



IMPACT OF HEALTH AND NUTRITION EDUCATION PROGRAMMES ON NUTRITIONAL STATUS AND DIETARY PATTERN OF ADOLESCENT GIRLS

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ABSTRACT

Background: Adolescent girls form an important vulnerable and neglected sector of the Indian population. Malnutrition among adolescent girls adversely affects their physical growth, delays the pubertal development, declines cognition and impairs work capacity. Adolescents are at high risk for unhealthy eating and physical inactivity patterns that have become entrenched over the years resulting in the accumulation of obesity related complications and micronutrient deficiencies. The objective of the study was to screen malnourished adolescent girls from the selected area and to assess the impact of health and nutrition education programmes on nutritional status and dietary pattern of the selected subjects.

Methods: A multistage random sampling technique was used to ascertain the precise estimates of the population. A total number of 700 school going adolescent girls (13-17 years) were randomly selected for the study from 10 different schools of Puttaparthi, Anantapur District, Andhra Pradesh. Anthropometric assessment, haemoglobin level, blood pressure level and dietary pattern of adolescent girls were assessed before and after health and nutrition education intervention. The data analysis was carried out using the Statistical Package for Social Sciences (SPSS) Software.

Results: Post intervention results revealed a marked decline in the thinness among the subjects from pre-test to post-test i.e. from 13.7 to 9.1 per cent; overweight prevalence rate was also found to be decrease from 1.7 to 0.6 per cent among the subjects in the experimental group. Surprisingly, after intervention, 0.3 per cent of the obese subjects were found to be decreased and migrated from obese to overweight category. Health and nutrition education intervention produced a significant improvement in the haemoglobin profile and systolic and diastolic blood pressure levels in the experimental group. Among 13-15 years age group, the percentage increase in the average daily energy, protein and fat intake was found to be 15.8, 15.7 and 79 per cent, respectively in the experimental group. Similarly, among 16-17 years age group, the percentage increase in energy and protein intake was also found to be 20.7 and 15.5 per cent, respectively; the mean fat intake was observed to be decreased from 35.8 g/d to 34.9 g/d among the subjects. The mean intakes of micronutrients were also found to be enhanced after intervention in the experimental group.

Discussion: Health and nutrition education intervention programmes were found to improve food choices and dietary habits, which further persuaded health promotion and disease prevention among the subjects. The findings of the study strongly endorse the need to implement supplementation intervention programmes to prevent undernutrition and anaemia among adolescent girls. Besides this, the present study apostile the need to implement interventional measures for preventing obesity among adolescent girls.

KEYWORDS: Health and Nutrition Education, Dietary Pattern, Adolescent girls and nutritional status.



1. INTRODUCTION

The double burden of malnutrition is characterized by coexistence of undernutrition along with overweight and obesity. Despite a fast growing economy, substantial global and national mitigation strategies, India faces double burden of malnutrition, which is still inclining. During adolescence, changes in the physical characteristics and development of internal and external genitalia results in the maturation of a child to an adult capable of reproduction. Long term complications of malnutrition includes congestive heart failure, increased insulin resistance, diminished immune function, prone to infections, hypothermia, cardiac arrhythmia, stroke, hypertension, anaemia, diabetes and other vascular diseases.

Adolescent girls form an important vulnerable and neglected sector of the Indian population. WHO (2018) estimated that virtually anaemia is affecting 1.62 billion people across the globe with about 69.4 million adolescents, 56 million pregnant women, and 468 million non-pregnant women. Childhood and adolescence obesity is associated with a higher chance of obesity, premature death and disability in adulthood. Chronically malnourished girls are more likely to remain undernourished during adolescence and adulthood. It's a vicious cycle of malnutrition. However, despite adolescents being a huge segment of the population, focus on adolescent group is negligible. In order to overcome nutritional vulnerability, tremendous focus is required to be forced on imparting awareness regarding health and nutrition among adolescent girls.

Health and nutrition education is an imperative measure to revamp dietary habits, food choices and nutritional status, since indigent dietary behaviour and practices are the main reason for meager nutritional status of adolescents (Auwuh *et al.*, 2019; Shahsanai *et al.*, 2018).

