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Anthropometric parameters and body composition status of young sports persons in Kerala

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Abstract
This study aimed to determine the anthropometric parameters and body composition status of selected young sportspersons in Kerala. This study was conducted on 183 (94 males and 89 females) sportspersons of age group 13-23 years (18.38±2.119) from different colleges in Kerala. All the participants were assessed for height, weight, Body Mass Index (BMI), waist circumference, hip circumference, Waist-Hip Ratio (WHR) and body composition variables such as body fat percentage, water percentage, protein percentage, obesity percentage, bone mass, muscle mass, lean body mass, metabolism, visceral fat and body age. Anthropometry parameters and Body composition variables were measured using standard methods and instruments. In this study, descriptive statistics (mean, frequency, and standard deviation) and one sample t-test were used.
The results showed that the anthropometric parameters and body composition variables are statistically significant (except muscle mass) because their p-values were <0.05 and hence, the sportspersons showed good anthropometric measurements and body composition scores. In addition to developing a complete health assessment, individuals and health practitioners can monitor body fat and muscle growth to help sportspeople define exercise, diet, and lifestyle changes accordingly, allowing them to take better control of their health with a better understanding of body composition.

Keywords: Body composition - sportspeople - body fat percentage - lifestyle - anthropometry parameters

1. Introduction
Anthropometry is the study of the physical characteristics of the human body, including height, weight, body composition, and various body dimensions. Using these measurements, one can determine how athletes' physical attributes relate to their sport-specific performance. Athletes often use anthropometry parameters to evaluate their physical fitness, develop training programs, and identify their strengths and weaknesses. In order to improve performance and prevent injuries, coaches and trainers can use measurements like body fat percentage, muscle mass, and bone density.
As a result of anthropometric measurements, athletes can also be categorized based on their physical characteristics. Athletes are often divided into weight classes in sports like boxing and wrestling in order to ensure fair competition. Similarly, in track and field events, athletes are divided into different categories based on their height, weight, and other characteristics. The anthropometric evaluation of athletes' body is important in order to assess the fitness of body to a particular type of sports. Different sports have different body specifications required (like height, weight, body build, body composition etc.) which provide an extra aid to the athletes possessing ideal body structure [2]. The demands of the sport necessitate that athletes maintain standard levels of body composition. Some sports require athletes to be huge in stature, mass, or both, but others thrive when they are tiny in stature [4].
The process of breaking down the body into its fundamental parts is referred to as body composition. These measurements distinguish the body's necessary and stored fat from its fat-free mass (protein, minerals, and water in the body) [3]. Physical stress during training can cause body composition changes that can be harmful to athletes; hence athletes' long-term performance and health should be prioritized. This can be accomplished by closely monitoring body composition parameters (fat mass, fat-free mass, hydration status, and bone health), understanding the optimal physique for a specific athlete, and avoiding potentially harmful

practices that may result in excessively rapid and/or extensive changes in body composition [5]. Physical traits and body composition have been acknowledged to be important to develop and work on for gaining outstanding performance in sports and athletics. Body composition has relevance for both players and coaches since it can serve as a predictor of athletic performance. With rising body mass and fat percentage, especially when one or the other reaches extreme levels, physical performance tends to diminish.

Sport anthropometry can be used to design effective training programs to enhance the athletic performance of sportspersons by understanding their physical characteristics. Although certain athletes can tolerate greater levels of body mass and possibly percent body fat, it is generally advised that data gained from frequent body composition assessments be utilised to design training plans focused at reducing body fat while maintaining or growing lean body mass [4].

1.1 Relevance of the study

An athlete's nutritional status and the performance of a diet should be evaluated in light of its effectiveness. The key to controlling weight and adjusting body composition safely is to understand how training affects body composition.

1.2 Objectives

This study aimed to determine the anthropometric parameters and body composition status of selected young sportspersons in Kerala.

2. Methodology

2.1 Subjects

In this study, 183 sportspersons aged 13-24 (18.34±2.119) were recruited from Thiruvananthapuram district, Kerala (94 males and 89 females). Researchers explained the study's purpose to eligible participants on their first visit and allowed them to ask questions. Written informed consent was obtained from every participant before taking part in the study.

