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UNDERSTANDING THE ROLE OF BODY COMPOSITION IN ATHLETIC PERFORMANCE: INSIGHTS FROM CRICKET FAST BOWLERS AND KABADDI RAIDERS

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ABSTRACT Body composition is crucial in athletic performance, including Cricket and Kabaddi. Skeletal muscle percentage, body fat percentage, BMI, and metabolic rate significantly impact an athlete's ability to execute rapid movements and sustain physical exertion. This study primarily examined the body composition among Cricket fast bowlers and Kabaddi raiders. For this purpose, 25 male Cricket fast bowlers and 22 male Kabaddi raiders participated in state-level inter-collegiate tournaments were selected as study samples. Their age ranged between 18 to 25 years. The body composition variables, namely percent body fat, visceral fat, subcutaneous fat (whole body, trunk, legs, arms) and skeletal muscle percentage (whole body, trunk, legs, arms), were assessed by bioelectrical impedance analysis (BIA) method. A simple correlation method was adopted to compute the interrelationship among the selected body composition variables of Cricket fast bowlers and Kabaddi raiders. The result revealed that Cricket fast bowlers and Kabaddi raiders possessed suitable ratio between shedding of fat percentage and building of the muscle mass.

KEYWORDS : Body composition, percent body fat, visceral fat, subcutaneous fat, skeletal muscle, Cricket fast bowlers and Kabaddi Raiders.

INTRODUCTION

Body composition proposes numerous insights into health, fitness, and nutritional status[1,5]. Body composition comprised of fat, muscle, bone, and other tissues that makes up the body. It often refers to percentage of total body weight that consists of percent body fat, visceral fat, subcutaneous fat and lean body mass. All humans are not born with specific genetic body type, skeletal framework, and body composition **Vertinsky, (2007)**. As a human being we ensure the optimal body composition which is not only essential for our health, and general well-being but also to ensure athlete's performance and their longevity in sport[3,6]. The need of optimum amount of body fat differs from individual to individual. It is a known fact that, too much body fat increases the health from joint problems to heart disease[5]. Body composition, size and build are the determinants to choose the sporting discipline and performance so it is essential to monitoring and sustain body composition.[12,21]

Body composition standards depend on the type of sport, physical activity and training. Type of exercise and activity differs from the nature of sports i.e. indoor and outdoor games, which can suitably modify the athlete's body composition. Athlete's output and probability of winning competitions are based on the regular monitoring and evaluation of body composition[19]. Body composition directly influences on performance before, during and after the training and competitions. Sports professionals should be aware that, time to time analysis of Body composition is needed to optimize competitive performance and the quality of the training regimens [2,3,7]. A greater percentage of muscle mass and an adequate percentage of body fat improve sports performance in multidimensional[3].

The ideal body composition should not only focus on maximizing muscle mass but also on maintaining a healthy balance between muscle mass, bone density, and body fat. An athlete performance, strength, power, and endurance are based on the skeletal muscle percentage. Excess body fat can lead to increased risk of soft tissue injuries, while lower bone density can increase the risk of fractures[11,15].

It is believed in general that a complete knowledge of body composition and muscle mass building linkage with performance of Cricket and Kabaddi players. The above knowledge enables the coaches to plan for outcome based coaching and training programme. In the recent past, few studies have been conducted to examine and identify the connection between the body composition and performance of Kabaddi and Cricket players. Studies were very minimal in examining the body composition of university level Cricket and Kabaddi players. Hence, the researchers made a fruitful attempt to determine the linkage of body composition among the Cricket fast bowlers and Kabaddi raiders as well.

