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Original Research Article

Prevalence of stunting, thinness and anaemia among adolescents and their association with demographics and dietary habits

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ABSTRACT

Background: Adolescence marks the pinnacle of the nutritional need, therefore, it's crucial to detect undernutrition and anemia in adolescents before they exhibit adverse effects. To assess the prevalence of undernutrition and anemia among adolescents and their association with demographic factors and dietary habits.
Methods: A cross-sectional study was conducted over 18 months at the Hind Institute of Medical Sciences, involving 250 adolescents aged 10-19 years. Data collection included anthropometric measurements, hemoglobin assessment, and a structured questionnaire capturing demographic characteristics and dietary habits. Statistical analysis (Descriptive statistics, Chi-square test) was performed using SPSS version 23.0. A p value <0.05 was considered significant.
Results: The study found that 29.6% of adolescents were stunted, 27.6% were thin and 48% had anemia, with 11.6% classified as mild, 30% as moderate and 6.4% as severe anemia. No significant association was reported of stunting with demographic parameters. A significant association was found between thinness and joint family (p=0.044) but not with any other demographic parameter. An inverse relationship of Junk food intake with stunting (p<0.0001) and thinness (p<0.0001) was inferred. Anemia was found to be significantly associated with advancing adolescent age (p<0.0001), female gender (p<0.0001), nuclear family (p<0.0001), lower socioeconomic status (p=0.041), and vegetarian diet (p=0.009).
Conclusions: The high prevalence of undernutrition and anemia among adolescents highlights the urgent need for targeted nutritional interventions. Regular anthropometric assessments and nutritional education programs are essential to address these health issues.

Keywords: Adolescence, Anthropometric measurements, Anemia mukt bharat, Nutritional status, Nutritional education, Poshan abhiyaan, Undernutrition

INTRODUCTION

Adolescence is a critical changeover stage from childhood to adulthood during which changes happen initially in physical development and reproductive abilities, followed by psychological and social maturity.[1] The behavior and lifestyle developed throughout adolescence are continued throughout life.[2] According to the World Health Organization (WHO), this stage spans from 10 to 19 years and is categorized into early adolescents (10-13 years), mid adolescents (14-16 years), and late adolescents (17-19 years).[3] In India, around 253 million individuals (20% of the total population) fall into the adolescent category.[4] Adolescence marks the pinnacle

of the nutritional need, therefore, it's crucial to detect undernutrition and anemia in adolescents before they exhibit adverse effects.[5] Adolescent undernutrition is indicated by both stunting and thinness.[5] The prevalence of stunting and thinness among Indian adolescents was 27.4% and 24.4% respectively according to the Comprehensive National Nutrition Survey (CNNS-2016–18) conducted in India to find out more about the eating habits, hygiene habits, and general health and nutrition of adolescents.[5]

Growth charts tailored to each nation are required to track the development of children aged five to eighteen years.[6] Based on compiled national data from published studies conducted on 87022 children and adolescents who appeared to be in good health over the previous ten years, the IAP Growth Chart Committee created revised IAP growth references for Indian children aged five to eighteen for anthropometric assessment.[6]

Various demographic factors are associated with adolescent undernutrition e.g., illiteracy, lower socioeconomic status, livelihood, family type and dietary habits, etc.[7] A dearth of representative data on the prevalence, burden, and related determinants of anemia in adolescents hinders India's efforts to reduce anemia.[8] The prevalence of anemia was 28.5% among adolescents as per CNNS data (boys: 17.6%, girls: 39.6%).[8] About 72 million Indian adolescents are anemic, with the state of Uttar Pradesh comprising twice as many as any other state.[8]

According to NFHS projections, the prevalence of anemia among Indian teenagers aged 15-19 years has marginally increased between 2005 and 2021 (boys 30.2% to 31.1%, girls 55.8% to 59.1%).[8] Anemia can be caused by both nutritional and non-nutritional factors.[8] Causes of anemia include concurrent micronutrient deficits in iron, folic acid, vitamin B12 and vitamin A, chronic inflammatory diseases, parasite infections, malaria, hereditary hemoglobin abnormalities, etc.[8,9] Among them, iron deficiency is frequently thought to be the main cause of anemia.[8,9]

Anemia has negative long-term implications in addition to its current effects on health.[9] Academic performance, learning and cognitive function are all negatively impacted due to anemia.[9] The current study aims to evaluate the prevalence of undernutrition (stunting and thinness) and anemia among adolescents and their association with demographic factors and dietary habits.

