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Impact of nutrition education intervention on food consumption pattern of rural adolescent girls

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Abstract

Nutrition education plays a significant role in bringing out the dietary and behavioral changes among individuals thereby improving the nutritional status of the individual. This study is an attempt to investigate the impact of nutrition education on knowledge level which bringing out change in the consumption pattern of the individuals on 420 rural adolescent girls of Deoria district UP. The data was collected before and after nutrition education intervention to assess the impact on the respondents. Nutrition education is a modern approach which has a significant impact on improving the nutritional status in various parts of the world. The introduction of nutrition education brings about a positive change in the nutritional knowledge of the adolescent girls. The food consumption pattern changes which change the nutrient intake of the respondents. Nutrition and health intervention play a major role in bringing the change in dietary habits and eating pattern of the population. It is a very important tool used to inculcate the good healthy eating practices among the population and is considered a great tool for long term improvement among individuals. The nutrition education provided in schools will significantly contribute to preventing malnutrition in the following generation if students understand the correct dietary concepts and put them into practice as adults. The classroom, home, community, and school environments all need to be addressed for nutrition education to be effective. Healthy eating behaviors may be maintained with the aid of social support from teachers and families as well as nutrition teaching on healthy eating habits in the curriculum.

Keywords: Nutrition, education, consumption pattern, malnutrition, dietary intake

Introduction

The global adolescent population (aged 10-19) is currently the largest in recorded human history, with approximately 90% residing in low and middle-income countries (LMICs). (Dasgupta *et al.*, 2013) ^[1]. Recognition of the necessity to customize policies and initiatives to address the distinct requirements of this demographic is growing. Interventions focusing on health and nutrition should capitalize on this critical phase of growth and development to enhance health outcomes across generations (Ghose *et al.*, (2016); Islam *et al.*, (2015) ^[2, 3]. Safeguarding the health and well-being of adolescent girls is crucial, not just for their own benefit but also to ensure that they can transition into healthy mothers who raise healthy children. During adolescence, nutrient requirements escalate due to the growth spurt. Moreover, there is evidence indicating the potential for "catch-up" growth during this period with sufficient nutritional support (Jain *et al.*, (2010) ^[4]. Adolescence represents a critical juncture to establish the groundwork for lifelong health. The Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) framework, which has been recently devised, delineates the various determinants of adolescent nutritional status, encompassing factors at the individual, household, community, and societal levels (Jogelkar & Bhoi, 2016 ^[6] The immediate factors influencing nutritional status in adolescents encompass their dietary habits, physical activity levels, health status, and the occurrence of early pregnancies. These factors are influenced by the individual's access to and utilization of quality services, as well as their knowledge, attitudes, and behaviors. Additionally, individual characteristics such as physical and emotional well-being, school attendance, peer relationships, and empowerment also play a role. Household dynamics, including sociodemographic and economic factors, contribute to these influences, as do community aspects like land availability (Kamanth *et al.*, (2017) ^[7].

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In order to improve the nutritional status of girls, nutrition education has been characterised as instructional strategies for causing desired behavioural changes. In recent years, it has become clear that how important nutrition education is for improving the health and nutrition of communities in underdeveloped nations. This age is particularly prone to nutritional risks due to the dual demands of growth and exercise. This study provides a detailed description of adolescent girls' exposure to information and services, knowledge and practices related to nutrition and the food consumption pattern they follow.

Objectives of the study

- To assess the background information of the adolescent girls.
- To assess the nutritional status of adolescent girls between 13 to 19 years of age.
- To assess the gain in knowledge of adolescent girls through developed educational package.
- To check the effect of nutrition education intervention on the consumption pattern of adolescent girls.

Null hypothesis

There is no impact of nutrition-based education intervention on the consumption pattern of adolescent girls.

