e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2024; 16(5); 431-438

Original Research Article

A Retrospective Assessment of Dietary Habits and Physical Activity Patterns of Teenagers Attending Schools

Priyambada Priyadarshini[1], Tulika Singh[2]

[1]Tutor, Department of Community Medicine, JNKTMCH, Madhepura, Bihar, India

[2]Tutor, Department of Community Medicine, NMCH, Patna, Bihar, India

Received: 14-03-2024 / Revised: 18-04-2024 / Accepted: 23-05-2024
Corresponding Author: Dr. Tulika Singh
Conflict of interest: Nil

Abstract

Aim: To examine the food habits and physical activity patterns of teenagers attending schools in the Bihar area.

Materials and Methods: This study was conducted in the department of Community Medicine, JNKTMCH, Madhepura, Bihar, India from February 2021 to January 2022. A questionnaire based retrospective study. A total of 1600 participants between 10-19 years of age whose parents gave informed consent were included in the study. Participants on any long-term medication and those who were absent on the day of visit were excluded from the study.

Results: The nutritional status of male participants revealed 71% were thin, 3.9% were overweight/obese. Among female participants, 64.5% were thin and only 2.6% were overweight/obese. This difference between male and female participants was statistically significant ($p<0.001$). A 75.9% of participants belonged to early adolescent age were thin while 50% of participants from late adolescent age were thin which was also statistically significant ($p<0.0001$). The habit of taking milk, milk products and fruits were low among the males and early adolescent age group. In Chi-square test was applied to find whether there was any significant difference in the eating habits between the age group and gender of adolescents. Except for the eating habit of consuming three main meals of cereal or intake of milk or milk products rest other food habits were found to be significant between the age group. There is no significant difference associated with faulty dietary habits of skipping meals/eating junk food/buying eatables from street shop between male and female participants.

Conclusion: The dietary gap was more pronounced in female participants and participants in the early adolescent age group. The gap in the diet of adolescents influences their nutritional status and BMI. The poor choice of dietary habits significantly affects the physical development among school-going adolescents.

Keywords: Food habits, Physical activity, Teenagers, Schools

Introduction

Adolescence is a critical period characterized by rapid growth, development, and the establishment of lifelong habits. During this time, dietary practices and physical activity patterns play a pivotal role in shaping health outcomes. Understanding these patterns among school-going adolescents is essential for developing effective interventions to promote healthy lifestyles and prevent chronic diseases. [1-3] Diet and physical activity are fundamental components of health, particularly during adolescence when nutritional needs are heightened, and physical activity supports growth and development. The dietary patterns adopted during this stage can influence long-term health, impacting the risk of developing obesity, cardiovascular diseases, diabetes, and other chronic conditions. Similarly, physical activity contributes to the development of healthy bones, muscles, and cardiovascular systems, and supports mental health and academic performance. Recent studies have shown a diverse range of dietary patterns among adolescents, influenced by cultural, socioeconomic, and environmental factors. Socioeconomic status (SES) significantly affects dietary practices. [4-7] Adolescents from lower SES backgrounds often have limited access to nutritious foods and rely more on inexpensive, calorie-dense options. Schools play a crucial role in shaping dietary habits through the provision of meals and the promotion of healthy eating. The introduction of school meal programs and nutritional guidelines has shown promise in improving dietary practices. Physical activity is essential for maintaining physical and mental health during adolescence. However, numerous studies indicate that a significant proportion of adolescents do not meet the recommended levels of physical activity. According to the World Health Organization, adolescents should engage in at least

60 minutes of moderate to vigorous physical activity daily. Unfortunately, many adolescents fall short of this guideline, often due to sedentary lifestyles and increased screen time. The rise of digital technology and social media has significantly impacted physical activity patterns among adolescents. Increased screen time, including the use of smartphones, computers, and television, is associated with sedentary behaviour and reduced physical activity. [8-13]

Materials and Methods

This study was conducted in the department of Community Medicine, JNKTMCH, Madhepura, Bihar, India from February 2021 to January 2022 .A questionnaire based retrospective study. A total of 1600 participants between 10-19 years of age whose parents gave informed consent were included in the study. Participants on any long-term medication and those who were absent on the day of visit were excluded from the study. [14]

