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Prevalence and Predictors of Obesity among Undergraduate Medical Students:

A Hierarchical Modelling Approach

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Abstract

Background: Obesity is an escalating public health challenge in India, particularly among medical students who navigate high-stress "obesogenic" environments. This study assessed obesity prevalence and the relative impact of non-modifiable traits versus modifiable lifestyle behaviours among undergraduate medical students in northern West Bengal.

Methods: An observational, cross-sectional study was conducted in January 2026 at Jalpaiguri Government Medical College. Data were collected from 151 MBBS students via complete enumeration. Anthropometric measurements were taken, with obesity defined as a BMI ≥ 25 kg/m^2 as per NCDC India guidelines. Hierarchical logistic regression was performed: Model 1 assessed non-modifiable factors (age, sex, family history), and Model 2 added modifiable lifestyle factors (diet, sleep, exercise).

Results: The prevalence of obesity was 27.8%. Initial bivariate analyses showed no significant associations between obesity and individual predictors. In the hierarchical analysis, Model 1 demonstrated low explanatory power (Nagelkerke $R^2 = 0.033$) and poor fit. The addition of lifestyle variables in Model 2 improved model calibration (Hosmer–Lemeshow p = 0.353) and increased the explained variance to 19.1%. Notably, students participating in outdoor games 4–5 times weekly had significantly higher obesity odds (OR = 4.945; 95% CI: 1.060–23.068) than those playing less than once weekly, suggesting possible reverse causality. Other lifestyle factors did not reach levels of statistical significance.

Conclusion: A substantial proportion of medical students are obese. While most demographic and lifestyle variables lacked linear statistical significance, the improvement in model fit with behavioural factors suggests a more nuanced influence. Implementing campus-level wellness initiatives, including structured physical activity and sleep hygiene, is necessary to mitigate long-term health risks.

INTRODUCTION

Obesity is one of the most pressing public health issues of our time. In India, the situation is particularly complex as the country deals with a *"double burden of malnutrition"*, meaning that while undernutrition remains a stubborn problem, obesity rates are climbing right alongside it.[1] Rapid urbanization, a decrease in physical activity, and diets packed with processed, calorie-dense foods are fuelling this shift. Metabolic issues were thought to be mostly an older person's problem. Yet, newer data suggests abdominal obesity and metabolic syndrome are creeping up alarmingly among young adults, the very group that will drive the country's future economy and healthcare systems.[2]

Interestingly, medical students find themselves uniquely at risk.[3] Although doctors are thought to lead healthy lifestyles, the reality of medical school often creates an "obesogenic" environment.[4] The sheer academic pressure leads to massive psychological stress, chronic lack of sleep, improper

Keywords: obesity, metabolic syndrome, eating habits, sleep depreviation

eating habits, results in skipped meals and a reliance on late-night fast food. It is no surprise that studies across India, from Kolkata to the northern regions, show medical students struggling with high rates of obesity and being overweight due to these pressures.[5,6,7]

Despite the growing burden of obesity among medical students, it remains an under-researched area in this population, with no comprehensive data available from the northern districts of West Bengal. Most studies to date focus on estimating prevalence and identifying broad risk factors, and rarely explore in depth the influence of socio-demographic characteristics, family history, or specific daily lifestyle habits. Breaking this down is critical, because designing programs that actually work, needs a pinpoint identification of lifestyle choices, like sleep duration and exercise.[8]

The present study aims to fill this gap using hierarchical regression analysis. By grouping variables into distinct "blocks," the study attempts to, first, isolate the impact of background factors that students cannot control, like genetics and demographics. Once those are accounted for, the second step tries to determine if their lifestyle choices actually add any significant explanatory power. In public health research, this approach is highly practical.[9] It clearly shows whether the obesity being observed is largely fixed by background traits, or if it is being driven by behaviors that can be actively targeted upon and improved through university interventions.

MATERIALS AND METHODS

Study Type and Design: The present study was an observational study employing a cross-sectional study design.

Study Setting: The study was conducted at the Jalpaiguri Government Medical College and Hospital (JGMCH), a tertiary care teaching institution in West Bengal, India.

Study Period: The data collection was carried out over a period four weeks between 1st January and 31st January 2026.

