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Somatotype and Body Composition of Indian Male and Female Swimmers, and their Relationship to Countermovement Jump Performance

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Resumen

Introducción: El objetivo de este estudio fue: 1) determinar las características antropométricas de los nadadores indios y 2) investigar la posible asociación entre estas características y las métricas de salto con contramovimiento. **Método:** Participaron en el estudio cuarenta y dos nadadores indios de nivel nacional (18 mujeres y 24 hombres) que compiten regularmente en competiciones nacionales y/o internacionales. Se realizaron mediciones antropométricas de masa corporal, estatura, 8 sitios de pliegues cutáneos, 3 circunferencias y 2 anchuras. También se calcularon los somatotipos, el porcentaje de grasa corporal, la masa grasa y la masa corporal magra de todos los sujetos. Se realizó una prueba CMJ para medir la altura del salto vertical, la producción de potencia máxima y la producción de potencia máxima relativa. **Resultados:** El análisis de correlación de Pearson de las variables de composición corporal y las medidas CMJ reveló una asociación negativa muy grande entre el porcentaje de grasa corporal y la altura del salto vertical (R = - 0,726; p = 0,000) y entre el porcentaje de grasa corporal y la potencia máxima relativa (R = - 0,757;p=0,000); una gran asociación negativa entre el porcentaje de grasa corporal y la potencia máxima (R = -0,577; p = 0,000) y entre la masa grasa y la potencia máxima relativa (R = -0,560, p = 0,000); una asociación moderadamente negativa entre la masa grasa y la altura del salto vertical (R = -0,490, p = 0,001); una asociación positiva muy grande entre la masa corporal magra y la potencia máxima (R = 0,862, p = 0,000); y una gran asociación positiva entre la masa corporal magra y la altura del salto vertical (R = 0,599, p = 0,000) y una gran asociación positiva entre la masa corporal magra y la potencia máxima relativa (R = 0,530, p = 0,000); y una asociación moderadamente positiva entre el IMC y la potencia máxima (R = 0,413, p = 0,007). **Conclusión:** Existen diferencias significativas en las características antropométricas al analizar las características antropométricas de los nadadores indios que podrían atribuirse a las demandas específicas de cada evento. Las características antropométricas y las diferencias en la composición corporal influyen en el rendimiento en natación y varían según el sexo, la edad y el estado de maduración. Existe una correlación positiva sólida y significativa entre la masa corporal magra y la altura del salto vertical, lo que sugiere que una mejora de la masa magra de un individuo parece tener un impacto positivo en la producción de potencia de la parte inferior del cuerpo en los nadadores. Los planes de entrenamiento individualizados que se centran en la fuerza de las extremidades inferiores tendrán un efecto potencial positivo en el rendimiento en natación.

Palabras Clave: Composición corporal, Grasa corporal %, Natación, Salto con contramovimiento.

Abstract

Introduction: The aim of this study was:1) to ascertain the anthropometric characteristics of Indian swimmers and 2) to investigate the potential association between these characteristics and countermovement jump metrics. **Method:** Forty-two national level Indian swimmers (18 females and 24 males) who regularly compete in national and/or international competitions, took part in the study. Anthropometric measurements were performed for body mass, stature, 8 skinfold sites, 3 girths, and 2 breadths. Somatotypes, body fat %, fat mass and lean body mass for all athletes were also calculated. A CMJ test was performed to measure vertical jump height, peak power output, and relative peak power output. **Results:** The Pearson correlation analysis of body composition variables and CMJ measures revealed a very large negative association between body fat percent and vertical jump height (R = - 0.726; p = 0.000) and between body fat percent and relative peak power (R = -0.757; p = 0.000); a large negative association between body fat percent and peak power (R = - 0.577; p = 0.000) and between fat mass and relative peak power (R = -0.560, p = 0.000); a moderately negative association between fat mass and vertical jump height (R = -0.490, p = 0.001); a very large positive association between lean body mass and peak power (R = 0.862, p = 0.000); and a large positive association between lean body mass and vertical jump height (R = 0.599, p = 0.000) and a large positive association between lean body mass and relative peak power (R = 0.530, p = 0.000); and a moderately positive association between BMI and peak power (R = 0.413, p = 0.007). **Conclusion:** There are significant differences in anthropometric characteristics when analyzing the anthropometric characteristics of Indian swimmers which could be attributed to the specific demands of each event. Anthropometric characteristics and body composition differences influence swim performance and vary according to gender, age and maturation status. A robust and significant positive correlation exists between lean body mass and vertical jump height suggesting that an enhancement of an individual's lean mass seems to have a positive impact on lower body power production in swimmers. Individualised training plans that focus on lower limb strength will have a potential positive effect on swim performance.

