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# A COMPARATIVE STUDY OF BODY COMPOSITION ON SPORTSPERSONS AND SEDENTARY LIFESTYLE MEDICAL STUDENTS: A CROSS-SECTIONAL STUDY

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## ABSTRACT

**Background:** Body composition is an important determinant of physical fitness, athletic performance, and overall health. Regular sports participation is associated with greater lean body mass and lower body fat, whereas sedentary behaviour, common among medical students due to academic demands, may adversely affect body composition. This study compared the body composition of sportspersons and sedentary medical students. Methods: A comparative cross-sectional study was conducted among 160 participants aged 18–25 years, including 80 sportspersons and 80 sedentary medical students. Anthropometric and body composition parameters were measured using a Bioelectrical Impedance Analyser (INBODY 370S). Data were analysed using the independent Student's t-test, with $p < 0.05$ considered statistically significant. **Results:** Mean height was comparable between the groups. Sportspersons had significantly lower body weight and a normal mean BMI (22.60 ± 0.88 kg/m²) compared with the sedentary group (25.23 ± 3.00 kg/m²; $p = 0.0001$). They also exhibited significantly higher Total Body Water, Total Muscle Protein, and Skeletal Muscle Mass, while Body Fat Mass was markedly lower (10.91 ± 2.10 kg vs. 22.30 ± 5.90 kg; $p = 0.0001$). These findings indicate a more favourable body composition among physically active individuals. **Conclusion:** Regular sports participation is associated with greater lean mass and lower body fat compared with a sedentary lifestyle. Incorporating structured physical activity into medical education may improve body composition and help prevent lifestyle-related diseases in young adults.

**KEYWORDS :** Body composition, sportspersons, sedentary lifestyle, medical students, bioelectrical impedance analysis, body mass index.

## INRODUCTION

Human health and physiological function are fundamentally determined by physical activity. The World Health Organization (WHO) defines physical exercise as any skeletal muscle movement that increases energy expenditure above resting levels and is necessary for preserving social, mental, and physical well-being. By enhancing cardiovascular fitness, muscular strength, metabolic efficiency, and general physical performance, regular exercise—including aerobic, muscle-strengthening, bone-strengthening, and flexibility exercises—produces favourable physiological responses. On the other hand, urbanization, reliance on technology, extended academic obligations, and decreased engagement in leisure activities have all contributed to the rise in sedentary behaviour among young adults. Due to their rigorous academic schedules, extended screen time, erratic lifestyle choices, and psychological stress, medical students are especially susceptible to physical inactivity.

The relative amounts of skeletal muscle, body water, bone tissue, fat mass, and fat-free mass within the body are referred to as body composition. Compared to body weight or body mass index (BMI) alone, it offers a more accurate evaluation of metabolic health, physical fitness, and nutritional status. Insulin resistance, persistent low-grade inflammation, compromised respiratory mechanics, and an elevated risk of metabolic and cardiovascular disorders are all linked to increased adiposity, especially visceral fat accumulation. On the other hand, increased skeletal muscle mass enhances lipid oxidation, glucose consumption, resting metabolic rate, and physical performance. Lean body mass and physiological efficiency can also be determined by total body water and protein mass.

Participating in sports on a regular basis improves body composition by increasing skeletal muscle mass, decreasing body fat, boosting metabolic efficiency, and improving hydration. Improved strength, endurance, respiratory muscle function, and general athletic performance are all facilitated by these adaptations. Sedentary behaviour, on the other hand, has a negative impact on physical fitness and long-term health due to decreased energy expenditure, muscular atrophy, impaired mitochondrial function, and body fat accumulation. Bioelectrical impedance analysis has become a dependable, non-invasive technique for thorough body composition assessment in both clinical and athletic settings because BMI is unable to differentiate between fat mass and lean body mass.

Despite having sufficient health awareness, medical students are a special demographic where academic stress and physical inactivity may have a detrimental impact on body composition. Thus, the goal of the current study was to evaluate body composition measures between medical students (18–25 years old) who lead sedentary lifestyles and athletes. It was predicted that compared to inactive medical students, athletes would have far less body fat and more lean body mass. The results of this study may offer proof in favour of encouraging young individuals to engage in regular physical exercise in order to enhance their health and lessen the burden of lifestyle-related illnesses in the future.

## MATERIAL AND METHODS

The study was designed as a comparative cross-sectional analytical study to evaluate differences in body composition between sportspersons and sedentary lifestyle medical students.

The study was conducted in the Department of Physiology, M.L.N. Medical College, Prayagraj, with support from local sports institutions. Body composition was assessed using validated bioelectrical impedance (INBODY 370S) and anthropometric instruments. Data collection was completed over 11 months.

The study population consisted of 160 participants aged 18–25 years, including 80 sportspersons engaged in regular organized sports and 80 sedentary undergraduate medical students. The sample size was calculated using an independent two-sample *t*-test with an effect size of 0.45, 80% statistical power, and a 5% level of significance, yielding a minimum requirement of 156 participants; therefore, 160 participants were enrolled.