Study Population: The study population consisted of undergraduate medical students (MBBS) enrolled at JGMCH.

- **Inclusion Criteria:** All medical students from the selected batches (Batch 2022-2023 and 2023-2024) who were present during the data collection period and provided informed written consent were included.
- **Exclusion Criteria:** Students with chronic debilitating illnesses (other than metabolic syndrome components) known to affect weight were excluded.

Study Sample and Sampling Technique: The study included undergraduate MBBS students from batches 2022–2023 and 2023–2024. The total eligible population was 168 students of whom 151 students participated in the study, giving a response rate of 89.9%. A complete enumeration sampling technique was used.

Study Technique and Tools: Data were collected using a two-part instrument:

1. **Structured Questionnaire:** A pre-tested questionnaire was administered to collect data on:
   - ◊ *Socio-demographics:* Age, sex, residence (rural/urban), and monthly family income.
   - ◊ *Family & Personal History:* History of obesity and/or diabetes in the family and co-morbidities in self.
   - ◊ *Lifestyle:* Frequency of fast-food consumption, physical exercise, and sleep duration.
2. **Anthropometric Measurements:**
   - ◊ *Height:* Height was measured to the nearest 0.1 cm using a manual stadiometer following standard guidelines for measurement.[10]
   - ◊ *Weight:* Measured to the nearest 0.5 kg using a calibrated digital weighing scale with subjects wearing light clothing.
   - ◊ *BMI Calculation:* Body Mass Index (BMI) was calculated using the formula Weight (kg) / Height (m^2).

Outcome Definition: Obesity was defined using the NCDC India Classification for Obesity with BMI cut-off of ≥25 kg/m^2.[11]

Statistical analysis: Data were analyzed using jamovi (version 2.6.44), an open-source graphical statistical software built on the R statistical environment. Descriptive statistics i.e. mean, standard deviation, frequency, percentage (as applicable) were used to summarize the data. A Hierarchical Logistic Regression was performed in two steps:

- **Model 1:** Assessed non-modifiable factors (age, sex, family history).
- **Model 2:** Added modifiable lifestyle factors (sleep, diet, exercise) to determine their independent effect on obesity risk.

Model Validity Checks

- Multicollinearity was assessed using Variance Inflation Factors (VIF), and all values were found to be within acceptable limits (<2)
- Model fit assessed using Hosmer–Lemeshow test ($p > 0.05$ indicates good fit)
- Statistical significance was set at $p < 0.05$.

Ethical Issues: The study adhered to ethical guidelines for human research. The study was cleared by the Institutional Ethics Committee (IEC) of JGMCH. Informed written consent was obtained from all participants after explaining the study's purpose. Anonymity was maintained by using code numbers instead of names during data entry and analysis.

Operational Definitions

- **Physical activity:** Physical activity was defined as participation in structured or unstructured exercise, including outdoor games, sports, or gym-based activities, and was categorized based on frequency per week as: <1, 1–3, 4–5, and >5 times/week.
- **Fast food consumption:** Fast food was defined as commercially prepared, ready-to-eat food items that are typically high in calories, fat, sugar, and salt, such as fried snacks, burgers, pizza, packaged snacks, and sugar-sweetened beverages. Consumption was assessed based on self-reported frequency per week.
- **Adequate sleep:** ≥6–7 hours of uninterrupted sleep per night on ≥4 days/week

RESULT

Out of the 151 students analyzed, 42 (27.8%) met the criteria for obesity using the Asian-specific BMI cut-off of ≥ 25 kg/m². This left the majority, 109 students, or 72.2%, in the non-obese group **(Table 1)**.

Initial bivariate analyses yielded no statistically significant variables. A positive family history of obesity had higher obesity odds (COR = 1.851), although, it did not reach levels of statistical significance. (95% CI: 0.733–4.673). Similarly, independent assessments of individual lifestyle factors revealed no significant associations for this cohort **(Table 2)**.

The multivariable logistic regression involved two distinct stages/ hierarchy. Model 1 focused on baseline socio-demographics including age, sex, income, residence, and family background. Building on this, Model 2 brought in behavioural elements like physical activity, sleep, and diet.