2.2 Assessment of anthropometry

The science of anthropometry seeks to understand how the human body develops over time, as well as the dimensions of the parts of the body. Measurement of human anthropometry is one of the oldest and most fundamental aspects of the sport. From these measurements, ideal body shape or composition and their physical condition can be determined [1]. The field of anthropometry is used in a wide variety of fields related to the human body and its supporting equipment. Anthropometric tools used in sports and health measurement can determine body mass index (the ratio between height and weight).

2.2.1 Height

In order to measure the subject's highest point, a measuring rod was used with a horizontal cursor. To observe the subject's posture and positioning, he must be barefoot and lightly dressed. It is important that he stand on a flat surface with his feet joined at the heels, that he stand as straight as possible, and that he position his head in such a way that his line of sight is parallel with his body. On his back, buttocks, and heels, the subject lies flat and vertically with his arms hanging freely. A movable cursor is brought into contact with the highest point of the head. The height was measured in meters ± 0.1 centimeters.

2.2.2 Weight

The body mass was measured with an Eagle balance. The subject must be able to stand upright without assistance. A body must stand still in the middle of the weighing pan with its weight evenly distributed over two feet slightly apart. Shoes should be removed and the subject should be dressed lightly. The body mass was measured in kilograms ± 100 grams.

2.2.3 BMI

In order to calculate Body Mass Index (BMI = kg/hgt m2) for each individual, body weight (in kg) was divided by height (in meters).

2.2.4 Waist Circumference

In accordance with standard procedures, an anthropometric tape was used to measure the waist circumference. The waist circumference was measured on a standing participant along the midline between the lowest border of the rib cage and the iliac crest.

2.2.5 Hip Circumference

The hip circumference was measured using an anthropometric tape following standard procedures. A measurement of the hip circumference was taken at the convex part of the hip in the standing position.

2.2.6 Waist-Hip Ratio (WHR)

In the same measurement units, waist circumference and hip circumference are divided to determine the Waist-Hip Ratio (WHR).

2.3 Determination of body composition

Body composition is measured by distinguishing fat, protein, minerals, and body fluids in order to get an idea of a person's health. As a result, it provides a better picture of overall health and describes weight more accurately than older approaches. The results of a body composition study may reveal pinpoint accuracy regarding changes in fat mass, muscle mass, and body fat percentage. It is used to improve athletic performance by athletes seeking optimal body composition. A BCA is a quick and low-cost way to determine whether routines and lifestyle habits affects body and health.

2.3.1 Body fat percentage

A major criterion for determining a person's body composition has been their percentage body fat, defined as the percentage of total weight that is fat.

2.3.2 Muscle mass

In order to maintain good health and mobility, posture, and immunity, it is important to maintain skeletal muscle mass. Muscle weight is expected to be in the body. Muscle mass consists of skeletal muscles, smooth muscles, such as heart and digestive muscles, and the water they store. Muscles consume energy by acting as engines. In addition to increasing muscle mass, the body burns energy (calories) at a faster rate, which results in a healthy weight loss and reduction of excessive body fat levels. Muscle mass can be increased while overall body weight can be increased by vigorous exercise.

2.3.4 Bone mass

A statistical computation based on skeleton size and fat free mass is used to estimate bone mineral weight.

2.3.5 Visceral fat
Visceral fat is stored inside the abdominal cavity. There are several significant organs nearby, such as the liver, stomach, and intestines.

2.3.6 Water percentage
Water in the body is divided into two categories: extracellular water (ECW) and intracellular water (ICW). For optimal health, it is essential to maintain a healthy body water balance.

2.3.7 Protein percentage
Human bodies contain 18% protein, which is essential for cell structure and function. The amount of protein in muscle cells indicates an individual's nutritional status, physical development, and health.

2.3.8 Obesity percentage
There is a difference between the actual weight and the ideal weight that indicates the degree of obesity. The degree of obesity is an indicator of obesity.

Obesity = (actual weight-ideal body weight)/ideal weight * 100%

2.3.9 Lean body mass
The term lean body mass refers to both total body water and the amount of lean mass in the body, including water, muscle, bone, connective tissue, and internal organs.

2.3.10 Metabolism
Body metabolic rate refers to the number of calories the body needs to maintain itself at the most basic level. The body burns calories even at rest by performing basic life-sustaining tasks like breathing, circulation, digestion of nutrients, cell creation, and so on. The terms basal metabolic rate and resting metabolic rate are frequently used interchangeably. At rest, BMR is the number of calories required for fundamental processes.