2. MATERIALS AND METHODS

In the present study, multistage random sampling technique was used to ascertain the precise estimates of the population. Puttaparthi Mandal consists of 20 municipal wards, of which 10 wards were opted randomly and one school from each ward was randomly selected and adolescent girls were sampled with probability proportionate to size and the subjects from 10 different schools. The sample size was established presuming a 95% confidence level with 2% sampling error. In the present study, the data was apprehended from 1300 subjects based on the availability of the subjects and unified sample was used in statistical analysis.

A predesigned and pretested structured schedule was designed to carry out the investigation. The data was collected using personal interview and pretested structured schedule. The questionnaire was infused with the socio-demographic characteristics, anthropometric data, clinical symptoms, biochemical assessment, menstrual history and dietary history. Anthropometric assessment, haemoglobin level, blood pressure level and dietary pattern of adolescent girls were assessed before and after health and nutrition education intervention. Knowledge regarding health and nutrition aspects was imparted for a period of six weeks to the selected subjects in order to enhance their health and nutrition awareness and to change their dietary behaviour.

The entire data was coded and statistical analysis was carried out through SPSS version 21.0. Continuous variables were bestowed with descriptive statistics and discontinuous variables with percentages. The difference in mean values of different parameters among the different age groups of adolescent girls has been compared with the help of t-test. P values <0.01 and <0.05 were arbitrated significant. Statistical analysis of the data was also performed using a two-way ANOVA calculation with Duncan's pair wise comparisons between groups.

3. RESULTS

Health and nutrition education have a potential relationship with dietary and nutritional status of an individual. During adolescence, meeting the nutritional needs has a greater impact on learning achievements and overall personality development of adolescents. The socioeconomic characteristics of the selected subjects for health and nutrition education intervention programme were indicated in table 1. Out of the sample, maximum number of subjects (20.6%) belonged to age 14 years followed by 20.3, 20.0, 19.7 and 19.4 per cent for age 13, 16, 17 and 15 years respectively.

Data pertaining to the financial status of the selected subjects revealed that about 10.1 per cent of the subjects belonged to economically weaker section with income <2500/month. Income between 2501 to 5500/month were noticed to an extent of 25.6 per cent. About 58.6 per cent of the subjects belonged to middle income group with income ranging between 5501 to 10,000/month. Remaining subjects i.e., 5.7 per cent had income >10,000/month.

Religion and the caste wise distribution of the selected subjects showed that Hindus



constituted the majority (70.3%) of the subjects, 23.9 per cent were Christians and 5.8 per cent of them were Muslims. About 49.4 per cent subjects belonged to the most backward classes. Scheduled caste and Scheduled tribe constituted 2.5 and 1.71 per cent of the total selected population respectively. About 4.57 per cent subjects belonged to the forward class. Minorities constituted 21.7 per cent of the total selected subjects for the study.

Data pertaining to the parental educational status of the selected subjects revealed that fathers' had better educational status over mothers'. Among 700 subjects, fathers' of the

selected adolescent girls, 55.9 per cent of them had secondary school education. Less than one-fourth (26.9%) of them studied upto higher secondary level and only 7.9 per cent of them were graduates. Around 5.3 percent of them were educated up to primary level. However, 4 per cent did not receive school education at all. Majority of the mothers' (47%) received education up to primary school level followed by secondary school education (12.4%), higher secondary school education (2.43%) and only 0.57per cent received education up to graduation level. About 37.6 per cent of subjects' mothers were found to be illiterate.

Table 1. Socioeconomic characteristics of the subjects (N= 700) for Health and Nutrition Education Intervention

SNO.	SOCIOECONOMIC GRADIENTS	N	%
1.	Age		
	13 years	142	20.3
	14 years	144	20.6
	15 years	136	19.4
	16 years	140	20
	17 years	138	19.7
	Total	700	100
2.	Family income		
	Economically weak (< 2500 INR/month)	71	10.1
	Low income (2501 - 5500 INR/month)	179	25.6
	Middle income (5501 - 10,000 INR/month)	410	58.6
	High income (>10,001 INR/month)	40	5.7
	Total	700	100
3.	Religion		
	Hindu	492	70.3
	Christian	167	23.9
	Muslim	41	5.8
	Total	700	100
4.	Caste/ Community		
	Forward caste	32	4.57
	Backward caste	346	49.4
	Most backward caste	141	20.1
	Scheduled caste	17	2.5
	Scheduled tribe	12	1.71
	Minority	152	21.7
	Total	700	100
5.	Fathers' Education		
	Illiterate	29	4
	Primary level (1 st -4 th)	37	5.3
	Secondary level (5 th - 10 th)	391	55.9
	Higher secondary (11 th & 12 th)	188	26.9
	Graduation & above	55	7.9