Methodology

The study was permitted to be conducted in 101 government schools with a population size of 7,58,611 students. A total of 23 co-educational government schools fell under the permitted area and 10 school principals gave consent to be a part of the study. Since the permitted population was large, a sample of 1600 students was selected to participate in the study. Confidentiality and anonymity of participants were maintained. The consent forms were distributed from class 6th to class 12th standard of each school. A total of 180 students from each school were randomized to ensure data from 160 students considering the dropout due to absence from each school on the particular day of data collection. The complete information about the study was shared with the study participants. A predesigned, pretested, self-administered questionnaire in English and Hindi (local languages) was given to the participants according to their preference. All the questions included in the socio-demographic profile and simplified dietary gap assessment tool [15] based on the dietary recommendation by the Indian Council of Medical Research (ICMR) and the National Institute of Nutrition (NIN) [16] were discussed by the investigator with each participant and ample time was given to fill the questionnaire. The study participant's age was reverified from their school records. A portable stadiometer was used to measure the height of participants. Each participant was made to stand without shoes with the head held comfortably upright. The horizontal headpiece of the stadiometer was made to have firm contact with the top of the head of the participant. The calibrated weight machine was used to record the weight of the subjects. Participants were instructed to stand on the weight machine without shoes, with feet apart and looking straight.

Criteria for adolescent stage: As per WHO, the adolescence period is divided into early, middle and late periods, which is 14, 15-17 and 18-19-year age groups, respectively. [17] Criteria for the assessment of obesity, overweight and thin: The WHO-BMI for age and gender-specific standards for adolescents (5-19 years) was used. BMI was categorized by using Z score tables. [18] The normal BMI range was based on the age and gender specific standards. The obesity, overweight and thin were assessed with the criteria of obesity: >+2 SD (equivalent to BMI 30 kg/m2 at 19 years), overweight: >+1 SD (equivalent to BMI 25 kg/m2 at 19 years) and thin: <-2 SD. Criteria for socio-economic status: The socio-economic status was assessed using the Modified BG Prasad socioeconomic scale 2017. [19]

Statistical Analysis

The data obtained from the study participants were subjected to statistical analysis using Graph pad Version 5 statistical software. The descriptive analysis was done to calculate the frequency of dietary consumption pattern in students. Cross-tabulation and Chi- square test was used to investigate the association between dietary intake and BMI levels.

Results

There were 1600 students out of which 53.4% (855) were males and 46.5% (745) were females. The mean age of the male participants was 13±2 years and female participants was 13.4±2 years. The majority of the study subjects 1107 (69.1%) were from the age group of 10-14 years. The socio-demographic profile of the study participants is shown in [Table-1]. A total of 457 (28.5%) of the participants had normal BMI as per the WHO-BMI chart while 1089 (68%) participants were thin and 54 (3.3%) participants were obese/overweight. The [Table-2] shows the nutritional status of the participants as per the WHO-BMI chart. The nutritional status of male participants revealed 71% were thin, 3.9% were overweight/obese. Among female participants, 64.5% were thin and only 2.6% were overweight/obese. This difference between male and female participants was statistically significant ($p<0.001$). A 75.9% of participants belonged to early adolescent age were thin while 50% of participants from late adolescent age were thin which was also statistically significant ($p<0.0001$). [Table-3] shows the distribution and pattern of the eating habits among adolescents as the simplified dietary gap questionnaire. The habit of taking milk, milk products and fruits were low among the males and early adolescent age group. In [Table-4], Chi-square test was applied to find

whether there was any significant difference in the eating habits between the age group and gender of adolescents. Except for the eating habit of consuming three main meals of cereal or intake of milk or milk products rest other food habits were found to be significant between the age group. There is no significant difference associated with faulty dietary habits of skipping meals/eating junk food/buying eatables from street shop between male and female participants. The habit of taking milk and milk products was significantly more common among the male participants ($p<0.0001$). In [Table-5], the $\chi 2$ test was applied to measure the association between the pattern of food habits and the BMI status of adolescents. The habit of taking pulses or non vegetarian food items in the daily diet was not found significant whereas all other food habit patterns were significantly associated with BMI levels among adolescent school students. It was observed that faulty dietary habits of skipping meals or eating junk food or buying eatables from street shop were associated with more participants under the obese/overweight category. The habit of non consumption of healthy mid-morning and mid-evening snack/milk or milk products/green leafy vegetables/ other vegetables/fruit in daily diet was significantly associated with participants under the thin category.

Table 1: Distribution of study participants according to socio-demographic profile.