Methodology

The study employed a quantitative research approach with a descriptive design. A nonprobability purposive sampling technique was used to select 420 adolescent girls aged 13 to 19 years. Participants underwent a comprehensive assessment, including a detailed history, sociodemographic evaluation, and physical examination, to evaluate their baseline clinical status. Data collection relied on primary sources, and informed consent was obtained from all participants. Additionally, permission was obtained from the school authority. The questionnaire utilized in the study was structured into three sections.

Section I: Background information: this proforma was used to obtain the background information of the sample for e.g., name, age, religion, family type, socio-economic status, parents educations qualification and annual income.

Section II: Nutritional assessment proforma: This section comprises of three parts: the first is anthropometric data in which height, weight, waist, and hip ration was recorded. BMI was calculated. The second and third part comprise of already available standardised food frequency table and 24-hour dietary recall proforma.

Height: Height measurements were taken using a measuring tape affixed to a wall. Participants stood barefoot with their heels together, ensuring their heads were held perpendicular to their bodies. The highest point on the head was aligned with the scale, and height was recorded to the nearest 0.5 centimeters (Jelliffe, 1996) [5].

Weight: It was measured using a digital scale. It was routinely calibrated using recognised weights. Every day, the zero error was checked for and fixed if it was found. The closest 500 grammes were used to measure their weight (Jelliffe, 1996) [5].

BMI: Each participant's BMI was calculated using the formula weight (kg)/height (m²), and different nutritional status grades were assigned based on proposed criteria. Socio-economic status was calculated by Kuppaswamy scale classification. Data was collected by personal interview with a structured questionnaire and care was taken to avoid fasting and festival days while noting the dietary intake. Data was analysed using MS Excel. Mean and standard deviation was calculated.

Section III: Knowledge based questionnaire: This proforma was made by the investigator to assess the knowledge regarding various nutritional parameters like General health and diet, human digestive system, recommended dietary concepts, food-based knowledge, and nutritional deficiency disorders.

Data collection method

Primary sources are used to collect data. Utilizing primary data, it is determined that the offline questionnaire survey method is appropriate because replies from a very large number of respondents are required. The chosen samples were given a detailed, organized questionnaire with all the three sections that addressed every aspect of the objectives specified. The questionnaire's design included closed-ended questions, making it simple and quick to complete. Each knowledge-based section has 4 options to choose from. The questionnaire is designed in bilingual language making it easy to understand as per the preference. All survey tools were drafted in English, translated into Hindi, back translated, and pretested on 80 samples prior to data collection.

Development of intervention package

Different materials were reviewed, these included various publications related to the development and implementation of nutrition education programs, previous nutrition education packages and workshop documentations that have discussed or reviewed nutrition education programs (Kapantais *et al.*, (2011) [8]). The purpose of the review was to identify existing nutrition education materials and gaps. The information was intended to guide the drafting of nutrition education package including materials to be used. After reviewing the existing literature, the drafting of the package was done. A student friendly nutrition intervention package was developed and evaluated by the experts for the relevance of the content which included PowerPoint presentations on various topics, e folders and e- booklet to give them an insight of the nutritional knowledge.

Statistical Analysis

Descriptive and inferential statistical analysis been carried out in the present study. Results on categorical measurements are presented in Number (%). Significance is assessed at 5% and 1% confidence limits into (No significance, significant and strongly significant) different levels of significance. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

Results and Discussion Socio-economic profile

The details of socio-economic status of the sample are presented in Table 1. More than 90% of the adolescents belonged to Hindu religion. Out of 420 rural adolescent girls

interviewed in the baseline survey prior to nutrition education intervention, all were successfully assessed in the post-intervention phase during the end-line survey. Thus, the study was able to reach out 100% of the target population who completed the assessment of nutrition knowledge in both surveys. Majority (50.47%) of the subjects were from joint family and 49.52% of them were from nuclear family. Majority of the subjects belonged to low-income group (64.28%) and middle-income group (32.14%). Only 3.57% were from high income families as they had a monthly income of >1 lakh. It was observed that majority belonged to rural area (74.28%). Only 25.71% of the adolescent girls were living in urban areas. Majority (51.46%) of the respondents were non-vegetarian. 38.57% were vegetarians and only 10% were found to be ovo-