Keywords: Body Composition, Body fat %, Swimming, Countermovement Jump

Introduction

Swimming is an aquatic Olympic sport, which includes events that vary in distance (50-m to 1500-m), in time duration (21-s to 15-min), in stroke type (freestyle, backstroke, breaststroke, and butterfly stroke), and physiological demands differ from many other sports (Stager & Babington, 1997; Stanković et al., 2018). It is a highly demanding sport that requires the application of propulsive force to surmount the resistance of water (Dopsaj et al., 2020). Success and high-level performance are highly dependent on the interaction of several factors, such as: psychological factors (Smith et al., 2002); physiological factors (Lima-Borges et al., 2022); and anatomical factors (Alves et al. 2022). Energetics, kinematics, and kinetics play a major role in swimming performance (Fone & van den Tillaar, 2022), while training undergone at a younger age will highly influence the rate of growth and eventually the physical development and composition in swimmers (Pyne and Sharp, 2014; Gulati et al., 2021).

Anthropometric measurements are essential to get and better understanding of the body composition of swimmers and the utilization of factors pertaining to anthropometric measures facilitates the examination of optimal body composition for competitive swimmers across various skill sets (Jeyapal et al., 2017, Stanković et al., 2018). For instance, less body fat, wider shoulders and hips, and an extended arm span measurement is a crucial determinant for swimmers (Nevill et al., 2020; Shahidi, et al., 2023). For the longest time, it was believed that swimmers possessing higher body fat percentage would assist the buoyancy factor and enhance the swimming performance (Siders, et al., 1993). However, research in recent years has established that swimming is affected by the swimmer’s body shape, morphology, and density of the body as well as by the body position in water (Dopsaj et al., 2020). An individual's swimming performance is determined by their muscular strength, endurance, and anthropometric attributes (Keiner, M et al., 2015). To reach optimal performance, swimmers must possess a significant level of muscular power in their lower limbs.

The swimming start can be conceptualized as an explosive maneuver akin to a leap, necessitating the rapid application of substantial force (Roy et al., 2015). The presence of a robust association between muscle size and the resultant strength and power produced by muscles lends support to the notion that augmenting muscle or fat-free body mass can enhance a swimmer's ability to generate greater muscular power during specific movements. In turn, this leads to improvements in speed, agility, acceleration, and quickness, irrespective of the swimmer's age or gender (Dopsaj et al., 2020). A similar study substantiated a strong link between the anthropometric measurements of swimmers (such as height) and their recorded times (Jeyapal et al., 2017). The identification of athletes' somatotypes is a scientific approach that aids in understanding their physical capacities and the potential influence on performance, particularly in sports where body characteristics may affect biomechanics of movement and subsequent performance outcomes (Armendáriz et al., 2023; Gutnik et al., 2015; Jakovljević et al., 2022; Tóth et al., 2014). Researchers defined somatotype as a three-number system that depicts the endomorphic, mesomorphic, and ectomorphic parts of the human body in a way that always stays the same. The comprehensive examination of body composition and somatotype among Indian swimmers is an area that has not been extensively investigated. Therefore, the primary objective of the present study examines the somatotype and body composition characteristics of male and female swimmers in India and investigates the potential association between these characteristics and countermovement jump metrics.

Material and Methods

Subjects

Forty-two National level swimmers, consisting of 18 females (mean ± SD and [range]) age = 17.1 ± 3.1 [12-23] years, body mass = 58.3 ± 7.7 [48-74] kg, height = 163.5 ± 4.0 [154-171] cm, arm span = 170.7 ± 6.58 [161-184] cm) and 24 males (mean ± SD and [range]) age = 17.1 ± 3.0 [13-24] years, body mass = 65.6 ± 9.5 [49-92] kg, height = 173.4 ± 7.1 [163-184] cm, arm span = 180.1 ± 8.1 [166-193] cm) volunteered to take part in this study. Only athletes who were associated with Inspire Institute of Sport (Vidyanagar, India) and regularly compete in national and/or international competitions were eligible to take part in the study. The study was part of the general sports science provision of the Institute and all the procedures used were reviewed and approved by the local ethics committee (EC/IIS/2023/007) and conformed to the recommendations of the Declaration of Helsinki.

Anthropometric Measurements

Anthropometric measurements were performed following the protocol developed by the International Society for The Advanced of Kinanthropometry (ISAK manual 2019). Anthropometric variables collected included body mass, body stature, 8 skinfold sites (biceps, triceps, subscapular, iliac crest, supraspinale, abdominal, front thigh, and medial calf), 3 girths (upper arm flexed, upper arm relaxed, and medial calf), and 2 breadths (humeral and femoral epicondyles). Body stature was measured to the nearest 0.1 cm using a stadiometer (Holtain Ltd., Crymych, United Kingdom) and body mass to the nearest 0.1 kg using a calibrated weighing scale (Essae DS-215, Bangalore, India). Skinfold thickness was recorded to the nearest 0.2 mm at a constant pressure of 10 $g \cdot mm^{-1}$ using a calibrated Holtain skinfold caliper (Holtain Ltd., Crymych, United Kingdom). Skinfolds were measured two times at each site in a rotation system, and a third measure was taken if required. Body fat (%) was estimated using the Faulkner equation for males and females, respectively. Girths were determined to the nearest 0.1 cm using a flexible anthropometric tape (Anthroflex, Minneapolis, USA). All measurements were conducted by accredited ISAK L1 (RA) and ISAK L2 (SP) practitioners with a depth of experience in taking measures.

