A Cross-Sectional Study on the Prevalence of Overweight and Obesity among Children and Adolescents in Mysore Region

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Abstract

Background: Obesity is an excessive accumulation or abnormal distribution of body fat. Obesity is one of the most prevalent nutritional disorders of children and adolescents in many developed and developing countries. Childhood obesity has become a significant public health issue in developing countries including India, due to the changes in children's lifestyles and eating habits because of the influence of urban culture and technological advancements. Children who are overweight and obese during childhood are more likely to stay overweight and obese in their adulthood and they are more prone to non-communicable diseases when they reach their adulthood.

Objective: The main objective of the study was to assess the prevalence of overweight and obesity among children and adolescents.

Methodology: The cross-sectional study was conducted among 200 students (100 children of age 6-9 years and 100 adolescents of age 10-19 years) of KV School, Mysore. Anthropometric measurements like height, weight and MUAC was measured and clinical signs, and symptoms were examined. A semi-structured questionnaire consisting of subjective, objective data and dietary assessment tools like the Food Frequency Questionnaire (FFQ) and 24-Dietary Recall were used to assess the nutritional status, consumption pattern, and average intake of nutrients. CDC standards were used for defining Overweight and Obesity. After assessment of data, Nutrition Education was provided for children and adolescents who were overweight and obese.

Results: Out of 100 Children 13% were overweight and 9% were obese whereas in adolescents out of 100, 20% were overweight and 20% were obese. The prevalence of overweight and obesity was seen more in adolescents than in children.

Conclusion: The prevalence of overweight and obesity was comparatively higher in adolescents. Lifestyle pattern, behavioral changes and dietary habits were identified as major factors which influenced the overweight and obesity status of children and adolescents.

Keywords: BMI; Obesity; Overweight; Prevalence; School Children; Adolescents; Food Frequency Questionnaire; Dietary Habits; Nutrition Education

"The children of today will make the India of tomorrow. The way we bring them upwill determine the future of the country."
- Jawaharlal Nehru

Introduction

Good health is a prerequisite for human productivity and the developmental process. Health is the state of well-being

of individuals and the community [1]. Obesity has been identified as a major public health problem by the World Health Organization. The *"New World Syndrome"* of non-communicable diseases, of which obesity is the first wave, significantly impacts public health and the socioeconomic conditions of developing countries. The percentage of children and adolescents who are overweight and obese has also been rising, following the rise in adult obesity [1]. Childhood is a critical period because of rapid physical, neurological, and social development. Besides, it has been shown that intervention of obesity in adulthood faces more difficulties than in childhood since adults are more prone to non-communicable diseases [2]. The main cause of childhood obesity is the behaviour children pick up from their parents and caregivers. Thus, prevention of childhood obesity with emphasis on increased physical activity is of prime importance [3]. Behavioural changes and lifestyle modifications are the primary tools for reducing obesity [4]. Nutrition education interventions can be effective in promoting children's eating habits and preventing obesity. It is also believed that early intervention can have an influence on children's eating habits and weight status in a positive way [5].

Review of Literature

Prevalence of Overweight and Obesity among Chennai's School Children and Adolescents

Jagadesan S, et al. conducted a cross-sectional survey which was conducted in Chennai, India. 2963 kids from 12 schools in Chennai, ranging in age from 5 to 19, were all involved in the study. The sample was selected using a multistage sampling technique. A structured questionnaire was employed in the study to gather information on anthropometric measures, dietary practices and demographic factors, and physical activity levels. Descriptive statistics were used to analyze the data using SPSS software, and the prevalence of overweight and obesity was calculated. According to the survey, there were 9.9% and 4.6%, respectively, more school children and adolescents in Chennai who were overweight or obese than normal weight. The study also found that dietary habits and physical activity levels were important predictors of overweight and obesity among school-aged children and adolescents in Chennai. Boys are more likely to be overweight or obese than girls who support gender-specific interventions to prevent and control overweight and obesity. Private schools had a greater prevalence of overweight and obesity is especially interesting since it raises the possibility that socioeconomic factors may play a role in the development of overweight and obesity. It was concluded that for the prevention and management of overweight and obesity among school children and adolescents in India, and the need for intervention that concentrates on dietary habits and physical activity levels, as well as socio-economic factors.