vegetarians. Majority of the fathers (51.42%) and mothers (32.38%) have completed their graduation. In the illiterate category, mothers account for 42.38 per cent while only 11.19 per cent of the fathers were illiterate. Family educational level and socioeconomic status have a marked effect on children’s lifestyles and dietary habits (Prakash *et al.*, (2013) [11]. This brings out to the conclusion that food expenditure merely depends on family income. BMI can be considered an alternative for direct measures of body fat (Rajpoot *et al.*, (2016) [12]. Additionally, BMI is an inexpensive and easy to perform method of screening for weight categories that may lead to health problems. For children and teens, BMI is age and sex specific and is often referred to as BMI for age.

Table 1: Socio-economic profile

Variable	Description	Percentage
Religion	Hindu	92.85
	Muslim	7.14
Type of family	Joint family	50.47
	Nuclear family	49.52
Locality	Rural	74.28
	Urban	25.71
Family income	Low Income Group (> ₹25000)	64.28
	Middle Income Group (₹ 25001- ₹1 lakh)	32.14
	High Income Group (< ₹ 1 lakh)	3.57
Type of diet	Vegetarian	38.57
	Non-vegetarian	51.42
	Ovo-vegetarian	10.00

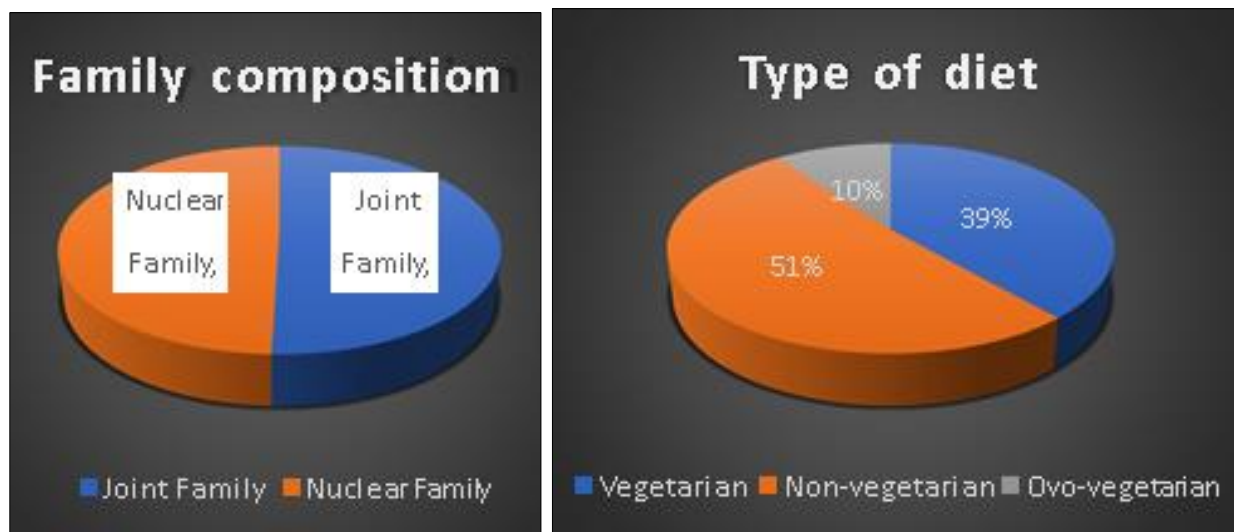


Fig 1: Family composition and type of diet

Table 2: Educational qualification and occupation of parents

Sr. No.	Variables	Father		Mother		
		f	%	f	%	
1.	Educational qualification	Up to 8 th	14	3.33	19	4.52
		High school	34	8.09	18	4.28
		Intermediate	72	17.14	60	14.28
		Graduation	216	51.42	136	32.38
		Post-graduation	37	8.80	9	2.16
		Illiterate	47	11.19	178	42.38
2.	Occupation	Government	59	14.04	18	4.28
		Private	159	37.85	43	10.26
		Self Employed	155	36.90	22	5.23
		Unemployed	47	11.19	-	-
		Housewife	-	-	337	80.23

