Relationship Between Serum Creatinine Levels and Body Mass Index Among Physical Education Students

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ABSTRACT:

The study investigates the relationship between serum creatinine levels and Body Mass Index (BMI) among physical education students engaged in cross–country training at Bangalore University. A total of ten students (five males and five females) participated. Data were collected for serum creatinine levels and BMI, analyzed using descriptive statistics and Pearson's correlation. Results indicated that males exhibited higher mean values for both BMI and serum creatinine compared to females, reflecting natural physiological differences in muscle mass and body composition. A moderate positive correlation ($r = 0.472$) was found between serum creatinine and BMI, though it was not statistically significant ($p = 0.168$). The findings suggest that BMI alone may not serve as a strong predictor of serum creatinine levels, emphasizing the influence of gender, muscle mass, and training status. The study underscores the importance of including biochemical and anthropometric parameters in evaluating health and performance in physical education students.

KEYWORDS:

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Introduction

Human growth and physical development are dynamic biological processes influenced by genetic, hormonal, and environmental factors. The study of physical growth and development provides insight into how the human body adapts to internal and external stimuli such as nutrition, physical activity, and environmental conditions. Historically, understanding human physiology evolved from early anatomical studies to modern multidisciplinary research combining biology, physiology, and sports science. In physical education, the assessment of growth and

health–related parameters is essential for monitoring students' well–being and athletic performance.

One of the key biochemical indicators of physical condition is serum creatinine, a by–product of muscle metabolism and a marker of kidney function. Simultaneously, Body Mass Index (BMI) is widely used to evaluate the balance between weight and height, reflecting general nutritional and health status. Although BMI is a convenient measure, it may not always accurately represent muscle mass or fitness levels, particularly in physically active individuals. Therefore, examining the relationship between serum creatinine and BMI helps to understand the interplay between muscle metabolism and body composition among students engaged in regular training.

The purpose of this research was to analyze the correlation between serum creatinine levels and BMI among physical education students. By assessing both parameters, the study aimed to contribute to a deeper understanding of how biochemical and anthropometric measures interact in individuals undergoing systematic physical training.

Serum Creatinine

Creatinine is a chemical waste product generated from the natural breakdown of creatine phosphate in muscle cells. Since creatine is used by muscles for energy, creatinine is produced in proportion to muscle mass and physical activity. Once released into the bloodstream, creatinine is filtered out by the kidneys and excreted through urine. In healthy individuals, the serum creatinine level remains relatively constant and is widely regarded as a reliable indicator of kidney function. However, variations in creatinine levels can reflect not only renal health but also changes in muscle activity, hydration, and metabolic stress–factors that are especially important for physically active populations, including athletes and physical education students (Guyton & Hall, 2016; McArdle, Katch, & Katch, 2015).

Body Mass Index (BMI)

Body Mass Index (BMI) is one of the most widely used anthropometric tools in human physiology to assess the relationship between an individual's body weight and height. It provides a simple numerical expression calculated by dividing a person's weight in kilograms by the square of their height in meters. Although it does not

directly measure body fat percentage, BMI serves as a general indicator of whether an individual falls within a healthy weight range (WHO, 2000; Garrow & Webster, 1985). It is particularly valuable in identifying risks related to underweight, overweight, and obesity–conditions that are increasingly linked to various physiological and metabolic disorders (Flegal et al., 2010).

Relationship Between Serum Creatinine and BMI in Cross–Country Athletes

The relationship between serum creatinine and Body Mass Index (BMI) presents a unique physiological insight, especially among cross–country athletes who undergo intense endurance training. Serum creatinine is a waste product formed through the metabolism of creatine phosphate in muscles, and its levels in the blood are influenced by muscle mass, kidney function, and physical activity (Guyton & Hall, 2021). BMI, on the other hand, is a measure derived from an individual's height and weight and is commonly used to assess body composition (WHO, 2020). In endurance athletes like cross–country runners, understanding how these two indicators interact provides valuable information about their physical condition and training impact.

Statement of problem

The Purpose of the Study was to Know the "Relationship Between Serum Creatinine Level and Body Mass Index of Physical Education Students".