Skinfolds

Sum of 4 Skinfolds = triceps + subscapular + supraspinale + abdominal

Sum of 6 Skinfolds = triceps + subscapular + supraspinale + abdominal + front thigh + medial calf

Sum of 8 Skinfolds = biceps + triceps + subscapular + iliac crest + supraspinale + abdominal + front thigh + medial calf

Body Fat Percentage (Faulkner Equation)

For Males: Body Fat (%) = 0.153 (Sum of 4 Skinfolds) + 5.783

For Females: Body Fat (%) = 0.213 (Sum of 4 Skinfolds) + 7.9

Fat Mass (kg) = (Body Fat/100) X Body Weight

Lean Body Mass (kg) = Body Weight – Fat Mass

Somatotype

The Heath-Carter [1967] method was followed for somatotype rating. The following equations were used for calculating somatotype components:

$$\text{Endomorphy} = -0.7182 + 0.1451 \times \sum SF - 0.00068 \times \sum SF^2 + 0.0000014 \times \sum SF^3$$

where ∑SF = (sum of Triceps, Subscapular and Supraspinale skinfold) multiplied by (170.18/Height in cm).

$$\text{Mesomorphy} = 0.858 \times \text{Humerus breadth} + 0.601 \times \text{Femur breadth} + 0.188 \times \text{corrected Arm girth} + 0.161 \times \text{corrected Calf girth} - \text{Height} \times 0.131 + 4.5$$

Three different equations are used to calculate Ectomorphy according to the height -weight ratio (HWR):

1) If HWR is greater than or equal to 40.75 then, Ectomorphy = 0.732 × HWR − 28.58
2) If HWR is less than 40.75 and greater than 38.25 then, Ectomorphy = 0.463 × HWR − 17.63
3) If HWR is equal to or less than 38.25 then, Ectomorphy = 0.1

X-Coordinate = Ectomorphy - Endomorphy

Y-Coordinate = 2 x Mesomorphy – (Endomorphy + Ectomorphy)

Countermovement Jump (CMJ) Test

A CMJ (a vertical jump test) test was performed to measure the explosive power of the leg musculature and has been extensively used in literature (Markovic et al., 2004; Sathashivam et al., 2023). This was assessed on a force platform (FDLITE-03-94485, VALD Performance, Brisbane, Queensland, Australia) which is linked to an equipment specific data collection and analysis system (VALD Performance, ForceDecks 2.0.7594). The force desk platforms are 'zeroed,' and the athlete's weight is assessed before the test begins. Among the forty-two athletes evaluated, there were no exclusions due to poor performance or any kind of compensatory mechanism. All participants were informed about the testing procedure. Athletes were instructed to begin on the force plates by standing upright with a straight torso on the platform, as still as possible, and with weight evenly distributed across both feet. The test required athletes to place both hands on their hips and the test was repeated three times, with a 30-s rest was provided in-between each jump, as indicated by Komi and Bosco (1978). The findings from the subjects' three completed trials were compiled. Following the end of the three trials, the cumulative sum of each participant's peak power outputs was relativized to their body weight and recorded. Data were removed if there was evidence of an individual employing compensatory tactics to complete the test or if the participants did not follow the directions given. Vertical jump height, peak power output, and relative peak power output were used for subsequent analysis.

Statistical Analysis

Data are presented as the mean ± SD and the Statistical Package for the Social Sciences (SPSS), version 28, for Windows were used for analysis. Descriptive statistics were used to estimate the basic functional status of the athletes with the mean, SD, and range (minimum and maximum values) calculated for measured parameters. Correlation coefficients were calculated using Pearson product moments between body composition variables and physical performance outcomes. And a priori alpha level of 0.05 was used in determining significant relationships. Correlation coefficients were interpreted as trivial (r = 0.00 – 0.1), small (r = 0.1 – 0.3), moderate (r = 0.3 – 0.5), large (r = 0.5 – 0.70), very large (r = 0.7 – 0.9), and nearly perfect (r = 0.9 – 1.0) as recommended by Hopkins (Hopkins, 2002).

Results

Table 1 presents the descriptive statistics of basic measurements (age, height, weight, BMI), anthropometrical measurements (skinfolds, girths, breadths, corrected girths, ratios, sum of skinfolds), somatotype body components (endomorph, mesomorph, ectomorph), percent body fat, fat-mass, and lean body mass among male and female swimmers.