	Total	700	100
6. Mothers' Education			
Illiterate		263	37.6
Primary level (1 st -4 th)		329	47
Secondary level (5 th - 10 th)		87	12.4
Higher secondary (11 th & 12 th)		17	2.43
Graduation & above		4	0.57
	Total	700	100

Impact of Health and Nutrition Education Intervention on Nutritional Status

Anthropometric Assessment

Table 2 depicts the impact of health and nutrition education intervention on anthropometric assessment of the subjects of different age groups.

The comparison of data on height, weight and body mass index during pre and post intervention period revealed that there was no change. Among all age groups, the mean height was found to be lower than ICMR standards.

During pre-assessment, among 13, 14 and 15 years age group, the mean weight of subjects in experimental group was found to be lower (5.7%, 6.5% and 1.8% respectively) than ICMR standards. Accelerated weights were observed among 16 and 17 years age group. When compared with ICMR standard, the weights were found to be higher (5.8% and 25%) respectively.

Post intervention results indicated an increment in mean weight and BMI of the subjects in experimental group. Among 13 years age group, the percentage increase in weight (6.4%) was found to be significantly ($p<0.05$) higher in experimental group in comparison with control group (0.3%). The mean weight increased significantly ($p<0.05$) from initial value of 34.4 to 36.2 kg in the experimental group of 14 years of the subjects. In the

experimental group, an increment in mean weights of 15 years subjects was observed ($p<0.05$), ranging between 38.1 and 39.7 kg. The health and nutrition education intervention produced a significant ($p<0.05$) progressive decline (5.3% and 6.2%) in the mean weight of 16 and 17 years subjects respectively.

A slight increase in mean BMI of 13, 14 and 15 years of subjects was observed from pre to post assessment in control as well as experimental group, whereas a reduction in the mean BMI was noticed in experimental group of 16 and 17 years of the subjects.

Nutritional Grades of BMI

Table 3 indicates the impact of health and nutrition education intervention on nutritional grades of the subjects. During pre-assessment, 13.7 per cent of adolescent girls in the experimental group fell under thinness category followed by severe thinness (5.4 per cent), overweight (1.7 per cent) and obesity (0.3 per cent) in the experimental group.



TABLE 2. IMPACT OF HEALTH AND NUTRITION EDUCATION INTERVENTION ON WEIGHT, HEIGHT AND BMI

AGE	GROUP	ICMR STANDARD			PRE TEST			POST TEST			Difference of BMI	't'-test		
		Wt (kg)	Ht (cm)		Wt (kg)	Ht (cm)	BMI (kg/m ²)	Wt (kg)	Ht (cm)	BMI (kg/m ²)		Wt (kg)	Ht (cm)	BMI (kg/m)
13 YEARS (N=142)	CONTROL GROUP (n = 71)			MEAN	31.1	135.5	17.1	31.2	135.5	17.3	0.2	0.2	0.0	0.3
		33.3	143.9	SD#	0.2	1.4	2.1	2.6	0.4	0.1				
	EXPERIMENTAL GROUP (n =71)			MEAN	31.4	136.1	17.2	33.4	136.1	18.7	1.5	1.7*	0.0	1.9*
				SD#	3.4	2.5	0.3	0.2	1.1	2.3				
14 YEARS (N=144)	CONTROL GROUP (n = 72)			MEAN	33.1	140.1	17.1	33.1	140.1	16.9	-0.2	0.3	0.0	0.2
		36.8	147.5	SD#	2.1	3.4	2.5	0.3	0.2	1.1				
	EXPERIMENTAL GROUP (n =72)			MEAN	34.4	140	17.3	36.2	140	18.6	1.3	1.6*	0.0	2.1*
				SD#	2.6	0.4	0.3	1.2	2.6	0.3				
15 YEARS (N=136)	CONTROL GROUP (n = 68)			MEAN	38.2	142.1	18.8	38.2	142.1	18.9	0.1	0.02	0.0	0.08
		38.8	149.6	SD#	1.8	0.3	0.1	2.1	3.4	2.4				
	EXPERIMENTAL GROUP (n =68)			MEAN	38.1	142	18.9	39.7	142	19.7	0.8	2.7*	0.0	1.9*
				SD#	3.7	2.1	2.6	2.6	0.4	3.4				
16 YEARS (N=140)	CONTROL GROUP (n = 70)			MEAN	43.8	147.8	20	44	147.8	20.1	0.1	0.07	0.0	0.4
		41.1	151.1	SD#	2.8	3.4	2.5	2.1	2.6	0.4				
	EXPERIMENTAL GROUP (n =70)			MEAN	43.5	147.2	20.1	41.2	147.2	19	- 1.1	1.7*	0.0	2.4*
				SD#	2.1	2.6	2.6	0.4	3.4	2.5				
17 YEARS (N=138)	CONTROL GROUP (n = 69)			MEAN	53.2	148	25.1	53.8	148	25.2	0.1	0.4	0.0	0.03
		42.4	151.5	SD#	2.1	3.4	3.4	2.5	3.4	2.5				
	EXPERIMENTAL GROUP (n =69)			MEAN	53	148.4	25	49.7	148.4	22.6	- 2.4	1.8*	0.0	2.1*
				SD#	2.6	0.4	1.1	2.1	2.6	0.4				

