RESEARCH ARTICLE

INTERNATIONAL JOURNAL OF KINANTHROPOMETRY

DOI: 10.34256/ijk2516

BMI Patterns and Academic Progression: A Study of Primary School Boys

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DOI: https://doi.org/10.34256/ijk2516
Received: 20-12-2024; Revised: 12-03-2025, Accepted: 04-04-2025; Published: 13-04-2025

Abstract

Introduction: Childhood obesity is a global health concern, necessitating research on Body Mass Index (BMI) patterns among primary school children. This study investigates BMI trends across academic progression among primary school boys in Jashore District, Bangladesh. The study aims to analyze BMI patterns and their association with academic progression among primary school boys, informing interventions for obesity prevention and management. Method: Data were collected from 300 boys in Classes 1 to 5 across urban, suburban, and rural schools. Height, weight, and BMI were measured using standardized methods. Statistical analyses included descriptive statistics, tests of normality, and non-parametric tests. Results: The findings revealed a progressive increase in weight with advancing academic classes. Significant differences were observed between Class 1 and all other classes ($p < .05$), indicating that weight varied significantly across academic levels. Additionally, significant differences were found between Class 2 and Classes 3, 4, and 5, as well as between Class 3 and Classes 4 and 5. However, the difference between Class 3 and Class 4 was not statistically significant ($p = .095$). Similar to weight, height exhibited a progressive pattern with increasing academic classes. Significant differences were detected between Class 1 and all other classes ($p < .05$), indicating significant variation in height across academic levels. Furthermore, significant differences were observed between several pairs of classes, except for Class 2 and Class 3, where the difference was not statistically significant ($p = .192$). The study also found a progressive trend in BMI growth with higher academic classes. Significant differences were observed between Class 1 and all other classes ($p < .05$), as well as between Class 2 and Classes 4 and 5, and between Class 2 and Class 3. However, no significant difference was found between Class 3 and Class 4 ($p = .914$). Conclusion: The study highlights the importance of monitoring BMI trends to inform interventions promoting healthy growth and development among primary school boys. This research contributes valuable insights for obesity prevention and management strategies in Jashore District.

Keywords: BMI Patterns, Academic Progression, Primary School Boys, Jashore District, Bangladesh.

Resumen

Introducción: La obesidad infantil es un problema de salud mundial que requiere investigación sobre los patrones del Índice de Masa Corporal (IMC) entre los niños de la escuela primaria. Este estudio investiga las tendencias del IMC a lo largo de la progresión académica entre los niños de la escuela primaria en el distrito de Jashore, Bangladesh. El estudio tiene como objetivo analizar los patrones de IMC y su asociación con la progresión académica entre los niños de la escuela primaria, informando las intervenciones para la prevención y el manejo de la obesidad. **Método:** Se recopilaron datos de 300 niños en las clases 1 a 5 en escuelas urbanas, suburbanas y rurales. La altura, el peso y el IMC se midieron utilizando métodos estandarizados. Los análisis estadísticos incluyeron estadísticas descriptivas, pruebas de normalidad y pruebas no paramétricas. **Resultados:** Los hallazgos revelaron un aumento progresivo en el peso con las clases académicas avanzadas. Se observaron diferencias significativas entre la Clase 1 y todas las demás clases ($p < .05$), lo que indica que el peso varió significativamente entre los niveles académicos. Adicionalmente, se encontraron diferencias significativas entre la Clase 2 y las Clases 3, 4 y 5, así como entre la Clase 3 y las Clases 4 y 5. Sin embargo, la diferencia entre la

Clase 3 y la Clase 4 no fue estadísticamente significativa (p = .095). Similar al peso, la altura exhibió un patrón progresivo con el aumento de las clases académicas. Se detectaron diferencias significativas entre la Clase 1 y todas las demás clases (p < .05), lo que indica una variación significativa en la altura entre los niveles académicos. Además, se observaron diferencias significativas entre varios pares de clases, excepto para la Clase 2 y la Clase 3, donde la diferencia no fue estadísticamente significativa (p = .192). El estudio también encontró una tendencia progresiva en el crecimiento del IMC con clases académicas más altas. Se observaron diferencias significativas entre la Clase 1 y todas las demás clases (p < .05), así como entre la Clase 2 y las Clases 4 y 5, y entre la Clase 2 y la Clase 3. Sin embargo, no se encontraron diferencias significativas entre la Clase 3 y la Clase 4 (p = .914). **Conclusión:** El estudio destaca la importancia de monitorear las tendencias del IMC para fundamentar intervenciones que promuevan el crecimiento y desarrollo saludables en niños de primaria. Esta investigación aporta información valiosa para las estrategias de prevención y control de la obesidad en el distrito de Jashore.

Palabras Clave: Patrones del IMC, Progreso académico, Niños de primaria, Distrito de Jashore, Bangladesh.

Introduction

The Body Mass Index (BMI) is a widely recognized measure used to assess the weight status of individuals (Çakmur, 2023; Hales et al., 2022). It is calculated by dividing a person's weight in kilograms by the square of their height in meters (Blackburn & Jacobs, 2014). BMI helps categorize individuals into weight groups, such as underweight, normal weight, overweight, and obese (Lebiedowska et al., 2021; Weir & Jan, 2024). In recent years, there has been growing concern over rising rates of childhood obesity and overweight, particularly in Asia (Parvin et al., 2024; De Onis et al., 2010; Mistry & Puthussery, 2015; Tee, 2002).