2.3.11 Body age
Biological age is defined as the gradual deterioration of cells and tissues in the body. It's sometimes referred to as physiological or functional age. A biological age differs from a chronological age in that it considers other factors besides the date of birth. The biological age of an individual can change depending on their lifestyle, nutrition, exercise, sleep, attitude, and stress. In some cases, this will be higher or lower than the chronological age, depending on genetic factors and lifestyle choices.

2.4 Statistical Analysis
The data was analyzed by using Mean, Standard Deviations (SD), Standard Error and two-tailed t-test. The mean nutrient intake of different foods was compared with the Recommended Dietary Allowance (RDA) using the two-tailed sample t-test. A probability value of ≤ 0.05 was considered significant. Data were analyzed using the Statistical Package of Social Sciences (SPSS) version 20.

3. Results and Discussions

3.1 Socio-demographic profile

Table 1: Socio-demographic profile of young sportspersons in Kerala

Age		
13-16 yrs.	11	6.01%
16-20 yrs.	118	64.4%
20-24 yrs.	56	30.60%
Gender		
Males	94	51.4%
Females	89	48.6%
Educational qualification		
08-10th class	3	1.63%
10-12th class	82	44.80%
Degree	97	53.0%
PG	1	0.54%
Type of family		
Joint	64	35%
Nuclear	118	64.5%
Extended	1	.5%
Area of residence		
Rural	118	64.5%
Urban	19	10.4%
Coastal	46	25.1%
Tribal	0	0%
Economic Status		
Yellow card	16	8.7%
Pink Card	114	62.3%
Blue Card	40	21.9%
White Card	13	7.1%

The socio-demographic profile of young sportsperson in Kerala is shown in Table 1. Participants in the study ranged in age from 13 to 24. In the study, 6.01% of the participants were between the ages of 13 and 16, 64.4% were between the ages of 16 and 20, and 30.60% were between the ages of 20 and 24. 51.4% were male and 48.6% were female. The

number of males was 94 and female was 89. Approximately 1.63% and 44.80% of the population attended 8-10th class and secondary schools, respectively. 53% attended Degree and 0.54% attended PG. Nuclear and joint families make up 64.5% and 35% of households, respectively. Whereas extended family adds to 5%. According to the study, 64.5% of the 183 subjects lived in rural areas, 10.4% in urban areas, and 25.1% in coastal regions. Out of 183 subjects, 8.7% belonged to yellow card category (Most economically backward section of society), 62.3% belonged to pink card category (Priority or Below Poverty Line (BPL)), 21.9% blue card category (Non - Priority subsidy or Above Poverty Line (APL)) and only 7.1% fall into white card category (Non - Priority).

3.2 Personal/Sports profile

Table 2: Personal/Sports profile of young sportspersons in Kerala

Parameters	Total number	Percentage
Sports Specialization		
Cricket	10	5.5
Wrestling	2	1.1
Archery	2	1.1
Football	117	63.9
Wushu	1	.5
Handball	6	3.3
Hockey	1	.5
Netball	2	1.1
Kho-Kho	7	3.8
Athletics	21	11.5
Karate	6	3.3
Decathlon	1	.5
Judo	6	3.3
Kabbadi	1	.5
Level of Participation		
School	55	30.1
Inter-collegiate	7	3.8
s-district	3	1.6
District	18	9.8
State	57	31.1
Revenue	4	2.2
South	1	.5
National	37	20.2
Khelo-India	1	.5
Nutrition Class		
Yes	68	37.2
No	115	62.8
Special Diet		
Yes	24	13.1
No	159	86.8
Sleep		
4-6 hrs	9	4.9
6-8 hrs	85	46.4
8-10 hrs	80	43.7
10-12 hrs	9	4.8

The personal/sports profile of young sportsperson in Kerala is shown in Table 2. Participants in the study specialized in Cricket (5.5%), Wrestling (1.1%), Archery (1.1%), Football (63.9%), Wushu (.5%), Handball (3.3%), Hockey (0.5%), Netball (1.1%), Kho-Kho (3.8%), Athletics (11.5%), Karate (3.3%), Decathlon (.5%), Judo (3.3%) and Kabbadi (.5%). The study involved 30.1% of participants had school level of participation, 3.8% had inter-collegiate, 1.6% had s-district, 9.8% had district, 31.1% had state level, 2.2% had revenue, .5% had south, 20.2% had national level and .5% had Khelo-India level of participation. 37.2% of participants attended nutrition class and 62.8% of them were not. The study found that 13.1% of the 183 subjects had special diet and 86.8% of them did not have special diet. Out of 183 subjects, 4.9% of them slept for 4-6 hours per day, 46.4% slept for 6-8 hours per day, 43.7% slept for 8-10 hours per day and 4.8% slept >10 per day.

