



Prevalence of Undernutrition and Effect of NEP on the Dietary Pattern of College Going Girls (15- 20 Years) in Mumbai

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Authors' contributions

This work was carried out in collaboration between both authors. Author HHB designed the study, performed the statistical analysis, wrote the protocol, wrote the first draft of the manuscript and also managed the analyses of the study. Both authors read and approved the final manuscript.

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ABSTRACT

Aim: To assess the prevalence of undernutrition and to study the effect of Nutrition Education Program (NEP) on dietary pattern of adolescent girls (15 to 20 years) in Mumbai.

Place and Duration of the Study: Department of Clinical Nutrition and Dietetics, S.N.D.T. Women's University, Matunga, Mumbai (India), between December 2018 to February 2019.

Methodology: For this study, Pre-test and Post-test experimental research design was used. 200 adolescent girls were selected to assess their dietary patterns and nutritional status through purposive random sampling method. Nutritional parameters such as height for age, weight for height and weight for age were calculated along with 3 days 24-hour diet recall among adolescent girls.

Results: Prevalence of undernutrition was observed among adolescent girls. The overall mean consumption of energy, protein and carbohydrate was less as per the ICMR 2010 guidelines for adolescent girls. The mean consumption of day 1 energy was increased from 1515 ± 127 to $1623 \pm$

127. Similarly increase in the mean consumption of day 1 protein (from 38.20 ± 6.46 to 43.90 ± 6.45) and carbohydrate (from 353.90 ± 39.88 to 387.30 ± 37.75) was also documented. However, the fat consumption also seemed to be increased (from 45.70 ± 4.52 to 48.40 ± 4.54 on day 1) which might be due the consumption of outside High Fat High Salt (HFHS) food.

Keywords: Undernutrition; adolescent girls; Nutrition Education Program (NEP).

1. INTRODUCTION

“Undernutrition is defined as insufficient intake of energy and nutrients to meet an individual's needs to maintain good health”. It is a very dangerous condition where one can suffer from cachexia (involuntary weight loss) due to micronutrient deficiencies or low intake of food or reduced absorption ability of the bod. It is more common in adolescents as there is increased demand of nutrients for their development and physical growth [1].

According to William in 2003, basically, under consumption and over consumption of calories tends to result in malnutrition. For one to have a very good or optimum nutritional status, one must be both food and nutrition secured. However, for those individuals who are on borderline nutrition, the nutrition security is difficult to achieve. Therefore, even though a person maybe food secured, he or she might not necessarily be nutrition secured. According to WHO in 2001, Individual nutrition status depends on the interaction between consumption of food, the overall state of health and the physical environment [2].

Adolescence is considered as especially nutritionally vulnerable period of life for several reasons. Firstly, because there is a greater demand for nutrients and calories due to the rapid increase in physical growth and development over a relatively short period of time. Secondly, a change in the lifestyle and food habits of adolescents could affect both nutrient intake and nutrient requirement [3].

To understand the type of undernutrition and to assess the nutritional status, it is necessary to examine the anthropometric measurements of the sample which include their height, weight and Body Mass Index (BMI). In some circumstances such as obesity we should also measure the Waist to Hip ratio (WHR) to know the abdominal fat and lower body fat. Therefore, prevalence of undernutrition was observed after evaluating nutritional parameters such as weight for height, height for age and weight for age.

Stunting reflects failure to receive adequate nutrition over a long period of time and is also affected by recurrent and chronic infection. Height-for-age, therefore, represents the long-term effects of malnutrition in a population and does not vary according to recent dietary intake [4].

Weight-for-age reflects body mass relative to chronological age. It is influenced by both the height of the child (height-for-age) and his or her weight (weight-for-height), and its composite nature makes interpretation complex [5].

Nutrition education can be defined as any set of learning experiences designed to facilitate the voluntary adoption of eating and other nutrition-related behaviours conducive to health and well-being [6]. Thus, an attempt to study the effect of Nutrition Education Program (NEP) on dietary patterns of the adolescent girls was made in the study.

The objective of the present study is to determine the prevalence of undernutrition among college going girls and to compare the dietary pattern before and after the Nutrition Education Program. The validity of 24 hour is less therefore 3 days dietary recall is a better option than 24-hour diet recall. 3 days dietary recall provides clearer picture about the quality and variations of the diet consumed by the participants. It contains 48 hours of dietary recall from weekdays and 24-hour dietary recall from weekend i.e. Sunday. This also indicates the dietary pattern of the subjects on weekends [7].