Childhood and adolescence are critical periods of growth and development, marked by rapid physical, cognitive, and emotional changes (Iqbal et al., 2024; Ramesh, 2022; Scott & Saginak, 2016). These early years lay the foundation for lifelong health, making it essential to understand the factors influencing health outcomes. Among these, education plays a crucial role, as it can profoundly impact both physical and mental well-being (García Bacete et al., 2014; Jetten et al., 2012).

Numerous studies have documented the positive relationship between educational attainment and health outcomes, showing that higher levels of education are associated with reduced chronic disease prevalence, lower mortality rates, and better general health (Hayward & Farina, 2023; Cantu et al., 2021; Raghupathi & Raghupathi, 2020). The mechanisms behind this relationship involve a variety of socioeconomic, behavioral, and psychosocial factors (Kuzhiyengal Mambra & Kotian, 2023). Anthropometric measurements, such as BMI, height, and weight, are widely used to assess the growth and nutritional status of children and adolescents (Kamruzzaman et al., 2021; Shehzad et al., 2022). Changes in these measures reflect not only biological development but also environmental factors such as diet, physical activity, and socioeconomic conditions (Bae et al., 2011; Lee et al., 2000).

While much of the existing research on the link between education and health has focused on adults, the impact of education on children's anthropometric outcomes is still relatively underexplored. Academic class progression represents a significant transition in a child's life, involving increased cognitive and social demands, which may influence their physical health and behavior (Hirst et al., 2011). As students move through different academic levels, they are exposed to varying academic challenges, peer interactions, and extracurricular activities, all of which may impact their growth and development (Boby & Shara, 2023; Feldman & Matjasko, 2005; Gorski, 2021; Shaunessy-Dedrick et al., 2015). Despite the growing interest in the relationship between education and health, only a limited number of studies have specifically examined how academic progression influences anthropometric outcomes among children.

Childhood obesity is a growing public health concern globally, with significant implications for both physical and mental well-being. In Bangladesh, as in many other countries, the rising prevalence of childhood obesity highlights the need to understand the underlying factors that shape children's growth patterns. Addressing childhood obesity effectively requires research into how various social, environmental, and behavioral factors influence BMI and related health outcomes, particularly among vulnerable groups such as primary school children.

This study aims to address this gap by examining the association between academic class progression and anthropometric measurements among primary school boys in Jashore District, Bangladesh. Existing research in Bangladesh has focused predominantly on girls (Parvin et al., 2024), leaving a gap in understanding BMI patterns among boys. Boys may exhibit different growth trajectories due to variations in physical activity levels, dietary habits, and other environmental influences. The present study builds on the research of (Parvin et al. 2024), which analyzed BMI patterns among girls in Jashore District, and extends the focus to boys to provide a more comprehensive understanding of childhood obesity in the region. By analyzing longitudinal data, this study aims to

explore how BMI, height, and weight evolve as boys' progress through academic levels. Understanding these dynamics is essential for developing effective public health initiatives and education policies that promote healthy growth and development in this population.

Material and Methods

Participants

The study included 300 primary school boys, aged 6 to 11 years, from five primary schools in the Jashore district of Bangladesh. Participants were selected through a random sampling process to ensure fairness and avoid bias. From each school, **12 boys** were randomly chosen per academic level (Classes 1 to 5), totaling 60 boys from each school. This provided an even distribution of 60 boys per academic level, with 12 boys from each class in each school (Table 1).

The schools represented different geographical regions, categorized as urban, suburban, and rural. This stratified selection process ensured balanced representation of participants based on both age and geographical location.

Table 1. Distribution of Participants by Academic Level, Age, and Geographical Region

Academic Level	Age Range (Years)	School 1 (Urban)	School 2 (Urban)	School 3 (Suburban)	School 4 (Rural)	School 5 (Rural)	Total (n)
Class 1	6-7	12	12	12	12	12	60
Class 2	7-8	12	12	12	12	12	60
Class 3	8-9	12	12	12	12	12	60
Class 4	9-10	12	12	12	12	12	60
Class 5	10-11	12	12	12	12	12	60
Total	6-11	60	60	60	60	60	300

Criterion measure

BMI was the measuring criterion for the present study. BMI was measured by measuring their height (m) and weight (Kg).

Instruments and tools used

The study utilized a digital weight machine and a stadiometer to accurately measure the weight and height of the participants. The Body Mass Index (BMI) was calculated using the formula: weight (kg) divided by the square of the height (m^2). In addition to the anthropometric measurements, demographic information was collected using a structured data sheet. This demographic data included participants' age, academic level (Class 1 to 5), geographical location (urban, suburban, or rural), and socioeconomic status, which was assessed based on parental occupation and household income. All data were systematically recorded by trained data collectors to ensure accuracy and consistency throughout the process.

Procedure for collecting data

A survey was conducted to measure the height and weight of primary school boys in the Jashore district. Trained data collectors visited the selected schools, following standardized procedures. Height was measured using a stadiometer, while weight was measured with a calibrated scale to ensure accuracy. Schools were selected through random sampling, and consent was obtained from parents, guardians, or teachers after they were informed about the study's purpose and scope. Ethical considerations were prioritized throughout the process to maintain participant privacy and confidentiality. This careful approach to data collection aimed to provide a detailed understanding of BMI patterns in primary school boys, supporting the development of interventions for managing overweight and obesity within this group.