SD : Standard Deviation ; * Significant at 5 % level



TABLE 3. IMPACT OF HEALTH AND NUTRITION EDUCATION INTERVENTION ON NUTRITIONAL GRADES OF THE SUBJECTS

SNO	BMI FOR AGE (WHO z- score)	SUBJECTS (N=700)							
		CONTROL GROUP (n = 350)				EXPERIMENTAL GROUP (n =350)			
		PRE TEST		POST TEST		PRE TEST		POST TEST	
		N	%	N	%	N	%	N	%
1.	Severe Thinness	27	7.7	25	7.1	19	5.4	-	-
2.	Thinness	50	14.3	52	14.3	48	13.7	32	9.1
3.	Normal	269	77.1	269	76.9	276	78.9	316	90.1
4.	Overweight	3	0.9	3	0.9	6	1.7	2	0.6
5.	Obesity	1	0.3	1	0.3	1	0.3	-	-
	Total	350	100	350	100	350	100	350	100

Post intervention results produced an increment in the nutritional grades of the subjects. Majority of the subjects (90.1 per cent) had normal BMI in the experimental group. About 9.1 per cent of the subjects were categorized under thinness grade. The prevalence of overweight was also observed among 0.6 per cent of the subjects. None of the subjects were suffering from severe thinness and obesity.

In control group, the prevalence of overweight, obesity and thinness remained unchanged between pre-assessment and post-assessment, except a slight reduction in severe thinness category.

Haemoglobin Profile

Table 4 shows the impact of health and nutrition education intervention on haemoglobin profile of subjects. Post intervention results indicated a significant ($p<0.05$) improvement in the haemoglobin profile (10.5 g/dl to 12.9 g/dl) of the subjects of the experimental group. The percentage increase in haemoglobin level was 13.3 per cent indicating the efficacy of health and nutrition education intervention.

Table 4. Impact of Health and Nutrition Education Intervention on Haemoglobin Profile of the

Parameters	NORMAL HB LEVEL	CONTROL GROUP (N = 350)			EXPERIMENTAL GROUP (N =350)			F value	P value
		PRE TEST	POST TEST	DIFFER ENCE	PRE TEST	POST TEST	DIFFE RENCE		
Haemoglobin (g/dl)	≥ 12 g/dl	10.2 \pm 0.2	10.3 \pm 2.6	0.1	10.5 \pm 1.6	11.9 \pm 0.3	1.4	26.18	0.000*

Subjects (N=700)

Values are mean \pm SD of number of subjects under each group.

Blood Pressure Profile

Table 5 represents the impact of health and nutrition education intervention on blood pressure profile of the subjects.

The health and nutrition education intervention produced a significant ($p<0.01$) decline

in systolic and diastolic blood pressure levels; the mean systolic blood pressure was reduced from 121.3 mmHg to 118.2 mmHg and the mean diastolic blood pressure was reduced from 74.1 mmHg to 71.6 mmHg.