3.3 Body Mass Index (BMI)

Table 3: Body Mass Index (BMI) of young sportspersons in Kerala

BMI	Number	Percentage
<18.5 - Underweight	27	14.75
18.5-22.9 – Normal	113	61.74
23-24.9 - Overweight	23	12.56
25-29.9 – Pre-Obese	16	8.74
≥30 – Obese 30-40 - Obese Type 1	4	2.18

Table 3 presents the distribution of these players according to their BMI classification. The majority (61.74%) were in the normal category while 14.75% were in the underweight category. There were also 12.56% and 8.74% of overweight and obese players, respectively. 2.18% of them fit into the category of obese Type I.

3.4 Waist-Hip Ratio (WHR)

Table 4: Waist-Hip Ratio (WHR) of young sportspersons in Kerala: Male

Waist-Hip Ratio (WHR)	Excellent <0.85	Good 0.85-0.89	Average 0.90-0.95	At Risk ≥0.95
Male	34	15	18	27

Table 4 presents the Waist-Hip Ratio (WHR) of male sportspersons in Kerala. The majority (34%) of them were in excellent category, 15% of them in good category, 18% in average category and 27% were in risk category

Table 5: Waist-Hip Ratio (WHR) of young sportspersons in Kerala: Female

Waist-Hip Ratio (WHR)	Excellent <0.85	Good 0.85-0.89	Average 0.90-0.95	At Risk ≥0.95
Female	5	1	42	41

Table 5 presents the Waist-Hip Ratio (WHR) of female sportspersons in Kerala. The majority (5%) of them were in excellent category, 1% of them in good category, 42% in average category and 41% were in risk category