Statistical Analysis

BMI was calculated using the standard formula:

BMI = Weight (kg) / [Height (m)] ²

The calculated BMI values were categorized according to the World Health Organization (WHO) guidelines for classifying underweight, normal weight, overweight, and obesity. Descriptive statistics, including mean and standard deviation, were used to summarize height, weight, and BMI data. To assess the distribution of the data, normality tests (Kolmogorov-Smirnov and Shapiro-Wilk tests) were performed. Given that some variables were not normally distributed; non-parametric tests were employed. The Mann-Whitney U test was used for pairwise comparisons to determine significant differences between academic classes in terms of weight, height, and BMI.

All statistical analyses were performed using the SPSS software package, a widely recognized tool for research data analysis. A significance level of 0.05 was set, and p-values less than 0.05 were considered statistically significant. This comprehensive statistical approach ensured the robustness and reliability of the findings.

Results

Table 2. Analysis of Normality and Non-parametric Testing

Category	Academic year	Kolmogorov-Smirnov[a]			Shapiro-W		ilk
		Statistic	df	Sig.	Statistic	df	Sig.
Age	Class 1	.357	60	.000	.635	60	.000
	Class 2	.296	60	.000	.665	60	.000
	Class 3	.236	60	.000	.814	60	.000
	Class 4	.235	60	.000	.842	60	.000
	Class 5	.218	60	.000	.805	60	.000
Height	Class 1	.087	60	.200*	.978	60	.359
	Class 2	.271	60	.000	.579	60	.000
	Class 3	.141	60	.005	.921	60	.001
	Class 4	.090	60	.200*	.981	60	.457
	Class 5	.103	60	.175	.969	60	.137
Weight	Class 1	.139	60	.006	.931	60	.002
	Class 2	.140	60	.005	.954	60	.024
	Class 3	.161	60	.000	.888	60	.000
	Class 4	.171	60	.000	.920	60	.001
	Class 5	.167	60	.000	.944	60	.009
BMI	Class 1	.125	60	.020	.936	60	.004
	Class 2	.128	60	.016	.781	60	.000
	Class 3	.181	60	.000	.874	60	.000
	Class 4	.200	60	.000	.877	60	.000
	Class 5	.098	60	.200*	.955	60	.028

Table 2 presents the results from the Kolmogorov-Smirnov and Shapiro-Wilk tests, assessing the normality of BMI scores among primary school boys across different classes. These tests are suitable for small sample sizes (<50) but can also handle larger sample sizes up to 2000. The findings indicate that BMI scores for primary school boys in Class-1 through Class-5 were not normally distributed. As a result, non-parametric statistical tools, such as the Mann-Whitney U test, were utilized to analyze the data and draw inferences. With a significance level (p-value) set at 0.05, differences between BMI scores among different classes were considered significant if p was less than

0.05. By opting for non-parametric testing, the researcher ensured robust analysis and interpretation of the collected data, despite deviations from normal distribution observed in the BMI scores across various class levels.

Observation of Height

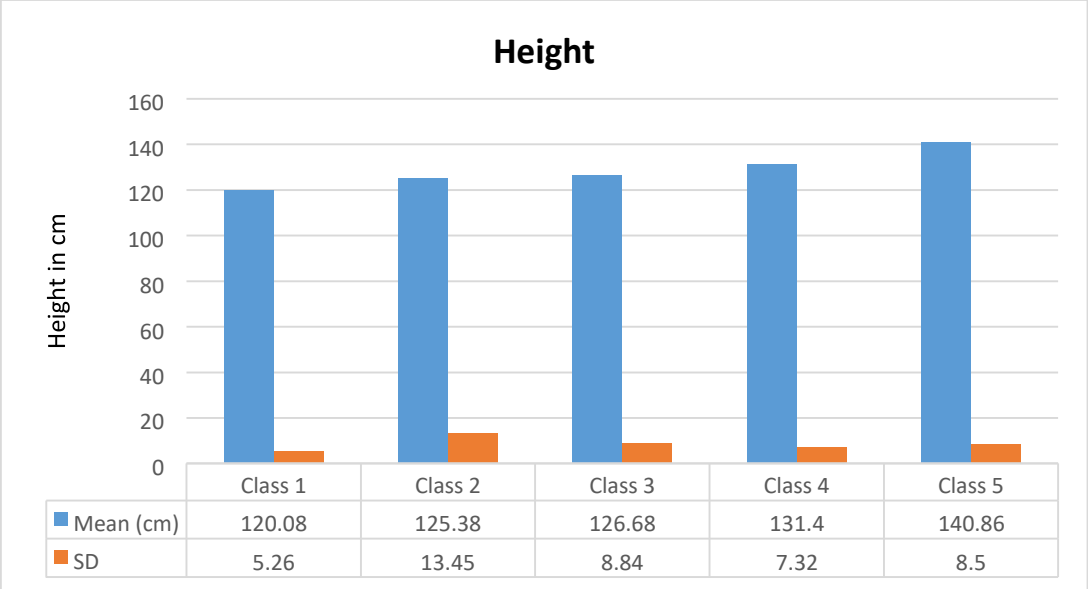

Figure 1. Mean and Standard Deviation of Height from class one to five

Here, figure-1 shows the mean values and standard deviation of height from class one to five where class 1 values is 120.08 cm ± 5.26, class 2 value is 125.38 cm ± 13.45, class 3 value is 126.68 cm ± 8.84, class 4 value is 131.4 cm ± 7.32 and class 5 value is 140.86 cm ± 8.50.