It is seen that obese adolescents have a 70%-80% chance of developing adult obesity [6].

Prevalence of Obesity and Overweight among Students in Delhi, India

Kaur S, et al. conducted a study that aimed to identify the socio-demographic characteristics linked to overweight and obesity. 30 randomly chosen schools in Delhi, India were selected and the sample size of the study was 2,819 students of age 6 to 18 years old. Anthropometric measurements were collected to calculate the BMI of the students and a questionnaire was used to collect socio-demographic information. Based on WHO (World Health Organization) standards students were classified as underweight, normal weight, overweight and obese. The study findings revealed that the overall prevalence of overweight and obesity was 16.3% and 4.9% respectively, with a total of 21.2%. The prevalence of overweight and obesity was higher in boys (18.2%) than in girls (14.5%). The prevalence of overweight and obesity is increased with age, with the highest prevalence amongst students aged 15 to 18 years old. Also, the prevalence of overweight and obesity was higher among students from higher socio-economic backgrounds, with higher levels of parental education, and those who are consuming fast food and soft drinks. The study also found an interesting fact that there was no significant association between physical activity and overweight and obesity. The need for interventions to address the increasing prevalence of overweight and obesity in school children. Interventions should focus on promoting healthy eating habits, fast food and soft drink consumption should be decreased and physical activity levels should be increased [7].

A Prospective Study on the Prevalence of Childhood Overweight and Obesity in Urban-Adolescents School Children

Dutt V, et al. conducted a study to determine the prevalence of childhood obesity and overweight among urban adolescent school children in India. The methodology of the study was cross-sectional and the sample size was 500 urban adolescent school aged 12 to 16 years using random sampling. The anthropometric measurements were collected to calculate BMI. The WHO standards BMI-for-age was used to classify the children as underweight, normal, overweight, or obese. A standardized questionnaire was used to gather information on dietary habits, demographic data, and physical activity levels. According to the survey, the prevalence of overweight and obesity among urban adolescent school children were 10.4% and 4.2% respectively. Male children had a higher prevalence than female children. The children who consumed fast food and soft drinks frequently and were involved in less physical activity had a higher prevalence of obesity and overweight. The findings provide insight into

the growing prevalence of childhood obesity and overweight among urban adolescent school children in India. The need for implementing interventions that encourage children that promote healthy eating habits and increased physical activity. Also the need for regulations on the availability and marketing of fast food and sugary drinks to children. One of the strengths is that they employed a multistage random sampling procedure to make sure the sample was representative of the study population. Additionally, the use of WHO standards for BMI-for-age allowed for the accurate classification of participants as underweight, normal, overweight, and obese [8].

Materials and Methods

Aim

The study aims to determine the prevalence of overweight and obesity in Children and Adolescents of age 6-19 years.

Objectives

- To assess the prevalence of overweight and obesity among children of age 6-9 years and Adolescents of age 10-19 years.
- To assess the nutritional status of children and adolescents.
- ➢ To assess the anthropometric measurements
- ➢ To assess clinical, signs and symptoms
- ➢ To assess the dietary behaviour of Children and adolescents.
- To provide nutritional education for children and adolescents who are obese.