Students who played outdoor games four to five times a week had significantly higher odds of obesity than those playing less than once weekly (OR = 4.945; 95% CI: 1.060–23.068). Meanwhile, other predictors such as fast food intake, regular exercise, and uninterrupted sleep, failed to retain statistical significance **(Table 3)**.

Evaluating model diagnostics pointed to a modest boost once lifestyle factors were added. Initially, Model 1 showed poor/ no fit (Hosmer–Lemeshow p-value = 0.049) alongside a very low/no explanatory power (Nagelkerke R^2 = 0.033). Factoring in the behavioural variables improved Model 2's calibration considerably (Hosmer–Lemeshow p = 0.353). The Nagelkerke R^2 climbed to 0.191, meaning the final model explained roughly 19.1% of the variance in obesity status compared to 3.3% of the previous model. The −2 Log Likelihood also dropped from 175 down to 157.1. However, the overall change in the model chi-square fell short of statistical significance (p = 0.265) **(Table 4)**.

DISCUSSION

The present study evaluated obesity prevalence and its predictors among undergraduate medical students. The setting was a tertiary care teaching hospital in northern West Bengal. A Similar study from a medical college in Kolkata, in 2016, reported overweight / obesity as 19% and 9% as per WHO classification of BMI.[6] Similarly, Gupta et al.,[12] utilized WHO BMI classification tables at a peripheral medical college in southern West Bengal, reporting a combined prevalence of 21% (17% overweight and 3% obese). Nationally, a systematic review of 99 studies involving 47,455 Indian medical students estimated a pooled overweight prevalence of 18% (95% CI: 17%–20%) and an obesity prevalence of 9% (95% CI: 7%–11%). The combined prevalence of excess weight (overweight and obesity) was calculated to be 24% (95% CI: 22%—27%).[13] This review further noted that male students exhibited a higher pooled prevalence, which increased alongside the proportion of male participants in the samples.[13] In contrast, the present study identified a higher overall prevalence of 27.8% (male: 29.4%, female: 24.5%). This discrepancy likely stems from the use of NCDC India Classification for Obesity cutoff values rather than the standard WHO classifications employed in the aforementioned studies. Such findings align with global trends showing that obesity increasingly impacts young adults, including those in health training programs.[13] This remains a critical issue, as future physicians are expected to model healthy behaviors and provide credible lifestyle counseling in their clinical practice.[14]

Medical training is characterized by demanding schedules, psychological stress, irregular meals, and sleep deprivation, factors frequently linked in the literature to unhealthy weight gain.[15] However, unadjusted analyses within this study cohort failed to show statistically significant links between most variables and obesity. This may be attributed to cohort homogeneity, limited exposure variability, or insufficient statistical power.

To gain deeper insights, hierarchical logistic regression was employed. Model 1, which isolated non-modifiable factors, yielded poor explanatory capacity (Nagelkerke R^2 = 0.033) and a lack of fit, suggesting that demographics and family history alone cannot explain obesity risk in this group. However, the introduction of modifiable lifestyle variables in Model 2 improved the overall fit, with the Nagelkerke R^2 rising to 0.191. This indicates that while lifestyle behaviors contribute to obesity risk in this demographic, their influence is nuanced.

The factors associated with obesity among medical students vary considerably across the literature, reflecting the multifactorial nature of the condition. While several investigations have identified physical inactivity, poor diet, and family history as significant predictors,[16,17] recent research, including to the present one, indicates that these traditional risk factors are not always consistently associated with obesity in this population. For example, a cross-sectional study at Jazan University found no significant association between obesity and sociodemographic factors, activity levels, or dietary habits.[14] Conversely, Nowara et al.,[18] identified female sex, physical inactivity, cognitive restraint, and emotional eating as significant predictors among Egyptian medical students.

Interestingly, other modifiable behaviours in the adjusted model lacked significant associations, contradicting prior expectations. Factors such as fast-food intake, general exercise frequency, and sleep duration failed to predict obesity status here, despite established links between short sleep and hormonal shifts in broader literature.[19,20,21] Furthermore, students playing outdoor games four to five times weekly faced significantly higher obesity odds (OR ≈ 4.9) than those playing less than once a week. Reverse causality offers a plausible explanation: overweight individuals may be more likely to increase their physical activity specifically to manage their weight.