3.5 Body Fat Percentage

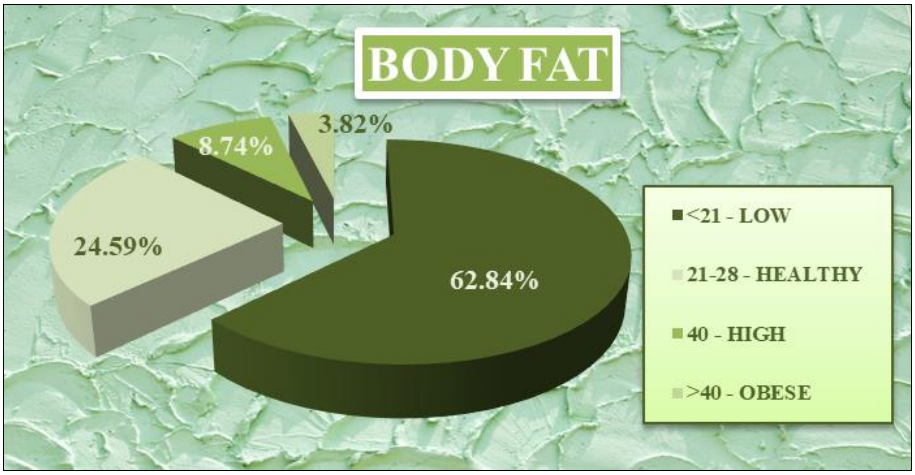

Fig 1: Body fat percentage distribution of young sportspersons in Kerala

3.5 Muscle Mass

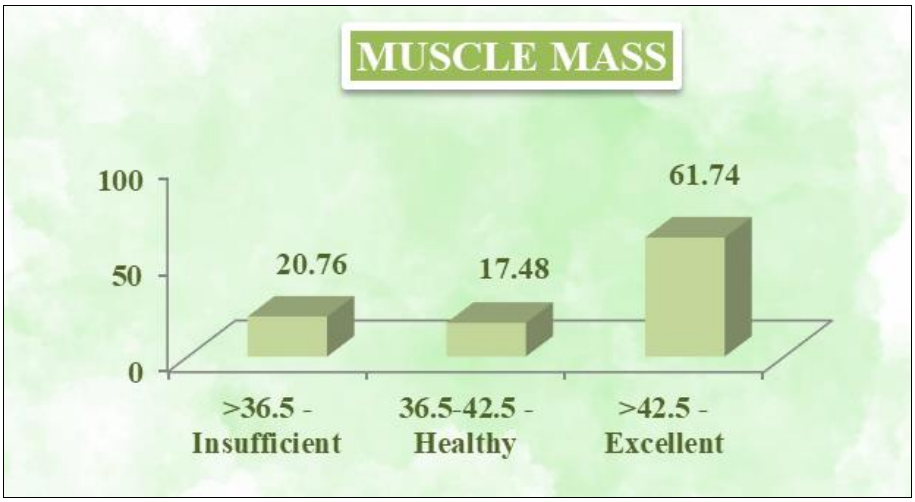

Fig 2: Muscle mass distribution of young sportspersons in Kerala

3.6 Water Percentage

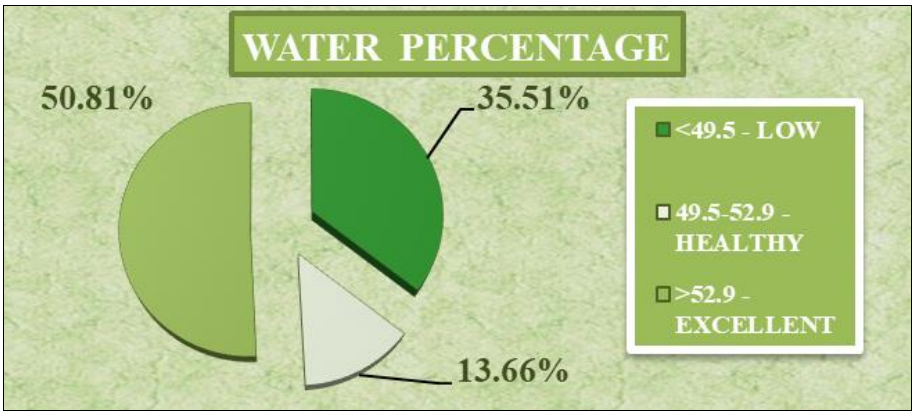

Fig 3: Water percentage distribution of young sportspersons in Kerala

3.7 Bone Mass

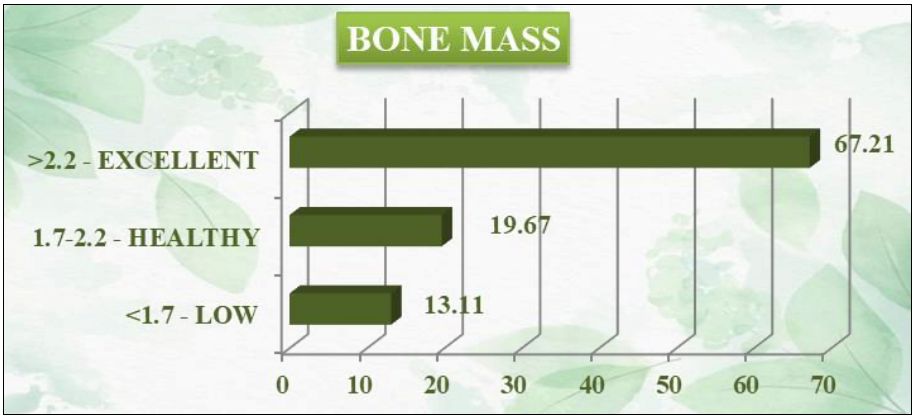

Fig 4: Bone mass distribution of young sportspersons in Kerala

3.8 Metabolism

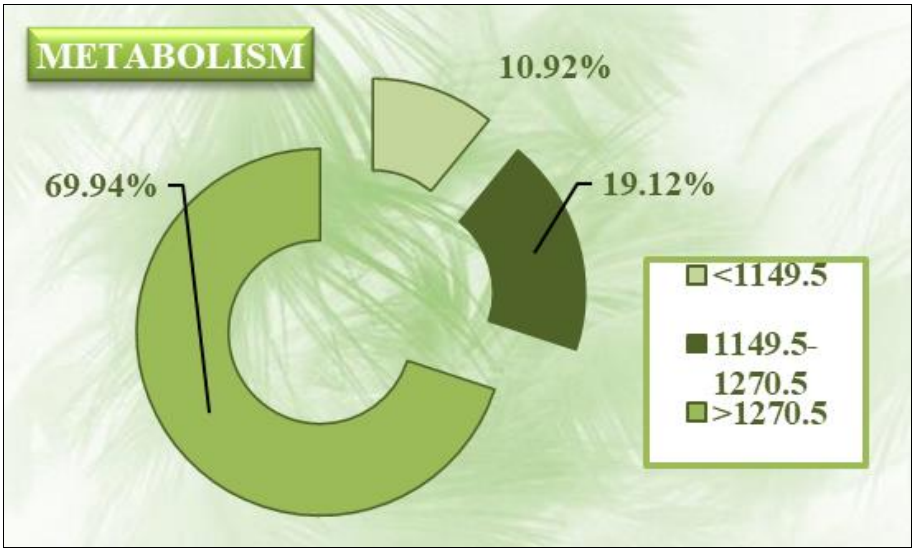

Fig 5: Metabolism distribution of young sportspersons in Kerala

