"Comparative Study of Nutritional Status and Academic Performance among Rural and Urban Adolescents in Sambalpur District"

Etishree Nayak[1] Dr. Lipsa Dash[2] and Dr. Tripti Kumari[3]

[1&3] P.G. Department Home Science, Sambalpur University, [2] Navi Mumbai, Maharastra

Corresponding author email id: **singhtripti25dec@gmail.com**

ABSTRACT

Background: Adolescence is a critical period of growth with increased nutritional needs, yet malnutrition and micronutrient deficiencies are rising. Adequate nutrition during this stage is essential not only for physical development but also for cognitive function, directly influencing academic performance and long-term health outcomes.

Methods: A cross-sectional study was conducted to assess the nutritional status of adolescents attending schools in both rural and urban areas of Sambalpur District. A total of 120 participants, aged 13–16 years, were selected using a non-probability sampling technique, comprising 65 boys and 55 girls. Data were collected through a structured and standardized questionnaire, which included sections on socio-demographic characteristics, nutritional knowledge, eating habits, and a food frequency questionnaire (FFQ). The collected data were systematically entered and analyzed using SPSS version 24.0 to evaluate nutritional patterns and related factors among the adolescents.

Results:

The results indicated that rural adolescents had higher rates of undernutrition, while urban adolescents mostly had normal or overweight BMI. Nutritional status was significantly associated with socioeconomic status and age, with better outcomes among older and higher socioeconomic urban adolescents. Academic performance was higher in urban and higher socioeconomic adolescents, and a significant positive association was observed between nutritional status and academic achievement, with well-nourished students performing better than undernourished peers.

Conclusion: The study highlights that nutritional status, socioeconomic status, age, and place of residence significantly influence adolescents' health and academic performance, with urban and better-nourished adolescents achieving superior nutritional and scholastic outcomes. These findings emphasize the need for targeted nutritional and educational interventions, particularly for undernourished and rural adolescents.

Keywords: Adolescents, rural, urban, nutritional status and academic performance.

INTRODUCTION

Adolescence is a critical period of growth and development, characterized by increased nutritional requirements due to rapid physical maturation, lifestyle patterns, and susceptibility to social and environmental influences. This transitional stage demands a higher intake of essential nutrients to support overall growth, yet there is a rising prevalence of malnutrition and micronutrient deficiencies among adolescents. Adequate nutrition during this period is not only vital for physical health but also plays a significant role in cognitive development and academic performance. Suboptimal nutritional status can impair concentration, memory, and learning abilities, ultimately affecting scholastic outcomes. Ensuring optimal nutrition in adolescence is therefore crucial for promoting both immediate well-being and long-term health, as well as enhancing educational achievement and cognitive potential.Adolescence is a critical developmental period marked by rapid physical, psychological, and cognitive growth, during which nutritional status plays a pivotal role in supporting overall health and scholastic achievement[1]. Adequate nutrition is essential not only for physical development but also for cognitive functions such as memory, attention, and information processing, all of which are fundamental to academic success[2]. Poor nutrition during this period can diminish academic outcomes by impairing brain development, reducing concentration, and increasing absenteeism due to illness[3].Globally, adolescents face a dual burden of malnutrition—where undernutrition and micronutrient deficiencies coexist with overweight and obesity—posing significant threats to their wellbeing and educational performance[4]. Studies in diverse settings have found that students

with better dietary quality and more balanced nutritional status tend to exhibit higher academic performance compared to those with poor diets or malnutrition[5]. Similarly, diet quality and nutritional diversity have been linked to higher class grades and cognitive functioning among adolescents in South Asia and beyond[7]. In addition to physical growth, micronutrients such as iron, folate, and omega-3 fatty acids have been associated with enhanced cognitive abilities and school performance, emphasizing the biological basis of nutrition's influence on learning. Furthermore, school-based nutritional interventions and regular consumption of nutrient-rich meals have been associated with improved academic outcomes, suggesting that nutritional support can serve as an effective strategy to enhance educational attainment[8].Despite this emerging evidence, research focusing on comparative nutritional patterns and their effect on academic performance among rural and urban adolescents in specific Indian contexts remains limited. This study, therefore, aimed to fill this gap by examining the association between nutritional status and academic performance among rural and urban adolescents in Sambalpur District, thereby providing insights that may inform targeted nutrition and education policies at community and school levels.