**Table 5. Impact of Health and Nutrition Education Intervention on Blood Pressure Profile of the Subjects (N=700)**

GROUP	CONTROL GROUP (N = 350)		EXPERIMENTAL GROUP (N = 350)		F value	P value
	PRE TEST	POST TEST	PRE TEST	POST TEST		
Systolic Blood Pressure	120.7± 1.2	121.1± 0.3	121.3±1.4	118.2± 0.9	26.23	0.000*
Diastolic Blood Pressure	73.4 ± 0.1	74.2± 2.7	74.1± 0.2	71.6± 2.3	25.70	0.000*

Values are mean ± SD of number of subjects under each group

*Significant at $p < 0.01$ level.

Impact of Health and Nutrition Education Intervention on Dietary Pattern

Post intervention results indicated a significant increment in the intake of all nutrients of the experimental group. Table 6 and 7 represents mean nutrient intake before and after health and nutrition education intervention among 13- 15 and 16- 17 years age group respectively.

Among 13-15 years age group, the percentage increase in the average daily energy, protein and fat intake was found to be 15.8, 15.7 and 79 per cent, respectively in the experimental group. Similarly, among 16-17 years age group, the percentage increase in energy and protein intake was also found to be 20.7 and 15.5 per cent, respectively; the mean fat intake was observed to be decreased from 35.8 g/d to 34.9 g/d among the subjects. The mean intakes of micronutrients such as β -carotene, B vitamins, vitamin C, calcium, iron, magnesium were also found to be enhanced after intervention in the experimental group. The daily average intake of fibre among 13-15 years and 16-17 years of subjects were found to be significantly ($p < 0.05$) higher in experimental group in comparison with control group.

Post intervention results produced a significant increase in the consumption pattern of whole grains, green leafy vegetables, other vegetables, fruits, egg, fish, meat products, milk and milk products, health drinks and fresh fruit juices among the subjects. Surprisingly, a drastic decline in the consumption pattern of junk foods and fast foods, carbonated beverages, coloured juices, dark chocolate and milk chocolate were observed among the subjects after intervention in the experimental group.



TABLE 6. IMPACT OF HEALTH AND NUTRITION EDUCATION INTERVENTION ON THE NUTRIENT INTAKE PROFILE OF THE SUBJECTS OF 13 -15 YEARS
13 -15 YEARS (N = 422)

SNO.	NUTRIENT	RDA* (13-15yrs)	13 -15 YEARS (N = 422)											
			CONTROL GROUP (N = 211)						EXPERIMENTAL GROUP (N =211)					
			Pre Test		Post Test		Mean Diff#	't'-Value	Pre Test		Post Test		Mean Diff#	't'-Value
MEAN	SD	MEAN	SD	MEAN	SD	MEAN			SD					
1.	Energy (Kcal./d)	2330	2020	0.2	2021.2	0.6	1.2	0.1	2021	0.01	2341	1.7	320	2**
2.	Protein (g/d)	51.9	44	2.4	45	1.7	1	0.3	45	0.03	52.1	0.8	7.1	0.9*
3.	Fat (g/d)	40	22.6	1.7	23	2.4	0.4	0.02	23	2	41.2	0.2	18.2	2.4**
4.	β carotene (µg/ d)	4800	2813	0.8	2815	0.02	2	1.4	2878	2.4	4920	2.4	2042	3.7**
5.	Thiamine (mg/ d)	1.2	0.65	1.3	0.65	1.3	0.0	0.0	0.7	1.7	1.3	1.7	0.6	0.8
6.	Riboflavin (mg/ d)	1.4	1.1	0.6	1.17	0.2	0.07	0.04	1.1	0.8	1.42	0.8	0.32	1.3
7.	Niacin (mg/ d)	14	12	1.7	12.2	2.4	0.2	0.8	12	0.2	14.7	1.3	2.7	1.9*
8.	Pyridoxine (mg/ d)	2.0	1.6	2.4	1.61	1.7	0.01	0.03	1.6	2.4	2.4	0.6	0.8	1.7*
9.	Dietary Folate(µg/ d)	150	88.2	0.02	88.4	0.8	0.2	0.1	88	1.7	162	1.7	74	2.6**
10.	Vitamin B ₁₂ (µg/ d)	0.2 -1.0	0.8	1.1	0.8	1.1	0.0	0.0	0.7	0.8	1.2	0.01	0.5	1.7*
11.	Vitamin C (mg/ d)	40	37	2.7	37.3	0.6	0.03	0.03	37	1.3	43	0.03	6	3.4**
12.	Calcium (mg/ d)	800	680	0.03	682	1.7	2	1.6	681	0.6	825	2	144	0.02
13.	Iron (mg/ d)	27	21	2.4	21.	2.4	0.0	0.0	22	1.7	28.1	0.1	6.1	2.6*
14.	Magnesium (µg/ d)	210	130	2.1	132	0.02	2	1.2	129	2.4	215	0.01	86	1.7*
15.	Zinc (mg/d)	11	8	0.1	8.1	1.1	0.1	0.06	7	0.2	11.9	1.7	4.9	2*
16.	Fibre (g/d)	25-30	20	0.2	20.3	2.7	0.3	0.02	19	2.4	26.7	0.8	7.7	2.1*