Participants were included if they were healthy adults who provided written informed consent. Sportspersons had participated in organized sports for at least one year and achieved at least 150 minutes of moderate-to-vigorous physical activity per week, whereas sedentary medical students had no organized sports participation and demonstrated low physical activity levels. Individuals with chronic respiratory or cardiovascular diseases, neurological or psychiatric disorders, smoking history, severe obesity (BMI ≥40 kg/m²), recent respiratory infection, or medications affecting respiratory or cognitive function were excluded to minimize confounding factors.

The independent variable was the level of physical activity (sportsperson versus sedentary lifestyle), while the dependent variables included anthropometric measurements, body composition. Anthropometric parameters comprised age, height, weight, and BMI. Body composition variables measured by bioelectrical impedance analysis (INBODY 370S) included skeletal muscle mass, body fat mass, total body water, and total muscle protein, providing a comprehensive assessment of physiological status beyond BMI alone. These variables were selected to investigate the influence of regular sports participation on physical health and functional performance in young adults.

Data were analysed using appropriate descriptive and inferential statistical methods. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD). The arithmetic mean was used as the measure of central tendency and standard deviation as the measure of dispersion.

Comparisons between sportspersons and sedentary lifestyle medical students were performed using the independent (unpaired) Student's *t*-test for continuous variables. Statistical significance was considered at a *P* value of <0.05. Data analysis was carried out using appropriate statistical software.

The study protocol was approved by the Institutional Ethics Committee before commencement of the study. Written informed consent was obtained from all participants after explaining the purpose and procedures of the research. Participation was voluntary, and confidentiality of participant information was strictly maintained. Participants were informed of their right to withdraw from the study at any stage without any consequences. The study involved no invasive procedures and adhered to the ethical principles of beneficence, non-maleficence, and respect for participant autonomy. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki for research involving human participants.

## OBSERVATION AND RESULTS

**Table 1** ***Demographic distribution of Case and Control groups.***

| | Parameter | Mean | SD | t- value | p- value |
|---|---|---|---|---|---|
| Sportsperson | Height | 171.40 | 4.00 | 383.26 | 0.0001 |
| | Weight | 66.5 | 4.83 | 123.14 | 0.0001 |
| | BMI | 22.60 | 0.88 | 229.70 | 0.0001 |
| Control | Height | 171.50 | 6.53 | 234.90 | 0.0001 |
| | Weight | 74.30 | 10.70 | 62.10 | 0.0001 |
| | BMI | 25.23 | 3.00 | 75.22 | 0.0001 |

The anthropometric profiles of the sportsperson and control groups were evaluated to establish baseline physical characteristics (Table 1). The mean height of the sportspersons was 171.40 ± 4.00 cm, which was nearly identical to the control group's mean height of 171.50 ± 6.53 cm (p = 0.0001). Despite this similarity in stature, significant variations were observed in total body weight and Body Mass Index (BMI). Sportspeople had a considerably lower mean body weight of 66.50 ± 4.83 kg than the control group, which was 74.30 ± 10.70 kg (t = 123.14, p = 0.0001). The sportsperson group had a computed BMI of 22.60 ± 0.88 kg/m², indicating normal weight. In contrast, the control group had a mean BMI of 25.23 ± 3.00 kg/m² (t = 75.22, p = 0.0001). All evaluated anthropometric variables showed strong statistical significance, indicating a clear physical difference between the active and sedentary groups.

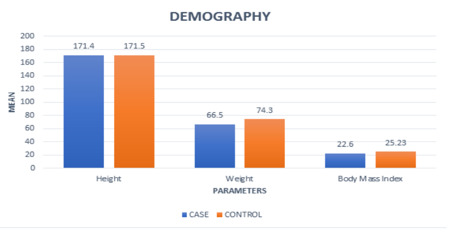


**Figure 1** ***Demographic distribution of Case and Control groups.***

**Table 2: Comparison of Body Composition parameters in Case and Control groups.**

| PARAMETERS | Sportspersons | | Control | | t-value | p-value |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| TBW | 38.67 | 3.6 | 35.24 | 4.50 | 5.32 | 0.0001 |
| TMP | 10.65 | 0.92 | 8.98 | 1.18 | 9.98 | 0.0001 |
| SMM | 30.26 | 3.18 | 26.60 | 3.62 | 6.79 | 0.0001 |
| BFM | 10.91 | 2.1 | 22.30 | 5.90 | 16.26 | 0.0001 |

The sportsperson cohort exhibited superior markers for lean body mass. Total Body Water was significantly higher in athletes (38.67 ± 3.60) compared to controls (35.24 ± 4.50; *t* = 5.32). Similarly, markers of muscular development showed substantial elevations in the active group: Total Muscle Protein averaged 10.65 ± 0.92 versus 8.98 ± 1.18 in the control group (*t* = 9.98), and Skeletal Muscle Mass was recorded at 30.26 ± 3.18 compared to 26.60 ± 3.62 in the sedentary cohort (*t* = 6.79). Conversely, the most dramatic variance between the two populations was observed in adiposity. The sedentary control group carried more than double the Body Fat Mass (22.30 ± 5.90) compared to the sportspersons (10.91 ± 2.10), yielding a remarkably high *t*-value of 16.26.