Study Methodology

A cross-sectional study was designed to assess the prevalence of overweight and obesity among children and adolescents. A randomized sampling technique was used to select 200 subjects of age 6 - 19 years. Out of 200 subjects, 100 were children who belong to the age category of 6 - 9 years and 100 were adolescents who belong to the age category 10 - 19 years. The students were oriented before the start of the study and the assessment was done using standard tools and techniques used for nutrition assessment. The duration of the study was 4 months at Kendriya Vidyalaya School, Mysore.
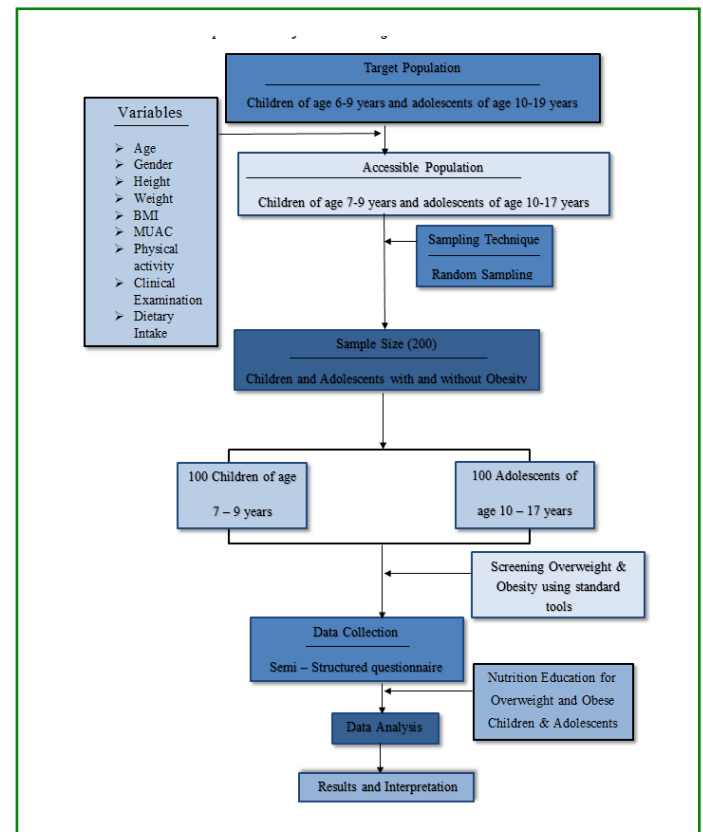
Inclusion Criteria

- Children Aged between 6-9 years and Adolescent aged between 10-19 years.

Exclusion Criteria

- Those below 6 years and above 19 years of age.
- Children and adolescents with other comorbidities.

Schematic Representation of Research Design:

Tools used for Data Collection

The anthropometric measurements used are body weight, height, and MUAC. For measuring body weight, a weighing scale is used. The zero error of the weighing scale is checked before taking the weight. For measuring heights in children and adolescents, a stadiometer is used. MUAC was measured on the left hand of the subject using a measuring tape. BMI is used to measure body fat based on height, weight, and age of children and adolescents.

BMI	Interpretation
< 5th Percentile	Underweight
5th – 85th Percentile	Normal
85th - < 95th Percentile	Overweight
≥ 95th Percentile	Obesity

Table 1: Depicts BMI standards by Centres for Disease Control and Prevention (CDC).

Subjective and objective data was collected using a semi-structured Questionnaire. The data includes anthropometric measurements, Clinical signs and symptoms, Physical activity and Screen time. The dietary intake was assessed using food frequency questionnaire, and 24-hour dietary recall.

Statistical Analysis

Descriptive statistics- Statistical analysis was performed using Microsoft Excel
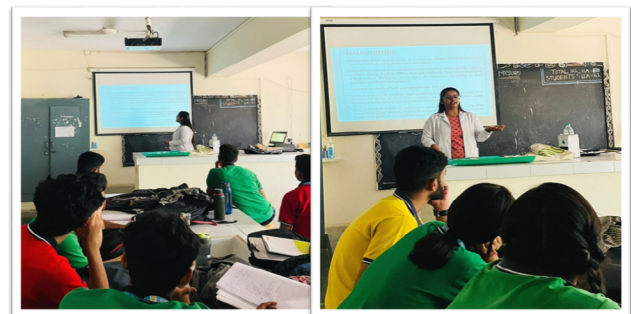
Nutrition Education