METHODS

Study design

This cross-sectional study was carried out among adolescents attending the Outpatient department (OPD) in the Department of Pediatrics at Hind Institute of Medical Sciences, Mau, Ataria, Sitapur, Uttar Pradesh over 18 months after obtaining ethical approval from Institutes Ethical Committee and informed consent from parents and assent from the adolescents

Inclusion criteria

Adolescents aged 10-19 years of either gender were included.

Exclusion criteria

Patients having trauma, chronic illness like HIV, heart disease and chronic liver disease were excluded.

Sampling

We used a convenient sampling method. Sample size (n) of 246 was calculated using OpenEpi online software for sample size calculation taking the prevalence of 20% adolescent population from WHO data, 95% confidence interval and a margin of error of 5%.[4,10] The actual study was done on 250 adolescents.

Data Collection

For the data collection of the study population; a questionnaire, anthropometric measurements, and hemoglobin estimation were used. Details of the adolescents were noted down on a predesigned proforma.

Questionnaire

A questionnaire consisting of different components which included personal details, demographic characteristics, and, dietary history was used as a data collection tool. A detailed history was taken and clinical examination were performed. Demographic characteristics included age, gender, religion, type of family, livelihood, and socioeconomic status using the Modified Kuppuswamy Socioeconomic Status Scale 2023.[11] Dietary history including the type of diet i.e. vegetarian and non-vegetarian diet and frequency of junk food intake.

Anthropometric measurements

All anthropometric measurements were taken twice from each child by a nurse/doctor according to standardized procedures of the National Institute of Nutrition. Weight was recorded in kilogram (kg), using an electronic weighing scale, nearest to 0.01 kg. The weighing scale was checked for zero each time before use. Undernutrition is low weight for age. Standing height was recorded with a Stadiometer in cm using a standardized method. BMI is calculated as the ratio of weight (in kg) to the square of height (in meters) ($BMI=Weight/Height^2$).

BMI was used to assess the nutritional status of adolescents. Weight for age Z score (Standard deviation score=SDS), Height for age Z-score, and BMI for age Z-

scores were plotted using the WHO Growth reference data for 5-19 years.[12-15] Adolescent undernutrition is indicated by both stunting and thinness.

Stunting

Stunting is low height for age. WHO Growth reference data for 5-19 years of children categorize stunting as height for age Z-score<-2SDS while severe stunting as height for age Z-score<-3SDS.[13,14]

Thinness

Thinness is a low BMI for age. WHO growth reference data for 5-19 years of children categorize thinness as BMI Z-score<-2SDS while severe thinness as BMI Z-score <-3SDS.[14,15]

Hematological assessment

For complete blood count a 2 ml blood sample was taken by venipuncture using a sterile syringe and blood was transferred to a test tube containing Ethylenediaminetetraacetic acid (EDTA). Collected blood samples were analyzed in the pathology lab in a 5-part hematology analyzer (Mindray). Anemia was categorized as per WHO guidelines Hemoglobin <115 g/l for boys and girls 10–11 years old, Hb <120 g/l for boys 12–14 years old and girls 12–19 years old, and Hb <130 g/l for boys 15–19 years old.[16]

The grades of anemia severity are summarized in Table 1 as per WHO guidelines.[16] All data was entered in the Microsoft Excel sheet and analyzed using SPSS version 23.0. Mean and standard deviation were calculated for quantitative variables. Frequency and percentage were calculated for qualitative variables. For the association between two qualitative variables, the Chi-square test was used. A p value<0.05 was considered as the data statistically significant.

RESULTS

The mean (SD) age of early, mid, and late adolescents was 11.35 (0.782), 14.95 (0.779) and 17.84 (0.840) years respectively. The overall mean age of adolescents under study was 14.47 (2.64) years. The demographic parameters and dietary habits of adolescents are summarized in Table 2. The mean weight, height, and BMI were 39.61 (11.29) kg, 149.16 (13.02) cm and 17.37 (2.56) kg/m2 respectively. The mean weight Z-score, height Z-score, and BMI Z-score were -1.39 (1.29), -1.21 (0.96) and -0.90 (0.98) respectively. The mean hemoglobin (gm/dl) and PCV were 11.39 (1.96) gm/dl and 34.74 (5.98) % respectively.