Variations in obesity data often stem from differences in study populations and methodologies, such as residential settings, self-reporting accuracy, and sample sizes. Because most studies are cross-sectional, they cannot capture weight gain over time.[22] Relying on self-reported data introduces potential recall and social desirability biases.[23] Data collection was restricted to a single institution leading to lack of generalisability of the data. The exclusion of specific metrics, such as perceived stress, caloric intake, and screen time, may result in residual confounding. The Variance Inflation Factor (VIF) for all included variables remained below 2, suggesting no significant multi-collinearity, although a degree of conceptual redundancy between certain lifestyle and demographic factors cannot be entirely ruled out. Finally, the primary logistic regression model (Model 2) included 22 predictor variables, but there were only 42 cases, indicating an events per variable (EPV) ratio of about 1.9, which is much lower than the recommended 10 per variable, which has resulted in an overfitted model. Despite these constraints, the study's methodological strengths, including complete enumeration, standardized anthropometric measurements, and hierarchical modelling, reinforce its internal validity.[24]

Obesity prevalence among future physicians raises distinct public health concerns. Personal health practices directly impact a physician's likelihood of offering lifestyle counselling. It also affects their clinical credibility.[26,27] Medical colleges serve as critical environments for early intervention. Implementing structured wellness initiatives is necessary. Active integration of physical activity, healthier cafeteria standards, sleep hygiene protocols, and stress management programs can help reduce long-term cardiometabolic risks in this population.

CONCLUSION

A considerable proportion of medical students in this setting experience obesity. Medical knowledge alone provides no inherent protection against weight gain. Most demographic and lifestyle variables failed to reach statistical significance. Hierarchical regression analysis did, however, capture a modest behavioral influence. There was a positive link between frequent outdoor game participation and higher obesity odds. It demands targeted investigation. Obesity among young adults remains deeply multifactorial. Future research requires multicentric, longitudinal designs. Relying on objective behavioral measurements is necessary to map out true causal pathways and build effective, campus-level prevention programs.

CONFLICT OF INTEREST

None Declared

FUNDING

Not declared

Table 1: Proportion of medical students with obesity (n=151)

Obesity	Frequency	Percent
Absent	109	72.2
Present	42	27.8
Total	**151**	**100.0**

Table 4: Model summary and goodness-of-fit statistics for the hierarchical binary logistic regression models predicting obesity

Model	Omnibus Tests of Model Coefficients			Change Statistics (Block)			Goodness of Fit		
	$\chi 2$	df	Sig.	$\Delta\chi 2$	Δdf	Sig. Change	Hosmer-Lemeshow (p)	-2 Log Like-lihood	Nagelkerke R^2
1	3.52	7	0.833	3.52	7	0.833	0.049	175	0.033
2	21.48	22	0.491	17.96	15	0.265	0.353	157.1	0.191

Table 2: Univariate analysis of predictors of obesity in the study population (n=151)