*RDA : Recommended Dietary Allowance

SD: Standard Deviation

≠Mean Diff: Mean Difference= Mean Score of (Post Test – Pre Test)

*Significant at 5 % level; **Significant at 1 % level



TABLE 7. IMPACT OF HEALTH AND NUTRITION EDUCATION INTERVENTION ON THE NUTRIENT INTAKE PROFILE OF THE SUBJECTS OF 16-17 YEARS

SNO.	NUTRIENT	RDA* (16-17yrs)	16-17 YEARS (N = 278)											
			CONTROL GROUP (N = 139)						EXPERIMENTAL GROUP (N = 139)					
			Pre Test		Post Test		Mean Diff [#]	't'-Value	Pre Test		Post Test		Mean Diff [#]	't'-Value
MEAN	SD [#]	MEAN	SD [#]	MEAN	SD [#]	MEAN			SD [#]					
1.	Energy (Kcal/d)	2440	2023	1.7	2026	0.8	3	0.4	2451	0.1	2425	0.1	26	3.1**
2.	Protein (g/d)	55.5	49	0.8	48.9	0.2	-0.1	0.07	49.1	1.7	56.7	1.7	7.6	2.4*
3.	Fat (g/d)	35	35.9	0.2	38.4	2.4	2.5	0.2	35.8	2.4	34.9	2.4	-0.9	2.5*
4.	β carotene (µg/ d)	4800	2176	2.4	2179	1.7	-3	0.03	2178	1.7	4860	0.02	2682	5.6**
5.	Thiamine (mg/ d)	1.0	0.9	1.7	0.88	0.8	-0.02	0.06	0.9	0.8	1.2	0.1	0.3	1.7*
6.	Riboflavin (mg/ d)	1.2	1	0.8	0.9	1.3	-0.1	0.07	1	0.2	1.29	1.7	0.29	2*
7.	Niacin (mg/ d)	14	11.2	1.3	11	0.6	-0.2	0.06	11.4	2.4	14.7	2.4	3.3	0.6
8.	Pyridoxine (mg/ d)	2.0	1.6	0.6	1.56	1.7	-0.04	0.07	1.5	1.7	2.3	0.8	0.8	1.7*
9.	Dietary Folate(µg/ d)	200	81	1.7	80	2.4	-1	1.4	82	0.8	210	1.3	128	2.4**
10.	Vitamin B ₁₂ (µg/ d)	0.2 – 1.0	0.8	0.01	0.77	1.7	-0.03	0.02	0.81	1.3	1.5	0.6	0.69	0.02
11.	Vitamin C (mg/ d)	40	38	0.03	38.2	0.8	0.2	0.6	38	0.6	45.7	1.7	7.7	2.6*
12.	Calcium (mg/ d)	800	601	2	603	1.3	2	1.7	602	1.7	817	0.01	215	5.7**
13.	Iron (mg/ d)	28	21	0.6	21	0.6	0.0	0.0	21	0.01	32	0.03	11	4.2**
14.	Magnesium (µg/ d)	235	127	0.01	128.5	1.7	1.5	1.7	128	0.03	245	2	117	3.7**
15.	Zinc (mg/d)	12	8	1.7	8.4	0.01	0.4	0.8	8.1	2	12.9	0.1	4.8	1.9*
16.	Fibre (g/d)	25-30	18	0.8	19	1.7	-1	0.03	19	0.1	28.1	0.8	9.1	3.8**