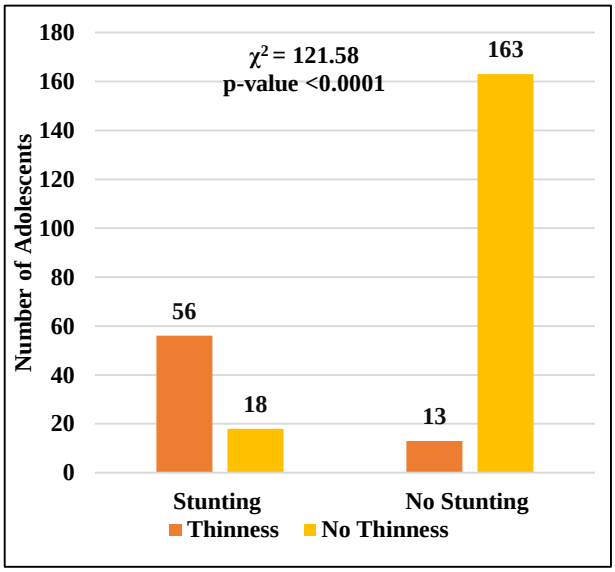

Figure 1: Association of thinness with stunting (n=250)*.

The prevalence of stunting, thinness, and anemia was 29.6%, 27.6% and 48% among the study adolescents respectively. Mild, moderate, and severe anemia were present in 11.6%, 30% and 6.4% of cases respectively. The association of stunting with demographics and dietary habits is summarized in Table 3. The association of thinness with demographics and dietary habits is outlined in Table 4.

The double burden of thinness and stunting was seen in 56 (22.4%) and there was a significant association between the two (p<0.0001) (Figure 1). Table 5 shows the association of anemia with demographics and dietary habits. There was no significant association of anemia with stunting (p=0.492) and thinness (p=0.377).

Table 1: Grades of anaemia severity as per WHO guidelines.[16]

Population	Haemoglobin concentration (g/l)			
	No anaemia	Mild anaemia	Moderate anaemia	Severe anaemia
Children, 5–11 years				
Children, 12–14 years, nonpregnant girls	≥115	110–114	80–109	<80
Children, 12–14 years, boys	≥120	110–119	80–109	<80
Adults, 15–65 years, nonpregnant women	≥120	110–119	80–109	<80
Adults, 15–65 years men	≥130	110–129	80–109	<80

Table 2: Demographic parameters and dietary habits of adolescents (n=250).

Demographic parameters		Number	%
Age groups	Early adolescents (10-13 years)	85	34
	Mid adolescents (14-16 years)	101	40.4
	Late adolescents (17-19 years)	64	25.6
Gender	Male	119	47.6
	Female	131	52.4
Religion	Hindu	171	68.4
	Muslim	72	28.8
	Others	7	2.8
Type of family	Nuclear family	90	36
	Joint family	160	64
Livelihood	Rural	199	79.6
	Urban	51	20.4
Socioeconomic status	Upper	7	2.8
	Upper middle	92	36.8
	Lower middle	79	31.6
	Upper lower	57	22.8
	Lower	15	6
Dietary habits			
Type of diet	Vegetarian	163	65.2
	Non-vegetarian	87	34.8
Junk food intake frequency	Nil	135	54
	Daily	30	12
	Weekly	29	11.6
	Once a month	56	22.4

Table 3: Association of stunting with demographics and dietary habits (n=250).

Demographic parameters		Stunting		X^2	P value
		Yes (%)	No (%)		
Adolescent age groups	Early	26 (10.4)	59 (23.6)	0.381	0.826
	Mid	31 (12.4)	70 (28)		
	Late	17 (6.8)	47 (18.8)		
Gender	Male	31 (12.4)	88 (35.2)	1.373	0.241
	Female	43 (17.2)	88 (35.2)		
Religion	Hindu	48 (19.2)	123(49.2)	2.772	0.250
	Muslim	22 (8.8)	50 (20)		
	Others	4 (1.6)	3 (1.2)		
Type of family	Nuclear	23 (9.2)	67 (26.8)	1.104	0.293
	Joint	51 (20.4)	109 (43.6)		
Socioeconomic status	Upper	1 (0.4)	6 (2.4)	9.029	0.060
	Upper middle	26 (10.4)	66 (26.4)		
	Lower middle	20 (8)	59 (23.6)		
	Upper lower	25 (10)	32 (12.8)		
	Lower	2 (0.8)	13 (5.2)		
Livelihood	Rural	59 (23.6)	140 (56)	0.001	0.974
	Urban	15 (6)	36 (14.4)		
Dietary habits					
Type of diet	Vegetarian	52 (20.8)	111 (44.4)	1.191	0.275
	Non-vegetarian	22 (8.8)	65 (26)		
Frequency of junk food intake	No	31 (12.4)	104 (41.6)	13.445	0.004
	Daily	17 (6.8)	13 (5.2)		
	Weekly	9 (3.6)	20 (8)		
	Once a month	17 (6.8)	39 (15.6)		

Table 4: Association of thinness with demographics and dietary habits (n=250).

