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Studying The Impact Of Dietary And Lifestyle Factors On BMI In Overweight And Obese Children And Adolescents

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Abstract

Introduction: *The Global Prevalence Of Childhood Obesity Is Increasing At An Alarming Rate, Leading To Significant Public Health Concerns. Dietary Habits, Lifestyle Patterns, And Sociodemographic Factors Are Known To Influence Nutritional Status Among Children And Adolescents.*

Aim Of The Study: *This Study Aimed To Assess The Nutritional Status, Dietary Habits, And Lifestyle Habits Of A Group Of Children And Adolescents, And To Explore Their Associations With Various Sociodemographic Characteristics.*

Methods: *This Cross-Sectional Study Was Conducted On 69 Children And Adolescents Aged 5-18 Years, Visiting The Adolescents Departments Of Bangladesh Shishu Hospital & Institute. Participants, Classified As Overweight Or Obese Based On WHO's BMI-For-Age Growth Charts, Were Selected Through Convenience Sampling. Data On Dietary Habits, Physical Activity Levels, And Other Potential Confounders Were Collected Using Structured Questionnaires Over A Year. Food Items Were Categorized Into Two Groups For Better Organization. BMI Was Calculated Using Standard Procedures. Multiple Regression Analysis Was Used To Assess The Association Between Dietary And Lifestyle Factors And BMI, With A P-Value Of Less Than 0.05 Considered Statistically Significant.*

Result: *This Study Included 39.13% Overweight And 60.87% Obese Participants. The Majority Of Participants Were Aged Between 11 And 15 Years Old, With A Slightly Higher Proportion Of Males Than Females. Most Participants Had A Good Socioeconomic Status And Came From Nuclear Families. Fast Food Consumption Was Significantly Negatively Correlated With Nutritional Status, Indicating That Higher Fast-Food Intake Was Associated With Poorer Nutritional Status. A Novel Finding Was The Significant Negative Correlation Between Mutton Consumption And Nutritional Status.*

Conclusion: *The Study Underscores The Association Of Overweight And Obesity Among Children And Adolescents. These Findings Highlight The Urgent Need For Interventions Promoting Healthier Dietary And Lifestyle Habits Among Children And Adolescents, And Further Research To Explore The Observed Associations.*

Keywords: *Obesity, Overweight, BMI, Adolescent, Dietary Pattern*

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I. INTRODUCTION

The escalating prevalence of overweight and obesity among children and adolescents has emerged as a significant public health concern worldwide. According to the World Health Organization (WHO), the number of overweight children under the age of five was estimated to be over 38 million in 2019, with over 340 million children and adolescents aged 5-19 being overweight or obese in 2016.(1,2) This alarming trend underscores the urgency of addressing this issue, given the severe health consequences associated with childhood obesity. Overweight and obesity in childhood and adolescence are linked to a plethora of health complications, both immediate and long-term. These include a higher risk of developing chronic diseases such as cardiovascular diseases, type 2 diabetes, and certain types of cancer in adulthood.(1,3) Moreover, the economic burden of managing these health conditions places a substantial strain on healthcare systems globally. In Asia, the situation is particularly concerning. The prevalence of overweight and obesity among children and adolescents has been increasing at an alarming rate. For instance, in Bangladesh, a study reported that the prevalence of overweight and