Methodology

To achieve the purpose of the study, 22 Kabaddi raiders and 25 Cricket fast bowlers were selected as subjects, representing the Gandhigram Rural Institute (Deemed to be University) team. They participated in district and state-level inter-collegiate tournaments during the academic year 2024-25. The players' chronological age ranged between 18 to 25 years. The data were collected on selected body composition variables such as percent body fat, visceral fat, subcutaneous fat (whole body, trunk, legs, arms), skeletal muscle percentage (whole body, trunk, legs, arms) from Cricket fast bowlers and Kabaddi raiders. The height and weight of the players were accurately measured by a Stadiometer and weighing machine, respectively. Bioelectrical impedance analysis (BIA) was adopted to measure the body composition, i.e. percent body fat, visceral fat, subcutaneous fat and skeletal muscle percentage. A simple correlation method was applied to compute the inter-relationship between selected body composition variables of Cricket fast bowlers and Kabaddi raiders. The confidence level was fixed at 0.05 to test the significance level.

Table: I Creterion Mesures

Sl. no.	Parameters	Instrument	Unit of Measurement
1.	Height	Stadiometer	Centimeter

2.	Weight			Weighing machine	Kgs
3.	BMI			Weight (kgs) / Height (m)^2	Numbers
4.	Body composition	Subcutaneous fat	Whole body	Karada Scan (BIA Method)	%
			Trunk		%
			Arms		%
			Legs		%
		Skeletal muscle	Whole body		%
			Trunk		%
			Arms		%
			Legs		%
		Percent body fat			%
		Visceral fat			Numbers

Table: II Descriptive Statistics On Selected Variables Of Fast Bowlers And Raiders

Variables			Mean ± S.D.		Minimum		Maximum	
			Fast bowlers	Raiders	Fast bowlers	Raiders	Fast bowlers	Raiders
Height			171.3 ± 6.27	169.97 ± 21.19	159.50	78.90	185.50	185.00
Weight			60.12 ± 12.03	70.75 ± 8.48	46.30	54.10	97.50	88.00
BMI			20.9 ± 3.48	23.45 ± 2.84	14.90	18.90	28.80	29.30
Body Composition	Subcutaneous fat	Whole body	12.44 ± 3.89	12.79 ± 3.93	5.20	6.4	19.2	18.7
		Trunk	10.44 ± 3.75	11.32 ± 3.81	5.30	5.2	17.6	17.00
		Legs	18.18 ± 5.01	18.38 ± 5.37	9.30	9.6	28.10	27.3
		Arms	19.04 ± 4.46	19.35 ± 5.21	11.10	11.20	28.10	29.30
	Skeletal muscle	Whole body	35.58 ± 2.42	35.39 ± 2.52	30.70	31.20	40.00	40.40
		Trunk	29.45 ± 3.34	29.13 ± 3.51	23.00	23.70	34.70	35.60
		Legs	52.81 ± 2.31	52.55 ± 2.41	48.00	48.50	57.10	57.40
		Arms	41.66 ± 3.35	40.54 ± 2.71	36.20	37.00	52.80	48.20
	Percent body fat		17.42 ± 5.59	18.50 ± 5.33	6.60	8.80	27.40	26.50
	Visceral fat		4.56 ± 3.32	6.90 ± 2.84	1.00	2.00	13.00	12.00
N			25	22	25	22	25	22

Table: III Correlation Among Body Composition Of Cricket Fast Bowlers:

Body Composition	Percent Body Fat	Visceral Fat	Subcutaneous Fat%				Skeletal Muscle%			
			Whole Body	Trunk	Arms	Legs	Whole Body	Trunk	Arms	Legs
Percent Body Fat	1	0.873*	0.867*	0.985*	0.994*	0.996*	-0.966*	-0.987*	-0.786*	-0.963*
Visceral Fat		1	0.792*	0.919*	0.848*	0.853*	-0.873*	-0.882*	-0.767*	-0.874*
Subcutaneous Fat	Whole body		1	0.985*	0.853*	0.857*	-0.849*	-0.860*	-0.726*	-0.846*
	Trunk			1	0.978*	0.980*	-0.971*	-0.988*	-0.811*	-0.967*
	Arms				1	0.998*	-0.960*	-0.981*	-0.773*	-0.955*
	Legs					1	-0.963*	-0.984*	-0.777*	-0.958*
Skeletal Muscle	Whole body						1	0.992*	0.780*	0.985*
	Trunk							1	0.793*	0.983*
	Arms								1	0.772*
	Legs									1