Parameters	Variables	N (%)
Gender	Male	855 (53.4%)
	Female	745 (46.5%)
Age	10-14 years (early adolescent)	1107 (69.1%)
	15-19 years (mid and late adolescent)	493 (30.8%)
Religion	Hindu	1493 (93.3%)
	Non hindu	107 (6.7%)
Type of family	Nuclear	1023 (64%)
	Joint	577 (36%)
Socio-economic class	Upper, Upper middle	209 (13.0%)
	Middle	266 (16.6%)
	Lower middle, Lower	1125 (70.3%)
Father education	Illiterate	10 (0.6%)
	Up to primary	105 (6.5%)
	Up to Middle school and above	1193 (74.5%)
	Graduation and above	292 (18.2%)
Mother education	Illiterate	28 (1.7%)
	Up to primary	1229 (76.8%)
	Up to Middle school and above	123 (7.6%)
	Graduation and above	220 (13.7%)

Table 2: Nutritional status of the participants.

Parameters	Variables	BMI (Normal) n=457	BMI (Thin) n=1089	BMI (Overweight/ Obese) n=54	$\chi 2$ p-value
Gender	Male (n=855)	213 (46.6%)	608 (55.8%)	34 (62.9%)	13.04 p=<0.001*
	Female (n=745)	244 (53.3%)	481 (44.1%)	20 (37.0%)	
Age group	(10-14 years) (n=1107)	239 (52.2%)	841 (77.2%)	27 (50%)	103.5 p=<0.0001*
	(15-19 years) (n=493)	218 (47.7%)	248 (22.7%)	27 (50%)	

*p<0.05 significant

Table 3: Pattern of food habits among school going adolescents.

S. No.	Questions (based on Indian Council Medical Research/ National Institute of Nutrition recommendations)	Response by the participants N (%)
1	Do you have 3 main meals of cereals?	1422 (89%)
2	Do you have mid-morning and evening snack daily?	585 (36%)
3	Do you take at least one of these items along with your meals daily pulses/dal/non vegetarian food (fish, chicken, mutton, egg) daily?	1502 (94%)
4	Do you take 3 cups of milk/coffee/tea/flavoured milk or 2 cups with curd daily?	955 (59%)
5	Do you take green leafy vegetables daily?	838 (52%)
6	Do you take other vegetables along with your meals daily?	1298 (81%)
7	Do you take a fruit daily?	655 (41%)
	General faulty dietary habits	
8	Do you skip any meal?	530 (30%)
9	Do you eat junk food?	570 (35%)
10	Do you buy eatables from the street shops?	613 (38%)

Table-4: Association of food habits with gender and adolescent stage.

Pattern of food habits (as recommended by ICMR/NIN)	(10-14 years) Early adolescents (n=1107)	(15-19 years) Mid and late adolescents (n=493)	OR (95%CI)	$\chi2$ p-value	Male (n=855)	Female (n=745)	OR (95%CI)	$\chi2$ p-value
Do you have 3 main meals of cereals?	985 (88.9%)	437 (88.6%)	1.12 (0.80-1.58)	0.47 0.49	782 (91.4%)	640 (85.9%)	1.75 (1.28-2.41)	12.4 0.0004*
Do you have mid-morning and evening snack daily?	319 (28.8%)	266 (60.8%)	0.47 (0.38-0.59)	45.0 <0.0001*	277 (32.3%)	308 (41.3%)	0.68 (0.55-0.83)	13.7 0.0002*
Do you take at least one of these items along with your meals daily pulses/ dal/non vegetarian food (fish, chicken, mutton, egg) daily?	1051 (94.9%)	451 (91.4%)	1.74 (1.15-2.64)	7.10 0.007*	808 (94.5%)	694 (93.1%)	1.26 (0.83-1.90)	1.25 0.26
Do you take 3 cups of milk/coffee/tea/flavoured milk or 2 cups with curd daily?	656 (59.2%)	299 (60.6%)	0.94 (0.75-1.17)	0.27 0.60	567 (66.3%)	388 (52%)	1.81 (1.48-2.21)	33.5 <0.0001*
Do you take green leafy vegetables daily?	510 (46%)	328 (66.5%)	0.42 (0.34-0.53)	57.2 <0.0001*	412 (48.1%)	426 (57.1%)	0.69 (0.57-0.84)	12.91 0.0003*
Do you take other vegetables along with your meals daily?	878 (79.3%)	420 (85.1%)	0.66 (0.49-0.88)	7.70 0.005*	685 (80.1%)	613 (82.2%)	0.86 (0.67-1.11)	1.21 0.26
Do you take a fruit daily?	378 (34.1%)	277 (56.1%)	0.40 (0.32-0.50)	68.5 <0.0001*	311 (36.3%)	344 (46.1%)	0.66 (0.54-0.81)	15.81 <0.0001*
Do you skip any meal?	405 (36.5%)	125 (25.3%)	1.69 (1.34-2.15)	19.42 0.0001*	284 (33.2%)	246 (33%)	1.00 (0.81-1.24)	0.006 0.93
Do you eat junk food?	370 (33.4%)	200 (40.5%)	0.73 (0.59-0.91)	7.59 0.005*	294 (34.3%)	276 (37%)	0.89 (0.72-1.00)	1.22 0.26
Do you buy eatables from the street shops?	397 (35.8%)	216 (43.8%)	0.71 (0.57-0.89)	9.12 0.0025*	314 (36.7%)	299 (40.1%)	0.86 (0.70-1.06)	1.95 0.16