Observation of Weight

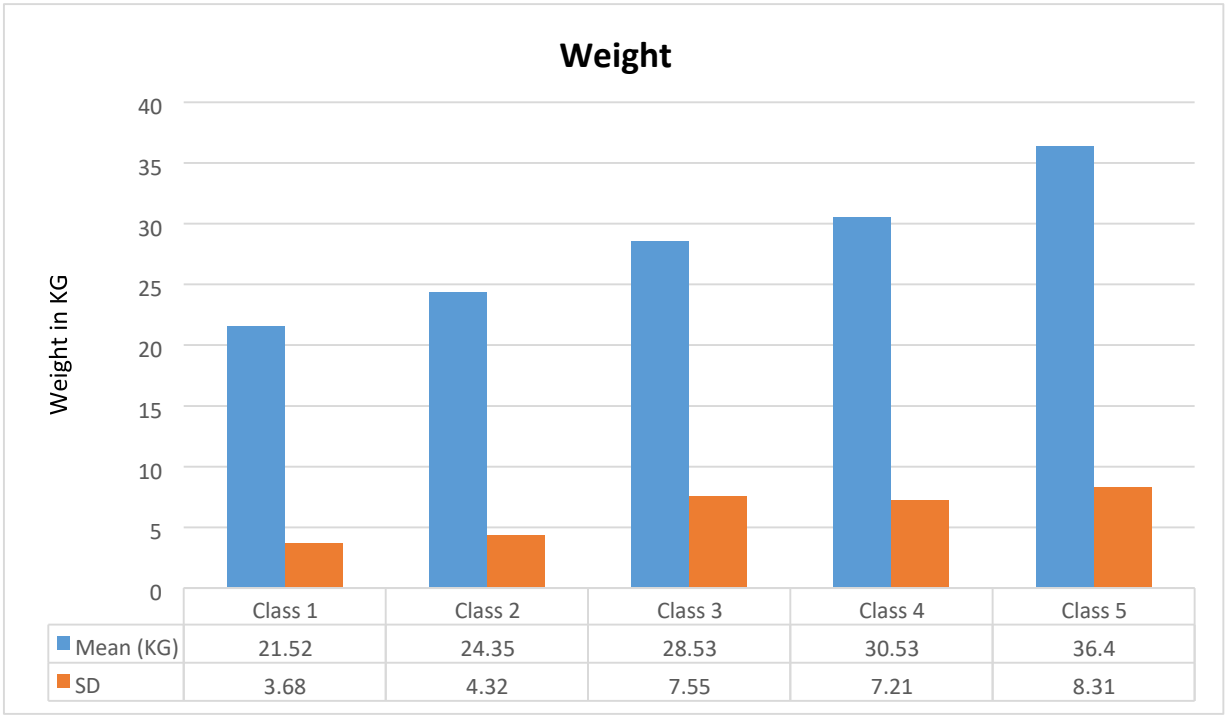

Figure 2. Mean and Standard Deviation of Weight from class one to five

Here, figure-3 shows the mean values and standard deviation of weight from class one to five where class 1 values is 21.52 Kg ± 3.68, class 2 value is 24.35 Kg ± 4.32, class 3 value is 28.53 Kg ± 7.55, class 4 value is 30.53 Kg ± 7.21 and class 5 value is 36.4 Kg ± 8.31.