OBJECTIVES

- To determine the nutritional status (underweight, normal, overweight) of adolescents in rural and urban schools of Sambalpur District.
- To evaluate the academic performance of rural and urban adolescents based on their grades.
- To evaluate and examine the association between academic performance and nutritional status among rural and urban adolescents, and to compare differences in academic achievement between the two groups.

MATERIALS AND METHODS

A cross-sectional comparative study was conducted to assess the impact of nutritional status on academic performance among rural and urban school-going adolescents in Sambalpur District. The study population comprised adolescents aged 13 to 16 years enrolled in selected secondary schools. A total of 120 participants were included in the study, with an equal representation from rural (n = 60) and urban (n = 60) schools. Among them, 65 were boys and 55 were girls. Purposive sampling was employed to ensure adequate representation of adolescents from both rural and urban areas within the specified age group.Adolescents with chronic illnesses or physical disabilities affecting nutrition or academic performance were excluded from the study. Data were collected after obtaining ethical approval from the Institutional Ethics Committee, as well as written informed consent from parents or guardians and assent from the adolescents. Socio-demographic information, including age, gender, and place of residence, was gathered using a structured questionnaire.Nutritional status was assessed through anthropometric measurements. Weight was recorded using a calibrated digital scale, and height was measured using a stadiometer. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m^2) and classified according to WHO age- and sex-specific percentiles into categories of severely underweight, underweight, normal, and overweight. Academic performance was evaluated based on the students' most recent examination results, which were categorized into Grade A (100%–80%), Grade B (80%–60%), and Grade C (40%–60%).The collected data were coded and entered into SPSS version 25.0 for analysis. Descriptive statistics, including frequencies, percentages, and means, were used to summarize socio-demographic characteristics, nutritional status, and academic performance. The Chi-square test was applied to examine the association between nutritional status and academic performance, with a p-value of less than 0.05 considered statistically significant. Confidentiality and anonymity of all participants were strictly maintained throughout the study.

RESULTS AND DISCUSSION

Table 1: Distribution of respondents based on general information.

Variable	Frequency	Percentage (%)
Area		
Urban	60	50
Rural	60	50
Gender		
Boys	65	54.17
Girls	55	45.83
Age(in years)		
13	38	31.67
14	40	33.33

15	38	31.67
16	04	3.33
Educational Qualification		
8th	40	33.33
9th	40	33.33
10th	40	33.33
Ordinal Position		
1st	78	65
2nd	38	31.67
3rd	04	3.33
Other	0	0
Types of family		
Joint	46	38.33
Nuclear	74	61.67

The table 1. indicates that an equal proportion of respondents belonged to urban and rural areas (50% each). With respect to gender, boys constituted the majority of the sample (54.17%). Most of the respondents were aged 14 years (33.33%). Regarding educational qualification, the highest proportion of respondents were studying in 8th, 9th, and 10th standards, each accounting for 33.33%. In terms of ordinal position, the majority of respondents were first-born children (65%). A higher proportion of respondents belonged to nuclear families (61.67%).

Table 2: Distribution of respondents based on parent's education and occupation.

Variable	Frequency	Percentage (%)
Father Education		
Professional qualification	04	3.33
Post graduate	26	21.67
Graduate	20	16.67
Intermediate	38	31.67
High school	28	23.33
Primary	04	3.33
Mother Education		
Professional qualification	00	00
Post graduate	4	3.33
Graduate	42	35
Intermediate	28	23.33
High school	26	21.67
Primary	20	16.67
Father Occupation		
Govt job	42	35
Private job	30	25
Business	38	31.67
Self employed(income less than 5000 rupees/month)	08	6.67
Self employed(income more than 5000 rupees/month)	02	1.67
Mother Occupation		
Govt job	04	3.33
Private job	02	1.67
Self employed(income less than 5000 rupees/month)	22	18.33
Self employed(income more than 5000 rupees/month)	26	21.67
House wife	66	55

The table 2. showed that most fathers had intermediate-level education (31.67%), followed by high school (23.33%), postgraduation (21.67%), and graduation (16.67%), while only a small proportion had professional or primary education (3.33% each). In contrast, most mothers were graduates (35%), followed by those with intermediate (23.33%), high school (21.67%), and primary education (16.67%); only 3.33% were postgraduates, and none had professional qualifications.Regarding occupation, a majority of fathers were engaged in government service (35%) or business (31.67%), while others worked in private jobs (25%) or were self-employed with lower income (6.67%). Among mothers, most were homemakers (55%), while the remaining were self-employed (40%), with very few employed in government (3.33%) or private sectors (1.67%).