In this study, out of 200 children, 21.5% were found to be overweight and obese. Children and Adolescents who were overweight and obese were provided with nutrition education. The lecture method was used to provide nutrition education. For increasing the effectiveness of the lecture, appropriate aids were used and there was a provision for discussion at the end of the lecture. Teaching aids included in the study were PowerPoint Presentations, Charts, and Posters. The nutrition education program included messages about the influence of media and advertising on attitudes and behaviours toward food. Children and adolescents were taught about the relationship between TV viewing and poor dietary behavior. Children were taught about healthy eating, the food pyramid, and My Plate which encourages students to have a balanced diet and to choose a variety of colours from fruit and vegetable groups. Childhood obesity, types, causes, prevention, dietary interventions, and foods to be included and avoided were also a part of the Education which helps them to understand and change their lifestyles and behavior patterns. To assess their knowledge and understandings a quiz was also conducted for children and adolescents who were overweight and obese. The quiz was given before and after the nutrition education which included 12 questions.

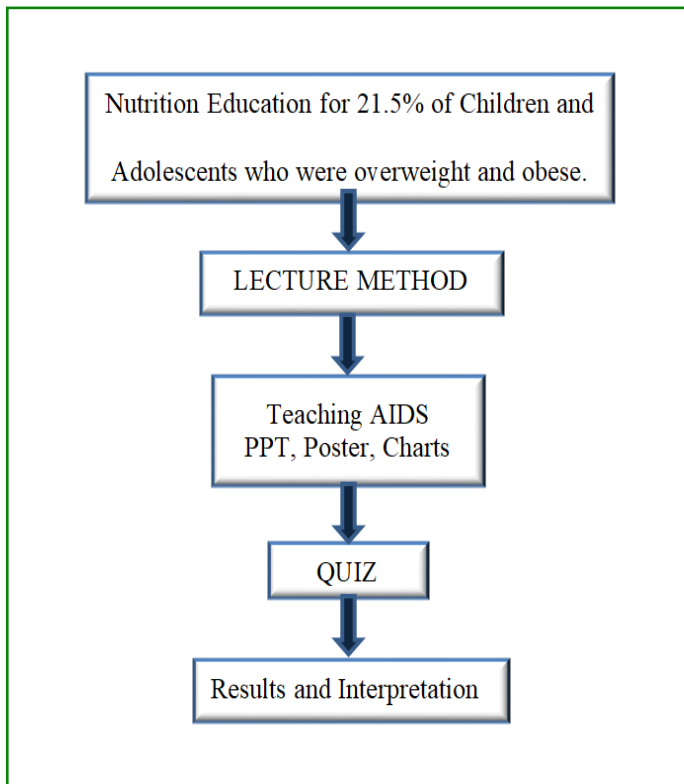## Teaching aids used for Nutrition Education

Teaching aids are required to increase the effectiveness of communication methods. The teaching aids used in this study were charts, posters, and PPT presentations.

Figures 1 & 2: Charts and Posters used for Nutrition Education.

Figures 3 & 4: PPT Presentations used for Nutrition Education.

Results and Discussion

The study aimed to assess the prevalence of overweight and obesity in Children and Adolescents. The study population included 100 children and 100 adolescents. The results are discussed in the following section-

Demographic Data

Age-Group	Percentage %	
Children	50	
Adolescents	50	
Gender	Male%	Female%
Children	55	45
Adolescents	57	43

Table 2: Depicts distribution of subjects according to their demographic data.