Observation of BMI

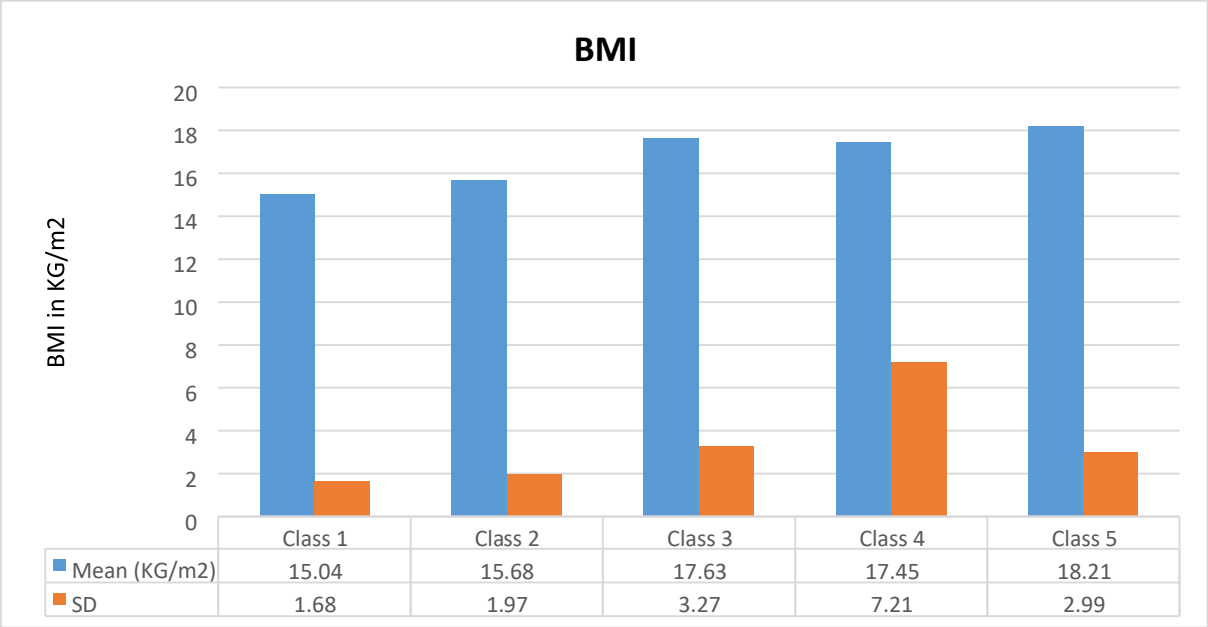

Figure 3. Mean and Standard Deviation of BMI from class one to five

Here, figure-3 shows the mean values and standard deviation of weight from class one to five where class 1 values is 15.04± 1.68, class 2 value is 15.68± 1.97, class 3 value is 17.63 ± 3.27, class 4 value is 17.45± 2.96 and class 5 value is 18.21± 2.99

Table 3. Hypothesis test summary

Null Hypothesis	Test	Sig.	Decision
The distribution of Height is the same across categories of class	Independent sample Kruskal- Wallis Test	.000	Reject the null hypothesis

The significance level is p ≤ .05

Table 4. Summary Statistics and Post Hoc Test Results for Height Across Classes

Class	Mean	SD	Post Hoc (Mann-Whitney U Test)	P Value	Remark
Class I	120.08 cm	± 5.26	Class I - Class II	.007	Significant
Class II	125.38 cm	± 13.45	Class I - Class III	.000	Significant
Class III	126.68 cm	± 8.84	Class I - Class IV	.000	Significant
Class IV	131.40 cm	± 7.32	Class I - Class V	.000	Significant
Class V	140.86 cm	± 8.50	Class II - Class III	.192	Not Significant
			Class II - Class IV	.000	Significant
			Class II - Class V	.000	Significant

			Class III - Class IV	.002	Significant
			Class III - Class V	.000	Significant
			Class IV - Class V	.000	Significant

Table 4 presents the average height across different classes, indicating significant differences. Class I (120.08 cm) is significantly shorter than all other classes. Classes II (125.38 cm), III (126.68 cm), IV (131.40 cm), and V (140.86 cm) show a progressive increase in height, with Class V being the tallest. Classes II and III do not differ significantly from each other, but both are taller than Class I. Classes IV and V also show significant differences from Class each other, indicating a clear trend of increasing height with class level and I.

Table 5. Hypothesis test summary

Null Hypothesis	Test	Sig.	Decision
The distribution of weight is the same across categories of class	Independent sample Kruskal- Wallis Test	.000	Reject the null hypothesis

The significance level is α=.05.

Table 6. Summary Statistics and Post Hoc Test Results for Weight Across Classes

Class	Mean	SD	Post Hoc (Mann-Whitney U Test)	P Value	Remark
Class I	21.52 kg	± 3.68	Class I - Class II	.006	Significant
Class II	24.35 kg	± 4.32	Class I - Class III	.000	Significant
Class III	28.53 kg	± 7.55	Class I - Class IV	.000	Significant
Class IV	30.53 kg	± 7.21	Class I - Class V	.000	Significant
Class V	36.40 kg	± 8.31	Class II - Class III	.003	Significant
			Class II - Class IV	.000	Significant
			Class II - Class V	.000	Significant
			Class III - Class IV	.095	Not Significant
			Class III - Class V	.000	Significant
			Class IV - Class V	.002	Significant

*The significance level is p≤.05.

Table 6 reveals significant differences in mean weight among the classes. Class I has the lowest average weight (21.52 kg), while Class V has the highest (36.40 kg). Each class is significantly heavier than Class I, with Classes II (24.35 kg), III (28.53 kg), and IV (30.53 kg) all significantly differing. However, Classes III and IV do not show significant differences in weight, suggesting similarities between these middle classes.

Table 7. Hypothesis test summary

Null Hypothesis	Test	Sig.	Decision
The distribution of BMI is the same across categories of class	Independent sample Kruskal-Wallis Test	.000	Reject the null hypothesis

*The significance level is p≤.05.

Table 8 shows that Class I has the lowest mean BMI (15.04), which is significantly different from the higher classes. Class V has the highest mean BMI (18.21), with significant differences noted from all lower classes. Classes II (15.68) and III (17.63) show significant differences from Class I, while Class IV (17.45) does not differ significantly from Classes III or V. This suggests that while there are overall trends in BMI across classes, some

middle classes exhibit similarities. Overall, the results from these tables indicate significant variations in height, weight, and BMI across different classes, with Class I consistently showing lower measurements compared to the higher classes, highlighting potential influences of class status on these physical characteristics.

