety? *Turkiye Klinikleri J Den tal Sci*. 2021;27(2):178–83.
5. Matlabburar A, Bakris GL, Black H, Cushman WC, Green LA, Izzo J, et al. *A The Journal of the American Medical Association* . 2003;289.
6. Navi N, Verma S. Correlation of Length of Index Finger (2D) to Ring Finger (4D) Ratio (2D:4D) and coronary artery disease - A Study in Male Population of South Rajasthan. *Acta Scientific Medical Sciences*. 2021;5(8):65–68.
7. Saniya M, Jehaan M, Rodwin S. Sexual Dimorphism of Digit Ratio (2D:4D) in Madhya Pradesh. A. *Int J Sci Stud*. 2017;4(10):155–59.
8. Oedema B, Bf, Iyiola OA, At, Alamukii NA. 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;19:234–243.
9. Gosh A, Sarkar D, Mukherji B, Pal R. Prevalence and risk correlates of hypertension among adult rural population in Bihar. *Annals of Tropical Medicine and Public Health*. 2013;6(1).
10. Kumar N, Sallehuddin M, Syed S, Idris M, Jamba T, Ravindra S, et al. The Ratio of Second to Fourth Digit Length (2D:4D) and heart disease. *Bangladesh Journal of Medical Science*. 2016;15:529–561.
11. Kukda N, Verma S. Correlation of Length of Index Finger (2D) to Ring Finger (4D) Ratio (2D:4D) and coronary artery disease - A Study in Male Population of South Rajasthan. *Acta Scientific Medical Sciences*. 2021;5(8):65–68.

## Author biography

Sunil Kumar, Ph. D Scholar

Sadakat Ali, Professor and Head

**Cite this article:** Kumar S, Ali S. To find 2D:4D ratio of fingers and its correlation with hypertension and its implications for risk factors in cardiovascular diseases in north Indian population. *IP Indian J Anat Surg Head, Neck Brain* 2024;10(2):40-43.