Lifestyle Habits

Figure 5: Graphical representation of Physical Activity and Screen time in Children & Adolescents.
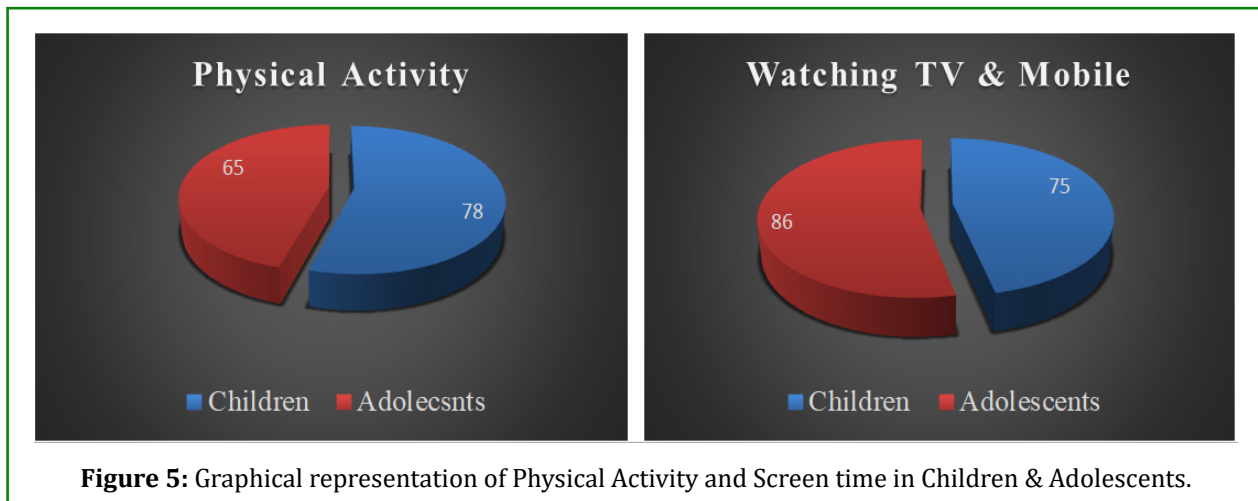
Anthropometric Data

The average height, weight and MUAC of 7-9 year boys were 129cm, 25.04kg and 18.8 respectively. Adolescent boys of age group 10-13 had an average height, weight and MUAC of 145cm, 44.35kg and 22.31 respectively and for 14-17 years adolescent boys the height, weight and MUAC was 165.6cm, 61.71kg and 25.19 respectively.

The average height, weight and MUAC of 7-9 year girls were 126.2cm, 29kg and 19.3 respectively. Adolescent girls of age group 10-13 had an average height, weight and MUAC of 147.3cm, 38.8kg and 23.29 respectively and for 14-17 years adolescent girls the height, weight and MUAC was 156.7cm, 56.19kg and 24.3 respectively.
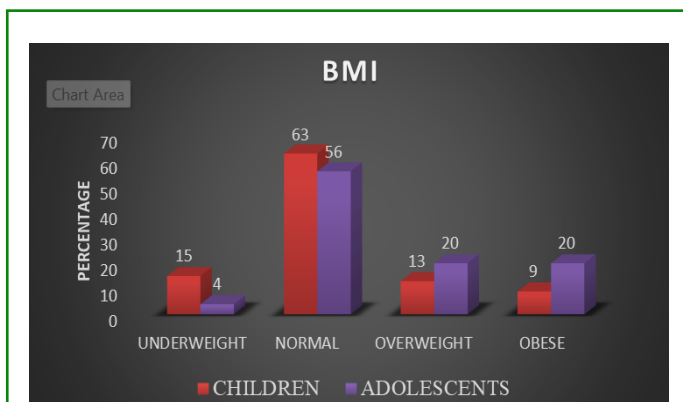

Figure 6: Graphical Representation of BMI in Children and Adolescents.
Source: BMI Classification of Children and Adolescents

Discussion: In demographic data, out of the total selected population (n=200), 50% are children and 50% are adolescents. In children, 55% are males, and 45% are females whereas in adolescents 57% are males and 43% are females.