*RDA : Recommended Dietary Allowance

#SD: Standard Deviation

≠Mean Diff: Mean Difference= Mean Score of (Post Test – Pre Test)

*Significant at 5 % level; **Significant at 1 % level



4. DISCUSSION

Health and nutrition education is an imperative measure to revamp dietary habits, food choices and nutritional status, since indigent dietary behaviour and practices are the main reason for meager nutritional status of adolescents (Auwuh *et al.*, 2019; Shahsanai *et al.*, 2018).

In the present study, post intervention results indicated a significant increment in mean weight and BMI among 13-15 years of the subjects in experimental group. A decline in the mean weight and BMI was observed among 16-17 years of the subjects after intervention. Based on the nutritional grades of BMI for age (z-scores), the post intervention results revealed a marked decline in the thinness among the subjects from pre-test to post-test i.e. from 13.7 to 9.1 per cent; overweight prevalence rate was also found to be decreased from 1.7 to 0.6 per cent among the subjects in the experimental group. After intervention, 0.3 per cent of the obese subjects classified into overweight category. None of the subjects were affected with severe thinness after nutrition education intervention.

Growth may be sensitive to nutritional deficit and surfeit, adolescent anthropometry provides indicators of nutritional status and health risk, and may be diagnostic of obesity and underweight. Findings of the present study are in concurrence with the study conducted by Baldasso *et al.*, (2016), which revealed that the overall prevalence of overweight and obesity was found to be 24.2 per cent. After intervention, 5.6 per cent of obese subjects classified into overweight. Post intervention results of nutrition education revealed a marked increase in the mean weights and BMI of the subjects. In the experimental group, the prevalence of severe thinness (2.41%) and thinness (7.93%) were found to be decreased and our results were in accordance with the study of Dharmade and Kale, (2017).

Post intervention results indicated a significant improvement in the haemoglobin profile of the subjects of the experimental group. The levels increased significantly from initial value of 10.5 g/dl to 12.9 g/dl in the experimental group. The percentage increase in haemoglobin content was found to be 13.3 per cent in the experimental group after imparting health and nutritional awareness among the subjects. Findings of the present study were in concurrence with the study conducted by Kaur *et al.*, (2011), which revealed similar results among the adolescent girls of 17-19 years age group. Nutrition education intervention revealed a significant rise in haemoglobin levels of the subjects from the initial value of 11.20 g/dl to 11.75 g/dl as compared to baseline with 12 months follow up study.

Karmakar *et al.*, (2014) showed similar effects of increase in the knowledge regarding anaemia among adolescent girls. Such educational programmes for adolescent girls are extremely essential to do away with the menace of nutritional anaemia in a community. There was a positive correlation between knowledge and attitude of adolescent girls with regard to prevention of anaemia. A study conducted by Resmi *et al.*, (2017) revealed that the inadequate knowledge and neutral attitude among adolescent girls regarding prevention of anaemia was the major cause of anaemia among them. The study concluded that adolescent girls should be sensitized with the knowledge regarding prevention of anaemia to enhance their understanding and surpassing attitude towards health and nutrition.

In the present study, the health and nutrition education intervention showed declining trend in systolic and diastolic blood pressure levels; the mean systolic blood pressure reduced from 121.3 mmHg to 118.2 mmHg and the mean diastolic blood pressure from 74.1 mmHg to 71.6 mmHg. Ribeiro, (2014) revealed that educational interventions were potential tools for improving the blood pressure levels in the patients with hypertension. Evidences revealed that higher intake of potassium, calcium and magnesium are inversely related to blood pressure levels. A study conducted by Falkner *et al.*, (2000) showed that among adolescents with hypertension, the blood pressure levels found to be lower in those with higher intakes of dietary nutrients such as potassium, calcium, magnesium and dietary folate.