Table 1. Proportionality and kinanthropometric descriptive characteristics

Parameters	**Male (n = 24)**		**Female (n = 18)**	
	M (SD)	**Range**	**M (SD)**	**Range**
Basic Measurements				
Age (Years)	17.08 (2.98)	13.00 - 24.00	17.11 (3.12)	12.00 - 23.00
Height (cm)	173.43 (7.05)	159.70 - 183.70	163.52 (4.02)	154.00 - 171.00
Weight (kg)	65.60 (9.51)	49.00 - 92.20	58.33 (7.66)	47.90 - 73.80
Sitting-Height (cm)	89.35 (3.14)	79.50 - 94.10	86.38 (2.72)	80.40 - 91.30
Arm Span (cm)	180.05 (8.11)	165.50 - 192.90	170.68 (6.58)	160.60 - 183.70
Leg Length (cm)	84.08 (4.79)	71.30 - 90.40	77.14 (3.89)	67.60 - 83.10
BMI (kg/m^2)	21.74 (2.20)	18.00 - 27.41	21.81 (2.62)	17.26 - 25.94
Skinfold Thickness (mm)				

Triceps	7.26 (2.28)	4.50 - 11.50	12.46 (3.30)	7.00 - 19.40
Subscapular	9.20 (2.05)	5.90 - 13.30	11.15 (2.91)	6.00 - 16.40
Biceps	4.20 (1.43)	3.00 - 9.50	6.93 (2.68)	2.60 - 13.10
Iliac Crest	9.20 (3.80)	3.80 - 21.50	14.92 (5.44)	4.70 - 25.20
Supraspinale	7.76 (3.85)	4.25 - 22.30	10.96 (3.96)	5.00 - 19.50
Abdominal	12.29 (5.75)	5.90 - 27.00	15.76 (4.10)	8.80 - 24.00
Front Thigh	10.30 (3.98)	5.40 - 20.25	19.04 (3.66)	11.30 - 27.20
Calf	7.07 (2.28)	3.75 - 11.80	13.12 (3.56)	5.20 - 20.10
Girths (cm)				
Arm - Relaxed	24.21 (4.58)	16.00 - 31.80	24.57 (5.22)	17.00 - 32.40
Arm - Flexed	26.50 (4.43)	18.20 - 33.80	25.76 (5.63)	17.50 - 33.50
Waist	67.67 (6.29)	53.50 - 80.00	64.89 (8.09)	55.20 - 82.50
Hip	85.83 (5.14)	72.00 - 97.00	88.21 (8.38)	77.00 - 101.20
Calf	28.93 (4.86)	22.00 - 36.20	29.96 (6.40)	21.50 - 38.00
Breadths (cm)				
Humerus Breadth	6.46 (0.29)	6.00 - 7.00	5.75 (0.34)	5.00 - 6.20
Femur Breadth	9.47 (0.58)	8.60 - 11.20	8.72 (0.46)	8.10 - 9.70
Corrected Girths (cm)				
Corrected Arm	25.77 (4.46)	17.75 - 32.83	24.51 (5.57)	16.35 - 31.56
Corrected Calf	28.22 (4.84)	21.53 - 35.02	28.64 (6.30)	20.49 - 36.29
Ratios				
Waist-Hip	0.79 (0.04)	0.70 - 0.86	0.73 (0.03)	0.68 - 0.82
HWR	43.13 (1.42)	40.01 - 45.72	42.30 (1.77)	39.60 - 45.87
Arm Span to Height	1.04 (0.03)	0.99 - 1.09	1.04 (0.03)	1.00 - 1.12
Somatotype Components				
Endomorph	2.34 (0.72)	1.48 - 3.98	3.65 (1.02)	1.95 - 5.60
Mesomorph	2.40 (1.90)	-0.73 - 6.22	2.47 (2.43)	-0.91 - 5.18
Ectomorph	3.00 (1.02)	0.89 - 4.89	2.41 (1.24)	0.71 - 5.00
Sum of Skinfolds (mm)				
Sum of 4 Skinfolds	36.52 (12.42)	21.75 - 65.05	50.33 (12.84)	29.90 - 76.80
Sum of 6 Skinfolds	53.89 (17.53)	30.90 - 96.60	82.49 (18.25)	46.40 - 120.40
Sum of 8 Skinfolds	67.29 (21.84)	38.55 - 119.60	104.34 (23.68)	56.20 - 158.70
Body Fat (%)	11.37 (1.90)	9.11 - 15.74	18.62 (2.73)	14.27 - 24.26
Fat Mass (kg)	7.55 (2.19)	4.50 - 14.50	10.96 (2.59)	7.00 - 16.10
Lean Body Mass (kg)	58.05 (7.70)	44.50 - 77.70	47.37 (5.70)	40.10 - 60.20

Note: M = Mean; SD = Standard Deviation; HWR = Height Weight Ratio (cm/kg$^{1/3}$)

Table 2 presents descriptive statistics of various physical performance outcomes (vertical jump height, peak power output, and relative peak power output). A comparison between male and female gender revealed a significant difference between all the physical performance variables: vertical jump height ($p=0.000$, $\eta^2 = 0.526$), peak power output ($p=0.000$, $\eta^2 = 0.497$), and relative peak power output ($p=0.000$, $\eta^2 = 0.536$).

