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Original Research Article

Comparative assessment of anthropometric parameters, body mass index and vital signs among school children and college students

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ABSTRACT

Background: The present study highlights comparative evaluation of anthropometric measurements, Body mass index (BMI), and vital parameters among school children (6th-7th standard) and college students.
Methods: A total of 69 students were included, comprising 50 school children and 19 undergraduate students. Parameters such as height, weight, BMI, heart rate (BPM), and oxygen saturation (SpO_2) were recorded and analyzed.
Results: The results showed significant differences in anthropometric characteristics between the two groups, reflecting normal growth and developmental progression. College students exhibited higher mean height (5.26±0.33 ft) and weight (49.53±10.70 kg) compared to school children (4.40±0.27 ft and 27.32±5.92 kg, respectively). The mean BMI of college students (19.92±3.54) fell within the normal adult range, while school children showed a lower mean BMI (15.78±2.83), consistent with age-related standards. However, instances of undernutrition were observed in both groups. Vital parameters revealed slightly higher mean heart rate in college students (103.47±15.41 BPM) compared to school children (100.00±12.03 BPM), possibly influenced by situational factors. Oxygen saturation levels were within normal limits for both groups, indicating overall good respiratory health.
Conclusions: The findings highlight the coexistence of undernutrition and overweight conditions, reflecting the emerging double burden of malnutrition. This study underscores the importance of regular health monitoring and targeted nutritional interventions in educational institutions. Future studies with larger and more diverse populations are recommended to better understand the determinants of health in different age groups.

Keywords: Anthropometry, Body mass index, School children, College students, Heart rate, Oxygen saturation, Nutritional status

INTRODUCTION

Growth and development during childhood and adolescence are critical determinants of long-term health outcomes. Anthropometric parameters such as height and weight serve as essential indicators of physical development, while Body mass index (BMI) is widely used to assess nutritional status across populations.[1] Adolescence represents a transitional phase characterized by rapid physiological and metabolic changes, necessitating adequate nutritional intake and health monitoring.[2] BMI is a simple yet effective tool for evaluating undernutrition, overweight, and obesity. According to the World Health Organization, BMI classifications for adults provide standardized thresholds; however, in children and adolescents, BMI interpretation requires age- and sex-specific references.[3,4] In developing countries like India, the prevalence of both undernutrition and overnutrition has been increasing, leading to a dual or "double burden" of malnutrition.[5]

In addition to anthropometric indices, vital parameters such as heart rate and oxygen saturation (SpO_2) are important indicators of physiological health. Normal heart

rate varies with age, typically being higher in children and gradually decreasing into adulthood.[6] Oxygen saturation reflects respiratory efficiency and overall health status, with values between 95-100% considered normal in healthy individuals.[7]

Dietary habits and lifestyle factors significantly influence both anthropometric and physiological parameters. Recent studies emphasize that dietary quality, meal regularity, and diversity are more critical than simple dietary classifications.[8]

Therefore, comparative studies between different age groups can provide valuable insights into health patterns and help identify early risk factors for chronic diseases.[9] The present study aims to compare anthropometric measurements, BMI, and vital signs between school children and college students to understand developmental and health-related variations.

METHODS

Study design and participants

The present study was a cross-sectional observational study conducted among two groups: school children (6th and 7th standard) and undergraduate college students (BSc). A total of 69 participants were included, comprising 50 school children and 19 college students. Participants were selected using a convenience sampling method.[10] The present cross-sectional study was conducted over a three-month period from January 2026 to March 2026.

Data collection

Anthropometric and physiological parameters were recorded using standard procedures. Height was measured in feet using a measuring scale, and weight was recorded in kilograms using a digital weighing balance. BMI was calculated using the standard formula:

BMI=Weight (kg)/Height² (m²). Vital parameters included heart rate (beats per minute, BPM) measured using a pulse oximeter and oxygen saturation (SpO_2) expressed as a percentage.[11]

Classification criteria

Participants were recruited via a convenience sampling method. The inclusion criteria comprised healthy school children currently enrolled in the 6th and 7th standards and female undergraduate students pursuing a Bachelor of science (BSc) degree at the host institution. The exclusion criteria included individuals with a known history of chronic cardiovascular or respiratory disorders, those experiencing acute illness or fever at the time of data collection, and students who declined to provide informed consent.

BMI classification for college students was based on WHO guidelines, where values between 18.5-24.99 kg/m² were considered normal.[3] For school children, BMI values were interpreted cautiously, considering age-related variations as recommended by international guidelines.[2]

Data analysis

Data were expressed as mean±standard deviation (SD). Comparative analysis between groups was performed descriptively to assess differences in anthropometric and physiological parameters. Variability and range were also considered to identify extremes such as underweight and overweight conditions.