2. METHODOLOGY

Pre-test and post-test experimental research design were adopted for carrying out the research. A purposive random sampling technique was used for this study. All the subjects were adolescent girls from Dr.B.M.N. College of Home Science and M.M.P. Shah College in India. 200 adolescent girls in the age group of 15 – 20 years were involved in the study. The present study was conducted for a period of 4 months.

To monitor the prevalence of stunting (Height for age) in adolescents WHO Anthro-Plus Software was used. The WHO Reference 2007 is a reconstruction of the 1977 National Centre for Health Statistics (NCHS)/WHO reference. The WHO Anthro-Plus is a software for the global application of the WHO Reference 2007 for 5-19 years to monitor the growth of school aged children and adolescents. In this study, stunting was defined as HAZ equal to or below minus two standard deviation (-2 SD) of the mean of National Centre for Health Statistics (NCHS) standard. Severe stunting was also defined as HAZ equal to or below minus three (-3 SD) of this reference standard.

To study the prevalence of wasting NCHS normalized reference weight-for-length (49-84 cm) and weight- for-height (85-130 cm) by sex tables were used.

To study the prevalence of undernutrition, The Indian Academy of Paediatrics Software was used. The Indian Academy of Paediatrics and Govt. of India have adopted WHO 2006 under five standards for monitoring children under the age of 5 years. This booklet provides these new charts for use in children from 5 to 18 years of age. IAP monitoring committee 2014 recommends use of these charts for monitoring growth of children beyond 5 years of age for height, weight and BMI.

Nutrition education program was enlightened through large group counselling and audio-visual aids (power-point presentation) to provide basic information on 5 food groups and also macronutrients and micronutrients. Knowledge on prevalence of undernutrition in India and consequences of undernutrition along with dietary recommendations to overcome the problem of undernutrition was delivered to the

subjects. Also, the information on Iron deficiency anaemia and iron rich foods was given to the subjects.

3 days 24-hour diet recall was taken to evaluate the effect of NEP on adolescent's dietary patterns. It is an open ended format recall sheet. This open-ended response structure was designed to prompt respondents to provide a comprehensive and detailed report of all foods and beverages consumed. Information on intake of food consumed by the subjects such as portion size was asked. Assessment of portion size was facilitated by the use of measurement aids such as standard household measures, photo, food models, etc. To calculate energy and nutrient intakes, the estimated portion size or the amount of food intake is multiplied by the values of nutrient content in foods as found in the food composition tables given by National Institute of India (NIN).

The macronutrients were then compared with pre-intervention and post-intervention to evaluate the macronutrient intake as per Recommended Dietary Allowance (RDA).

3. RESULTS

3.1 Type of Malnutrition

Most of the subjects belonged to 18 years of age. It was observed that there was diversity in the type of malnutrition according to weight for age, height for age and weight for height. Table 1 and Fig. 1 revealed that most of the adolescent girls (80%) were stunted followed by 15.2% of the adolescents were underweight out of total study population. Whereas, 4.8% showed wasted condition. This indicated that the majority of the subjects were undernourished and had a poor concept about healthy food habits.

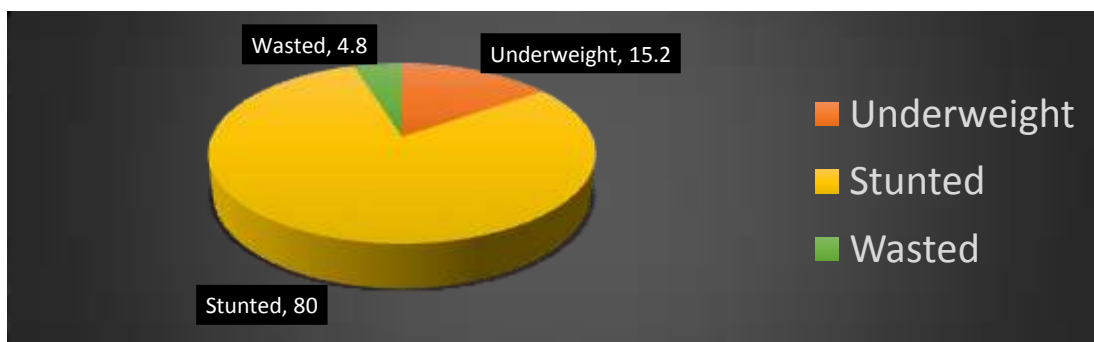


Fig. 1. Type of malnutrition

Table 1. Type of malnutrition (No of samples =200)