Majority of the fathers (51.42%) and only (32.38%) of the mothers have completed their graduation. It was observed that most of the fathers were occupied with some kind of

earning but only 20% of the mothers were working. Rest of them were housewives.

Table 3: Distribution of study subjects according to nutritional status.

Nutritional Status	Grade	BMI	Frequency	Percentage
Under weight	Grade III under Nutritional	<16.0	85	20.3
	Grade II under Nutritional	16.0-16.99	63	15.1
	Grade I under Nutritional	17.0-18.49	104	24.9
Normal	Normal	18.5-22.9	147	35.2
	Over weight	23.0-24.9	15	3.6
Over weight	Pre-obese	25.0-29.9	04	1.0
	Type-1 obese	30-40	-	-

Malnutrition, as per the World Health Organization (WHO) criteria, refers to a set of pathological conditions arising from an inadequate intake of nutrients relative to the body's requirements. It can manifest as underweight, overweight, obesity, or various other nutritional deficiencies (Shaikh *et al.*, 2018) [20].

According to body mass index (BMI) data, a majority (60.3%) of individuals were identified as undernourished, with 20.3% categorized as grade III, 15.1% as grade II, and 24.9% as grade I. Only 3.6% and 1% of individuals were classified as overweight or pre-obese, respectively, while 35.2% were deemed to have a normal weight or be well-nourished.

Table 4: Distribution of respondents on the basis of height and weight

Age (years)	Height (m) Mean ± S.D.	Weight (kg) Mean ± S.D.
13	1.49±0.01	37.21±3.57
14	1.49±0.03	37.91±2.78
15	1.5±0.02	50±4.12
16	1.51±0.06	44.92±2.64
17	1.52±0.04	49.98±3.76
18	1.5±0.06	44.53±6.25
19	1.51±0.02	47.8±3.11

Table 4 presents the heights of respondents categorized by age groups. The data indicates that respondents aged 13-14 had an average height of 1.49 meters. At 15 years old, the average height increased slightly to 1.5 meters. For those

aged 16 and 17, the mean heights were 1.51 and 1.52 meters, respectively. Teenage girls aged 18 and 19 had average heights of 1.5 and 1.51 meters, respectively.

Overall, the data suggests a general trend of increasing height with age during adolescence, with some variation between age groups. However, it's important to note that individual growth patterns can vary, and factors such as genetics, nutrition, and overall health can also influence height during this period.

The research findings indicate that the average weight of 13-year-old respondents was 37.21 kg, which slightly increased to 37.91 kg for 14-year-olds. However, the mean weight peaked at 50 kg for 15-year-olds. For the 16-17 age group, the average weights were 44.92 kg and 49.98 kg, respectively. The overall average weight for all subjects was 44.54 kg. For those aged 19 and older, the mean weight was 47.8 kg.

Comparing these findings to a study on rural adolescent girls in Lucknow district, which reported heights ranging from 1.45 m to 1.5 m and weights from 36.92 kg to 44.83 kg, it can be inferred that the height and weight of the study population were similar to those of the Lucknow district girls. Additionally, the BMI ranges in both studies were comparable, falling between 17.32 kg/m² and 19.71 kg/m².

These similarities suggest that the physical characteristics of the study population align with those of rural adolescent girls in Lucknow district. This information can be valuable for further research and interventions aimed at improving the health and well-being of adolescent girls in similar settings.