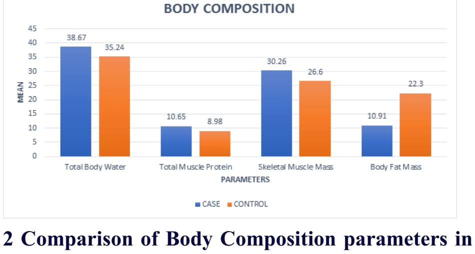


**Figure 2 Comparison of Body Composition parameters in Case and Control groups.**

## DISCUSSION

The sportsperson cohort exhibited a tightly clustered BMI (SD = 0.88 kg/m²), indicating that regular engagement in structured training regimens promotes a consistently lean and metabolically efficient physique. The control group, largely composed of medical students subject to prolonged sitting and high academic workloads, demonstrated significant weight gain and broader physical variance (SD = 10.70 kg). The transition of the control group's mean BMI across the 25.0 kg/m² threshold highlights a concerning shift toward overweight status, which is a recognized precursor to metabolic dysfunction and lifestyle-related diseases.

Overall, the highly significant statistical metrics (*p* = 0.0001) associated with these parameters confirm that the absence of regular physical exercise leads to detrimental shifts in body composition, whereas daily sports participation serves as a critical mechanism for maintaining optimal anthropometric health in young adults.

The anthropometric findings of this study robustly corroborate the well-documented inverse relationship between regular sports participation and excessive body mass accumulation (Rankinen & Bouchard, 2008). Because the average heights of the two cohorts were virtually identical, the elevated weight and BMI observed in the control group can be confidently attributed to increased adiposity resulting from physical inactivity and hereditary/lifestyle interactions (Bouchard, 1991).

The sportsperson cohort exhibited a tightly clustered BMI, indicating that regular engagement in structured training regimens promotes a consistently lean and metabolically efficient physique. Conversely, the transition of the control group's mean BMI across the 25.0 kg/m² threshold highlights a concerning shift toward overweight status. This sedentary-driven transition is a heavily recognized precursor to metabolic dysfunction, lifestyle-related diseases, and broader all-cause mortality risks over a patient's lifespan (Blair, 1989).

The simultaneous elevation of SMM, TMP, and TBW in the sportsperson group is a direct reflection of exercise-induced muscular hypertrophy. Skeletal muscle tissue is highly metabolically active and consists of approximately 70-75% water. Therefore, the significantly higher Total Body Water observed in the active group is an expected physiological corollary to their elevated Skeletal Muscle Mass and Total Muscle Protein. The tight standard deviations across these parameters in the active group (e.g., TMP SD = 0.92) further indicate that regular physical training reliably normalizes protein synthesis and muscle mass across the athletic population.

The disparity in Body Fat Mass is the most critical finding regarding metabolic health risks. The sportspersons maintained a highly constrained and low body fat profile (SD = 2.10). In stark contrast, the control group not only exhibited a mean fat mass twice as high as the athletes, but also demonstrated a much wider standard deviation (SD = 5.90). This massive variance indicates that a sedentary lifestyle—likely compounded by the academic stresses of the medical students comprising the control group—leads to unpredictable and detrimental fat deposition.

The exceptionally high *t*-value (16.26) associated with body fat mass confirms that physical inactivity is a primary driver of adiposity. These specific structural differences—diminished muscle protein paired with elevated fat mass—are recognized clinical precursors to reduced metabolic efficiency, insulin resistance, and long-

The structural differences identified in this study—diminished muscle protein paired with heavily elevated fat mass in the control group—are highly concerning from a clinical perspective. Physical inactivity and the subsequent accumulation of body fat are well-documented primary drivers of reduced metabolic efficiency, systemic inflammation, and eventual insulin resistance (Bouchard, 1991). Conversely, the sportspersons' profile demonstrates how daily physical activity acts as a protective mechanism, actively maximizing the metabolically active tissue required to maintain long-term physiological health and mitigate the risk of lifestyle-related diseases (Blair, 1989).

## CONCLUSION

This study concludes that sportspersons possess a highly favourable body composition profile characterized by greater skeletal muscle mass, increased muscle protein, optimal hydration, and significantly reduced body fat mass compared to sedentary medical students. The lack of structured physical activity in medical education environments actively contributes to unfavourable physiological shifts, including increased adiposity. Incorporating mandatory physical fitness programs into academic schedules is highly recommended to improve overall health and prevent lifestyle-related diseases in young adults.

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