Table 2. Physical performance descriptive characteristics

Parameters	Male (n = 24)		Female (n = 18)	
	M (SD)	Range	M (SD)	Range
Vertical Jump Height (cm)	38.54 (6.90)[b]	29.10 - 55.00	25.91 (4.75)[a]	17.90 – 36.90
Peak Power (W)	3614.63 (735.40)[b]	2485.00 – 5329.00	2396.94 (420.04)[a]	1736.00 – 3186.00
Relative Peak Power (W/kg)	55.01 (7.45)[b]	45.68 – 76.68	41.11 (5.13)[a]	32.57 - 51.48

Note: M = Mean; SD = Standard Deviation; a, b = significantly different to male and female respectively.

Figure 1 illustrates the somatotypes of all the swimmers (both male and female), while Figure 2 illustrates the mean somatotypes of the male and female swimmers.

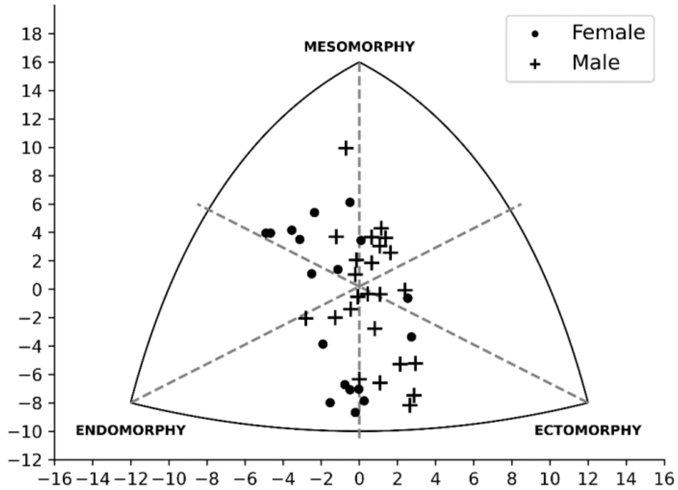

Figure 1. Somatoplot of male and female swimmers.

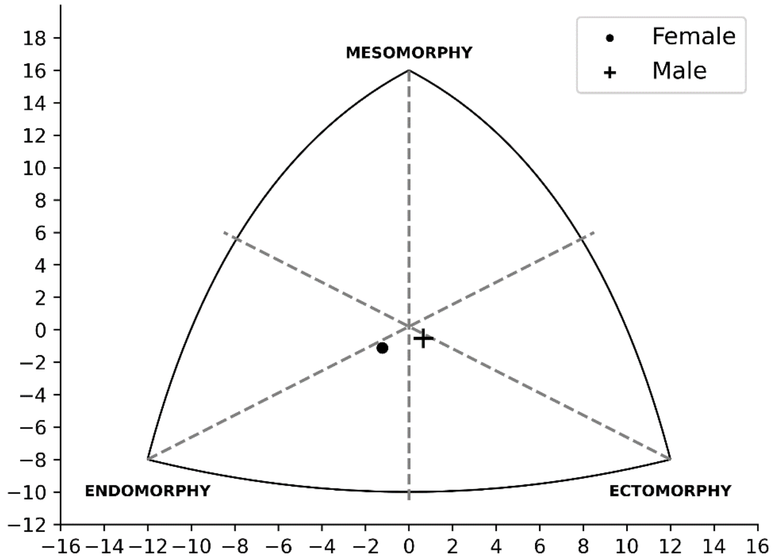

Figure 2. Somatoplot comparison between male and female

To examine the relationship between various body composition variables and physical performance outcomes, a Pearson correlation analysis was conducted. The Pearson correlation analysis of body composition variables and jump height revealed a very large negative association between body fat percent and vertical jump height (R = - 0.726, p = 0.000); a moderately negative association between fat mass and vertical jump height (R = -0.490, p = 0.001); and a large positive association between lean body mass and vertical jump height (R = 0.599, p = 0.000; Figure 3).

