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 SUBCAPITAL - CLINICAL CORRELATION OF 2ND (INDEX) TO 4TH (RING)
 DIGIT RATIO WITH HIGH BLOOD PRESSURE AND ITS IMPLICATION FOR
CORONARY HEART DISEASE IN WEST U.P. MALES

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ABSTRACT BACKGROUND - The aim of our research work was to estimate the association with high blood pressure and the 2D : 4D ratio, and the intimation of this association with the cardiovascular problem in males living in the west of the Uttar Pradesh. As a result of exposure to prenatal sex steroids the ratio of the index finger to the ring finger of the hand is changed. **METHOD** - Three hundred adult male human subjects from the west up region served as participants in the study. The total number of subjects was divided into two groups: one group consisted of 150 west U.P males with high blood pressure (also known as hypertension), while the other group consisted of 150 west U.P. males with normal blood pressure (also known as normotensive) and served as the control group. The length of the index and ring fingers (2D:4D) was measured, and then we estimated the mean value, the standard deviation, and the p-value. **RESULT** – According to the measurements that we were taken, the results exhibit that there is a great distinction of of 2D:4D ratio with the control category and the hypertensive category, and the ratio is greater in both hands for the hypertensive group than it is for the control category. In counting to this, the ratio was found to be greater in the left hand of the hypertension group. If the p-value is < 0.05, then there is a statistically distinction positive association. **CONCLUSION** - The findings of the recent work indicate that there is a statistically great direct correlation with 2D:4D ratio and hypertension in adult males. This connection may serve as a predictor for coronary heart disorders that are connected to prenatal sex hormones. Nevertheless, additional research is required to validate these preliminary findings.

KEYWORDS : Hypertension, 2D :4D, Coronary vascular disease.

INTRODUCTION

The common occurrence of high blood pressure is steadily growing at panic cost in both industrialized and emerging nations, making it a critical problem in both the medical and public health areas^{1,2}. This is the foremost exposure for coronary disease, chronic kidney problem, and stroke is high blood pressure³. It is estimated that there are 1.1 billion people living in India, and it is expected that the common occurrence of high blood pressure would reach 34.5 percent in males and 33.5 percent in females in the next few years^{4,7}. The body mass index, weight-height ratio, and waist circumference, have been shown to have a great connection with hypertension as well as cardiovascular disorders taken by anthropometric measurements and indices⁸. According to a variety of pieces of epidemiological evidence and s2D:4D, which refers to the length of the index finger (2D) to the ring finger length (4D).

The 2D:4D ratio is the most studied digit ratio and is calculated by dividing the length of index finger of a given hand by the length of the ring finger of the same hand. These researches established a connection between the 2D:4D ratio and its relation with hypertension and cardiovascular disease. According to the findings of the studies, the ratio of men's 2D to women's 2D is higher^{9,10,11}. The human urogenital system as well as the appendicular skeleton are controlled by HOX genes.

This regular command of digit and gonad contrast shows that the creation of digits could be tied to the production of spermatozoa as well as the concentration of hormones. Recent research indicates that a persons digit ratio (2D:4D) can provide insight into whether or not they were exposed to prenatal testosterone during the second trimester of their pregnancy. If the digit proportion is low, during the gestation period the testosterone exposure is likely to be higher. This results in the ring finger being longer than the index finger. Testosterone has an effect on the development of digits as well as the dermatoglyphics of digits. As a consequence of this, the ratio of 2D to 4D correlates with the testicular activity of adults¹⁰.

There are three separate peaks that make up human perinatal testosterone production: one peak occurs mid-gestation, while the other two peaks occur postnatally. The mid-gestational peak is the one of these three different peaks that is recognized to have a substantial biological effect on causing the variations between sexes at birth. Nevertheless, there is a possibility that sex distinction will remain after

delivery¹². Still, the association with the 2D:4D ratio and hypertension, which is big consequence for cardiovascular disease, still has not been classically demonstrated in any article. According to our understanding, the effects of the 2D:4D ratio on the cardiovascular system have been demonstrated via myocardial infarction, neck circumference, and atherosclerotic formation. Therefore, the motive of the current research is to review and determine whichever there is a definite connection with the (2D:4D) finger length ratio and hypertension in the male population of the west of Uttar Pradesh.

MATERIALAND METHODS

The present research work was done in the Anatomy Department, S.N. Medical College, Agra, on 300 human male subjects: 150 with known case of hypertension and 150 without any history of hypertension (control group). The male subjects were above age of 18 yrs - 65 yrs. A well described consent in writing was taken from the subjects prior to the study. Approval of institutional Research committee and Ethical panel was taken prior to the beginning of this research work.

Excluded Criteria - subject should not have any congenital deformity, injury, inflammation, and surgery in the hand.

MEASUREMENT OF 2D: 4D- "The Index finger and ring finger length were measured from both hands. We asked the subject to put their hand on the table and the finger should be in extended position. Palm is in supine position (palm facing upward direction). We measured the length of index finger and ring finger on palmer side of the hands from the mid-point of the proximal crease to the mid-point of the tip of the finger in the both hands by using slider vernier caliper. Each finger length was measure two times".



- D = Length of ring finger (4D). Measurements were taken by the slider vernier caliper in cm.

Measurement Of Blood Pressure

The blood pressure was measured with the help of mercury sphygmomanometer and stethoscope using normal procedures. The individual was made relax and sat for at least five minutes on a chair then two reading were taken 5 minutes apart, and the average of the two reading was recorded. Blood pressure reading, medical records and family history were used to identify hypertensive patients.