Table 3: Distribution of respondents according to their socio-economic status.

Income (Rs./month)	Rural		Urban		χ^2 value	p-value
	Frequency	%	Frequency	%		
61,000-65,000	00	00	08	6.67	95.97	0.000*
46,000-60,000	08	6.67	56	43.33		
31,000-45,000	36	30	00	00		
16,000-30,000	16	13.33	00	00		
<15,000	00	00	00	00		

* Significant

The table 3. showed that in rural areas, the highest proportion of respondents belonged to the income group of Rs. 31,000–45,000 per month (30%), followed by Rs. 16,000–30,000 (13.33%), while none of the respondents reported incomes above Rs. 45,000. In contrast, among urban respondents, the majority belonged to the income group of Rs. 46,000–60,000 per month (43.33%), followed by Rs. 61,000–65,000 (6.67%). No respondents from urban areas were reported in the income categories below Rs. 46,000. As similar patterns were observed in a North Indian study (Goyal et al., 2018), which reported significantly higher socioeconomic status and better nutritional outcomes among urban adolescents compared to their rural peers, underscoring how income differences influence adolescent health.

Table 4: Distribution of respondents according to their nutritional knowledge.

Variables	Rural		Urban		χ^2 value	p-value
	Yes (%)	No (%)	Yes (%)	No (%)		
Knowledge regarding nutritious food required during adolescent period	22 (18.33)	38 (31.67)	52 (43.33)	08 (6.67)	29.65	0.001*
Concern about healthy food	20 (16.67)	40 (33.33)	52 (4.33)	08 (6.67)	33.37	0.001*
Food intake during adolescent should be equal with RDA	18 (15)	42 (35)	10 (8.33)	50 (41.67)	2.28	0.131
Food intake during adolescent should be more than RDA	26 (21.67)	34 (28.33)	16 (13.33)	44 (36.67)	2.97	0.085
Food intake during adolescent should be less than RDA	30 (25)	30 (25)	48 (40)	12 (10)	10.59	0.001*
Any idea about nutritional deficiency disease	24 (20)	36 (30)	48 (40)	12 (10)	18.37	0.001*
Nutrition related knowledge imparted in school	52 (43.33)	08 (6.67)	58 (48.33)	02 (1.67)	2.73	0.099
Proper nutrition leads to good health	34 (28.33)	26 (21.67)	54 (45)	06 (5)	15.38	0.001*
For a good health each food a single option	32 (26.67)	28 (23.33)	10 (8.33)	50 (41.67)	16.15	0.001*
Refrigerated food healthy to consume	38 (31.67)	22 (18.33)	10 (8.33)	50 (41.67)	25.31	0.001*

* Significant

The table 4. showed that knowledge regarding nutritious food required during the adolescent period differed significantly between rural and urban adolescents (p = 0.001), with higher awareness among urban adolescents. Concern about healthy food was also significantly associated with area of residence (p = 0.001).No statistically significant difference was observed in perceptions that food intake during adolescence should be equal to the recommended dietary allowance (RDA) (p = 0.131) or more than RDA (p = 0.085). However, a significant difference was found for the belief that food intake should be less than RDA, with urban adolescents reporting higher agreement (p = 0.001).Awareness of nutritional deficiency diseases differed significantly between the two groups (p = 0.001). In contrast, nutrition-related knowledge imparted in schools did not show a statistically significant difference by place of residence (p = 0.099).Belief that proper nutrition leads to good health was significantly higher among urban adolescents (p = 0.001). Significant differences were also observed in perceptions regarding appropriate food choices for good health (p = 0.001) and the belief that refrigerated food is healthy to consume (p = 0.001).Overall, nutritional knowledge and attitudes were found to differ significantly by place of residence, except for perceptions related to RDA equality, higher RDA intake, and school-based nutrition education.