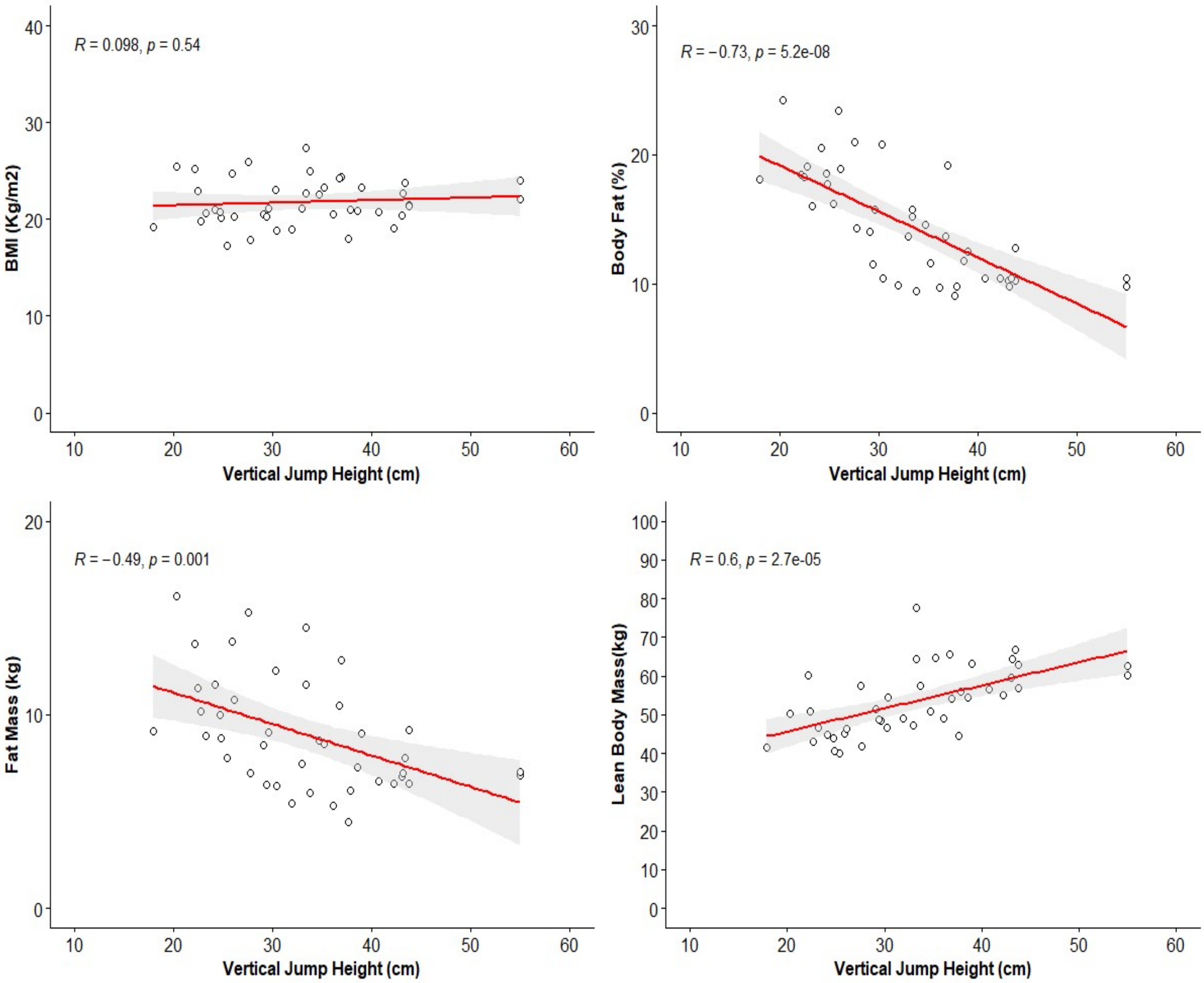

Figure 3. Pearson correlation coefficient (correlation coefficient; significance level) between body composition and vertical jump height (cm).

The Pearson correlation analysis of various body composition variables and peak power output revealed a moderately positive association between BMI and peak power (R = 0.413, p = 0.007); a large negative association between body fat percent and peak power (R = - 0.577, p = 0.000); and a very large positive association between lean body mass and peak power (R = 0.862, p = 0.000; Figure 4).

The Pearson correlation analysis of various body composition variables and relative peak power output revealed a very large negative association between body fat percent and relative peak power (R = -0.757, p = 0.000); a large negative association between fat mass and relative peak power (R = -0.560, p = 0.000); and a large positive association between lean body mass and relative peak power (R = 0.530, p = 0.000; Figure 5).