Normal value of systolic and diastolic B.P is in the range of $\geq 120/80$ Prehypertensive - "systolic B.P.is 120-139 or diastolic B.P.is 81-89 mmHg

Stage -1 Hypertensive - "systolic B.P. is 140 -159 or diastolic B.P. is 90-99 mmHg'

Stage-2 Hypertensive-"systolic≥160 or diastolic≥100 mm of Hg"

The data entry was carried using Microsoft Office Excel worksheet. Data was analyzed statistically by mean ± standard deviation, independent t- test was used to calculate significant level, pearsons correlation, were used to review the connection with the 2D:4D proportion and study groups.'

RESULTS

The outcome of research indicates that there is a great distinction of 2D:4D with the control category and the hypertension category. These results are based on the measurements that were used. And as compared to the control group, the hypertension category shows a greatly higher ratio in both hands. In addition to this, the ratio was much higher in the left hand of the hypertension group (Table 1).

The results, which are dependent on the measures that were employed, indicate that there is a significant discrepancy of 2D:4D between the groups serving as a control and those with hypertension and as contrast to the control category, the hypertension category show a greatly higher ratio in both hands. In addition to this, the ratio was much higher in the left hand of the hypertension group (Table 1).

The results indicate that there is a important distinction of 2D:4D on the control group and the hypertension group. These results are based on the measurements that were used. And as compared to the control group, the hypertension group displayed a significantly higher ratio in both hands. In addition to this, the ratio was found to be greater in the left hand of the hypertension group.

Table no. 1 : Measurement of (2D :4D) ratio in study population in	n
control and hypertensive group (n = 150)	

Variables	Control (mean±SD)	Hypertensive (Mean±SD)	p-value
Age	23.33±1.56	44.33±3.11	0.00
Rt.2D	7.18±0.50	7.20±0.37	0.45
Lt.2D	7.35±0.30	7.37±0.27	0.46
Rt.4D	7.57±0.40	7.62±0.35	0.64
Lt.4D	7.61±0.42	6.68±0.24	0.24
Rt.2D:4D	0.94±0.02	0.95±0.03	0.00
Lt.2D:4D	0.95±0.01	0.96±0.05	0.00

Table no. 2: Comparison of 2D:4D ratio among groups divided according to Hypertension

Hypertension	Rt. 2D	Lt. 2D	Rt. 4D	Lt. 4D	P value	
					Rt	Lt.
					(2D:4D)	(2D:4D)
Stage 1	0.754	0.744	0.749	0.742	0.00	0.00
_	±0.034	± 0.034	± 0.034	±0.033		
Stage 2	0.864	0.867	0.857	0.862	0.00	0.00
	±0.017	± 0.011	± 0.014	±0.010		

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

DISCUSSION

A new connection with hypertension and the index finger to the ring finger length ratio is shown by the current research work (2D:4D). One of the most significant public health challenges facing developing nations like India and others is hypertension. The incidence of hypertension is significantly greater in the states located in northern India¹⁶. It is possible that the second- and fourth-digits lengths ratio, sometimes known as 2D:4D, can give a straightforward and reliable

anthropometric diagnostic of prenatal exposure to androgens¹⁷. It is currently commonly used for research on the effects of prenatal androgenic exposure in human beings. There was no evidence to suggest that the ratio of 2D to 4D had changed with increasing age10. Although the mechanisms that underlie the connection with the (2D:4D) ratio and hypertension are unknown, an imbalanced exposure of the sex hormones during the gestational period may be the primary cause. This is because during the gestational period the sex hormones can influence the variety of organ system development, including the cardiovascular system. ¹⁸Phillips, he discovered that free testosterone was strongly associated to cardiovascular disease in postmenopausal women, provided further evidence in support of this theory ¹⁹. Previous research ^{11,13} has shown that the ratio of 2D : 4D can be used as a predictor for coronary heart disorders. These earlier research indicated that "people with hypertension have a larger ratio of the length of their index finger to the length of their ring finger. Our findings confirmed these findings. In addition, araised 2D:4D ratio was discovered in the group of people with stage II hypertension, and the p - value for both the right and left hands was statistically significant. [table 2]. In the current investigation, we came to the conclusion that the 2D:4D ratio of the hypertension group's right and left hands was significantly larger than that of the control group on a statistical level (table1)". Wu Xing et al. came to a conclusion that was comparable to ours 13 .They discovered that the ratio of 2D to 4D was high in coronary artery disease in Chinese males. and Fink B et al¹⁴, who discovered definite connection with the 2D:4D ratio and neck circumference in men, point to the possibility of a propensity towards coronary heart disease (CHD). During the first 12 weeks of pregnancy, the ratio of 2D to 4D was discovered to be a useful index of both testosterone and oestrogen levels by Manning et al 11. According to the findings of their research, there is an reverse connection with the 2D:4D ratio and the age at which a man experiences his first myocardial infarction. This suggests that "men who have low 2D:4D ratios are more likely to experience their first MI later in life than men who have high 2D:4D ratios. On the other hand, Xing Liwu et al13 suggested a positive connection between 2D:4D and coronary heart disease in men. In a similar vein, Fink et al¹⁴ discovered that after accounting for body mass index, the link with the 2D:4D and neck circumference was stronger in males than it was in females".

In our study, accounting for body mass index, the link with the 2D:4D and neck circumference was stronger in males than it was in females".

CONCLUSION

The preliminary findings of the present research work indicated that a ratio of 2D:4D and hypertension in males is associated with one another and this ratio may be a predictor for coronary heart disorders that are linked to prenatal sex hormones. On the other hand, these preliminary findings need to be confirmed by further research.

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