Ethical clearance

The study protocol was reviewed and approved in accordance with the ethical standards of the institutional research committee. Prior to formal data collection, written informed consent was obtained from all adult participants. For the school children (minors), formal institutional permission was granted by the respective school authorities, and verbal or written assent was obtained directly from the students. All investigative procedures were strictly non-invasive, and participant confidentiality was rigorously maintained throughout the study.

RESULTS

This study presents a comparative analysis of health metrics between two distinct age groups: 19 senior college students (BSC) and 50 school children from grades 6th and 7th. The data was analyzed to understand the physiological differences and health status across these developmental stages. The comparative data for anthropometric measurements and vital signs between the two study groups are summarized in Table 1.

Anthropometric measurements (height and weight)

As expected, there is a clear distinction in physical development between the two groups. The college students have a significantly higher mean height (5.26 ft) and weight (49.53 kg) compared to the school children (4.40 ft and 27.32 kg, respectively) (Table 1).

This reflects the expected growth from late childhood to early adulthood. The weight range for college students (38-80 kg) is also much broader, indicating greater variability in body composition compared to the more homogenous school-aged group (20-46 kg).

Body mass index

The body mass index (BMI) data provides insight into the nutritional status of the participants. The mean BMI for college students is 19.92, which falls within the "Normal"

range for adults. However, there is considerable variation, with a range extending from 14.7 (Underweight) to 26.8 (Overweight). In contrast, the school children have a lower mean BMI of 15.78. While adult BMI classifications do not directly apply to growing children, these values are generally within expected ranges for their age. Notably, the lowest overall BMI in the entire dataset (11.6) was observed in a male school child, suggesting a need for nutritional attention in some younger participants.

Table 1: Comparative analysis of anthropometric measurements and vital parameters between college students and school children (mean±SD).

Groups	Count (n)	Height (ft)	Weight (kg)	BMI	BPM (heart rate)	SPO_2 (%)
College students (BSC)	19	5.26±0.33	49.53±10.70	19.92±3.54	103.47±15.41	95.05±4.27
School children (6th and 7th)	50	4.40±0.27	27.32±5.92	15.78±2.83	100.00±12.03	96.68±3.47
Overall	69	4.64±0.49	33.43±12.68	16.92±3.65	100.96±13.04	96.23±3.74

Vital signs (BPM and SPO_2)

Heart rate (BPM)

The average heart rate is slightly higher in college students (103.47 BPM) than in school children (100.00 BPM). This is an interesting finding, as younger children typically have faster resting heart rates. The higher average in the college group may be influenced by temporary factors like anxiety or activity just before measurement, as indicated by a maximum rate of 132 BPM. The school children's rates are more tightly clustered around the median, suggesting a more consistent resting state.

Oxygen saturation (SPO_2)

Both groups exhibit healthy average SPO_2 levels, with the school children averaging 96.68% and college students averaging 95.05%. All group medians are at or above 97%, which is considered excellent. The slightly lower mean for college students is influenced by a few readings in the high 80s, which might warrant a second look but are not cause for concern for the group as a whole.

Categorical data overview

Type of diet: "Mix" diet is the most common across both groups. A notable observation is the higher prevalence of "Non-veg" diets among school children compared to the college group. This demographic information can be used for further cross-tabulation to explore potential correlations between diet and the numerical health metrics (BMI, BPM, SPO_2).

DISCUSSION

The findings from this comparative analysis of school children and college students reveal important insights into the health status of these two distinct age groups, which can be interpreted within the broader context of existing literature on pediatric and adolescent health. The significant difference in mean height (4.40 ft vs. 5.26 ft) and weight (27.32 kg vs. 49.53 kg) between school children and college students reflects expected developmental progression through adolescence into young adulthood. This pattern aligns with established understanding that adolescence represents a period of rapid growth and development with increased nutritional and energy demands.[2] The greater variability in weight among college students (range: 38-80 kg) compared to school children (20-46 kg) suggests increasing divergence in body composition as individuals transition into adulthood, potentially influenced by lifestyle factors and genetic predispositions.[12]

The BMI data warrants careful interpretation using appropriate age-specific classification systems. For the college students (mean BMI 19.92), the majority fall within the healthy weight range according to World Health organization adult criteria (18.5-24.99 kg/m²).[3] However, the range extending from 14.7 to 26.8 indicates the presence of both underweight and overweight individuals in this population. This finding is consistent with the "triple burden" of malnutrition undernutrition, micronutrient deficiencies, and overnutrition that characterizes many low and middle-income countries.[2,13]