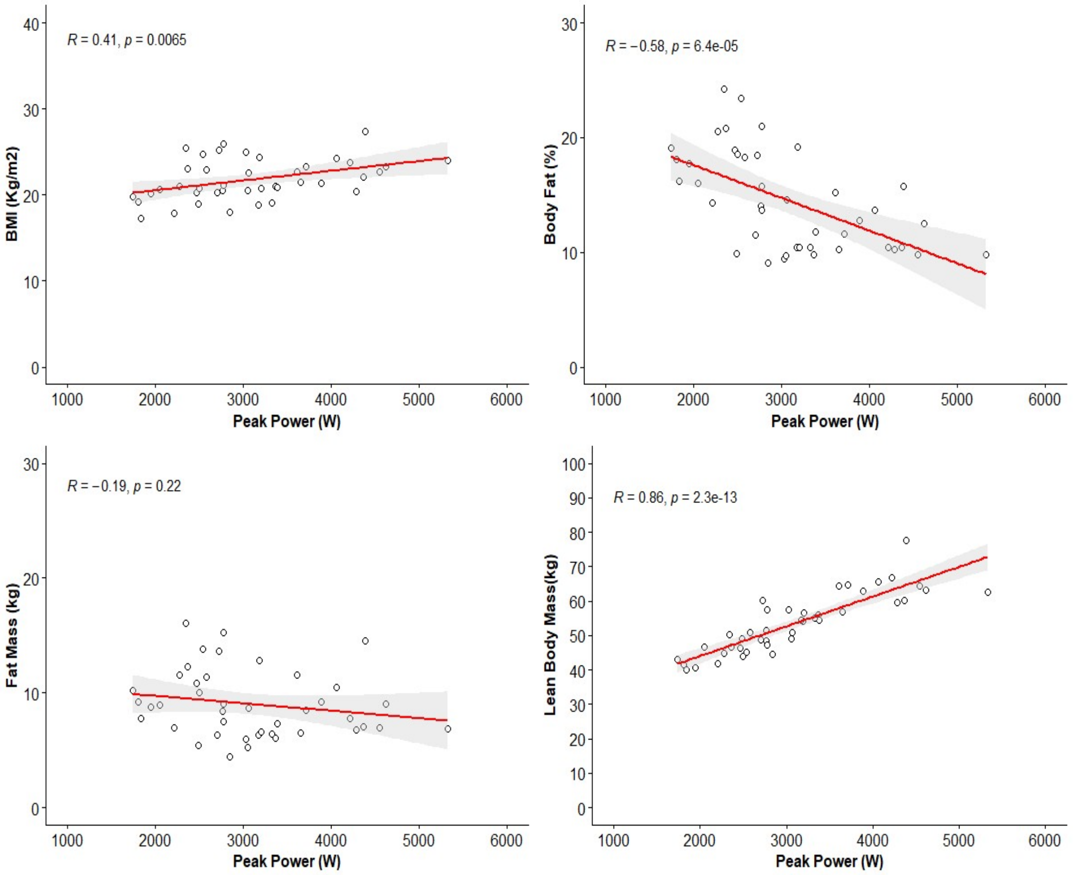

Figure 4. Pearson correlation coefficient (correlation coefficient; significance level) between body composition and peak power (N).

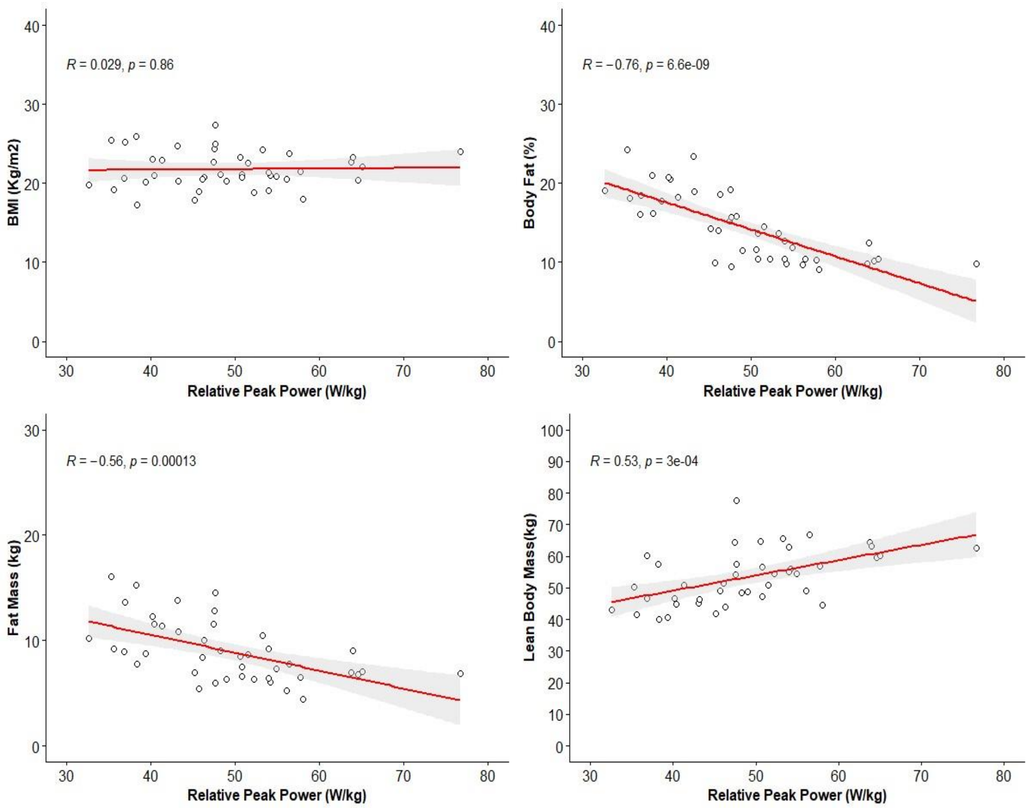

Figure 5. Pearson correlation coefficient (correlation coefficient; significance level) between body composition and relative peak power (W/kg).