Data on lifestyle habits shows that Among 100 children 78% of children were involved in physical activity whereas only 65% of adolescents were involved in physical activity. 75% of children spent time watching television & Mobile whereas 86% of adolescents spend their time watching television and mobile. Studies have shown that there is a significant relationship between physical activity, watching television and obesity [9]. Clinical Signs and Symptoms like dry & brittle hair and bleeding gums were seen in Children and Adolescents. Dry and brittle hair indicates a deficiency of protein and biotin which was seen in 13% of children and 10% of adolescents. Bleeding Gums were observed in 11% of children and 14% of adolescents which indicates a deficiency of vitamin C and riboflavin which was seen in 11% of children and 14% of adolescents.

Dietary Habits

Among 100 children, 53% of them consumed a vegetarian diet, 23% of them consumed eggitarian diet and 24% of them consumed non-vegetarian diet. Out of 100 adolescents, 31% of them consumed vegetarian diet, 12% of the consumed eggitarian diet and 56% of them consumed non-vegetarian diet.

Food frequency questionnaire: The average consumption of different food groups were derived from FFQ of children and adolescents to assess the quality of diet. The study found that the cereals and millet daily intake is moderate i.e., 38% and 40.75% respectively in both children and adolescents. Millets consumption was very less in both children and adolescents. In pulses and legumes, 57% of children consumed daily whereas adolescents 70% of them consumed daily. Pulses consumption is seen more in adolescents than children. The average consumption of green leafy vegetables, 1 % of them consumed green leafy vegetables daily whereas in adolescents 9 % of them consumed daily. It is seen that

more children and adolescents rarely consumed green leafy vegetables. One of the study showed that increased green leafy vegetables consumption resulted in weight loss [10].

Other vegetables like cluster beans, capsicum, etc., and Roots and tubers consumption is less in both children and adolescents. It is seen that 26% of children and 53% of adolescents daily consumed fruits and 39% of children and 38% of adolescents consumed weekly. Milk consumption was adequate whereas consumption of milk products like butter, curd, ghee, paneer, etc. was moderate in both children and adolescents. Nuts and oil seeds daily consumption was 2% in children 9% in adolescents whereas weekly consumption was 23% in children and 10% in adolescents. 22% of children and 33% of adolescents never consumed nuts and oil seeds. 8% of children consumed eggs daily, 32 % of them consumed weekly, 52 % of them never consumed eggs. In adolescents 15 % of them consumed egg daily, 51 % of them consumed weekly, 32% of them never consumed eggs. The protein consumption and egg consumption was also less which can be the reason for The percentage of children not consuming meat, poultry, and seafood, is more when compared to adolescents. Daily consumption of junk foods was more in both children and adolescents. The consumption of sweets in was less when compared to the consumption of chocolates in both children and adolescents.

The daily consumption of Tea and coffee was 0.3 % in children and 11% in adolescents. 69.3 % of children never consumed it whereas in adolescents 34.6 % of them never consumed Tea and coffee. Consumption of soft drinks was seen more in adolescents than children. Studies show that consumption of soft drinks and sweetened beverages has been associated with childhood and adolescent obesity [11]. It is seen that fast foods consumption was 32.5 % of children consumed weekly, 18 % of them consumed monthly. In adolescents 18 % of them consumed weekly, 51 % of them consumed fast foods monthly. A study showed that fast food consumption rate had increased by 12% with each year of increase in child's age [12].

24-Hour Recall

RDA and Average Consumption of Nutrients in Children (7-9):

Nutrients	RDA	Mean & Standard Deviation	Percent Adequacy
Energy	1700 kcal/day	1116.06 ± 195.47	65%
Carbohydrates	130 g/day	141.41 ± 33.41	108.70%
Proteins	23.3 g/day	29.44 ± 14.90	126.35%
Fats	47.2 g/day	48.40 ± 12.86	102.54%

Table 5: Depicts the RDA and Average consumption of nutrients in 24 hours by Children (7-9).