For the school children, adult BMI classifications are not directly applicable. According to the International obesity task force (IOTF) criteria, BMI in children must be interpreted using age and sex-specific cut-offs.[4] The mean BMI of 15.78 observed in this study falls within expected ranges for 11–13-year-old children, though the presence of values as low as 11.6 (observed in an 11-year-old male) raises concern for undernutrition. A recent study among adolescents in Mumbai reported that 39.7% of participants were underweight, suggesting that undernutrition remains a significant concern in Indian youth populations, co-existing with rising overweight prevalence.[5,14]

The heart rate findings reveal an interesting pattern: school children demonstrated a mean BPM of 100.00, while college students showed a slightly higher mean of 103.47. This contrasts with expected physiological norms, as children typically have faster resting heart rates than adults. According to established reference ranges, school-

age children (5-12 years) normally have heart rates between 75-118 BPM, while adolescents (13-18 years) range from 60-100 BPM, and adults from 60-100 BPM.[6,15] The higher mean observed in college students may reflect measurement-related factors such as anxiety during data collection, as suggested by the maximum rate of 132 BPM, rather than true physiological differences.

The elevated heart rates observed in several participants (e.g., 132 BPM in a college student, 136 BPM in a school child) exceed the normal resting range and could be classified as tachycardia (resting heart rate >100 BPM).[16] Tachycardia can be caused by various factors including anxiety, fever, electrolyte imbalance, or excessive caffeine consumption.[17] Given that these measurements were likely obtained in a school setting, situational anxiety may have contributed to elevated readings.

Regarding oxygen saturation (SPO_2), both groups demonstrated mean values within the normal range (95-100%) for children and adults.[7] The school children's mean of 96.68% and college students' mean of 95.05% both exceed the 95% threshold considered normal. Values below 95% are generally considered abnormal, though the few readings in the high 80s observed in this study may warrant individual follow-up.[11] It is worth nothing that older adults typically have slightly lower oxygen saturation levels, but this age-related decline would not apply to the young populations studied here.[18]

The predominance of "Mix" diet across both groups reflects the diverse dietary practices common in Indian households.[19] The higher prevalence of non-vegetarian diets among school children compared to college students may reflect changing dietary preferences across generations or differences in family dietary practices.

Recent research has highlighted the importance of dietary patterns beyond simple vegetarian/non-vegetarian classification. A critical review by Schwendler et al, identified eight subconstructs specific to child and adolescent healthy diets, including food group diversity and variety, macronutrient balance, eating frequency, and regularity.[8] These factors may be more predictive of health outcomes than diet type alone. The finding that irregular meal patterns are associated with increased BMI z-score and waist-height ratio during early adolescence, underscores the importance of meal regularity as a modifiable risk factor for unhealthy weight gain.[20]

Limitations

Several limitations should be acknowledged when interpreting these findings. First, the cross-sectional design precludes causal inferences about the relationships between measured parameters.[21] Second, the college student sample was entirely female, limiting gender-based comparisons across age groups. Third, vital signs measurements may have been influenced by situational factors (time of day, recent physical activity, anxiety) that were not controlled for.[22] Fourth, the relatively small sample size, particularly for the college group (n=19), limits generalizability and statistical power for subgroup analyses.[23]

CONCLUSION

This comparative analysis of health metrics among school children (grades 6-7) and college students (BSC) reveals both expected developmental patterns and areas of potential health concern. The significant differences in anthropometric measurements between groups reflect normal growth trajectories from late childhood through young adulthood. Overall, both populations appear generally healthy based on mean BMI and vital signs within normal ranges for their respective age groups. However, the range of observed values indicates the presence of individuals at both extremes those who are underweight and those with elevated BMI, as well as individuals with heart rates exceeding normal limits. These findings underscore the importance of continued health monitoring in educational settings and suggest the need for targeted interventions addressing both undernutrition and emerging overweight concerns. The co-existence of underweight and overweight individuals within the same populations reflects the "double burden" of malnutrition increasingly recognized in transitioning economies. This complexity necessitates nuanced approaches to health promotion that address the full spectrum of nutritional challenges rather than focusing on issues.

Future research should explore the relationships between dietary patterns (beyond simple vegetarian/non-vegetarian classification) and health outcomes in these populations, employing longitudinal designs to track changes over time. Additionally, expanding the sample to include more diverse populations and both genders across all age groups would enhance generalizability and enable more sophisticated analyses of the factors influencing health during these critical developmental periods.

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