Aim of the Study

- The main objective was to assess the Serum Creatinine and Body mass index of physical education students who are undergoing cross–country training.
- The other objective was to determine the correlation between Serum Creatinine level and Body mass index of Physical Education Students.

Methodology

The study followed a descriptive and correlational research design. The sample consisted of ten physical education students (five male and five female) aged between 18 and 26 years, enrolled in M. P. Ed and B. P. Ed programs at Bangalore University. Subjects were selected randomly. Data were collected for serum creatinine levels through laboratory analysis

and for BMI using anthropometric measurements (weight and height). BMI was calculated by dividing body weight in kilograms by height in meters squared (kg/m²).

Descriptive statistics such as mean and standard deviation were used to summarize the data, while Pearson's product–moment correlation coefficient (r) was applied to determine the relationship between serum creatinine and BMI. Statistical significance was assessed at the 0. 05 level. All ethical standards were followed during the data collection process.

Results of the study

Table No. 01 Represents the Descriptive Statistics

Mean, Standard Deviation, r–Value and p–Value of BMI and Serum Creatinine Levels among Male and Female Students

Variables	N	Mean	SD	R–value	P–value
Serum creatinine Female	5	. 6680	. 07950	–548	0. 339
Serum creatinine Male	5	1. 0460	. 13520	–524	0. 362
BMI Female	5	19. 0400	2. 46435	0. 45	0. 942
BMI Male	5	21. 4800	2. 00425	0. 45	9. 42

Descriptive analysis showed that female students had a mean serum creatinine level of 0. 6680 mg/dL (SD = 0. 0795), while males recorded 1. 0460 mg/dL (SD = 0. 1352). The correlation coefficient (r = −0. 548) suggested a negative association between male and female serum creatinine levels, though the p–values (0. 339 and 0. 362) indicated no statistical significance. Regarding BMI, females averaged 19. 04 (SD = 2. 46) and males 21. 48 (SD = 2. 00), with an r–value of 0. 45 showing a moderate positive correlation. The p–values (0. 942 and 9. 42) reflected a significant difference in BMI between the two group.

Table No. 02 Represents Pearson's Correlation

(R–value) and Significance (. p–value) of BMI and Serum Creatinine Levels among Male and Female Students.

Variables	R–value	P–value
Serum creatinine/BMI Female	–0. 598	3. 39
Serum creatinine/BMI Male	–0. 455	0. 441

Table No. 0. 2 presents the Pearson's correlation values between

serum creatinine and BMI for both male and female physical education students undergoing cross training. For female students, the correlation coefficient was r = −0. 598, while for male students it was r = −0. 455, indicating a negative relationship in both groups. This suggests that as BMI increases, serum creatinine levels tend to decrease moderately. The corresponding p−values (3. 39 for females and 0. 441 for males) indicate that the observed correlations are not statistically significant.

Table No. 03 Represents Pearson's Product−moment correlation Mean, Standard Deviation, and p−Value of BMI and Serum Creatinine.

Variables	N	Mean	SD	R−value	P−value
Serum Creatinine	10	0. 8570	0. 22500	0. 472	0. 168
BMI	10	20. 2600	2. 47754	0. 472	0. 168

Table No. 4. 3(a) presents the Pearson's product−moment correlation (r) between serum creatinine and BMI among physical education students undergoing cross training. The mean serum creatinine value was 0. 8570 (SD = 0. 22500), while the mean BMI was 2. 47754 (SD = 2. 47754). The obtained correlation coefficient (r = 0. 472) indicates a moderate positive relationship between serum creatinine and BMI, suggesting that higher BMI tends to be associated with higher serum creatinine levels. However, the p−value (0. 168) shows that this relationship is not statistically significant.