Discussion: The percent adequacy of energy is 65% in children whereas the percent adequacy of carbohydrates is 108.7%, proteins was 126.35%, and fats was 102.54%. A study showed that the percent adequacy of calorie intake in 7-9 years old children was 113.55% and the percent adequacy of protein was 182.78% [13].

RDA and Average Consumption of Nutrients in Adolescent Boys:

Age Group : 10-12			
Nutrients	RDA	Mean & Standard Deviation	Percent (%) Adequacy
Energy	2220kcal/day	1310.32 ± 152.43	59.02%
Carbohydrate	130g/day	185.33 ± 25.45	142.50%
Protein	31.8g/day	30.97 ± 6.59	97.38%
Fats	61.6g/day	46.42 ± 6.76	75.35%
Age Group : 13-15			
Energy	2860kcal/day	1337.4 ± 171.92	46.76%
Carbohydrate	130g/day	182.87 ± 21.36	140.60%
Protein	44.9g/day	32.89 ± 5.49	73.25%
Fats	79.4gday	47.75 ± 9.68	60.13%

Age Group : 16-17			
Energy	3320kcal/day	1319.90 ± 108.24	39.75%
Carbohydrate	130g/day	175.61 ± 31.37	135.08%
Protein	55.4g/day	34.37 ± 2.70	62.03%
Fats	92.2g/day	57.92 ± 6.95	62.81%

Table 6: Depicts the RDA and Average consumption of nutrients in 24 hours by Adolescent Boys (10-17).

Discussion: The average intake is 1319 kcal and the percentage adequacy of 10-12 old year boys is 59.02%, 13-15 years is 46.76% and 16-17 is 39.75%. Percent adequacy of protein is 97.38% in 10-12 year old boys, 73.25% in 13-15 years and 62.03% in 16-17 years. The percent adequacy of fat is 75.35% in 10-12 year old boys, 60.13% in 13-15 and 62.81% in 16-17 years. Whereas the percent adequacy of carbohydrates is 142.5% in 10-12 years, 140.6% in 13-15 years 135.08% in 16-17 old year boys.

A study showed that the percent adequacy of energy and protein in 10-12 year old boys were 111.4% and 171.88% respectively. The percent adequacy of energy and protein in 13-15 year old boys were 82.68% and 122.8% respectively. In 16-17 year old boys the percent adequacy of energy and protein was 91.5% and 131.11% respectively [13].

RDA and Average Consumption of Nutrients in Adolescent Girls:

Age Group : 10-12			
Nutrients	**RDA**	**Mean & Standard Deviation**	**Percent (%) Adequacy**
Energy	2060kcal/day	1310.32 ± 152.43	63.60%
Carbohydrate	130g/day	185.33 ± 25.45	142.50%
Protein	33.8g/day	32.57 ± 6.59	96.30%
Fats	57.2g/day	46.42 ± 6.76	81.10%
Age Group : 13-15			
Energy	2400kcal/day	1294.68 ± 122.71	53.90%
Carbohydrate	130g/day	178.62 ± 22.72	137.40%
Protein	43.2g/day	32.41 ± 4.38	75%
Fats	66.6g/day	48.37 ± 7.09	72.60%
Age Group : 16-17			
Energy	2500kcal/day	1310.32 ± 152.43	52.40%
Carbohydrate	130g/day	185.33 ± 25.45	142.50%
Protein	46.2g/day	32.57 ± 6.59	70.40%
Fats	69.4g/day	46.42 ± 6.76	66.80%

Table 7: Depicts the RDA and Average consumption of nutrients in 24 hours by Adolescent Girls (10-17).