*$r_{(0.05)}23 = 0.399$

From the analysis of table-III, it is understood that there is a strong positive correlation exists between the percent body fat versus visceral fat (r =0.873*) and Subcutaneous Fat% in whole body(r =0.867*), trunk (r=0.985), arms (r =0.994*) and leg(r=0.996*). Hence, the correlation is statically significant between percent body fat versus visceral fat and Subcutaneous Fat% in whole body, trunk, arms and legs. Further the correlation is negatively significant between percent body fat versus Skeletal Muscle% in whole body (r= -0.966*), trunk (r= -0.987*) arms, (r= -0.786*) and legs (r= -0.963*).

A strong and statistically significant positive correlation exists between visceral fat versus Subcutaneous Fat% in whole body (r =0.985*), trunk (r =0.853*), arms (r =0.848*) and legs (0.853*). The correlation is negatively significant between visceral fat verses skeletal Muscle% in whole body (r= -.873*), trunk (r= -0.882*), arms (r= -0.767*) and legs r= -0.874*).

A positive correlation exists between Subcutaneous Fat% in whole body versus subcutaneous Fat% in trunk(r=0.985*) Arms (r=0.853*) and legs (r=0.857*). A negative correlation is observed between Subcutaneous Fat% in whole body versus Skeletal Muscle% in whole body (r = -0.849*), trunk (r = -0.860*), arms (r = -0.726*) and legs (r = -0.846*). A strong positive correlation exists between Subcutaneous Fat% in trunk versus arms (r = 0.978*) and legs (r = 0.980*). A negative correlation is observed between Subcutaneous Fat% in trunk versus skeletal muscle in whole body (r = -0.971*), trunk (r = -0.988*), arms (r = -0.811*) and legs (r = -0.967*). A strong and statistically significant positive correlation exists between subcutaneous fat % in arms and subcutaneous fat% in legs (r = 0.998*). The correlation is significantly negative between subcutaneous fat % in arms versus skeletal muscle% in whole body (-0.960*), trunk (-0.981*), arms (-0.773*) and legs (-0.955*). A strong and negative correlation exists between subcutaneous fat % in legs versus skeletal muscle % in whole body (r= -0.963*), trunk (r= -0.984*), arms (r= -0.777*) and legs (r= -0.958).

There exists a significantly positive correlation between skeletal muscle% in whole body versus skeletal muscle% in trunk (r = 0.992*) arms (r = 0.780*) and legs (r = 0.985*). A significant and positive correlation is evident between Skeletal muscle % in trunk versus Skeletal muscle % in arms (r = 0.793*) and legs (r = 0.983*). Further, the correlation between Skeletal muscle % in arms and legs (r = 0.772*) is positive and statistically significant.

Table: IV Correlation Among Body Composition Of Kabaddi Raiders:

Body Composition		Percent Body Fat	Visceral Fat	Subcutaneous Fat				Skeletal Muscle			
				Whole Body	Trunk	Arms	Legs	Whole Body	Trunk	Arms	Legs
Percent Body Fat		1	0.860*	0.963*	0.959*	0.967*	0.909*	-0.945*	-0.959*	-0.704*	-0.943*
Visceral Fat			1	0.824*	0.839*	0.825*	0.772*	-0.813*	-0.811*	-0.709*	-0.813*
Subcutaneous Fat	Whole body			1	0.999*	0.948*	0.989*	-0.979*	-0.991*	-0.744*	-0.977*
	Trunk				1	0.949*	0.983*	-0.977*	-0.989*	-0.752*	-0.975*

	Arms					1	0.938*	-0.956*	-0.952*	-0.699*	0.956*
	Legs						1	-0.980*	-0.991*	-0.712*	0.979*
Skeletal Muscle	Whole body							1	0.996*	0.719*	1.000*
	Trunk								1	0.728*	0.995*
	Arms									1	0.719*
	Legs										1