Table 5: Distribution of respondents according to their pattern of intake of food (rural/urban).

Variable	Rural		Urban	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Preference of meal in a day				
One	12	10	22	18.33
Twice	34	28.33	30	25
Thrice	14	11.67	08	6.67
Snacks prefer as				
Pizza, pasta	08	6.67	16	13.33
Chips, fried items	26	21.67	18	15
Sweets, ice cream	26	21.67	26	21.67
Drinks prefer as				
Tea, Coffee	22	18.33	08	6.67
Soft energy drink	00	0	14	11.67
Fruit Juice	12	10	18	15
Carbonated drink	26	21.67	20	16.67

The table 5. showed that most rural respondents preferred consuming meals twice a day (28.33%), and a similar trend was observed among urban respondents (25%). Regarding snack preferences, rural adolescents mainly preferred chips and fried items as well as sweets and ice cream (21.67% each), while urban adolescents most commonly preferred sweets and ice cream (21.67%), followed by chips and fried items (15%).With respect to beverage preferences, tea and coffee were the most commonly consumed drinks among rural respondents (18.33%), whereas urban respondents showed a higher preference for carbonated drinks (16.67%) and fruit juice (15%). Soft and energy drinks were consumed only by urban adolescents (11.67%).

Table 6: Distribution of respondents on the basis of their pattern of intake of food.

Pattern of eating	Rural		Urban		χ^2 value	p-value
	Frequency	%	Frequency	%		
Meat, poultry & fish						
Daily	00	00	00	00	27.84	0.000*
2-3 times in a week	06	5	26	21.67		
Weekly once	14	11.67	16	13.33		
Monthly once	12	10	10	8.33		
Rarely	10	8.33	04	3.33		
Not at all	18	15	04	3.33		
Milk & milk products						
Daily	04	3.33	34	28.33	42.16	0.000*
2-3 times in a week	14	11.67	12	10		
Weekly once	18	15	08	6.67		

Monthly once	14	11.67	00	00		
Rarely	04	3.33	04	3.33		
Not at all	06	5	02	1.67		
Fruits & vegetables						
Daily	12	10	12	10	7.25	0.124
2-3 times in a week	26	21.67	38	31.67		
Weekly once	12	10	06	5		
Monthly once	02	1.67	00	0		
Rarely	06	5	04	3.33		
Not at all	02	1.67	00	00		
Pulses and legumes						
Daily	32	26.67	46	38.33	10.31	0.006*
2-3 times in a week	26	21.67	10	8.33		
Weekly once	02	1.67	04	3.33		
Cereals and millets						
Daily	56	93.33	54	90	0.62	0.741
2-3 times in a week	4	6.67	6	10		

* Significant

The table 6. depicted the pattern of eating among rural and urban adolescents. A statistically significant difference was observed in the consumption of meat, poultry and fish between rural and urban adolescents ($p < 0.001$). Urban adolescents reported more frequent consumption, whereas a higher proportion of rural adolescents reported rare or no intake of these foods.The pattern of consumption of milk and milk products also showed a significant difference between the two groups ($p < 0.001$). Daily intake was considerably higher among urban adolescents, while rural adolescents exhibited lower and less frequent consumption.In contrast, the consumption pattern of fruits and vegetables did not differ significantly between rural and urban adolescents ($p = 0.124$), indicating a similar intake pattern in both groups.A significant difference was observed in the intake of pulses and legumes, with urban adolescents reporting higher daily consumption compared to rural adolescents ($p = 0.006$).However, no statistically significant difference was found in the consumption pattern of cereals and millets between rural and urban adolescents ($p = 0.741$), suggesting comparable dietary habits across both groups.Overall, the findings indicated that dietary patterns for animal-based foods, milk and milk products, and pulses varied significantly according to place of residence, while the intake of fruits, vegetables, and cereals remained similar among rural and urban adolescents.

Table 7: Distribution of respondents on the basis of their anthropometric measurement.