obesity among school-aged children in Dhaka was 9.5% and 5.1%, respectively.(4) This trend is worrisome, given the country's limited resources to manage the associated health and economic burdens. The Body Mass Index (BMI), a simple index of weight-for-height, is commonly used to classify overweight and obesity in children and adolescents. While genetic factors play a role in determining a person's BMI, lifestyle and dietary factors are also crucial determinants.(5) Dietary habits, including the type and quantity of food consumed, have a significant impact on energy balance and, consequently, weight status.(6) A diet high in energy-dense, nutrient-poor foods, such as fast food, sugary drinks, and snacks, has been associated with higher BMI in children and adolescents.(7) Conversely, a diet rich in fruits, vegetables, whole grains, and lean proteins can promote healthy weight.(8) Lifestyle factors, particularly physical activity levels and sedentary behaviors, also play a crucial role in energy balance and weight status. Regular physical activity can help maintain a healthy weight by increasing energy expenditure. On the other hand, sedentary behaviors, such as prolonged screen time, have been linked to higher BMI in children and adolescents.(9) Physical activity (PA) is a key behavioral factor for maintaining health and well-being at individual and population levels. Physical activity (PA) is a crucial behavioral factor for maintaining overall health and well-being at both the individual and population levels.(10–12) The Global Physical Activity Questionnaire (GPAQ) is an instrument that has been endorsed by the World Health Organization (WHO) for its STEPwise Approach to Chronic Disease Risk Factor Surveillance (STEPS).(13,14) The GPAQ provides a standardized tool for assessing physical activity levels, enabling effective monitoring and surveillance of physical activity patterns globally. Despite the known impact of dietary and lifestyle factors on BMI, there is a need for more research in this area, particularly in specific populations such as children and adolescents in Dhaka, Bangladesh. This study aims to explore the impact of dietary and lifestyle factors on BMI in overweight and obese children and adolescents in this population. The findings of this study could contribute to the development of effective interventions to prevent and manage overweight and obesity in this population. Existing literature on the relationship between BMI and dietary/lifestyle factors in children and adolescents, particularly in the context of Bangladesh, is sparse. Furthermore, the findings of previous studies are often conflicting, with some studies reporting significant associations while others do not. This inconsistency in the literature underscores the need for further investigation. This study aims to fill this gap in the literature by examining the association between dietary and lifestyle factors and BMI in overweight and obese children and adolescents in Dhaka, Bangladesh. The findings of this study could provide valuable insights for developing targeted interventions to address the growing problem of childhood and adolescent obesity in Bangladesh and similar contexts.

II. METHODS

The study employed a cross-sectional design to explore the impact of dietary and lifestyle factors on BMI in overweight and obese children and adolescents. The study population comprised children and adolescents aged between 5 and 19 years, visiting the adolescents departments of Bangladesh Shishu Hospital & Institute. The inclusion criteria were children and adolescents aged between 5 and 19 years, individuals classified as overweight or obese based on the World Health Organization's BMI-for-age growth charts, individuals who were vesting the Bangladesh Shishu Hospital & Institute, and individuals who were willing to participate and whose parents or guardians had provided informed consent. The exclusion criteria included children and adolescents with any diagnosed metabolic or endocrine disorders that could influence body weight, such as hypothyroidism or Cushing's syndrome, individuals on any medication that could affect body weight, and individuals with any physical or mental condition that could affect dietary intake or physical activity levels. Finally, a total of 69 participants were selected through convenience sampling technique to participate in the study. Data collection occurred over a period of 1 year, from January 2022 to December 2022, using a structured questionnaire to gather information on dietary habits, physical activity levels, sedentary behaviors, and other potential confounders such as socioeconomic status and parental BMI. Dietary habits were assessed using a food frequency questionnaire, while physical activity and sedentary behaviors were evaluated using a validated physical activity questionnaire. Physical activity outcome measures the global physical activity questionnaire (GPAQ) Version 2 of GPAQ in Bengali language was used in this study.(15) The BMI was calculated using the standard formula (weight in kilograms divided by height in meters squared), with weight and height measurements taken using standardized procedures. Weight was measured to the nearest 0.1 kg using a digital scale, and height was measured to the nearest 0.1 cm using a standard measurement device. For batter organization, food items like beef, mutton, chicken, fish, eggs, rice and fast foods were divided categorized as food group 1, while vegetables, fruits and milk were categorized as food group 2. The collected data were analyzed using appropriate statistical methods. The association between dietary and lifestyle factors and BMI was assessed using multiple regression analysis, adjusting for potential confounders. All statistical analyses were performed using a statistical software package, with a p-value of less than 0.05 considered statistically significant.