Type of malnutrition	Percentage of samples
Wasting (weight for height)	4.8%
Stunting (height for age)	80.0%
Underweight (weight for age)	15.2%
Total	100.0%

3.2 Prevalence of Stunting

The height-for-age index is an indicator of linear growth retardation and cumulative growth deficits. Stunting reflects failure to receive adequate nutrition over a long period of time and is also affected by recurrent and chronic illness. Height-for-age, therefore, represents the long-term effects of malnutrition in a population and does not vary according to recent dietary intake [8]. Z-score above -2 SD was considered as stunting as per WHO guidelines. In Table 2(a). The prevalence of stunting was observed to be 66% of total samples. Remaining 34% of the

adolescent girls belonged to normal category. Thus, low socio-economic status, poor nutritional intake, skipping of meals, consumption of unhealthy food could be an indicator for prevalence of stunting among the subjects. Out of 66% of the adolescent girls, most of the subjects (37%) belonged to mild form of stunting (-1 SD) as per the Table 2(b) and Fig. 2. However, 24% of adolescents were moderately stunted (-2 SD) and remaining 5% of the adolescents were suffering from severe form of stunting (-3 SD). Healthy and low-cost recipe Guidelines was prepared for the samples.

3.3 Prevalence of Wasting

The data from 3(a) & Fig. 3 showed that the prevalence of wasting was present among only 4% of the total sample. Remaining 96% of the adolescents were normal according to NCHS normalized reference weight-for-length. Out of 4% of the total subjects, 2% of the adolescents were suffering from moderate form of wasting whereas only 1% of the adolescents were suffering from mild and severe wasting category respectively.

Table 2(a). Prevalence of stunting (No of samples =200)

		No. of samples	Percent of samples
Valid	Normal	68	34.0
	Stunted	132	66.0
	Total	200	100.0

Table 2(b). Classification of stunting

Type of stunting	Z-score for stunting (WHO reference 2007)	% of the subjects
Mild	≥ -1 SD	37%
Moderate	≥ -2 SD	24%
Severe	≥ -3 SD	5%
Total		66%

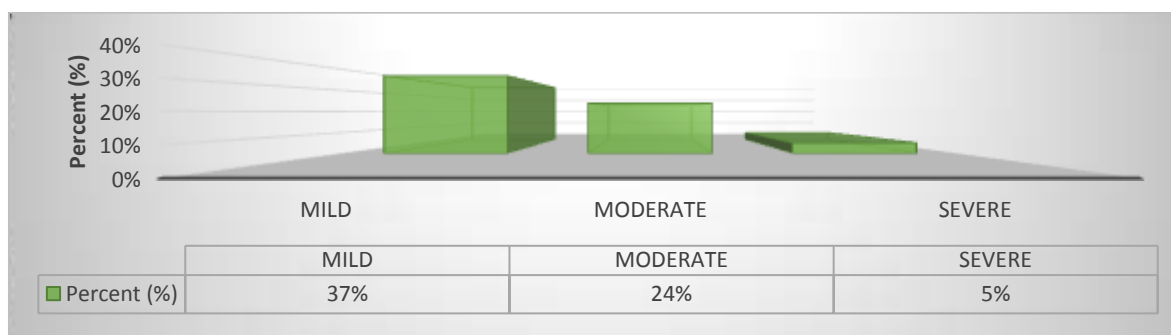


Fig. 2. Classification of stunting

Table 3(a). Prevalence of wasting

Classification		No. of samples	Percent of the subjects
Valid	Normal	192	96.0
	Wasted	8	4.0
	Total	200	100.0

Table 3(b). Classification of wasting

Type of Wasting	Z-score for wasting (WHO reference 2007)	% of the subjects
Mild	≥ -1 SD	1%
Moderate	≥ -2 SD	2%
Severe	≥ -3 SD	1%
Total		4%



Fig. 3. Classification of wasting

Table 4. Paired t-test for mean energy consumption among subjects (Pre-test and post-test)