3.9 Protein Percentage

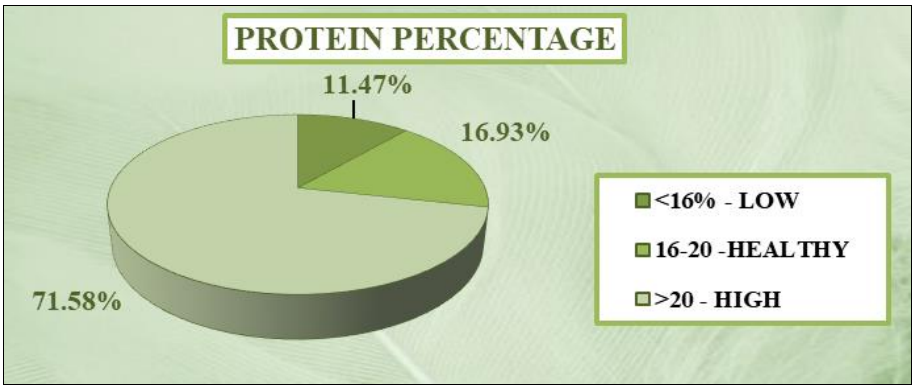

Fig 6: Protein Percentage distribution of young sportspersons in Kerala

3.10 Obesity Percentage

Table 6: Obesity Percentage of young sportspersons in Kerala

Obesity Percentage	Number	Frequency
<10% - Healthy	147	80.32
10-20% - Overweight	19	10.38
20-30% - Mildy	13	7.10
30-50% - Moderate	1	0.54
>50% - Severe	3	1.63

The distribution of obesity percentages is shown in Table 6. There was 80.32% in the healthy category and 10.38% in the overweight category. There were also 7.10% and 0.54% in the mild and moderate categories, respectively. There was 1.63% who fell into the category of extreme.