III. RESULTS

Table 1: Distribution of participants by Baseline Sociodemographic Characteristics (N=69)

Socio-Demographic Characters	Frequency	Percentage
Age		
<=10	10	14.49%
11-15	54	78.26%
>15	5	7.25%
Mean Age	12.94 ± 1.91	
Age Range	9-16	
Gender		
Male	37	53.62%
Female	32	46.38%
Socioeconomic Status		
Low	3	4.35%
Medium	9	13.04%
Good	57	82.61%
Monthly Family Income		
15000-20000	5	7.25%
20001-40000	4	5.80%
>40000	60	86.96%
Type of Family		
Nuclear	63	91.30%
Joint	6	8.70%
Residence		
Urban	66	95.65%
Rural	3	4.35%
School Performance		
Poor	8	11.59%
Moderate	28	40.58%
Good	33	47.83%
Height		
Mean ± SD	156.87 ± 10.53	
Minimum	128	
Maximum	178	
Weight		
Mean ± SD	65.4 ±13.05	
Minimum	37.5	
Maximum	100.4	
BMI		
Mean ± SD	23.68 ± 8.36	
Minimum	23	
Maximum	40.2	

Table 1 presents the distribution of participants (N=69) based on their baseline sociodemographic characteristics. The majority of participants were between 11 and 15 years old (78.26%), and slightly more were male (53.62%) than female (46.38%). Most participants had a good socioeconomic status (82.61%) and came from nuclear families (91.30%). The majority resided in urban areas (95.65%). School performance varied, with 47.83% classified as good, 40.58% as moderate, and 11.59% as poor. Anthropometric measurements indicated a mean height of 156.87 cm, a mean weight of 65.4 kg, and a mean BMI of 23.68 kg/m².

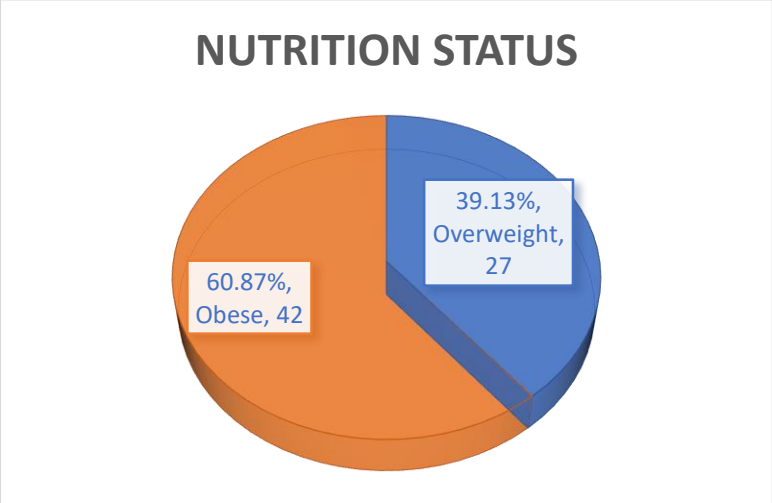

Figure 1: Distribution of participants by nutritional status (N=69)

Figure 1 displays the distribution of participants (N=69) according to their nutritional status. Among the participants, 27 individuals (39.13%) were classified as overweight, while 42 individuals (60.87%) fell into the obese category.

Table 2: Distribution of participants by food consumption habits (N=69)

Food Consumption Habit	More than once per day	Once per day	3-6 times per week	Once or twice per week	Once per month or less
Beef	-	1 (1.45%)	10 (14.49%)	35 (50.72%)	13 (18.84%)
Mutton	-	-	2 (2.90%)	11 (15.94%)	12 (17.39%)
Chicken	5 (7.25%)	5 (7.25%)	42 (60.87%)	16 (23.19%)	1 (1.45%)
Fish	7 (10.14%)	27 (39.13%)	26 (37.68%)	5 (7.25%)	4 (5.80%)
Eggs	4 (5.80%)	41 (59.42%)	13 (18.84%)	9 (13.04%)	2 (2.90%)
Rice	54 (78.26%)	13 (18.84%)	2 (2.90%)	-	-
Vegetables	14 (20.29%)	33 (47.83%)	10 (14.49%)	7 (10.14%)	5 (7.25%)
Fruits	6 (8.70%)	31 (44.93%)	17 (24.64%)	9 (13.04%)	5 (7.25%)
Milk	1 (1.45%)	34 (49.28%)	15 (21.74%)	9 (13.04%)	6 (8.70%)
Fast Foods	7 (10.14%)	20 (28.99%)	9 (13.04%)	22 (31.88%)	10 (14.49%)