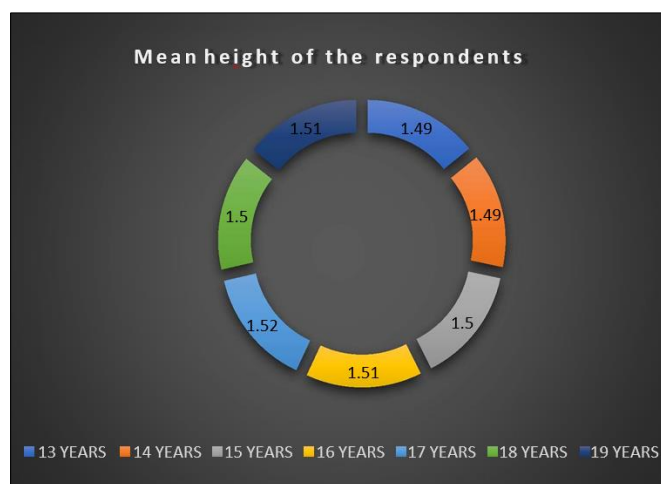
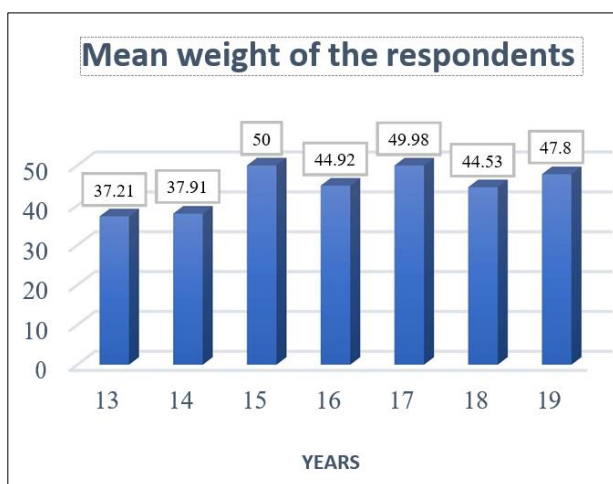


Fig 2: Anthropometric profile of the respondents

Table 5: Impact of nutrition intervention on nutritional knowledge

Sr. No	Items	Pre-intervention (%)	Post intervention (%)
1.	Significance of health	53.80	90.47
2	Measures to determine healthy weight	36.19	71.90
3.	Period of exercise per day	3.09	65.23
4.	Major health problem of adolescent girls	25.71	79.52
5.	My plate concept:	16.90	82.85
6.	Skipping breakfast	19.04	41.42
7.	Weekly outside eating pattern	12.61	26.19
8.	Food preferences while eating outside:	66.19	13.33
9.	Food selection influencers	73.57	73.57
10.	Food factor preference	21.19	58.33
11.	Carbohydrate requirement per day	15.71	49.52
12.	Protein intake	32.38	60.47
13.	Healthy fat intake per day:	17.61	46.66
14.	Iron needs per day:	24.76	66.66
15.	Calcium intake to function effectively	19.52	63.33
16.	Required haemoglobin level:	17.61	65.00
17.	Vitamin A (retinol) consumption per day:	16.66	52.85
18.	Body requirement of vitamin C per day:	16.42	74.28
19.	Dietary fibre consumed:	26.90	69.04
20.	Zinc recommendation for adolescent girls:	17.61	64.28
21.	Total cholesterol level in the body:	19.76	59.04
22.	Recommended vitamin D level:	9.76	55.95
23.	Iodine needs per day:	27.61	66.66
24.	Daily water intake:	13.57	55.00
25.	Balanced diet provides:	50.71	91.19
26.	Importance of balanced diet	21.66	71.67
27.	Non-Nutrient among them:	42.85	71.43
28.	Carbohydrate rich food	25.71	73.09
29.	Best source of energy:	14.28	73.57
30.	Eggs, pulses, and meat are good source:	38.57	76.19
31.	Fruits and vegetables are good source:	35.23	70.95
32.	Fat-soluble vitamins:	24.76	73.33
33.	Common sources of vitamin A:	20.23	68.33
34.	Citrus fruits are a rich source:	38.57	73.33
35.	Vitamin from sunlight	40.00	65.71
36.	Vitamin lost during cooking:	32.61	74.52
37.	Red fruits and vegetable provide nutrients:	13.33	51.19
38.	Milk and milk products provide:	21.19	75.47
39.	Rich sources of iron:	20.00	70.24
40.	Contains folic acid:	23.80	64.05
41.	Food group contains fibre:	30.23	66.67
42.	Meat supplement for vegetarians:	24.04	60.48
43.	Immunity providers:	28.57	71.90
44.	Fast/junk food contains:	21.90	52.85