	RDA (ICMR, 2010)	No of samples	$X \pm \sigma$ (kcal)	t-value	p-value
Pair 1	Day 1 (energy)	20	1515 ± 127	18.12	.000**
	Post.Day 1 (energy)	20	1623 ± 127		
Pair 2	Day 2 (energy)	20	1596 ± 108	11.57	.000**
	Post.Day 2 (energy)	20	1684 ± 115		
Pair 3	Day 3 (energy)	20	1634 ± 119	7.29	.000**
	Post.Day 3 (energy)	20	1743 ± 97		

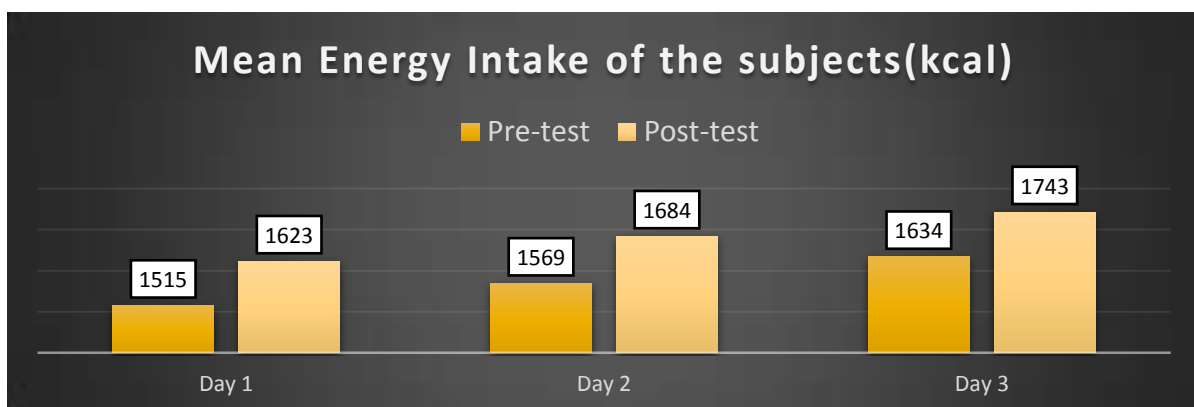


Fig. 4. Mean energy distribution per 3 days

Table 5. Paired t-test for mean protein consumption among subjects (Pre-test and post-test)

		RDA (ICMR, 2010)	No of samples	$X \pm \sigma$ (gm)	t value	Sig. (2- tailed)
Pair 1	Day 1 (Protein)	55.5 g	20	38.20 ± 6.46	5.90	.000**
	Post Day 1 (Protein)		20	43.90 ± 6.45		
Pair 2	Day 2 (Protein)	55.5 g	20	41.65 ± 6.38	6.94	.000**
	Post Day 2 (Protein)		20	46.20 ± 5.46		
Pair 3	Day 3 (Protein)	55.5 g	20	46.75 ± 4.17	6.49	.000**
	Post Day 3 (Protein)		20	50.75 ± 3.07		

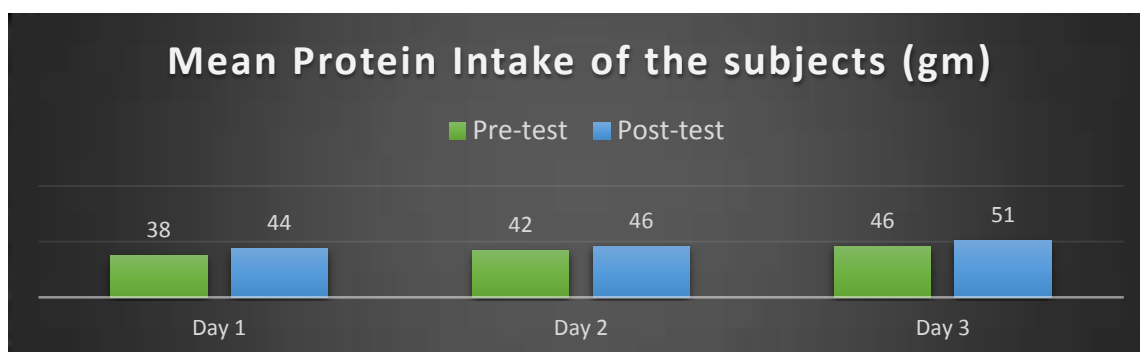


Fig. 5. Mean protein distribution per 3 days

Table 6. Paired t-test for mean fat intake among subjects

		RDA (ICMR, 2010)	No of samples	$X \pm \sigma$ (gm)	t value	Sig. (2- tailed)
Pair 1	Day 1 (Fat)	35 g	20	45.70 ± 4.52	7.42	.000**
	Post Day 1 (Fat)		20	48.40 ± 4.54		
Pair 2	Day 2 (Fat)	35 g	20	49.00 ± 3.35	10.43	.000**
	Post Day 2 (Fat)		20	51.45 ± 3.34		
Pair 3	Day 3 (Fat)	35 g	20	52.50 ± 4.22	7.52	.000**
	Post Day 3 (Fat)		20	55.65 ± 3.82		

