



Original Research Article

Digit ratio (2D:4D) and performance in Indian male bodybuilders

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ABSTRACT

Background: The ratio of 2nd to 4th digit is recognized marker of prenatal androgen exposure. A few studies linked to sporting ability and 2D:4D ratio. In this study, we observed professional body builders ratio of 2nd to 4th digit in comparison with controls.

Materials and Methods: This prospective observational study was conducted in department of Physiology, Kempegowda Institute of Medical Sciences, Bengaluru, India. In this study, 37 male body builders training at various gymnasiums who have participated in various competitions at national/international level were scanned and considered as cases. The lengths of 2nd and 4th digits of two hands were measured and calculated the ratios. The obtained values compared with 50 age and BMI matched controls (50 males), without any participation in sports/athletic activities.

Results: In this study, age and height were not significant, however, weight and BMI showed significant increase in cases than controls. Significant reduction in the ratio of 2nd:4th digit left (0.95±0.03) and 2nd:4th digit right (0.95±0.02) were observed in cases than controls. The 2nd:4th digit ($\Delta r -1$) were not altered between two groups.

Conclusion: Reduced ratio of 2nd:4th digit were observed in cases than controls.

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1. Introduction

Bodybuilding is a widely practiced sport all over the world. This sport developed in the late 19th century in Europe where men simply displayed their bodies as part of demonstration of strength or before the wrestling matches. Later it developed into a full fledged sport with thousands of competitions being held worldwide every year. While few individuals practice bodybuilding as a sport, many just practice it as a hobby, for passion or even simply for show of strength. Though in recent years women have entered this field in significant numbers, it still largely remains a male dominated sport.

Athletes should be strong enough physically to succeed in their field. It was documented that the testosterone role is important in the physique development.¹ The testosterone in the fetus and adults plays a role in maintenance of sex-dependent abilities linked with male physical competitiveness.²

It has been documented that digit ratio (2nd:4th) is negatively correlated with prenatal testosterone and reduced levels were seen in males than females.^{3,4} The 2nd to 4th digit ratio is known to be less in athletes than the non-athletes. A few studies were conducted in a variety of sports and yielded conflicting results.^{5,6} However, studies reported low right 2nd:4th and low right – left 2nd:4th digit difference ($\Delta r -1$). Association of 2nd:4th digit with ability in football, and medium distance running has been documented.⁵ The same findings were also reported in rugby, football players

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etc.^{6–8} Therefore, digit ratio may serve as a predictor of ability in rowing, requires cardiovascular efficiency and high-power output.⁹

The differences in 2nd:4th digit ratios between right and left hands (D r-l) is linked 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 2nd:4th ratio.¹⁰

However, a few studies reported unchanged 2nd to 4th digit ratio in athletes compared to controls.^{11,12} In addition to this, 2nd:4th digit ratio is also known to be related to ethnicity. However, the magnitude of sex differences in 2nd:4th is similar across ethnic groups.¹³ In view of paucity information, the current study aimed to determine the ratio of 2nd to 4th digit in professional body builders in comparison with controls.

2. Materials and Methods

This prospective observational study was conducted in Department of Physiology, Kempegowda Institute of Medical Sciences, Banashankari II stage, Bengaluru, India. In this study, 37 male body builders training at various gymnasiums who have participated in various competitions at national/international level were scanned and considered as cases. The lengths of 2nd and 4th digits of two hands were measured and calculated the ratios. The obtained values compared with 50 age and BMI matched controls (50 males), without any participation in sports/athletic activities. The study protocol has been approved by institutional ethics committee and written informed consent was obtained from all the subjects. Age of the study subjects was 23–31 years and were regularly practicing 6 hours/week for a minimum duration of 2 years.

Both hands of the study subjects were scanned by using HP scanjet printer. The subjects were asked to place their hands on the surface of the scanner with 2nd to 5th fingers held parallel and the tip of the middle finger aligned with the wrist and elbow. Images were scaled, printed and measurements of 2nd and 4th digit were taken from printouts with the use of vernier calipers (Quasmo – Range 0 – 150 mm, accuracy \pm 0.05 mm). These measurements were recorded 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. All the measurements were done by a single person. The 2nd:4th digit ratio was calculated. (Δ r –l) was calculated as the difference between right and left 2nd:4th digit.