*$r_{(0.05)}20 = 0.423$

From the analysis of table-IV, it is understood that there is a strong positive correlation exists between the percent body fat versus visceral fat (r =0.860*) and Subcutaneous Fat% in whole body (r =0.963*), trunk (r =0.959*), Arms (r =0.967*) and legs (r =0.909*). Hence, the correlation is statically significant between percent body fat versus visceral fat and Subcutaneous Fat%. Further the correlation is negatively significant between percent body fat and Skeletal Muscle% in whole body (r =0.945*), trunk (r =0.959*), arms, (r = -0.704) and legs (r = -0.943). A strong and statistically significant positive correlation exists between visceral fat versus Subcutaneous Fat % in whole body (r =0.824*), trunk (r =0.839*), arms (r =0.825*) and legs (r =0.772*). The correlation is negatively significant between visceral fat versus Skeletal Muscle% in whole body (r = -0.813*), trunk (r = -0.811*), arms, (r = -0.709*) and legs (r = -0.813*).

A strong and statistically significant positive correlation exists between Subcutaneous Fat% in whole body versus subcutaneous Fat% in trunk (r =0.999*), arms (r = 0.948) and legs (r=0.998*) and the correlation is statistically significant. Negative correlation is observed between Subcutaneous Fat% in whole body versus Skeletal Muscle% in whole body (r = -0.979*), trunk (r = -0.991*), arms (r = -0.744*) and legs (r = -0.977). A positive correlation between Subcutaneous Fat% in trunk versus Subcutaneous Fat% in arms (r = 0.949*) and legs (r = 0.983*). Negative correlation is observed between Subcutaneous Fat% in trunk versus Skeletal Muscle% in whole body (r = -0.977*), trunk (r = -0.989*), arms (r = -0.752*) and legs (r = -0.975*). A positive correlation between Subcutaneous Fat% in arms and in legs (r = 0.938*). Negative correlation is observed between Subcutaneous Fat% in arms versus Skeletal Muscle% in whole body (r = -956*), trunk (r = -952*), arms (r = -0.699*) and legs (r = -0.956*).

A strong and positive significant correlation exists between Skeletal muscle% in whole body versus in trunk (r=0.996*), Arms (r=719*) and legs (r=1.000*). A strong and positive significant correlation exists between Skeletal muscle % in trunk versus in arms (r=0.728*) and legs (r=0.995*). A strong positive significant correlation exists between Skeletal muscle % in Arms and in legs (r=0.719*).

DISCUSSION

A total of 25 Cricket fast bowlers and 22 Kabaddi raiders were investigated during the study.

Cricket Fast Bowlers

From the data analysis, fast bowlers' percent body fat, visceral fat and subcutaneous fat percentage are negatively associated with the skeletal muscle percentage. The mean value of the present study reveals that a minimal variation in height is observed between fast bowlers and raiders. Besides, the Raiders have more body weight than the fast bowlers. Fast bowlers have more muscle mass than the Raiders. This could affect the body composition of the fast bowlers and raiders. **Stretch (1987)** in his findings, provincial and international Cricketers had tall and athletic built, with explicit morphological differences among batsmen, bowlers and all-rounders. Excess fat weight makes movement inefficient and difficult. **Parihar et al., (2022)** reported that college level Cricketers in India found a mean BMI of 21.81 and a mean body fat percentage of 18.32%, according to worldwide journals. **Pote, Nicholls, king and Christie** conducted a systematic review in 2023 and came out with the information that, elite bowlers taller (185.64cm) and heavier (83.54 kg) than their batting counterparts. Whereas fast blowers height was 1.88mts and weighted around 87.9kgs **Stuelcken, Pyne and Sinclair, 2007**. A study conducted in 2020 on Physical profiling of international Cricket players in 2020 reported that, male fast bowler's average height and weight were 179.73 cm and 73.64 kgs respectively (https://www.Cricket matters.com › height-and-weight-Cricket-players**).** Skeletal muscles are crucial for fast bowlers as they enable the powerful and rapid movements needed for delivering the ball. A higher lean body mass contributes to overall fast bowling performance. Specifically, the deltoid, rotator cuff, and core muscles are essential for generating speed, maintaining accuracy, and stabilizing the body during the bowling action. The glutes and muscles in legs also play a significant role in generating power and propelling the bowler into the delivery. (https://explosivewhey.com › Fitness Nutrition). Michel Kandel (2017) and Powers & Howley (2007) mentioned the relative relationship between muscle force production and girth of the muscle. They had given an opinion to bowling and conditioning coaches that the role of lean muscle tissue in whole-body, trunk, arms and legs helps to generate higher speeds and consistent.