Table 2 presents the distribution of participants by their food consumption habits. The majority of participants consumed rice more than once per day (78.26%), followed by eggs (59.42%), and chicken (60.87%). Fish was consumed once per day by 39.13% of participants, while milk was consumed once per day by 49.28% of participants. In terms of weekly consumption, chicken was the most frequently consumed food item, with 60.87% of participants consuming it 3-6 times per week. This was followed by fish (37.68%), and eggs (18.84%). Beef was consumed once or twice per week by 50.72% of participants, making it the most frequently consumed food in this category. This was followed by chicken (23.19%), fast foods (31.88%), and mutton (15.94%). In terms of monthly consumption, beef was consumed once per month or less by 18.84% of participants, followed by mutton (17.39%), and fast foods (14.49%).

Table 3: Distribution of participants by lifestyle habits (N=69)

Lifestyle	Frequency	Percentage
Sedentary lifestyle	65	94.20%
TV watching Habit	11	15.94%
Mobile Usage Habit	47	68.12%
Outdoor Playing Habit	7	10.14%

Table 3 presents the distribution of participants (N=69) based on their lifestyle habits. The majority of participants (94.20%) reported having a sedentary lifestyle, indicating limited physical activity. When it comes to TV watching habits, 15.94% of participants reported regularly watching TV. Mobile usage was prevalent among the participants, with 68.12% indicating frequent use of mobile devices. In contrast, a smaller proportion of participants (10.14%) reported having an outdoor playing habit, suggesting limited engagement in outdoor activities.

Table 4: Correlation matrix between Nutritional Status and Dietary factors (Food Group 1)

Correlations									
		Nutrition Status	Beef	Mutton	Chicken	Fish	Eggs	Rice	Fast Foods
Nutrition Status	Pearson Correlation	1	-0.152	0.012	-0.104	0.042	-0.036	0.099	**-.244***
	Sig. (2-tailed)		0.214	0.922	0.395	0.729	0.768	0.416	0.044
Beef	Pearson Correlation	-0.152	1	-0.195	0.117	0.004	0.172	0.057	0.115
	Sig. (2-tailed)	0.214		0.108	0.340	0.973	0.157	0.641	0.349
Mutton	Pearson Correlation	0.012	-0.195	1	0.099	-0.059	0.116	0.029	-.293*
	Sig. (2-tailed)	0.922	0.108		0.417	0.632	0.344	0.811	**0.015**
Chicken	Pearson Correlation	-0.104	0.117	0.099	1	0.049	.393**	0.192	0.159
	Sig. (2-tailed)	0.395	0.340	0.417		0.692	**0.001**	0.115	0.192
Fish	Pearson Correlation	0.042	0.004	-0.059	0.049	1	0.050	0.024	0.087
	Sig. (2-tailed)	0.729	0.973	0.632	0.692		0.683	0.846	0.477
Eggs	Pearson Correlation	-0.036	0.172	0.116	.393**	0.050	1	-0.070	0.046
	Sig. (2-tailed)	0.768	0.157	0.344	**0.001**	0.683		0.568	0.705
Rice	Pearson Correlation	0.099	0.057	0.029	0.192	0.024	-0.070	1	0.232
	Sig. (2-tailed)	0.416	0.641	0.811	0.115	0.846	0.568		0.055
Fast Foods	Pearson Correlation	-.244*	0.115	-.293*	0.159	0.087	0.046	0.232	1
	Sig. (2-tailed)	**0.044**	0.349	**0.015**	0.192	0.477	0.705	0.055	
*. Correlation is significant at the 0.05 level (2-tailed).									
**. Correlation is significant at the 0.01 level (2-tailed).									

The correlation matrix in Table 4 presents the relationships between nutritional status and various dietary factors among the study population. Nutritional status showed a significant negative correlation with fast food consumption ($r = -0.244$, $p = 0.044$), indicating that higher fast food intake was associated with poorer nutritional status. Similarly, a significant negative correlation was observed between mutton consumption and nutritional status ($r = -0.293$, $p = 0.015$), suggesting that higher mutton intake was linked to poorer nutritional status. On the other hand, nutritional status showed non-significant correlations with the consumption of beef ($r = -0.152$, $p = 0.214$), chicken ($r = -0.104$, $p = 0.395$), fish ($r = 0.042$, $p = 0.729$), eggs ($r = -0.036$, $p = 0.768$), and rice ($r = 0.099$, $p = 0.416$). This indicates that the intake of these food items was not significantly associated with nutritional status in this study population. Among the dietary factors, a significant positive correlation was observed between chicken and egg consumption ($r = 0.393$, $p = 0.001$), indicating that individuals who consumed more chicken also tended to consume more eggs.