Discussion: The percent adequacy of energy in 10-12 old year girls is 63.6%, 13-15 years is 53.9% and 16-17 is 52.4%. Percent adequacy of protein e is 96.3% in 10-12 year old girls, 75% in 13-15 years and 70.4% in 16-17 years. The percent adequacy of fat is 81.8% in 10-12 year girls, 72.6% in 13-15 and 66.8% in 16-17 years. Whereas the percent adequacy of carbohydrates is 142.5% in 10-12 years, 137.4% in 13-15 years and 142.5% in 16-17 year old

girls.

A study showed that the percent adequacy of energy and protein in 10-12 year old girls were 106.37% and 138.63% respectively. The percent adequacy of energy and protein in 13-15 year old girls were 93.83% and 121.83% respectively. In 16-17 year old girls, the percent adequacy of energy and protein was 90.49% and 115.39% respectively [13].
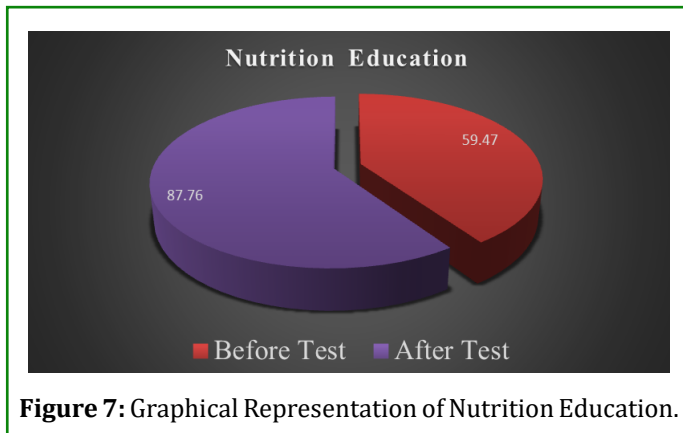
Impact of Nutrition Education

Figure 7: Graphical Representation of Nutrition Education.

Discussion: The graph represents the average percentage of marks scored by 43 students before and after nutrition education. The average score was 59.47% before nutrition education whereas after nutrition education the average percentage was 87.76%. This indicates Nutrition Education has improved the knowledge of students.

Conclusion

A cross-sectional study was conducted on the prevalence of overweight and obesity among children and adolescents. The study comprised 100 Children of age 6-9 years and 100 adolescents of age 10-19 years. The anthropometric measurements revealed that about 15% of children were underweight, 63% of them were normal, 13% were overweight and 9% of them were obese. In adolescents 4% of them were underweight, 56% of them were normal, 20% of them were overweight and 20% of them were obese. The anthropometric results depict that the prevalence of overweight and obesity is less in children (%) than in adolescents (%). It was also found that more percentage of children were involved in Physical activity than the percentage of adolescents. Clinical signs and symptoms like dry & brittle hair and bleeding gums were observed in both children and adolescents which depicts a deficiency of protein and vitamin C. In dietary Habits of children and adolescents, FFQ depicted that both children and adolescents consumed moderate amounts of cereals, pulses, vegetables, and fruits but increased consumption of sweets, processed foods, and beverages. From 24-Hour recall, it was observed that some students skipped meals. In children, the average intake of energy is low when compared to RDA whereas the average consumption of carbohydrates, proteins, and fats is higher than RDA. However, in adolescents, the average intake of energy, protein, and fat is low when compared to RDA whereas the average consumption of carbohydrates is higher than RDA. Thus, unhealthy dietary habits can cause overweight and obesity in children and adolescents.

Nutrition Education was provided for 43 overweight and obese children and adolescents. The results of the impact of Nutrition Education depict students have gained knowledge through nutrition education. The prevalence of overweight and obesity is seen more in adolescents than children. It is also found that adolescents are less involved in physical activities than children. Thus, behavioural changes and lifestyle modifications, and dietary habits are the primary tools for reducing overweight and obesity.

Future Scope of the Study

- Biochemical parameters can be included in the study.
- Micronutrient Deficiency can be determined for children and adolescents.
- The sample size can be increased and different schools can be included in the study to ensure diversity in the study group.

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