

RATIO OF SECOND TO FOURTH DIGIT AS A PREDICTOR OF PERFORMANCE IN ELITE INDIAN VOLLEY BALL PLAYERS

Background: Digit ratio (2D:4D) is considered as a marker of prenatal androgen exposure. There are evidences showing association between sporting ability and 2D:4D ratio.

Aims & Objective: To determine the ratio of second to fourth digit in elite Indian volley ball players and compare them with controls.

Materials and Methods: Both right and left hands of 16 male volley ball players attending training camp at the Bangalore regional centre of Sports Authority of India were scanned. Lengths of second and fourth digits were measured and their ratio calculated. The values were compared with Age & BMI matched subjects (25 males) who did not participate in any sports who formed the control group.

Results: A highly significant difference was found in 2D:4D ratios of both the hands with volley ball players having a lower ratio compared to their controls. There was no statistically significant difference in 2D:4D ($\Delta r - l$) between volley ball players and controls.

Conclusion: Lower second to fourth digit ratios was found in volley ball players in comparison with the controls.

Key Words: Digit Ratio (2D:4D); Indian; Volley ball

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INTRODUCTION

Prenatal androgens are implicated in the development of behaviors showing sex differences, such that higher levels are associated with the expression of more male-typical behavior across a variety of species.^[1,2] Direct assessment of prenatal androgen levels are not available for researchers, to study the early hormonal influence on adult behavior.^[3] The length of the index finger (2D) and the length of ring finger (4D) are taken as a marker for prenatal exposure of androgen.^[4]

Scientific evidences show that sex differences in 2D:4D ratios are unaffected at puberty^[5,6] suggesting that 2D:4D ratio is established very early in life. It appears in human fetus as early as 10-40 weeks of gestation and is reportedly stable by two years of age.^[7-9] This makes 2D:4D an excellent noninvasive biomarker for prenatal androgen exposure. Digit ratio (2D:4D) is considered as a putative marker of exposure to high levels of testosterone in intrauterine life.^[10] Males tend to have a longer ring finger in comparison to women.^[4]

Possible association of 2D:4D ratios has been found with sperm count, sexual orientation, autism, age at development of myocardial infarction, age at development of breast cancer, musical ability, and different aspects of cognitive ability and personality.^[11] Sporting ability and physical fitness is also associated with 2D:4D ratios.^[12,13] Association of 2D:4D with ability in

soccer, middle distance running & athletics has been reported.^[14] In comparison to general population controls athletes have a lower 2D :4D ratio and athletes with lower ratio have better performance.^[15] Right 2D:4D ratios minus left 2D:4D ratio (D r-l) is also associated with running speed in athletes such that men with lower right than left 2D:4D ratio are faster runners than with men having lower left than right 2D:4D ratio.^[8] Low right 2D:4D and low right - left 2D:4D differences are seen to be predictors of high rugby performance.^[16] 2D:4D can be taken as a performance indicator for men across a variety of sports.^[17]

Aim of the present study was to find out the 2D:4D ratio in volleyball players in comparison with the general population.

MATERIALS AND METHODS

The study was conducted at the Bangalore regional centre of Sports Authority of India, the official organization under Ministry of Youth Affairs & Sports, Government of India which trains sportsmen for national & international competitions. The study was approved by institutional ethics committee. A written informed consent was obtained from all the participants. 16 male volleyball players participated in the study. Volleyball players in the age group of 21-28 years who were practicing regularly 30 hours/week for at least 5 years and have participated in national/international competitions formed the study

group. Age & BMI matched subjects (25 males) who did not participate in any sports formed the control group.

Both the hands of subjects were scanned with a HP scan jet scanner. Participants placed their relaxed hands slightly on the surface of the scanner with second to fifth fingers held parallel and the tip of the middle finger aligned with the wrist and elbow. Scanned hand images were scaled and later printed by a HP laser jet printer. Measurements of second and fourth fingers were taken from printouts with the use of vernier calipers (Quasmo – Range 0 – 150 mm, accuracy ± 0.05 mm). These measurements were taken from the tip of the finger to the basal crease. Where two creases were visible at the base of the digit the proximal crease was chosen.

A single reader conducted all the measurements. The 2D:4D was calculated as the length of the second digit divided by the length of the fourth digit. ($\Delta r -l$) was calculated as the difference between right and left 2D:4D.