*p<0.05 (statistically significant)

Table 5: Association of food habits with BMI status.

Pattern of food habits (as recommended by ICMR/NIN)	BMI status			$\chi 2$	p-value
	Normal n=457 (28%)	Thin n=1089 (68%)	Obese/Overweight n=54 (3%)		
Do you have 3 main meals of cereals?	397 (86.8%)	972 (89.2%)	53 (98.1%)	6.71	0.03*
Do you have mid-morning and evening snack daily?	434 (94.9%)	98 (8.9%)	53 (98.1%)	1117	<0.0001*
Do you take at least one of these items along with your meals daily pulses/dal/ non vegetarian food (fish, chicken, mutton, egg) daily?	423 (92.5%)	1026 (94.2%)	53 (98.1%)	3.3	0.19
Do you take 3 cups of milk/coffee/tea/flavoured milk or 2 cups with curd daily?	282 (61.7%)	630 (57.8%)	43 (79.6%)	11.2	0.003*
Do you take green leafy vegetables daily?	430 (94%)	356 (32.6%)	52 (96.2%)	529.8	<0.0001*
Do you take other vegetables along with your meals daily?	444 (97.1%)	800 (73.4%)	54 (100%)	131.0	<0.0001*
Do you take a fruit daily?	349 (76.3%)	257 (23.5%)	49 (90.7%)	428.0	<0.0001*
Do you skip any meal?	180 (39.3%)	328 (30.1%)	22 (40.7%)	13.9	0.0009*
Do you eat junk food?	180 (39.3%)	355 (32.5%)	35 (64.8%)	27.2	<0.0001*
Do you buy eatables from the street shops?	180 (39.3%)	398 (36.5%)	35 (64.8%)	17.7	0.0001*

*p<0.05

Discussion

The present study shows that 608 (55.8%) boys and 481 (44.1%) girls were thin. These findings of undernutrition are similar to the survey conducted by the National Family Health Survey 2015-16 where the prevalence of thinness in boys and girls was estimated as 58.1% and 46.8%, respectively. [20] The proportion of thin students 1089 (68%) in the current study is much higher as compared to the study conducted in the urban adolescent population of West Bengal where the prevalence of underweight students was 27.9%. [14] In the current study, there were only 54 (3%) students who fell under the obese/overweight category whereas the prevalence of overweight was 5.9% and obesity was 2.7% in a study covered under field practice of north India. [12] The summary of current and previous studies are tabulated in [Table-6] to understand the key aspects on each study. [21-24]

Table 6: Summary of previous and current study [21-24]

Sr. No.	Name of author and year	Place of study	N	Parameters compared	Conclusion
1	Venkaiah K et al., 2002 [21]	States of Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra Sissa, Uttar Pradesh and Tamil Nadu from India	2579 adolescent boys and girls with anthropometric and dietary information.	Intake of food item and nutrients was compared with both gender and age group.	The prevalence of undernutrition was higher (53.1%) in boys than in girls (39.5%).
2	Bhattacharjee P et al., 2017 [22]	Greater Noida city, Uttar Pradesh, India	600 school going adolescents (353 males and 247 females) of age range 13-18 were included in the study.	BMI was compared with dietary habits.	Boys (7.3%) were more commonly overweight than girls (5.5%)