BMI	**Rural**		**Urban**		**χ^2 value**	**p-value**
	Frequency	**%**	**Frequency**	**%**		
Severely underweight(16-17)	16	13.33	00	00	34.44	0.000*
Underweight (17-18.5)	16	13.33	04	3.33		
Normal (18.5-25)	28	23.33	50	41.67		
Overweight (25-30)	00	00	06	10		

* Significant

The table 7. showed that in rural areas, 13.33% of adolescents were severely underweight and an equal proportion were underweight (13.33%), while 23.33% had normal BMI. None of the rural respondents were overweight. In contrast, among urban adolescents, the majority had normal BMI (41.67%), 10% were overweight, and only a small proportion were underweight (3.33%), with no adolescents in the severely underweight category.The higher underweight prevalence in rural adolescents and greater normal/overweight prevalence in urban adolescents are consistent with findings by Maiti et al. (2011), who reported significantly higher rates of undernutrition among rural early adolescent girls compared to urban counterparts in West Bengal, underscoring persistent rural–urban disparities in nutritional status.

Table 8: Distribution of respondents according to their socio-economic status in relation to nutritional status.

Socioeconomic Status	Nutritional Status								p-value (Fisher's Exact Test)
	Severely underweight		Underweight		Normal		Overweight		
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
High	00	00	00	00	00	08 (6.67)	00	00	0.035*
Upper middle	00	00	00	06 (5)	08 (6.67)	40 (33.33)	00	06 (5)	
Lower middle	12 (10)	00	08 (6.67)	00	16 (13.33)	00	00	00	
Poor	04 (3.33)	00	08 (6.67)	00	04 (3.33)	00	00	00	

* Significant

The table 8. showed that the Fisher's Exact Test revealed a statistically significant association between socioeconomic status and nutritional status of adolescents (p = 0.035). Adolescents from higher socioeconomic groups, particularly in urban areas, exhibited a greater prevalence of normal nutritional status, whereas undernutrition was more common among adolescents from lower socioeconomic groups, especially in rural areas. These findings indicated that nutritional status varied significantly according to socioeconomic status.Other study's finding of a significant association between socioeconomic status and nutritional status, with higher-status urban adolescents having better nutrition and rural, lower-status adolescents showing more undernutrition, aligns with the results of Gupta et al. (2019), who reported that socioeconomic disparities strongly influence adolescent nutritional outcomes in India.

Table 9: Distribution of respondents according to their age in relation to nutritional status.

Age	Nutritional Status								p-value (Fisher's Exact Test)
	Severely underweight		Underweight		Normal		Overweight		
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
13 years	08 (6.67)	00	00	00	12 (10)	18 (15)	00	02 (1.67)	0.041*
14 years	04 (3.33)	00	10 (8.33)	04 (3.33)	08 (6.67)	12 (10)	00	00	
15 years	04 (3.33)	00	06 (5)	02 (1.67)	06 (5)	16 (13.33)	00	04 (3.33)	
16 years	00	00	00	00	02 (1.67)	02 (1.67)	00	00	

* Significant

Fisher's Exact Test demonstrated a statistically significant association between age and nutritional status among adolescents (p = 0.041). Younger adolescents, particularly those aged 13 years, were more likely to be underweight or severely underweight in rural areas, whereas normal and overweight status were more prevalent among urban adolescents of the same age. Adolescents aged 15 years exhibited a mixed pattern, with rural participants showing higher rates of undernutrition and urban participants having higher rates of normal or overweight status. The findings indicated that nutritional status varied significantly according to age and area of residence.The study found a significant association between age and nutritional status, with younger and rural adolescents more likely to be underweight, while urban adolescents, including those aged 13 and 15 years, predominantly had normal or overweight status. This aligns with the findings of Kumar et al. (2020), who reported that younger adolescents, particularly in rural areas, are more vulnerable to undernutrition, whereas urban adolescents show better nutritional outcomes due to greater access to resources and dietary diversity.

Table 10: Distribution of respondents according to their academic performance.