Demographic parameters		Thinness		X^2	P value
		Yes (%)	No (%)		
Adolescent age groups	Early	28 (11.2)	57 (22.8)	5.157	0.076
	Mid	20 (8%)	81 (32.4)		
	Late	21 (8.4)	43 (17.2)		
Gender	Male	37 (14.8)	82 (32.8)	1.386	0.239
	Female	32 (12.8)	99 (39.6)		
Religion	Hindu	43 (17.2)	128 (51.2)	3.887	0.143
	Muslim	22 (8.8)	50 (20)		
	Others	4 (1.6)	3 (1.2)		
Type of family	Nuclear	18 (7.2)	72 (28.8)	4.065	0.044
	Joint	51 (20.4)	109 (43.6)		
Socioeconomic status	Upper	1	6	1.772	0.778
	Upper middle	28	64		
	Lower middle	20	59		
	Upper lower	17	40		
	Lower	3	12		
Livelihood	Rural	55 (22)	144 (57.6)	0.001	0.979
	Urban	14 (5.6)	37 (14.8)		
Dietary habits					
Type of diet	Vegetarian	41 (16.4)	122 (48.8)	1.403	0.236
	Non-vegetarian	28 (11.2)	59 (23.6)		
Frequency of junk food intake	No	32 (12.8)	103(41.2)	19.731	<0.0001
	Daily	15 (6)	15 (6)		
	Weekly	14 (5.6)	15 (6)		
	Once a month	8 (3.2)	48 (19.2)		

Table 5: Association of anemia with demographics and dietary habits (n=250).

Demographic parameters		Anemia		X^2	P value
		Yes (%)	No (%)		
Adolescent age groups	Early	25 (10)	60 (24)	19.343	<0.0001
	Mid	62 (24.8)	39 (15.6)		
	Late	33 (13.2)	31 (12.4)		
Gender	Male	43 (17.2)	76 (30.3)	12.810	<0.0001
	Female	77 (30.8)	54 (21.6)		
Religion	Hindu	81 (32.4)	90 (36)	4.152	0.125
	Muslim	33 (13.2)	39 (15.6)		
	Others	6 (2.4)	1 (0.4)		
Type of family	Nuclear	53 (21.2)	37 (14.8)	6.680	<0.0001
	Joint	67 (26.8)	93 (37.2)		
Socioeconomic status	Upper	4 (1.6)	3 (1.2)	9.963	0.041
	Upper middle	41 (16.4)	51 (20.4)		
	Lower middle	30 (12)	49 (19.6)		
	Upper lower	36 (14.4)	21 (8.4)		
	Lower	41 (16.4)	51 (20.4)		
Livelihood	Rural	97 (38.8)	102(40.8)	0.216	0.642
	Urban	23 (9.2)	28 (11.2)		
Dietary habits					
Type of diet	Vegetarian	88 (35.2%)	75 (30%)	6.728	<0.009
	Non-vegetarian	32 (12.8%)	55 (22%)		
Frequency of junk food intake	No	57 (22.8%)	78 (31.2%)	4.850	0.183
	Daily	15 (6%)	15 (6%)		
	Weekly	18 (7.2%)	11 (4.4%)		
	Once a month	30 (12%)	26 (10.4%)		

DISCUSSION

This study focuses on the anthropometric measurements, undernutrition, and anemia prevalence among adolescents, providing crucial insights into their nutritional status and health risks. The mean (SD) age of adolescents under study was 14.47 (2.64) years which was comparable to the average age of Indian adolescents of 14.4 (2.8) years.[5] The Male: Female ratio was 1:1.1 which was comparable to a study by Kumar M et al.[5] The prevalence of stunting, thinness, and anemia was 29.6%, 27.6% and 48% among the study adolescents respectively which was in accordance with the comprehensive national nutrition survey (CNNS-2016-18) data of prevalence of stunting (27.2%), thinness (24.1%), and anemia (28.5%) among adolescents.[5] Similarly, Pandurangi R et al reported the prevalence of stunting and thinness of 27.4% and 24.4% respectively among Indian adolescents.[17]