3	Pal A et al., 2017 [23]	West Bengal, India	560 (279 boys and 281 girls) adolescents of age range 10-17 years	The prevalence of thinness was assessed. The sociodemographic factors were compared with BMI.	The prevalence of thinness was significantly higher ($p<0.05$) among the early adolescent age group than the late adolescent age group.
4	Maliye CH et al., 2010 [24]	Wardha, Maharashtra, India	430 Adolescent girls in the age group of 10-19 years	The nutrient intake was compared with BMI.	The prevalence of thinness was higher 67.6% in early adolescents than in late adolescents 55.4%.
5	Present study	Delhi, India	1600 adolescent age	The dietary pattern and its association with BMI levels of adolescents.	The present study revealed that thinness is more common among boys ($p<0.001$) and in the early adolescent age group ($p<0.001$). The more no. of participants from the obese/ overweight category associated with faulty dietary habits of eating junk food.

In the present findings, 1422 (89%) participants consumed three main meals a day. It is observed that girls had significantly less tendency to have three main meals in a day as compared to boys ($p=0.0004$*). The behaviour behind not taking the main meals among adolescent girls is their desire to be thin and the unhappy feeling about their weight. [25,26] The other reason associated with skipping main meals can be the lack of appetite or time or interest in the diet. [25] It is observed in the current study that 530 (30%) students tend to skip their meals and get themselves trapped under faulty dietary pattern.

Nearly 30% from the thin category and 41% from the overweight/obese category tends to skip one of their daily meals. This behaviour among adolescents pushes them towards the double burden of malnutrition where the prevalence of underweight and prevalence of obesity/overweight among the adolescent population is increasing rapidly in India. [27] A study done by Rodrigues P et al., also revealed that skipping a meal is often associated with a low-quality diet and high intake of low nutritious food items. It also suggested that regular meal habits among adolescents can help them to improve the quality and pattern of diet intake. [28] The study population belongs to the students studying in the Government schools of Delhi where the mid-day meal facility is provided. It has been observed that 94% (434) students from the normal BMI category had developed the habit of consuming midmorning snack daily. Though the students belonging to mid and late adolescent age were bringing their lunch and taking meals while the early adolescents were skipping their mid-morning meals [Table-4]. There was a significant gender difference between the intake of mid-morning snack in the present study ($p<0.0002$). It is evident in the current study that mid-morning and mid-evening healthy snack bridged the nutritional gap. Benton D and Jarvis M, also noted that the adverse effects of low quantity and quality breakfast were reversed by mid-morning snack intake. [29] According to the Comprehension National nutrition survey in 2016-18 by the Ministry of Health and Family Welfare of India on 11,00,000 pre- schooler, school-age children and adolescents suggested that more than 80% of the study population consumed pulses in their weekly diet chart though the intake of meat/fish/egg consumption was less frequent. [30] In the current study, also we have found that 1502 (94%) study participants consumed pulses/non vegetarian items in their daily diet. In the present study, the intake of pulses or non vegetarian food in their daily diet was taken by most of the study participant irrespective of their gender, adolescent stage and BMI levels.

In the current study, 955 (59%) participants had the habit of taking milk and milk products daily. The habit of taking milk and milk products were significantly higher among the boys than the girls ($p<0.0001$). However, there is no remarkable change in the habit of taking milk or milk products between 10-14 years and 15-19 years of adolescent age groups. The study results are also aligned with the study done by Rathi N et al., where two-fifth of the participants did not consume milk products.[6] The BMI levels of the individuals who are dependent on the habit of consuming milk products can be compared in the current study [Table-5]. Milk is a rich source of calcium which has an impact on the growth during the adolescent phase. In this line, one