Data obtained in this study was analyzed statistically by using SPSS V.11.0. The results are expressed as mean, standard deviation. The data was analyzed using student t test. The difference was considered statistically significant whenever $P \leq 0.05$.

RESULTS

Anthropometric parameters were similar in the study and control group (Table 1). Our study indicates a difference in the ratio of 2nd to 4th digit between volleyball players and controls both in right & left hands. (Table 2). A highly significant difference was found in 2D:4D ratios of both the hands with volleyball players having a lower ratio compared to their controls. However there was no significant difference in 2D:4D ($\Delta r -l$) between volleyball players and controls though values were lesser in right hand compared to the left in both the groups.

Table-1: Anthropometric parameters of controls and study groups

Parameters	Control	Volleyball
Number of subjects	25	16
Age (year)	22.52 ± 4.29	23.75 ± 2.59
Height (cm)	173.92 ± 4.65	191.00 ± 9.34
Weight (kg)	69.45 ± 5.39	80.62 ± 7.84
BMI (kg/m ²)	23.01 ± 2.11	22.07 ± 1.43

Data presented are Mean ± SD

Table-2: Comparison of 2D: 4D ratio of both hands between volleyball players and controls

Parameters	Volleyball (n=16)	Control (n=25)	t-value	P-value
2D:4D Right	0.9360 ± 0.0254	0.9743 ± 0.0194	-5.457	<0.001
2D:4D Left	0.9528 ± 0.0257	0.9787 ± 0.0182	-3.781	0.001
2D:4D ($\Delta r -l$)	0.0148 ± 0.017	0.0039 ± 0.018	-1.938	0.06

DISCUSSION

Results of the present study have shown that Male Volley ball players had a significantly reduced 2D:4D ratio compared to their controls. This is in consistency with other studies who have found significant negative correlations between various sports and digit ratio.

Studies done on male rowers showed a significant negative correlation between rowing performance and digit ratio. Rowing performance over 2,000 m was assessed using the Concept 2 rowing ergometer. Significant negative correlations were observed between 2,000 m ergometer performance and male digit ratios, which persisted following adjustment for rowing experience and height. This data indicates that digit ratio is a predictor of ability in rowing, a sport which requires both cardiovascular efficiency and high power output.^[18] Similar results were obtained when the relationship between directly measured 2D:4D and fastest dry slope skiing time was examined in 72 competitive skiers and controls matched for age, sex and ethnicity. In this study the low 2D:4D in men is a correlate for ability in many sports. This relationship is presumably due to influence of prenatal testosterone on development of right hemisphere and visuospatial ability.^[19] Study done in national level Indian swimmers has found a significantly lower digit ratio in males but not in females.^[20] Digit Ratio has been related to sprinting speed in boys. Running times over 50 m were positively correlated with 2D:4D in a sample of 241 boys (i.e. runners with low 2D:4D ran faster than runners with high 2D:4D). The relationship was also found for 50 m split times (at 20, 30, and 40 m) and was independent of age, BMI, and an index of maturity. However, associations between 2D:4D and sprinting speed were much weaker than those reported for endurance running suggesting that 2D:4D is a relatively weak predictor of strength and a stronger predictor of efficiency in aerobic exercise.^[21] International Rugby players had lower 2D:4D for the right and left hand compared with controls. Players with low 2D:4D in their right hand and low right 2D:4D compared with their left (right - left 2D:4D difference) had high numbers of caps. First-choice players did not differ significantly from second-choice players in their 2D:4D but they had a lower right-left 2D:4D difference than second-choice players.^[16] A lower right to left 2D:4D difference is known to be a predictor of high athletic performance in males. In the present study no significant differences are found in 2D:4D ($\Delta r -l$) between Volley ball players and controls. Our study is in contrast to the study done in male rugby

players which shows significant differences in 2D:4D (Δr -1) between rugby players and controls. This is possibly due to two reasons – Volley ball is an intermittent sport unlike Rugby which is an endurance sport and secondly, Digit ratio is known to vary among people of different ethnic groups. Indian sportsmen may have lesser levels of athletic performance compared to western counterparts though a significant negative correlation exists in digit ratios. This is evident by the relatively higher 2D:4D values obtained in our study compared to values obtained in other populations.

CONCLUSION

To conclude lower digit ratios found in Volley ball players compared to their controls confirmed the results of previous studies done in various other sports. Measurement of 2D:4D can be used to predict future potential in sport by helping to identify talented individuals at a pre-competitive stage.

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