Post intervention results revealed a marked increment in the average daily intake of all nutrients among 13-15 and 16-17 years of the subjects in experimental group. Among 13-15 years age group, the percentage increase in the average daily energy, protein and fat intake were found to be 15.8, 15.7 and 79 per cent, respectively in the experimental group. Similarly, among 16-17 years age group, the percentage increase in energy and protein intake were found to be 20.7 and 15.5 per cent, respectively; the mean fat intake was observed to be decreased from 35.8 g/d to 34.9 g/d among the subjects. The mean intake of vitamins and minerals were also found to be enhanced after intervention among the subjects of both the age groups of 13-15 and 16-17 years in the experimental group. Findings of the present study were in concurrence with the study conducted by Amber and Sengupta, (2015), which revealed a significant increment in the mean protein intake from 47.27 to 53.67 g/d among 16-19 years of adolescent girls after imparting nutrition education programme. The dietary intakes for energy and fats were found to be decreased after intervention, which were found to be more than RDA at baseline. Sharma and Singh, (2017) revealed the effectiveness of Nutrition



Education Programme (NEP) among 13-17 years of adolescent girls in enhancing mean nutrient intake of all the nutrients except for calcium, which were still found to be lower than recommended dietary allowances.

5. CONCLUSIONS

Health and nutrition education intervention programmes were found to improve food choices and dietary habits, which further persuaded health promotion and disease prevention among the subjects. The findings of the study strongly endorse the need to implement supplementation intervention programmes to prevent undernutrition and anaemia among adolescent girls. Besides this, the present study apostle the need to implement interventional measures for preventing obesity among adolescent girls.

6. REFERENCE

1. Amber S.P. and Sengupta R. Effect of nutrition education programme on dietary eating patterns of adolescent girls (16-19 years). *International Journal of Pure and Applied Bioscience*. 2015; 3(2): 427-431.
2. Awuuh V. A., Appiah C. A. and Mensah F. O. Impact of nutrition education intervention on nutritional status of undernourished children (6-24 months) in East Mamprusi District of Ghana. *Journal of Nutrition and Food Science*. 2019; 49 (2):173-180.
3. Baldasso, Garcia J., Galante, A. P. and Ganen D. P. Impact of actions of food and nutrition education program in a population of adolescents. *Rev. Nutr*. 2016; 29(1): 65-75.
4. Dharmade P. N. and Kale M. P. Effect of nutrition education on anthropometric measurements of adolescent girls. *International Journal of Home Science*. 2017; 3(1): 136-140.
5. Falkner B., Sheriff K., Michel S. and Kushner H. Dietary nutrients and blood pressure in urban minority adolescents at risk for hypertension. *Arch Pediatr. Adolesc. Med*. 2000; 154: 918-922.
6. Karmakar N., Banerjee S., Das S. and Das A. Effectiveness of intervention on knowledge of anaemia among school going adolescent girls in a village of West Bengal. *International Journal of Medical Science and Clinical Invention*. 2014; 1(4): 140-153.
7. Kaur M., Bassi R. and Sharma S. Impact of nutrition education in reducing iron deficiency anaemia in adolescent girls. *Indian Journal of Fundamental and Applied Life Sciences*. 2011; 1 (4): 222-228.
8. Resmi. S., Latheef F. and Vijayaraghavan R. A descriptive study to assess the knowledge and attitude of adolescence girls regarding prevention of iron deficiency anaemia in selected rural communities in Bangalore. *Int. J. Pharm. Bio. Sci*. 2017; 8(2B): 179-182.
9. Ribeiro J. M. Special focus issue on hypertension guidelines: New hypertension guidelines: A view from Latin America. *The Journal of Clinical Hypertension*. 2014; 16(4): 261-262.
10. Shahsanai A., Farajzadegan Z., Sichani Z. H., Heidari K. and Omid R. Assessment of the relationship between nutritional knowledge and anthropometric indices in Isfahan children and adolescent. *Adv. Biomed. Res*. 2018; 7: 110.
11. Sharma V. and Singh V. Impact of assessment of nutrition education on nutritional status of adolescent girls. *Journal of Nutrition and Food Science*. 2017; 7(3): 2-5.
12. WHO (World Health Organization). Adolescents health risks and solution- fact sheet. Geneva, Switzerland, 2018. <https://www.who.int/en/news-room/fact-sheets/detail/adolescents-health-risks-and-solutions>