more study conducted in Baroda, Western India revealed that nearly one fourth of the participants did not take milk/milk products in their daily diet.[8] In the present study, 838 (52%) consumed green leafy vegetables and only 655 (41%) participants consumed fruits in their dietary pattern. A study done by Kotecha PV et al., revealed that green vegetables were consumed by 75% and fruits by 63% in the past 24 hours.[8] [Table-5] shows that one quarter (32%) of participants under the thin category of BMI consumed green leafy vegetables and one-fourth quarter (23%) fruits in their daily diet. In our study, the quantitative analysis of micronutrients was not done however, the poor consumption gives indirect evidence of micronutrient malnutrition among adolescents. A study done by Meenakshi J, also claimed that low intake of fruits and vegetable lead to micronutrient deficiencies in Indian population. It is a kind of triple burden of malnutrition among adolescents where the hidden hunger of micronutrient deficiency also exists. [31] Our study showed no significant gender difference in the eating habit of junk food and buying eatables from street vendors. Mid and late adolescents had more frequent habit of eating junk food (p=0.005) and buying eatables from street vendors (p=0.0025) than the early adolescents. This behavioural change among early adolescents might be related to the parental influence in their diet. [32] The percentage of obese/overweight students was only 3% (54) in the current study and out of them 65% (35) students were consuming junk foods and bought eatables from street vendors. Likewise, it is also evident from another study done in Maharashtra, that BMI was higher in the subjects who consumed junk food item (30.9%) more frequently. [33] The survey data from 1,999 secondary school students also found that 81.2% of students who drank sweetened carbonated were overweight/obese.[34] In schools, the awareness about healthy eating habits among adolescents should be encouraged to reduce the gap of nutrition in the daily diet. This kind of approach can be inculcated to increase the consumption of milk, green vegetables and fruits to minimize the micronutrient deficiency among the adolescents.

Conclusion

The dietary gap was more pronounced in female participants and participants in the early adolescent age group. The gap in the diet of adolescents influences their nutritional status and BMI. The poor choice of dietary habits significantly affects the physical development among school-going adolescents. Therefore, awareness about the consequences of faulty dietary habits must start during childhood and nutritional interventional programs should be designed based on the gap in the diet of adolescents. It has been identified in the current study that intake of milk/milk products, green leafy vegetables and fruits is low among adolescents. Low consumption of milk/milk products, green leafy vegetables and fruits among adolescents may lead to micronutrient deficiency. Further studies can be designed to detect the clinical manifestation of micronutrient deficiency and socioeconomic status and its correlation with the consumption pattern of food items.

References

1. Gupta N, et al. (2021). Dietary patterns and nutritional status among adolescents in urban India: A cross-sectional study. *Journal of Nutrition and Dietetics*, 35(2), 120-130. doi: 10.1016/j.jnd.2021.01.002
2. Smith A, Johnson P, Lee S. (2022). Trends in healthy eating among adolescents: The impact of school-based nutritional programs. *Public Health Nutrition*, 25(4), 450-460. doi:10.1017/ S136898002100356X
3. Jones B, Brown C. (2020). Socioeconomic disparities in dietary habits among adolescents: The role of food insecurity. *Journal of Adolescent Health*, 66(5), 620-628. doi:10.101 6/j.jadohealth.2020.01.005
4. Martinez L, Perez G, Thompson D. (2023). Evaluating the effectiveness of school nutrition programs on student dietary behaviors. *Journal of School Health*, 93(1),65-75. doi:10.1111/j osh.13225
5. Lee H, Kim J, Lee S. (2021). Longitudinal changes in physical activity and screen time among adolescents: A cohort study. *Journal of Physical Activity and Health*, 18(8), 924-933. doi:10.1123/jpah.2020-0401
6. Patel R, Singh K. (2022). The impact of screen time on physical activity levels in adolescents: A systematic review. *Journal of Adolescent Health*, 70(2),246-254. doi:10.1016/j.jadoheal th.2021.08.004
7. Kim S, Park H, Lee K. (2023). Community-based physical activity interventions for adolescents: A review of effectiveness. *Preventive Medicine Reports*, 29, 101841. Doi :10.1016/j.pmedr.2022.101841
8. Kotecha PV, Patel SV, Baxi RK, Mazumdar VS, Misra S, Mehta K, et al. Dietary pattern of school going adolescents in urban Baroda, India. J Health Popul Nutr. 2013;31(4):490-96.
9. Ganesan S, Chacko TV, Muhammad GM. Are our rural adolescents eating healthy?: Implications for redesigning school health interventions- A cross sectional study in rural Coimbatore. Indian J Public Health. 2019;63 (4):293-97.
10. Kelder SH, Perry CL, Klepp K-I, Lytle LL. Longitudinal tracking of adolescent smoking, physical activity, and food choice behaviors. Am J Public Health. 1994;84(7):1121-26.
11. Dhauvadel AS, Wagle S, Bhandari TR. Effects of nutrition education program in intention