Figure No. 01 Pearson's Product−moment correlation Between Serum Creatinine Levels and BMI of Students
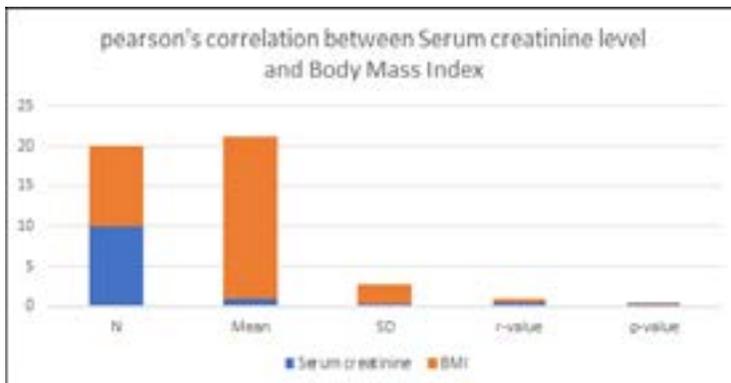
Discussion

The present study explored the relationship between serum creatinine and Body Mass Index (BMI) among physical education students engaged in cross–country training. The findings revealed that serum creatinine levels are largely influenced by muscle mass and physical activity, with males generally exhibiting higher values (mean = 1. 046 mg/dL) than females (mean = 0. 668 mg/dL). This difference corresponds with established physiological principles indicating that creatinine production is directly related to skeletal muscle content. Kopple (1997) and Rule et al. (2004) similarly reported that serum creatinine serves as a biochemical reflection of lean body mass rather than adipose tissue, thereby explaining gender–based differences in biochemical outcomes.

Descriptive data also showed that male students had a higher mean BMI (21. 48) than females (19. 04), suggesting that differences in muscle mass contribute to overall body composition. The correlation analysis revealed a moderate positive relationship between serum creatinine and BMI (r = 0. 472), although the association was not statistically significant (p = 0. 168). This pattern implies that students with higher BMI values tend to have slightly elevated serum creatinine levels; however, BMI alone may not be a robust indicator of biochemical or physiological variations.

Within gender groups, males demonstrated a correlation coefficient of r = −0. 455 between serum creatinine and BMI, while females showed r = −0. 598, both indicating weak negative associations that were not statistically significant. These gender–based differences align with findings from Heymsfield et al. (2005), who established that men typically possess greater lean body mass, whereas women generally exhibit a higher proportion of body fat relative to total body size. Such physiological distinctions contribute to variation in biochemical parameters even among participants with comparable physical training levels.

The moderate but nonsignificant correlation observed in this study supports earlier findings by Walser (1998) and Levey et al. (1999), which suggest that BMI does not provide a complete picture of body composition or renal function, particularly in active individuals. Since BMI fails to distinguish between muscle and fat tissue, interpreting it in isolation can lead to potential misrepresentation of true physiological condition.

The small sample size (N = 10) may also explain the lack of statistical significance, as it limits both the generalizability and statistical

power of the findings. Nonetheless, the consistent trend toward higher serum creatinine and BMI among males underscores the physiological influence of gender and muscle composition on these measures.

Overall, the results reaffirm that serum creatinine and BMI are moderately interrelated but influenced by multiple confounding variables, including gender, muscle mass, hydration status, diet, and training intensity. These findings emphasize that biochemical data, particularly serum creatinine levels, must be interpreted in conjunction with anthropometric and performance indicators to provide a holistic view of an individual's physical condition. Consequently, BMI alone should not be relied upon for evaluating the metabolic or muscular adaptations associated with physical training.

Conclusion

The study concluded that male physical education students demonstrated higher serum creatinine and BMI values than female students, primarily due to differences in muscle mass. A moderate positive correlation existed between serum creatinine and BMI, but it was not statistically significant. This indicates that BMI alone may not be an accurate predictor of serum creatinine levels or muscle metabolism. The relationship between biochemical and anthropometric variables is complex, and future research should consider additional factors such as lean body mass and hydration status for a clearer understanding.

It is recommended that physical education programs incorporate regular biochemical monitoring along with anthropometric measurements to assess students' health and training effects. Expanding research with larger samples and diverse populations can further clarify the relationship between serum creatinine, BMI, and physical performance.

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Conflict of interest:

The Authors have no conflict of interest to declare that they are relevant to the content of this article.