Table 5: Correlation matrix between Nutritional Status and Dietary factors (Food Group 1)

		Nutrition Status	Vegetables	Fruits	Milk
Nutrition Status	Pearson Correlation	1	0.073	-0.085	0.115
	Sig. (2-tailed)		0.55	0.486	0.346
	Sig. (2-tailed)	0.919	0.795	0.239	0.302
Vegetables	Pearson Correlation	0.073	1	.362**	0.083
	Sig. (2-tailed)	0.55		**0.002**	0.496
Fruits	Pearson Correlation	-0.085	.362**	1	.240*
	Sig. (2-tailed)	0.486	**0.002**		**0.047**
Milk	Pearson Correlation	0.115	0.083	.240*	1
	Sig. (2-tailed)	0.346	0.496	**0.047**	
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

In terms of the correlation between nutritional status and dietary factors, the Pearson correlation coefficient for nutritional status with vegetables is 0.073, indicating a weak positive correlation. However, the p-value of 0.55 suggests that this correlation is not statistically significant. Similarly, the correlation coefficient between nutritional status and fruits is -0.085, indicating a weak negative correlation. Again, the p-value of 0.486 suggests that this correlation is not statistically significant. For nutritional status and milk, the correlation coefficient is 0.115, indicating a weak positive correlation. However, the p-value of 0.346 suggests that this correlation is not statistically significant.

Moving to the correlation between dietary factors themselves, the correlation coefficient between vegetables and fruits is 0.362. This correlation is statistically significant at the 0.01 level (two-tailed), as indicated by the p-value of 0.002. Similarly, the correlation coefficient between fruits and milk is 0.240. This correlation is statistically significant at the 0.05 level (two-tailed), with a p-value of 0.047.

Table 6: Correlation Matrix between Nutritional status and non-dietary factors

		Patient's AGE	Gender	Monthly Income	Socioeconomic Status	Nutrition Status	Physical Activity	School Performance
Patient's AGE	Pearson Correlation	1	0.166	.417**	.319**	0.038	0.238	0.216
	Sig. (2-tailed)		0.172	**0.000**	**0.008**	0.756	0.052	0.079
Gender	Pearson Correlation	0.166	1	0.183	0.112	-0.207	0.026	0.106
	Sig. (2-tailed)	0.172		0.139	0.359	0.088	0.832	0.394
Monthly Income	Pearson Correlation	.417**	0.183	1	.883**	0.094	0.084	.411**
	Sig. (2-tailed)	**0.000**	0.139		**0.000**	0.449	0.504	**0.001**
Socioeconomic Status	Pearson Correlation	.319**	0.112	.883**	1	0.008	-0.013	.297*
	Sig. (2-tailed)	**0.008**	0.359	**0.000**		0.950	0.918	**0.015**
Nutrition_Status	Pearson Correlation	0.038	-0.207	0.094	0.008	1	-0.050	-0.160
	Sig. (2-tailed)	0.756	0.088	0.449	0.950		0.689	0.195
Physical Activity	Pearson Correlation	0.238	0.026	0.084	-0.013	-0.050	1	-0.052
	Sig. (2-tailed)	0.052	0.832	0.504	0.918	0.689		0.676
School Performance	Pearson Correlation	0.216	0.106	.411**	.297*	-0.160	-0.052	1
	Sig. (2-tailed)	0.079	0.394	**0.001**	**0.015**	0.195	0.676	
**. Correlation is significant at the 0.01 level (2-tailed).								

*. Correlation is significant at the 0.05 level (2-tailed).