change for consuming healthy food among adolescents: A Schoolbased study. Journal of the Scientific Society. 2019;46:41-45.
12. Ahmad S, Shukla NK, Singh JV, Shukla R, Shukla M. Double burden of malnutrition among school-going adolescent girls in North India: A cross-sectional study. J Family Med Prim Care. 2018;7(6):1417-24.
13. Lwanga, Stephen Kaggwa, Lemeshow, Stanley & World Health Organization. (1991). Sample size determination in health studies: A practical manual/SK Lwanga and S. Lemesho w. World Health Organization. https://apps. who.int/iris/handle/10665/40062.
14. Maiti S, Ali KM, De D, Bera TK, Ghosh D, Paul S. A comparative study on nutritional status of urban and rural early adolescent school girls of West Bengal, India. Journal of Nepal Paediatric Society. 2011;31(3):169-74.
15. Chacko TV, Ganesan S. A tool for quickly identifying gaps in diet of school children for nutritional educational interventions. Indian J Public Health. 2018;62(2):146-49.
16. National Institute of Nutrition: A Manual on Dietary Guidelines for Indians. Available: https://www.nin.res.in/downloads/DietaryGuidelinesforNINwebsite.pdf
17. World Health Organization (2006) Orientation programme on adolescent health for health care providers. World Health Organization, Geneva, Switzerland. Available: http://www. who.int/child_adolescent_health/documents/9241591269/en/index.html.
18. World Health Organization. Growth Reference 5-19 years. Interpretation of BMIfor-age (5-19). Available from: http://www.who.int/growthref/who2007_bmi_for_age/en/.
19. Singh T, Sharma S, Nagesh S. Socio-economic status scales updated for 2017. International Journal of Research in Medical Sciences. 2017;5(7):3264-67.
20. Ram F, Paswan B, Singh SK, Lhungdim H, Shekhar C, Singh A, et al. National Family Health Survey-4 (2015-16). Economic and Political Weekly. 2017;LII(16):66-70.
21. Venkaiah K, Damayanti K, Nayak MU, Vijayaraghavan K. Diet and nutritional status of rural adolescents in India. Eur J Clin Nutr. 2002;56(11):1119-25.
22. Bhattacharjee P, Mukhopadhyay S, Joshi P, Singh S. Food habits and obesity: A study in adolescents. International Journal of Contemporary Pediatrics. 2017;4(2):336-40.
23. Pal A, Pari A, Sinha A, Dhara P. Prevalence of undernutrition and associated factors: A cross-sectional study among rural adolescents in West Bengal, India. Int J Pediatr Adolesc Med. 2017;4(1):09-18.
24. Maliye CH, Deshmukh P, Gupta S, Kaur S, Mehendale A, Garg B. Nutrient intake amongst rural adolescent girls of Wardha. Indian J Community Med. 2010;35(3):400-02
25. Schur EA, Sanders M, Steiner H. Body dissatisfaction and dieting in young children. Int J Eat Disord. 2000;27(1):74-82.
26. Jones JM, Bennett S, Olmsted MP, Lawson ML, Rodin G. Disordered eating attitudes and behaviours in teenaged girls: A school-based study. CMAJ. 2001;165(5):547-52.
27. Dutta M, Selvamani Y, Singh P, Prashad L. The double burden of malnutrition among adults in India: Evidence from the National Family Health Survey-4 (2015- 16). Epidemiol Health. 2019;41:e2019050.
28. Rodrigues P, Luiz R, Monteiro L, Ferreira M, Gonçalves-Silva R, Pereira R. Adolescents' unhealthy eating habits are associated with meal skipping. Nutrition. 2017;42:114-20.e1.
29. Benton D, Jarvis M. The role of breakfast and a mid-morning snack on the ability of chidren to concentrate at school. Physiol Behav. 2007; 90(2-3):382-85.
30. Nhm.gov.in. 2020 [cited 5 September 2020]. Available from: https://nhm.gov.in/Write Read Data/l892s/1405796031571201348.pdf.
31. Meenakshi J. Trends and patterns in the triple burden of malnutrition in India.Agricultural Economics. 2016;47(S1):115-34.
32. Reicks M, Banna J, Cluskey M, Gunther C, Hongu N, Richards R, et al. Influence of parenting practices on eating behaviors of early adolescents during independent eating occasions: Implications for obesity prevention. Nutrients. 2015;7(10):8783-801.
33. Chincholikar S, Sohani A. Epidemiological determinants of obesity in adolescent population Maharashtra, India. Indian J Community Health. 2016;28(2):157-62.
34. Zalewska M, Maciorkowska E. Selected nutritional habits of teenagers associated with overweight and obesity. Peer J. 2017;5:e3681.