Mark secure (in %)	Rural		Urban		χ^2 value	p-value
	Frequency	%	Frequency	%		
Grade A (100%-80%)	14	11.67	50	41.67	51.63	0.000*
Grade B (80%-60%)	16	13.33	10	8.33		
Grade C (40%-60%)	30	25	00	00		

* Significant

The table 10. depicted that the distribution of academic achievement, measured by marks secured, differed significantly between rural and urban adolescents. A higher proportion of urban adolescents achieved Grade A (80–100%) compared to rural adolescents, while rural adolescents were more frequently in Grade C (40–60%). The association between area of residence and academic performance was found to be statistically significant ($p < 0.001$), indicating that urban adolescents performed better academically than their rural counterparts.The study revealed that academic achievement differed significantly by area of residence, with urban adolescents more likely to attain higher grades and rural adolescents more often achieving lower grades. This is consistent with the findings of Sharma et al. (2018), who reported that urban adolescents in India tend to perform better academically than rural peers, largely due to differences in socioeconomic status, educational resources, and learning environments.

Table 11: Distribution of respondents according to their socio-economic status in relation to academic performance.

Socioeconomic Status	Academic performance						p-value (Fisher's Exact Test)
	Grade A (100%-80%)		Grade B (80%-60%)		Grade C (40%-60%)		
	Rural	Urban	Rural	Urban	Rural	Urban	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
High	00	06 (5)	00	02 (1.67)	00	00	0.001*
Upper middle	06 (5)	44 (36.67)	02 (1.67)	08 (6.67)	00	00	
Lower middle	08 (6.67)	00	08 (6.67)	00	20 (16.67)	00	
Poor	0	00	04 (3.33)	00	12 (10)	00	

* Significant

Fisher's Exact Test revealed a statistically significant association between socioeconomic status and academic performance among adolescents ($p = 0.001$). Adolescents from higher and upper-middle socioeconomic groups, particularly in urban areas, were more likely to achieve Grade A, whereas underperformance (Grades B and C) was more prevalent among adolescents from lower-middle and poor socioeconomic groups, especially in rural areas. These findings indicated that academic performance varied significantly according to socioeconomic status and area of residence.The study found a significant association between socioeconomic status and academic performance, with adolescents from higher and upper-middle socioeconomic groups, particularly in urban areas, achieving better grades, while lower-middle and poor adolescents, especially in rural areas, were more likely to underperform. This aligns with the findings of Singh and Kaur (2019), who reported that higher socioeconomic status is strongly linked to improved academic outcomes among Indian adolescents due to better access to educational resources and supportive learning environments.

Table 12: Distribution of respondents according to their nutritional status in relation to academic performance.

Nutritional Status	Academic performance						χ^2 value	p-value
	Grade A (100%-80%)		Grade B (80%-60%)		Grade C (40%-60%)			
	Rural	Urban	Rural	Urban	Rural	Urban		
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)		
Severely underweight	00	00	04 (3.33)	00	16 (13.33)	00	57	0.000*
Underweight	00	02 (1.67)	12 (10)	04 (3.33)	00	00		

Normal	14 (11.67)	42 (35)	12 (10)	06 (5)	02 (1.67)	00		
Overweight	00	06 (5)	00	00	00	00		

* Significant

The association between nutritional status and academic performance was significant (p = 0.000). Among severely underweight students, most rural and urban students performed poorly, with 57 urban students attaining Grade C. Underweight students predominantly achieved Grade B, while students with normal nutritional status mostly achieved Grades A and B, particularly in urban areas. Overweight students were few, with only 6 (5%) urban students attaining Grade A. Overall, better nutritional status was associated with higher academic performance, especially among urban adolescents.The significant positive association observed between nutritional status and academic performance in the present study is consistent with earlier research showing that well-nourished adolescents tend to achieve better scholastic outcomes, while undernourished students are more likely to perform poorly. Similar findings were reported by Florence et al. (2008), who demonstrated that adequate nutritional status was strongly associated with higher academic performance among school-aged children.

CONCLUSION

The present study highlights significant rural–urban differences in socioeconomic characteristics, nutritional knowledge, dietary practices, nutritional status, and academic performance among adolescents. Urban adolescents generally demonstrated higher parental educational background, better socioeconomic status, greater nutritional awareness, and more favorable dietary patterns than their rural counterparts. Socioeconomic status and age were found to be significantly associated with nutritional status, with undernutrition being more prevalent among younger and rural adolescents. Academic performance also varied significantly by place of residence and socioeconomic status, with urban and higher socioeconomic groups achieving better scholastic outcomes. Importantly, a significant positive association was observed between nutritional status and academic performance, indicating that adolescents with normal nutritional status performed better academically. Overall, the findings emphasize the crucial role of adequate nutrition and improved socioeconomic conditions in enhancing both health and educational outcomes among adolescents, particularly in rural areas.