In the current study, no significant association was found between demographic characteristics and stunting among adolescents (p>0.05). In contrast, Kumar et al reported higher stunting prevalence during late adolescence age (OR 1.21, 95 % CI 1.15, 1.27).[5] Pandurangi R et al, reported that stunting was more likely to occur in adolescents in the 15–19 age group (AOR 1.23, 95% CI 1.11, 1.36) than in the 10–14 age group, and in females (AOR 1.20, 1.08, 1.33) compared to males but they found no significant association between stunting with religion and livelihood.[17] In contrast, Puri et al, reported an association of underweight with early adolescent age, male gender, Hindu religion, and adolescents from nuclear families.[18] Johnson et al reported an association of stunting with lower socio-economic class [AOR=2.75 (1.39-5.41), p=0.03] and late adolescence age (AOR=1.90 (1.24-2.90), p=0.03).[19]

In the present study, there was no significant association found between thinness and any demographic factor (p>0.05) except for joint family type (p=0.044). In comparison to our study, Mengesha DK et al study from Ethiopia found thinness in adolescents was significantly associated with early adolescent age, male gender, rural livelihood and lower socioeconomic status.[20] Akin to our study Pandurangi R et al study revealed no significant association between thinness and religion.[17] Similar to our research, Chaulagain K et al reported a significant association of thinness in adolescents living in joint families with >4 family members.[21] This could be because of the distribution of family resources among members leading to deficient intake. The double burden of thinness and stunting was seen in 22.4% and there was a significant association between the two (p <0.0001) which was comparable to a study by Pandurangi R et al that found the 8.6% double burden of stunting and thinness among adolescents.[17]

There was no significant association of stunting and thinness with the type of diet however stunting and thinness were significantly associated with the lower frequency of junk food intake in our study. In comparison to our study, Johnson et al reported no significant association of stunting with type of diet and frequency of junk food intake.[19]

Li L et al study did not find any significant association between stunting and thinness with the frequency of junk food intake.[22] Adity et al study reported a significant association of daily junk food intake with overweight and obesity (p<0.0001).[23] Junk food consumption is likely to increase obesity and therefore an inverse relationship was inferred by our study also.

In this study, adolescent anemia was significantly associated with advancing adolescent age (p<0.0001), female gender (p<0.0001), lower socioeconomic status (p=0.041) and nuclear family (p<0.0001) while no significant association was seen between different religions (p=0.125) and livelihood (p=0.642). This was comparable to a study by Chauhan et al that reported a significant association of anemia with late adolescent age, female gender, lower education status and rural livelihood.[24]

Similarly, Kumar et al, also reported similar findings.[5] In comparison, the Agarwal et al study found no significant association of anemia with religion, type of family, and socioeconomic status.[25] Anemia prevalence may be slightly higher as reported by the national average as our study participants were mainly from the rural background with a higher proportion lower socioeconomic status and vegetarian diet.[5]

There was a significant association found between anemia and a vegetarian diet however anemia was not significantly associated with the frequency of junk food intake in our study. Comparably, Agarwal et al did not report any association of anemia with dietary patterns.[25]

No significant association of anemia was seen with stunting and thinness in this study. In contrast, Yusufu et al study revealed higher odds of anemia in stunted adolescents than in non-stunted students.[26] Differing from our study, Sidenur et al reported a significant association of anemia in thin adolescents.[27]

The Government of India's flagship program, Anemia Mukt Bharat, focuses on preventative and therapeutic measures to eliminate anemia through a multi-sectoral and multi-stakeholder approach.[28] As a component of the National Nutrition Mission (Poshan Abhiyaan), the initiative supports India's efforts to meet the Sustainable Development Goals.[29] These programs need intensification in light of the findings of the present study and also those adolescents with severe anemia, thinness, and stunting should be screened in schools and referred to health facilities for early identification of the cause and its management.[30]

CONCLUSION

The study concluded the prevalence of stunting, thinness, and anaemia as 29.6%, 27.6% and 48% respectively. Anaemia was found to be significantly associated with advancing adolescent age, female gender, nuclear family, lower socioeconomic status and vegetarian diet. The high prevalence of undernutrition and anaemia among adolescents highlights the urgent need for targeted nutritional interventions. Regular anthropometric assessments and nutritional education programs are essential to address these health issues.

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