The American Dietetic Association (ADA, 2011) defines nutrition education as individual instruction or training aimed at fostering the acquisition of knowledge and/or skills connected to nutrition. According to Gil (2010), a group of planned educational activities known as nutrition education are aimed at promoting healthy eating among a particular demographic group. This could be done in a number of ways, but typically happens in settings geared towards young children and adolescents because it is thought that how they learn shapes their behavior and preferences as adults (Eat well, 2011). In the present study nutrition education was given to all the selected adolescent girls with attractive and informative PowerPoint slides as a teaching tool. A series of questions spanning several facets of fundamental nutrition were used to assess the respondents' knowledge of nutrition. The results are provided in the Table 5: Table 5 revealed that the nutrition knowledge changes post intervention. It was found that majority of the respondents were not aware about the basics of food. They

were not aware about the food sources and the recommended dietary intake they should take in order to maintain their body health and efficiency. Post nutritional knowledge represent a significant increase in the knowledge level of the respondents. The post intervention result revealed that a positive change was observed.

Table 6: Food consumption pattern

Food	Daily		Weekly	
	Pre	Post	Pre	Post
Cereals	98.57	99.04	-	-
Pulses	3.09	10.95	11.42	26.66
Green leafy vegetables	3.33	54.78	13.67	43.32
Nuts and oils	6.19	32.14	17.38	32.14
Milk and milk products	45.47	70.95	6.90	20.23
Meat and meat products	16.98	25.87	24.21	54.89

The adoption of dietary pattern analysis has gained popularity for its ability to assess the overall diet, capturing

complex behaviors and potential interactions among nutrients that can affect health outcomes.

In this study, data from Table 6 indicated that 98.57% of adolescents consumed cereals daily, a figure that increased to 99.04% post-intervention. This finding aligns with a study by Chacko and Begum (2017) ^[19], which found that cereal and cereal products were frequently consumed by a large segment of selected adolescents from middle-income families.

Regarding the consumption of whole pulses, the data showed that 3.09% of adolescents consumed them daily, with 11.42% consuming them weekly. After the nutrition education intervention, daily consumption increased to 10.95%, and weekly consumption rose to 26.66%.

The study also revealed that the frequency of vegetable consumption, including green leafy vegetables, roots, and tubers, was low, with only 3.33% consuming them daily. However, post-intervention, daily consumption increased significantly to 54.78%, and weekly consumption increased from 13.67% to 43.32%. These findings suggest that the nutrition education intervention had a positive impact on adolescents' dietary habits, particularly in increasing the consumption of whole pulses and vegetables. This highlights the effectiveness of targeted interventions in improving dietary behaviors among adolescents, which is crucial for their overall health and well-being.