Kabaddi Raiders

Kabaddi is a high-intensity, combat sport that requires a combination of strength, speed, agility, and tactical intelligence. Offensive players must possess exceptional motor fitness components and muscular efficiency to escape from defenders and score a point(s). The performance of a raider(s) depends on their ability to generate explosive movements, agility and sustain anaerobic endurance throughout the game [20]. Mostly in Kabaddi, winning and losing the momentum during tie breaker and golden ride completely relay on the performance of raiders. Body compositions of the Kabaddi players differ by their playing position (**Shelke et al., 2024**). Nature of the game Kabaddi involves with fundamental motor skills like pushing, pulling, catching, jump, etc. **Dey et al., (1993)** declared that above said skills involve commendable function and body dimentions among players. **Malhotra et al., 1972, Kansal et al., 1986; Sindhu et al., 1996** suggested that different physical activities depend upon the diverse body size, shape and proportions. **Mamidi et al., 2011 and Shome et al., 2014** explained that anthropometry quantitatively assists to understand the morphology of human as accurately as possible. Offensive players in Kabaddi with higher skeletal muscle mass might have better explosive power, which is essential for initiating quick raids. Conversely, higher visceral fat levels can hinder agility and reduce endurance, making it difficult for raiders to manoeuvre efficiently and sustain performance across multiple game intervals (**Singh et al., (2021**). Present research revealed that, raiders percent body fat, visceral fat and subcutaneous fat percentage had negative association with skeletal muscle percentage which indicates, increases in shedding of fat percentage results in decline the building of skeletal muscle percentage. Present research findings are also in line with the **Busta et al., 2018** specified that, higher amount of shedding fat minimize the athletes' performance whereas, lessen the fat leads to performance enhancement. In combat sports like Kabaddi, anthropometric traits could play a vital role. Examining fat-mass and lean body mass has its own importance in sports and games. The acquaintance of link between body composition and Kabaddi performance enable the sports

scientists to customise their training plan and to enhance players' overall performance (**Parveen, et al., (2018**). The participants involved in the present study underwent their regular training programme in the early morning and late evening to develop their fitness level and to enhance their sports performance. This could have influenced the ratio of fat and muscle mass among Cricket fast bowlers and Kabaddi raiders.

CONCLUSIONS

Based on the analysis of the data, the following conclusions were drawn:

1. Fast bowlers and raiders possessed a suitable ratio between the shedding of fat percentage and building muscle mass.
2. A very high degree of association was found among the percent body fat, visceral fat, subcutaneous fat and skeletal muscle mass, except for the skeletal muscle percentage in the arms of fast bowlers and raiders.
3. Fast bowlers and raiders' building of skeletal muscle in arms was moderately associated with their percent body fat, visceral fat and subcutaneous fat.
4. Fast bowlers and Kabaddi raiders had more skeletal muscle mass than their fat percentage.
5. Kabaddi Raiders have a higher fat percentage than Cricket Fast Bowlers.
6. The sports trainers & coaches, fitness trainers and physical educationist should have insightful approach on the above said conclusions to optimize their training outcomes.

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