Table 8. Summary Statistics and Post Hoc Test Results for BMI Across Classes

Class	Mean	SD	Post Hoc (Mann-Whitney U Test)	P Value	Remark
Class I	15.04	± 1.68	Class I - Class II	.009	Significant
Class II	15.68	± 1.97	Class I - Class III	.000	Significant
Class III	17.63	± 3.27	Class I - Class IV	.000	Significant
Class IV	17.45	± 2.96	Class I - Class V	.000	Significant
Class V	18.21	± 2.99	Class II - Class III	.006	Significant
			Class II - Class IV	.004	Significant
			Class II - Class V	.000	Significant
			Class III - Class IV	.914	Not Significant
			Class III - Class V	.107	Not Significant
			Class IV - Class V	.133	Not Significant

Discussion

The findings of this study demonstrate a significant association between academic class progression and various anthropometric measurements, including weight, height, and BMI among participants. These results align with previous research indicating the influence of educational attainment on health outcomes and behaviors (Cutler & Lleras-Muney, 2010; Raghupathi & Raghupathi, 2020). As students' progress through academic levels, there is a marked increase in weight, height, and BMI, suggesting implications for their overall health and well-being.

Regarding weight, the analysis reveals a significant correlation with academic class progression. Pairwise comparisons between different academic classes yield p-values indicating significant differences in weight. Specifically, as students transition from lower to higher academic classes, there is a consistent increase in weight, suggesting a cumulative effect of academic advancement on weight gain. This progressive trend in weight is consistent with existing literature, which suggests that higher levels of education may be associated with increased body weight due to improved access to resources and lifestyle changes (Kimbro et al., 2008; Lee & Seon, 2019; Wang et al., 2022).

Similarly, a significant relationship between height and academic class progression was observed. The pairwise comparison results indicate notable differences in height among students in various academic classes. The progressive increase in height aligns with expected growth patterns during adolescence, although variations may arise from genetic, environmental, and socioeconomic influences (Sanders et al., 2017; Limony et al., 2019; Wehkalampi et al., 2008). This warrants further investigation to determine whether these changes align with healthy growth trajectories or indicate underlying factors affecting height development (Liu et al., 2023; Northstone et al., 2013).

Additionally, the analysis reveals a significant association between BMI and academic class progression. Pairwise comparison results indicate marked differences in BMI across academic classes. Higher academic attainment often provides individuals with better access to health-promoting resources and opportunities for healthier lifestyle choices (Al-Momani, 2021; National Academies of Sciences et al., 2017; World Health Organization, 2003). However, the relationship between education and health is complex, with disparities evident across different socioeconomic strata (Khalatbari-Soltani et al., 2022). The progressive nature of BMI growth suggests that as students move through academic levels, changes in lifestyle factors, dietary habits, and physical activity levels may significantly influence BMI. This emphasizes the importance of promoting healthy behaviors among students to reduce the risk of unhealthy weight gain and obesity.

While significant associations were observed for weight, height, and BMI across various academic classes, some pairwise comparisons yielded non-significant results. For instance, the comparison between Class 2 and Class 3 for height showed a non-significant p-value, indicating no substantial difference between these two

academic classes. Similarly, certain comparisons in BMI also resulted in non-significant findings, suggesting that the relationship between academic class progression and BMI may not be uniform across all academic levels.

Overall, the findings of this study highlight the importance of understanding the impact of academic class progression on anthropometric measurements among students. The observed trends in weight, height, and BMI underscore the need for comprehensive health promotion initiatives within educational settings to support students in maintaining healthy lifestyles and achieving optimal growth and development. Further research is essential to explore the underlying factors driving these associations and to inform targeted interventions aimed at enhancing the health and well-being of students across different academic levels.

Conclusion

This study demonstrates a significant relationship between academic class progression and anthropometric measurements, including weight, height, and BMI, among primary school boys. The findings indicate a progressive increase in these measurements as student's advance through their academic levels, highlighting the potential impact of educational attainment on physical health and development. The results suggest that as students' progress academically, they may experience changes in weight and height that could influence their overall health and well-being. These changes could be attributed to various factors, including increased access to resources, shifts in lifestyle behaviors, and dietary habits associated with different academic stages. While most pairwise comparisons yielded significant results, some non-significant findings indicate the need for further investigation into the nuances of these relationships. In light of these findings, it is crucial for educational institutions to implement targeted health promotion strategies aimed at encouraging healthy behaviors among students. Such initiatives can help mitigate the risks of unhealthy weight gain and promote optimal growth and development.

Future research should explore the underlying factors driving these associations and evaluate the effectiveness of interventions designed to foster healthier lifestyles in educational settings. This study contributes valuable insights into the connection between academic progression and physical health, advocating for a comprehensive approach to education that prioritizes not only academic achievement but also the overall health and well-being of students.

References

Al-Momani, M. M. (2021). Health-promoting lifestyle and its association with the academic achievements of medical students in Saudi Arabia. *Pakistan Journal of Medical Sciences,* 37(2). https://doi.org/10.12669/pjms.37.2.3417

Bae, K.K., Kim, H., Cho, S.I. (2011). Trends in Body Mass Index and Associations with Physical Activity among Career Soldiers in South Korea*. Journal of Preventive Medicine and Public Health,* 44(4):167–175. https://doi.org/10.3961/jpmph.2011.44.4.167

Blackburn, H., Jacobs, D. (2014). Commentary: Origins and evolution of body mass index (BMI): continuing saga. *International Journal of Epidemiology,* 43(3): 665–669 https://doi.org/10.1093/ije/dyu061

Boby, F. A., Shara, S. S. (2023). Navigating Childhood Health: Unraveling the Tapestry of Anthropometric Indicators and Musculoskeletal Fitness in Elementary School Boys. *International Journal of Kinanthropometry,* 3(2): 9-16. https://doi.org/10.34256/ijk2332

Çakmur, H. (2023). Introductory Chapter: A Historical Index Widely Used in Medicine – Body Mass Index. In H. Çakmur (Ed.), *Body Mass Index—Overweight, Normal Weight, Underweight. Intech Open*.