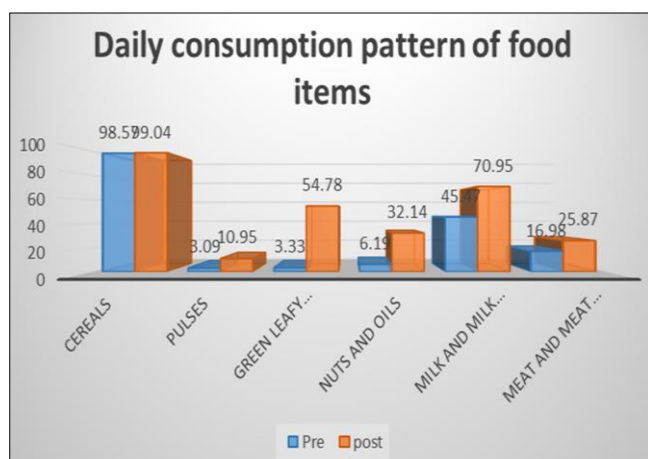


Fig 3: Daily consumption pattern of food items

Patton *et al.*, (2012) ^[9] and Roza *et al.*, (2019) ^[13] when assessing the food consumption pattern of adolescents also observed that the mean frequency of consumption of green vegetables was 8.5 per week, that is, adolescents consumed two or three servings per day. Milk is the product that is considered as a complete food. The study highlighted that 45.47% took milk daily and only 6.90% took milk on weekly basis. Post intervention consumption increased. About 16.98% consumed nonvegetarian food. Items such as fish and mutton were consumed weekly only.

Discussion

The study underscored the significant impact of family educational level and socioeconomic status on children's lifestyles and dietary behaviors. It was observed that lack of awareness about nutritious foods and healthy habits contributed to underweight among children. UNICEF (2016) indicated that under-nutrition, particularly underweight, was more prevalent among rural children and those with illiterate mothers (Sharma & Singh, 2017) ^[16-17].

The study also revealed a deficit in mean height and weight for age, aligning with findings by Perlstein *et al.* (2017) ^[10], which showed that all children were notably below the standards set by the Indian Council of Medical Research (ICMR) in terms of height and weight. Moreover, the frequency of consumption of milk products, fruits, and vegetables fell below the ICMR recommendations.

Research by Shivaramakrishna *et al.* (2011) ^[18] highlighted that foods available in low-income neighborhoods tend to be of lower quality, costlier, and less diverse compared to those in wealthier areas, as major suppliers often target higher-income consumers.

Overall, the study demonstrated an association between nutritional education interventions and the dietary habits of adolescents. This underscores the importance of such interventions in promoting healthier food consumption patterns among this demographic.

Conclusion

The study findings indicate that the dietary habits of adolescents in India are generally unhealthy. Cultural norms often prioritize eating less, leading to limited dietary variety among adolescents. Furthermore, recent market trends have seen a rise in the availability and promotion of junk foods, which has contributed to more adolescents consuming unhealthy foods.

Protein-rich foods such as chicken, meat, fish, or eggs are not consumed daily by most adolescents, with only about a third consuming them weekly. This lack of adequate protein intake is concerning given its importance for growth and development during adolescence.

The survey results suggest a link between nutrition education and the dietary patterns of adolescents, highlighting the potential effectiveness of educational interventions in promoting healthier eating habits. The study also recommends further research on nutritional interventions to improve the health status of adolescents, recognizing their significance as a key demographic group.

Suggestions for future research

1. A similar study can be taken up on other age groups and on males as well.
2. Schools can be motivated to spread and organize nutrition education related programs by incorporating this intervention package and longitudinal studies identifying its impact can be initiated.
3. Awareness about the importance of nutrition in adolescence and health of girls need to be popularized among the parents and the children. Nutrition promotion and education should be a continual effort to raise public awareness of the importance of good nutritional status in adolescents.
4. Sustainable nutrition education and promotion programs should be developed to raise public knowledge of the importance of good nutrition in children and adolescents.
5. Effective nutrition-health communication strategies as part of school curriculum are an area for future research which can enhance the impact of other interventions.
6. Effectiveness of participation of Government agencies and non-Governmental organizations is required for improving health of adolescent girls.

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