Discussion

The primary aim of this study was to describe the anthropometric characteristics of Indian swimmers. Secondly, we aimed to investigate the potential association between these characteristics and countermovement jump metrics. The study provides in-depth information around the anthropometric and physical performance characteristics of male and female national-level Indian swimmers, with significant differences observed between both groups (Table 1; Figure 1, 2, 3).

It has previously been established that swimmers vary in anthropometric and performance characteristics according to levels of swim performance (Jurimae et al., 2007), status of training (Benefice et al. 1990), maturation (Richardson et al., 2000), and gender (Zuniga et al. 2011). Competing in events from a younger age is directly associated with specific body proportions and compositions of each individual and an indicator of performance (Damsgaard et al., 2001). In agreement with previous research conducted by Schneider and Meyer (2005), our cohort of male swimmers are taller, heavier, and have a greater wingspan compared to their female counterparts. These characteristics contribute to differences in performance levels observed between genders. In addition, fat mass (kg) was higher in the female swimmers compared to the male swimmers by 3.41 kg, and this has been found to have a direct correlation with level of performance (Martinez et al., 2011), and buoyancy (Zuniga et al., 2011). Although swimming performance is highly affected by and dependant on one’s ability to minimise the hydrodynamic drag and generate propulsive force that opposes displacement (Martinez et al. 2011), improvement in swimming technique and biomechanical patterns do negate negative changes in swim performance (Scorţenschi 2019). Nevertheless, anthropometric characteristics and body composition differences further influence swim performance as variables associated with cycle distance and swimming index enable a higher physical capacity to produce strength and propulsive force (Ferraz et al. 2020).

Taking into consideration anthropometric variables have shown to affect power production in male and female individuals, with differences in somatotype and body composition resulting in differences in the ability to generate force (Dokumaci et al., 2017; Latt, 2010) a range of performance variables are currently used to gain a better understanding of the effectiveness of training. Countermovement jump performance is a widely used performance parameter to assess lower limb strength and is considered as a primary factor in successful swim starts (Benjanuvatra et al., 2007; Breed et al., 2003). The present results, indicate a favourable correlation between lean body mass and all variables of CMJ performance, and align with the findings of earlier researchers ($R = 0.530 – 0.862$, $p = 0.000$). Enhancing an individual's lean mass seems to have a positive impact on lower body power production, irrespective of the relative value of fat mass. Consequently, as the mass of an individual increases, a greater amount of force and power is required to accelerate that mass. However, this increased force does not result in greater jump heights. This is since a larger individual necessitates a greater amount of force to successfully execute the jumping task (Legg et al., 2021). The distribution of adipose tissue in the body cannot be accurately predicted by body fat percentage. However, anthropometric measures of skinfolds can provide valuable insights into the distribution of body fat. Since acceleration is equal to force divided by mass, extra body fat causes an increase in body mass, which impairs athletic performance in motions requiring speed and explosive power, like jumps (Piucco & dos Santos, 2009). Lower subcutaneous adipose tissue, particularly in the trunk area, is considered a favourable component of body composition due to its reduced ballast mass (fat) that does not contribute to power generation. Therefore, it results in a reduced body mass that can be carried and enables a greater vertical velocity to be attained during jumping performance (Roschel et al., 2009).

Our findings suggest that anthropometric measurements display a significant relationship with countermovement jump performance and ultimately affect certain aspects of swim performance. Improving strength and power through specific strength and conditioning programmes that focus on loaded and unloaded vertical jumps will improve swimmers’ performance, both in tethered and in actual sprint swimming (Loturco et al., 2015). However, more research is required to continue investigating this topic to further clarify the overall impact of countermovement jump performance and anthropometric variables, and its association with swimming performance.

Conclusion

In conclusion, anthropometric characteristics and body composition differences influence swim performance and vary according to gender, age and maturation status of individuals. A robust and significant positive correlation exists between lean body mass and vertical jump height suggesting that an enhancement of an individual's lean mass seems to have a positive impact on lower body power production in swimmers.

Practical Applications

Coaches and physical trainers can use this information to design sport-specific training programs that consider the anthropometric characteristics and somatotypes of swimmers. In addition, these findings can serve as an indicator in the process of long-term athlete development processes and provide valuable insights to coaches and practitioners.

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