Cantu, P. A., Sheehan, C. M., Sasson, I., Hayward, M. D. (2021). Increasing Education-Based Disparities in Healthy Life Expectancy Among U.S. Non-Hispanic Whites, 2000–2010. *The Journals of Gerontology: Series B,* 76(2): 319–329. https://doi.org/10.1093/geronb/gbz145

Cutler, D. M., Lleras-Muney, A. (2010). Understanding differences in health behaviors by education. *Journal of Health Economics,* 29(1), 1–28. https://doi.org/10.1016/j.jhealeco.2009.10.003

Hayward, D. M. A. R. K, Farina, M. P. (2023). Dynamic Changes in the Association between Education and Health in the United States. *The Milbank Quarterly,* 101(S1), 396–418. https://doi.org/10.1111/1468-0009.12611

De Onis, M., Blössner, M., Borghi, E. (2010). Global prevalence and trends of overweight and obesity among preschool children. *The American Journal of Clinical Nutrition,* 92(5): 1257–1264. https://doi.org/10.3945/ajcn.2010.29786

Feldman, A. F., Matjasko, J. L. (2005). The Role of School-Based Extracurricular Activities in Adolescent Development: A Comprehensive Review and Future Directions. *Review of Educational Research,* 75(2):159–210. https://doi.org/10.3102/00346543075002159

García Bacete, F. J., Marande Perrin, G., Schneider, B. H., Blanchard, C. (2014). Effects of School on the Well-Being of Children and Adolescents. *Handbook of Child Well-Being Springer Netherlands,* https://doi.org/10.1007/978-90-481-9063-8_149

Gorski, K. J. (2021). In School for After School: The Relationship Between Extracurricular Participation and School Engagement. *Sociological Forum,* 36(1): 248–270. https://doi.org/10.1111/socf.12671

Hales, C. M., Freedman, D.S., Akinbami, L., Wei, R., Ogden, C. L. (2022). Evaluation of alternative body mass index (BMI) metrics to monitor weight status in children and adolescents with extremely high BMI using CDC BMI-for-age growth charts. *National Center for Health Statistics (U.S.), 2(197).* https://dx.doi.org/10.15620/cdc:121711

Hayward, M. D., Hummer, R. A., Sasson, I. (2015). Trends and group differences in the association between educational attainment and U.S. adult mortality: Implications for understanding education's causal influence. *Social Science & Medicine*, 127: 8–18. https://doi.org/10.1016/j.socscimed.2014.11.024

Hirst, M., Jervis, N., Visagie, K., Sojo, V., Cavanagh, S. (2011). Transition to Primary School: A Review of the Literature. http://dx.doi.org/10.13140/RG.2.1.3122.3448

Iqbal, A., Boby, F. A., Mia, H., Sohel, M. (2024). Change of health-related fitness with respect to age for adolescent boys. *Journal of Human Sport and Exercise,* 19(4): 1009-1018. https://doi.org/10.55860/mswfwq70

Jetten, J., Haslam, C., Alexander, S. H. (2012). The social cure: Identity, *health and well-being (1st Edition). Psychology press. https://doi.org/10.4324/9780203813195*

Kamruzzaman, M., Rahman, S. A., Akter, S., Shushmita, H., Ali, M. Y., Billah, M. A., Kamal, M. S., Elahi, M. T., Paul, D. K. (2021). The anthropometric assessment of body composition and nutritional status in children aged 2–15 years: A cross-sectional study from three districts in Bangladesh. *PLOS ONE,* 16(9): e0257055. https://doi.org/10.1371/journal.pone.0257055

Khalatbari-Soltani, S., Maccora, J., Blyth, F. M., Joannès, C., Kelly-Irving, M. (2022). Measuring education in the context of health inequalities. *International Journal of Epidemiology,* 51(3): 701–708. https://doi.org/10.1093/ije/dyac058

Kimbro, R. T., Bzostek, S., Goldman, N., Rodríguez, G. (2008). Race, Ethnicity, and the Education Gradient in Health. *Health Affairs,* 27(2): 361–372. https://doi.org/10.1377/hlthaff.27.2.361

Kuzhiyengal Mambra, A. J., Kotian, S. S. (2023). Exploring the Influence of Socioeconomic Factors on Aggressive Behavior among Higher Secondary Students: A Literature Review. *International Journal for Multidisciplinary Research,* 5(5): 7078. https://doi.org/10.36948/ijfmr.2023.v05i05.7078

Lebiedowska, A., Hartman-Petrycka, M., Błońska-Fajfrowska, B. (2021). How reliable is BMI? Bioimpedance analysis of body composition in underweight, normal weight, overweight, and obese women. *Irish Journal of Medical Science (1971 -),* 190(3): 993–998. https://doi.org/10.1007/s11845-020-02403-3

Lee, A., Cardel, M., Donahoo, W.T. Social and Environmental Factors Influencing Obesity. 2019 Oct 12. IN: Feingold, K.R., Ahmed, S.F., Anawalt, B., Blackman, M.R, Boyce, A., Chrousos, G., Corpas, E., de Herder, W.W., Dhatariya, K., Dungan, K., Hofland, J., Kalra, S., Kaltsas, G., Kapoor, N., Koch, C., Kopp, P., Korbonits, M., Kovacs, C.S., Kuohung, W., Laferrère, B., Levy, M., McGee, E.A., McLachlan, R., Muzumdar, R., Purnell, J., Rey, R., Sahay, R., Shah, A.S., Singer, F., Sperling, M.A., Stratakis, C.A, Trence, D.L., Wilson, D.P., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000–. PMID: 25905211.