Variables		Obese n=42	Non-obese n=109	COR 95% CI)
Age [median (IQR)]		21.5 (20-23)	21 (21-23)	1.001 (0.822-1.218)
Log Per capita income [median (IQR)]		11250 (3645.8- 20625)	12500 (5000-17500)	1.004 (0.729-1.383)
Sex	Female	12 (24.5)	37 (75.5)	0.778 (0.358-1.695)
	Male	30 (29.4)	72 (70.6)	Reference
Residence	Urban	19 (24.7)	58 (75.3)	0.726 (0.355-1.484)
	Rural	23 (31.1)	51 (68.9)	Reference
Family history of obesity	Present	9 (39.1)	14 (16.9)	1.851 (0.733-4.673)
	Absent	33 (25.8)	95 (74.2)	Reference
Family history of diabetes	Present	19 (27.9)	49 (72.1)	1.012 (0.495-2.068)
	Absent	23 (27.7)	60 (72.3)	Reference
Personal history of comorbidity	Present	6 (40)	9 (60)	1.852 (0.616-5.569)
	Absent	36 (26.5)	100 (73.5)	Reference
History of alcohol intake	Present	1 (16.7)	5 (83.3)	0.507 (0.058-4.476)
	Absent	41 (28.3)	104 (71.7)	Reference
How many meals do you consume per day	> 2	35 (29.9)	82 (70.1)	1.646 (0.656-4.134)
	≤ 2	7 (20.6)	27 (79.4)	Reference
Type of diet	Non-vegetarian	34 (26.2)	96 (73.8)	0.576 (0.220-1.509)
	Vegetarian	8 (38.1)	13 (61.9)	Reference
How many days per week do you have fast food	>5 times	3 (12.5)	21 (87.5)	0.268 (0.061-1.180)
	4-5 times	10 (38.5)	16 (61.5)	1.172 (0.365-3.762)
	1-3 times	21 (26.9)	57 (73.1)	0.691 (0.256-1.865)
	Never to <1 per week	8 (34.8)	15 (65.2)	Reference
How many days per week do you play outdoors	>5 times	8 (36.4)	14 (63.6)	2.321 (0.832-6.480)
	4-5 times	6 (37.5)	10 (62.5)	2.437 (0.771-7.702)
	1-3 times	12 (27.5)	20 (62.5)	2.437 (0.990-6.000)
	Never to <1 per week	16 (19.8)	65 (80.2)	Reference
How many times do you exercise per week	>5 times	7 (29.2)	17 (70.8)	1.353 (0.467- 3.922)
	4-5 times	9 (33.3)	18 (66.7)	1.643 (0.605- 4.462)
	1-3 times	12 (30)	28 (70)	1.408 (0.571-3.474)
	Never to <1 per week	14 (23.3)	46 (76.7)	Reference
How many days per week do you sleep uninterrupted for 6-7 hours	>5 times	22 (28.6)	55 (71.4)	1.067 (0.259-4.395)
	4-5 times	15 (34.1)	29 (65.9)	1.379 (0.318-5.975)
	1-3 times	2(10.5)	17 (89.5)	0.314 (0.043-2.265)
	Never to <1 per week	3 (27.3)	8 (72.7)	Reference

Table 3: Hierarchical binary logistic regression analysis to explain obesity in the study population. (n=151)

	Model 1	Model 2
Constant	.254	.375
Age in years	0.995 (0.809- 1.223)	0.953 (0.761-1.192)
Log Per Capita Income	1.069 (0.746- 1.532)	1.053 (0.686- 1.616)
Female sex	0.836 (0.368- 1.897)	1.131 (0.409- 3.128)
Urban residence	0.707 (0.304- 1.646)	0.933 (0.350- 2.489)
Family history of obesity	1.850 (0.694- 4.927)	2.245 (0.728- 6.922)
Family history of diabetes	0.980 (0.452- 2.125)	0.998 (0.397- 2.508)
Presence of comorbidities	1.513 (0.483- 4.740)	1.523 (0.393- 5.903)
Personal history of drinking		1.007 (0.079- 12.760)
Non-vegetarian diet		0.729 (0.236- 2.246)
Food intake more than 2 meals per day		2.429 (0.829-7.118)
No fast-food intake/ less than once per week		Reference
Fast food intake 1-3 times per week		0.834 (0.255- 2.729)
Fast food intake 4-5 times per week		1.235 (0.305- 5.001)
Fast food intake more than 5 times per week		0.218 (0.037- 1.276)
No outdoor games/ less than once per week		Reference
Outdoor games 1-3 times per week		2.185 (0.723- 6.606)
Outdoor games 4-5 times per week		4.945 (1.060- 23.068)*
Outdoor games more than 5 times per week		3.285 (0.797- 13.539)
No exercise/ exercise less than once per week		Reference
Exercise 1-3 times per week		1.109 (0.367- 3.357)
Exercise 4-5 times per week		1.193 (0.361- 3.947)
Exercise more than 5 times per week		0.726 (0.154- 3.423)
Uninterrupted sleep for 6-7 hours, never/ less than once per week		Reference
Uninterrupted sleep for 6-7 hours, 1-3 times per week		0.195 (0.020- 1.917)
Uninterrupted sleep for 6-7 hours, 4-5 times per week		0.880 (0.169- 4.590)
Uninterrupted sleep for 6-7 hours, more than 5 times per week		0.731 (0.154- 3.461)

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