3.11 Visceral Fat

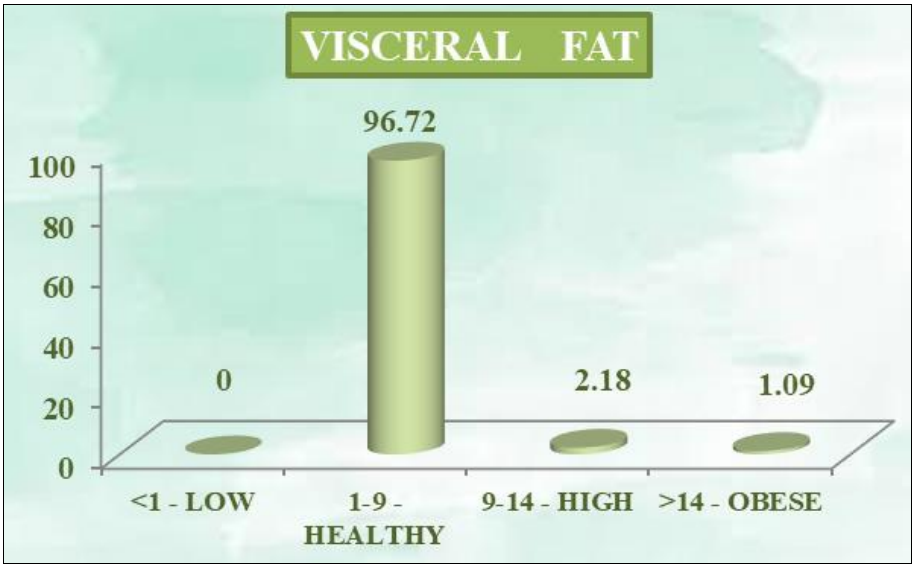

Fig 6: Visceral fat distribution of young sportspersons in Kerala

Table 7: Anthropometric Parameters of Sports Professionals

Anthropometric Parameters	Sports Professionals (N=183)	Normal Range	T Value	P Value
Height	1.63±.149	1.60	3.151	.002
Weight Body	57.50±10.57	55	3.208	.002
Mass Index (BMI)	21.22±3.64	22.9	-6.233	.000
Waist Circumference (WC)	75.98±9.84	90	-19.27	.000
Hip Circumference (HC)	86.60±8.81	90	-5.221	.000
Waist-Hip Ratio (WHR)	.87±.110	0.85	3.563	.000

An Independent sample t-test was used to analyze anthropometry parameters; the mean height was found to be 1.63±.149 (t=3.151, p=.002), were statistically significant. The mean weight was found to be 57.50±10.57 (t=3.208, p=0.002) and statistically significant. The mean Body Mass Index (BMI) was 21.22±3.64 (t=-6.233, p=.000); statistically significant. The mean waist circumference was 75.98±9.84 (t=-19.27, p=0.000) was statistically significant. The mean hip circumference was 86.60±8.81 (t=-5.221, p=0.000) was statistically significant. The mean Waist-Hip Ratio (WHR) was .87±.110 (t=3.563, p=0.000) was statistically significant.

Table 8: Body Composition variables of Sports Professionals

Body composition variables	Sports Professionals (N=183)	Normal Range	T Value	P Value
Body Fat Percentage	18.90±9.72	28	-12.648	.000
Muscle Mass	46.64±30.50	42.5	1.839	.068
Visceral Fat	2.88±2.28	5	-12.546	.000
Lean Body Mass	46.95±8.08	50	-5.092	.000
Water Percentage	51.21±8.23	53	-2.927	.004
Bone Mass	2.29±.56	2.2	2.317	.022
Metabolism	1397.04±192.91	1150	17.323	.000
Protein Percentage	21.55±4.27	20	4.920	.000
Obesity Percentage	-.714±16.52	10	-8.768	.000
Body Age	19.38±3.51	20	-2.374	.019

An Independent sample t-test was used to analyze body composition variables; body fat percentage (t=-12.648, p=.000) was within acceptable ranges and were statistically significant. The mean muscle mass was found to be above the acceptable range (t= 1.839, p=0.068) and not statistically significant. Mean visceral fat (t=-12.546 p=.000); statistically significant. The mean lean body mass (t=-5.092, p=0.000) was statistically significant. The mean water percentage (t=-2.927, p=0.004) was statistically significant. The mean bone mass (t=2.2, p=0.022) was statistically significant. The mean metabolism was found to be above the acceptable range (t= 17.323, p=0.000) and statistically significant. Mean protein percentage (t=4.920, p=.000); statistically significant. Mean obesity percentage (t=-8.768 p=.000); statistically significant.

4. Summary and Conclusions

According to anthropometric measurements, Body Mass Index (BMI), Waist Circumference, and Hip Circumference were less than the normal range, while Height, Weight, and Waist-Hip Ratio (WHR) were above the normal range (statistically significant). The body composition parameters such as body fat percentage, visceral fat percentage, lean body mass, water percentage, bone mass, obesity percentage, and age appear to be below the normal range, statistically significant. In contrast, muscle mass (not significant), metabolism, and protein percentage are above the normal range.

The results showed that the anthropometric parameters and body composition variables are statistically significant (except muscle mass) because their p-values were <0.05 and hence, the sportspersons showed good anthropometric measurements and body composition scores.

Performance in sports and activities is directly influenced by

body composition and physique. Sportspeople can use their body composition to determine their optimal competitive body weight, assess their health, and monitor their training effects. In order to maintain a high level of performance, players need to keep an eye on their anthropometric parameters and body composition status.

Health practitioners and individuals can take better control of their health by performing a comprehensive health assessment, tracking body fat and muscle growth, and making appropriate changes to their diet, exercise, and lifestyle.

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