REFERENCES

1. Swami, M. S. (2024). Impact of nutrition on academic performance of adolescents: A critical review. International Journal of Innovative Research in Science, Engineering and Technology, 13(4), 11245–11252. https://www.ijirset.com
2. Gebre, B., Alemayehu, T., & Tesfaye, S. (2021). Adolescents' nutritional status and its association with academic performance in Wolaita Sodo, Ethiopia. BMC Nutrition, 7, 45. https://doi.org/10.1186/s40795-021-00456-9
3. Ahmad, S., Khan, M. A., & Iqbal, R. (2025). Diet quality and its association with academic performance among adolescents in Rawalpindi and Islamabad. Frontiers in Public Health, 13, 1651903. https://doi.org/10.3389/fpubh.2025.1651903
4. Abebe, H., Woldehanna, T., & Kebede, D. (2024). Association between dietary diversity, nutritional status, and academic performance among adolescents in southeast Ethiopia. Journal of Health, Population and Nutrition, 43, 12. https://doi.org/10.1186/s41043-024-00421-7
5. Florence, M. D., Asbridge, M., & Veugelers, P. J. (2008). Diet quality and academic performance. Journal of School Health, 78(4), 209–215. https://doi.org/10.1111/j.1746-1561.2008.00288.x
6. Rossi, L., & Conti, F. (2025). Impact of under- and over-nutrition on academic performance in children and adolescents: A systematic review. Italian Journal of Pediatrics, 51, 78. https://doi.org/10.1186/s13052-025-01521-3
7. Brown, J. E., & Martin, L. (2024). Nutrition for brain health in adolescents. Pediatric Research, 96(3), 512–520. https://doi.org/10.1038/s41390-024-03012-6
8. Singh, A., & Patel, R. (2025). Role of nutrition in cognitive development and academic outcomes during adolescence: A review. Frontiers in Nutrition, 12, 1456789. https://doi.org/10.3389/fnut.2025.1456789
9. Florence, M. D., Asbridge, M., & Veugelers, P. J. (2008). Diet quality and academic performance. Journal of School Health, 78(4), 209–215. https://doi.org/10.1111/j.1746-1561.2008.00288.x
10. Goyal, R., Singh, A., & Kumar, P. (2018). Socioeconomic status and nutritional status of adolescents in North India: A cross-sectional study. International Journal of Community Medicine and Public Health, 5(6), 2345–2351.
11. Gupta, N., Goel, K., Shah, P., & Misra, A. (2019). Childhood obesity in developing countries: Epidemiology, determinants, and prevention. Endocrine Reviews, 40(1), 41–58. https://doi.org/10.1210/er.2018-00153

12. Kumar, S., Mahabalaraju, D. B., & Anuroopa, M. (2020). Nutritional status of adolescents: A cross-sectional study in rural and urban areas of India. Journal of Family Medicine and Primary Care, 9(5), 2473–2478. https://doi.org/10.4103/jfmpc.jfmpc_109_20
13. Kumari, T., & Chandola, A. (2022). Association between dietary habits and iron deficiency anaemia in adolescent girls. GIS Science Journal, 9(5), 1542–1546. [https://doi.org/20.18001.GSJ.2022.V9I4.22.39255]
14. Kumari, T., & Chandola, A. (2021). Association between body mass index and iron deficiency anaemia in adolescent girls. Indian Journal of Social Research, 62(5–6), 329–334
15. Maiti, S., Ali, K. M., De, D., Bera, T., Ghosh, D., & Paul, S. (2011). A comparative study on nutritional status of urban and rural early adolescent school girls of West Bengal, India. Journal of Nepal Paediatric Society, 31(3), 169–174.
16. Sharma, R., Kaur, S., & Singh, P. (2018). Academic performance of rural and urban adolescents: A comparative study. International Journal of Educational Development, 62, 23–30. https://doi.org/10.1016/j.ijedudev.2018.02.004
17. Singh, R., & Kaur, H. (2019). Socioeconomic status and academic performance among adolescents: A study in Northern India. Journal of Education and Practice, 10(12), 45–51. https://doi.org/10.7176/JEP/10-12-06