The correlation matrix in Table 6 presents the relationships between nutritional status and various non-dietary factors among the study population. Nutritional status showed non-significant correlations with the patient's age ($r = 0.038$, $p = 0.756$), gender ($r = -0.207$, $p = 0.088$), monthly income ($r = 0.094$, $p = 0.449$), socioeconomic status ($r = 0.008$, $p = 0.950$), physical activity ($r = -0.050$, $p = 0.689$), and school performance ($r = -0.160$, $p = 0.195$). This indicates that these non-dietary factors were not significantly associated with nutritional status in this study population. Among the non-dietary factors, significant positive correlations were observed between the patient's age and monthly income ($r = 0.417$, $p < 0.001$), the patient's age and socioeconomic status ($r = 0.319$, $p = 0.008$), monthly income and socioeconomic status ($r = 0.883$, $p < 0.001$), and monthly income and school performance ($r = 0.411$, $p = 0.001$). A significant positive correlation was also observed between socioeconomic status and school performance ($r = 0.297$, $p = 0.015$). These findings suggest that individuals with higher age, income, and socioeconomic status also tended to have better school performance.

IV. DISCUSSION

The present study provides a comprehensive analysis of the nutritional status, dietary habits, and lifestyle habits of a group of children and adolescents, and their associations with various sociodemographic characteristics. The findings reveals overweight and obesity is consistent with the global trend of increasing childhood obesity.(2) The majority of participants were aged between 11 and 15 years old, with a slightly higher proportion of males than females. This demographic profile is similar to other studies conducted in different parts of the world.(16–18) Theage group of 11-15 is a critical age group for the development of dietary and lifestyle habits that can influence health outcomes in later life.(19) The slightly higher proportion of males than females in the study is consistent with other studies that have reported a higher prevalence of obesity among boys than girls.(20) Most participants had a good socioeconomic status and came from nuclear families, which may reflect the demographic profile of the study area. The majority of participants resided in urban areas, which is noteworthy as urbanization is often associated with changes in dietary and physical activity patterns that can increase the risk of obesity.(21) School performance varied among the participants, suggesting that academic achievement may not be directly linked to nutritional status in this population. The anthropometric measurements indicated a mean BMI of 26.20 kg/m², which falls within the overweight range according to the World Health Organization's classification for children and adolescents.(1) This finding underscores the high prevalence of overweight and obesity among the study participants. The present study found a high prevalence of overweight and obesity among the participants, with 60.87% falling into the obese category and 39.13% classified as overweight. This is a concerning finding, as childhood obesity is associated with a range of health problems, including diabetes, cardiovascular diseases, and psychological issues.(1) The high prevalence of obesity and overweight in this study is consistent with the findings of multiple other studies, who reported a high prevalence of obesity among children and adolescents in Saudi Arabia, United States and other countries.(22–24) In terms of dietary habits, the majority of participants consumed rice more than once per day, followed by eggs and chicken. This pattern of food consumption is similar to that reported in other studies conducted in similar settings.(17) The study found a significant negative correlation between fast food consumption and nutritional status, indicating that higher fast food intake was associated with poorer nutritional status. This finding is in line with the results of other studies that reported a significant association between fast food consumption and obesity among children and adolescents.(16,25) The study also found a significant negative correlation between mutton consumption and nutritional status, suggesting that higher mutton intake was linked to poorer nutritional status. This is a novel finding that warrants further investigation in future studies. The majority of the participants reported having a sedentary lifestyle, indicating limited physical activity. This is a concerning finding, as physical inactivity is a known risk factor for obesity and other non-communicable diseases.(26,27) In terms of socioeconomic status, most participants had a good socioeconomic status. The study found no significant association between socioeconomic status and nutritional status. This contrasts with findings from other studies, which have reported a positive association between socioeconomic status and obesity in developing countries.(28,29) The discrepancy might be due to differences in the study populations and the measures used to assess socioeconomic status.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

V. CONCLUSION

In conclusion, this study highlights overweight and obesity among children and adolescents, consistent with global trends. The majority of participants, aged between 11 and 15, exhibited dietary habits and lifestyle patterns that could contribute to these health issues. Notably, fast food consumption was significantly associated with poorer nutritional status. The study also revealed a novel finding of a negative correlation between mutton consumption and nutritional status. Despite most participants having a good socioeconomic status, no significant association was found between socioeconomic status and nutritional status. These findings underscore the urgent need for interventions promoting healthier dietary and lifestyle habits among children and adolescents, and further research to explore the observed associations.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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