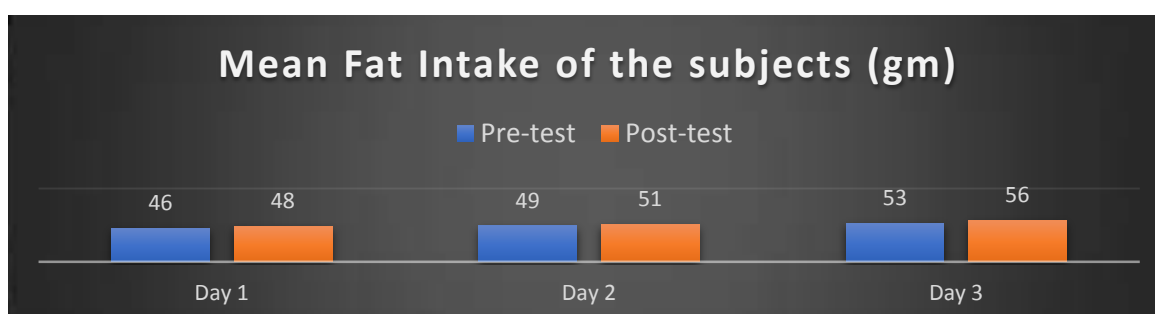


Fig. 6. Mean fat distribution per 3 days

3.4 Energy Distribution (per kcal)

A 24-hour 3 days diet recall was taken to administer the overall calorie and protein intake amongst adolescents. It was noticed that the energy consumption among the subjects were less than the recommended dietary intake as per

the ICMR 2010 guidelines for adolescent girls. However, the mean energy intake was increased after imparting nutritional intervention as per Table 4 and Fig. 4. The statistical data also showed a significant association in the pre-test and post-test.

Table 7. Paired t-test for mean CHO consumption among subjects (Pre-test and Post-test)

		RDA (ICMR, 2010)	No of samples	X ± σ (gm)	t value	Sig. (2-tailed)
Pair 1	Day 1 (CHO)	366 g	20	353.90 ± 39.88	5.75	.000**
	Post Day 1 (CHO)		20	387.30 ± 37.75		
Pair 2	Day 2 (CHO)	366g	20	378.25 ± 33.45	6.87	.000**
	Post Day 2 (CHO)		20	406.55 ± 31.04		
Pair 3	Day 3 (CHO)	366 g	20	409.25 ± 35.47	7.38	.000**
	Post Day 3 (CHO)		20	442.25 ± 37.56		