Lee, J., Seon, J. (2019). Educational Attainment and Health Behaviors among Young Adult Men: Racial/Ethnic Disparities. *American Journal of Men's Health,* 13(6): 155798831989448. https://doi.org/10.1177/1557988319894488

Limony, Y., Koziel, S., Friger, M. (2019). Association between the onset age of puberty and parental height. *PLOS ONE,* 14(1), e0211334. https://doi.org/10.1371/journal.pone.0211334

Liu, T., Sato, Y., Breaden, J. (2023). Factors influencing international students' trajectories: A comparative study of Chinese students in Japan and Australia. *International Journal of Comparative Education and Development,* 25(1): 23–39. https://doi.org/10.1108/IJCED-08-2022-0060

Mistry, S. K., Puthussery, S. (2015). Risk factors of overweight and obesity in childhood and adolescence in South Asian countries: A systematic review of the evidence. *Public Health,* 129(3), 200–209. https://doi.org/10.1016/j.puhe.2014.12.004

National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Population Health and Public Health Practice; Committee on Community-Based Solutions to Promote Health Equity in the United States, Baciu, A., Negussie, Y., Geller, A., Weinstein, J. N. (2017). The Root Causes of Health Inequity. In Communities in Action: Pathways to Health Equity. *National Academies Press (US).* https://doi.org/10.17226/24624

Northstone, K., Guggenheim, J. A., Howe, L. D., Tilling, K., Paternoster, L., Kemp, J. P., McMahon, G., Williams, C. (2013). Body Stature Growth Trajectories during Childhood and the Development of Myopia. *Ophthalmology,* 120(5): 1064-1073.e1. https://doi.org/10.1016/j.ophtha.2012.11.004

Parvin, T., Boby, F. A., Badhan, M. (2024). Growing up healthy: Body mass index patterns among primary school girls. *Journal of Anthropology, Sport and Physical Education,* 8(3): 11-14. https://doi.org/10.26773/jaspe.240702

Raghupathi, V., Raghupathi, W. (2020). The influence of education on health: An empirical assessment of OECD countries for the period 1995–2015. *Archives of Public Health,* 78(1): 20. https://doi.org/10.1186/s13690-020-00402-5

Ramesh, S. (2022). Cognitive Development and Childhood Learning. *The Political Economy of Human Behaviour and Economic Development, Springer International Publishing.* https://doi.org/10.1007/978-3-031-12666-6_5

Sanders, J. O., Qiu, X., Lu, X., Duren, D. L., Liu, R. W., Dang, D., Menendez, M. E., Hans, S. D., Weber, D. R., Cooperman, D. R. (2017). The Uniform Pattern of Growth and Skeletal Maturation during the Human Adolescent Growth Spurt. *Scientific Reports,* 7(1): 16705. https://doi.org/10.1038/s41598-017-16996-w

Scott, S. K., Saginak, K. A. (2016). Adolescence: Physical and Cognitive Development, *Human Growth and Development across the Lifespan, Wiley.* https://doi.org/10.1002/9781394258925.ch11

Shaunessy-Dedrick, E., Suldo, S. M., Roth, R. A., Fefer, S. A. (2015). Students' Perceptions of Factors that Contribute to Risk and Success in Accelerated High School Courses. *The High School Journal,* 98(2): 109–137. https://doi.org/10.1353/hsj.2015.0002

Shehzad, M. A., Khurram, H., Iqbal, Z., Parveen, M., Shabbir, M. N. (2022). Nutritional status and growth centiles using anthropometric measures of school-aged children and adolescents from Multan district. *Archives de Pédiatrie,* 29(2): 133–139. https://doi.org/10.1016/j.arcped.2021.11.010

Tee, E. S. (2002). Obesity in Asia: Prevalence and issues in assessment methodologies. *Asia Pacific Journal of Clinical Nutrition,* 11(s8): s694-s701. https://doi.org/10.1046/j.1440-6047.11.s8.12.x

Wang, L., Ren, J., Chen, J., Gao, R., Bai, B., An, H., Cai, W., Ma, A. (2022). Lifestyle choices mediate the association between educational attainment and BMI in older adults in China: A cross-sectional study. *Frontiers in Public Health,* 10: 1000953. https://doi.org/10.3389/fpubh.2022.1000953

Wehkalampi, K., Silventoinen, K., Kaprio, J., Dick, D. M., Rose, R. J., Pulkkinen, L., Dunkel, L. (2008). Genetic and environmental influences on pubertal timing assessed by height growth. American Journal of Human Biology, 20(4): 417–423. https://doi.org/10.1002/ajhb.20748

Weir, C. B., Jan, A. (2024). BMI Classification Percentile and Cut off Points. In StatPearls. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK541070/

World Health Organization. (2003). Skills for health: Skills-based health education including life skills: An important component of a child-friendly/health-promoting school*. World Health Organization.*

Funding

There is no external funding to declare.

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

DOI: 10.34256/ijk2516

Informed Consent Statement

All the athletes included in the study provided written informed consent.

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