2.1. Statistical analysis

Data expressed as mean \pm SD by using student t test. The level of significance was $P < 0.05$. Data analyses was done by using SPSS, version. 18.0.

3. Results

Anthropometric parameters like height and age were insignificant in both group. Weight and BMI showed significant increase in cases than controls. However, bodybuilders had slightly better BMI and more weight than controls (Table 1).

The current study, showed a significant difference in the ratio of 2nd to 4th digit between cases and controls both in right and left hands. (Table 2). Significant difference was found in 2D:4D ratios of both the hands with body builders having a lower ratio compared to their controls. However, there was no significant difference in 2D:4D (Δ r –l) between cases and controls.

4. Discussion

Studies reported sporting ability and lower 2nd:4th digit ratios in majority of the male athletes. Professional players had significantly reduced digit ratios (derived from right and left 2D:4D) compared with controls. However, this finding is not same to all sports and is found to be vary among different sports.

Results of the current study showed that male body builders had a significantly lower 2nd:4th digit ratio in comparison with controls and this findings were similar to the previous studies.^{6,7,14} Studies conducted in sports like rugby, rowing and skiing which needs both cardiovascular efficiency and high-power output has shown a significant association between digit ratio and performance.¹⁴ Studies done in skiers reported that skiers have a significantly lower ratio compared to controls. The 2nd:4th digit ratio was positively related to skiing times⁸ Similar studies done on male rowers showed a significant negative correlation between 2,000 m ergometer performance and male digit ratios. Our previous study done in national level Indian swimmers has found a significantly lower digit ratio in males but not in females.¹⁵

In the present study, insignificant difference were found in 2D:4D (Δ r –l) between two groups. A lower right to left 2nd:4th digit difference is known to be a predictor of high athletic performance in males. This is shown in the study done in male rugby players which shows significant differences in 2D:4D (Δ r –l) between rugby players and controls.¹⁶ Body building is not an endurance sport unlike rugby and hence has not shown significance in 2D:4D (Δ r –l). Different ethnic groups shows varied digit ratio.¹⁷ This is explained by the relatively lower 2D:4D values observed in many other populations compared to our study group.

5. Conclusion

The present study may conclude that male body builders had a significantly lower 2nd:4th ratio compared to the controls. Therefore, a lower right to left 2nd:4th ratio may be a good predictor of high athletic performance in males.

Table 1: Anthropometric parameters of controls and study groups

| Parameters | Controls (n=50) Mean ± SD | Bodybuilders (n=37) Mean ± SD | P-value |
|--------------------------|---------------------------|-------------------------------|---------|
| Age (year) | 24.52 ± 5.26 | 27.41 ± 3.67 | 0.09 |
| Height (cm) | 173.52 ± 4.35 | 172.4 ± 4.34 | 0.08 |
| Weight (kg) | 67.25 ± 5.23 | 74.3 ± 3.12 | 0.04* |
| BMI (kg/m ²) | 23.11 ± 2.18 | 25.83 ± 3.56 | 0.03* |

* Significant

Table 2: Comparison of 2D:4D ratio of both hands between controls and body builders

| Parameters | Controls (n=50) Mean ± SD | Bodybuilders (n=37) Mean ± SD | t-value | P-value |
|-----------------|---------------------------|-------------------------------|---------|---------|
| 2D:4D Left | 0.97±0.03 | 0.95±0.03 | 2.602 | 0.006* |
| 2D:4D Right | 0.96±0.03 | 0.95± 0.02 | 2.831 | 0.011* |
| 2D:4D (Δ r - l) | 0.03±0.02 | 0.03±0.02 | 1.328 | 0.178 |

* Significant

6. Source of Funding

Nil.

7. Conflict of Interest

Nil.

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