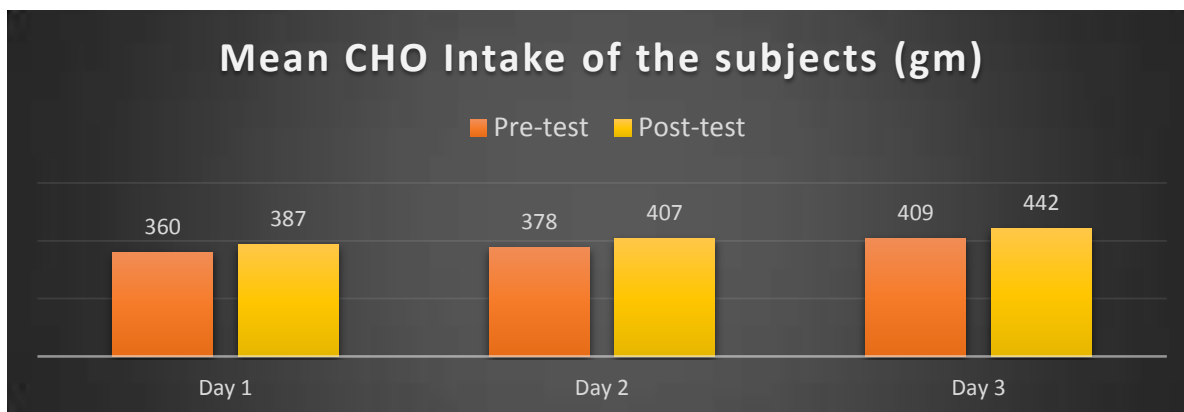


Fig. 7. Mean carbohydrate distribution per 3 days

3.5 Protein Distribution (per gram)

It was observed that the mean consumption of protein among the subjects was less than recommended dietary intake (55.5 g) as per ICMR 2010 guidelines. However, data revealed that mean protein intake was increased after nutrition education program as per Table 5 Fig. 5. The mean average intake of protein on Day 1 was 38.20 ± 6.46 gm which was increased to 43.90 ± 6.45 gm. Whereas the protein intake on Day 2 was 41.65 ± 6.38 gm, also increased to 46.20 ± 5.46 gm. Similarly, on Day 3 the intake also showed an increasing trend after imparting NEP to the subjects. Hence, overall intake of protein was found to be increased. The statistics also proved that there was a highly significant association between Pre-test and Post-test of protein intake among subjects which implies that the concept of Nutrition module was followed by each sample.

3.6 Fat Distribution (per gram)

It was observed that the fat consumption seemed to be high among the subjects than recommended dietary intake of visible fat as depicted in Table 6 Fig. 6. But there was a significant increase in the consumption of fat

after nutrition intervention. However, outside High Fat High Salt (HFHS) foods were also one of the factors which had contributed an increase in fat intake. The average intake of fat on Day 1 was 45.70 ± 4.52 gm which was increased to 48.40 ± 4.54 gm. Similarly, the average intake of day 2 was 49.00 ± 3.35 gm which also showed a minimal increase of 51.45 ± 3.34 gm. Whereas, on day 3 the intake was 52.50 ± 4.22 gm and after the nutrition program it was increased to 55.65 ± 3.82 gm respectively.

3.7 Carbohydrate Distribution (per gram)

The overall intake of carbohydrates was increased in the study as mentioned in Table 7 Fig. 7. Hence, it was observed that the mean intake of carbohydrate was increased gradually to meet the recommended dietary intake among the subjects. The recommended dietary intake of carbohydrate was calculated using 60% of total recommended energy intake (2440 kcal).

4. DISCUSSION

India has a unique opportunity to improve the health and nutritional status of its citizens as a result of its tremendous economic development in the past two to three decades. It was found

that there were impressive improvements in some health indicators in the past two decades, including a drop in the fertility rate and reduction in infant mortality rate, but improvements in nutritional status assumed to be less impressive [9]. More than half of the world's undernourished population lives in India [10]. The health consequences of a prolonged state of malnutrition among children and adolescents include delayed physical growth and impaired motor and cognitive development, diminished cognitive performance, lower intellectual quotient (IQ), poor social skills, greater behavioural problems and vulnerability to contracting diseases [11]. According to Singh in 2013, malnutrition also leads to important consequences in adult life in terms of physical growth, work capacity, reproductive performances and risk of chronic diseases.

Undernutrition was prevalent among adolescent girls. There was diversity in the type of malnutrition according to weight for height, height for age and weight for age. Out of 165 undernourished subjects, most of the samples (80%) were stunted (height for age) followed by 15.2% were underweight (weight for age) and 4.8% were wasted (weight for height) as per WHO growth standards.

There may be possibility that low socio-economic status and monthly income are responsible for stunting in sampled population. Hence, poverty might be one of the factors to cause impaired growth among the subjects which is the major indicator for malnutrition.

5. CONCLUSION

It was observed that, undernutrition was prevalent among adolescent girls. There was a diversity in the type of malnutrition according to weight for height, height for age and weight for age. The nutritional counselling showed a positive effect on the subjects as there was an increase in the overall consumption of energy, carbohydrate and protein intake. But fat consumption among subjects was also increased therefore Counselling on how to make healthy food choices by carrying homemade lunch boxes and reading food labels to understand the nutritional information was provided to the samples. Healthy low-cost recipe guidelines were prepared for the samples to aware the subjects with low cost economic food to improve their overall health. Most of the subjects were consuming foods from college canteen therefore

follow up with canteen was also required and canteen staff should be trained about low cost healthy food options so that the subjects could avail the facility from the canteen. Schools tend to focus on children's physical activity level through sports to increase the overall health and performance. However, little attention has to be focused on promoting physical activity among adolescent at college level.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

The study was approved by the jury members of the institutional committee (IEC) which was established in 2012 as per ICMR guidelines.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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