



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2019; SP5: 417-419

Sarita Srivastava  
Department of Home Science,  
B.R.A. Bihar University,  
Muzaffarpur, Bihar, India

Priyanka Kumari  
Assistant Professor, Department  
of Home Science, G.B.M. College,  
Magadh University, Gaya,  
Bihar, India

(Special Issue- 5)

**International Conference on  
“Food Security through Agriculture & Allied Sciences”  
(May 27-29, 2019)**

## **Impact of nutritional supplementation of quality protein maize based supplementary foods on nutritional status of adolescent girls**

**Sarita Srivastava and Priyanka Kumari**

### **Abstract**

Adolescent girls are the most vulnerable section of population that constitute about one-tenth total population. Under-nutrition among adolescents is a serious public health problem, especially in India. In this context, the present study was taken up among early adolescent girls residing in the urban area of Muzaffarpur District, Bihar, India. The objective of the study is to assess the Nutritional status of the early adolescent and to study the Morbidity pattern among these adolescent girls in Muzaffarpur District of Bihar. Cross-sectional study was carried out over a period of four months. 600 girls of age 13-17 years were examined during that period. Data was collected by interviewing the girls using predesigned, pre tested, semi-structured schedule. Anthropometric measurements were recorded using standardized methodology as recommended by World Health Organization (WHO). Body Mass Index (BMI) – BMI was calculated using the formula Weight in kg/height in m<sup>2</sup>. The subjects were categorized into various grade based on BMI according to WHO International Standard. Data were analyzed by using SPSS 16.0 version. A total 600 girls were studied. 37.4% were in the age group 13 years. According to WHO reference standards 56.4 % girls were under-nourished (BMI 23.5 kg/m<sup>2</sup>). 32.4% were showed clinical anaemia, 27.1% were having dental caries, 18.8 were having reproductive problem (Dysmenorrhoea), 16% were skin problem, 4% Eye problem (defective vision). It is concluded that there is a high prevalence of under nutrition, dental caries and clinical anaemia among adolescent girls in Muzaffarpur District of Bihar. The present study calls for Health education and nutrition interventions to reduce the serious health problem on priority basis.

**Keywords:** BMI, Thinness, under nutrition, Adolescent girls, Morbidity Pattern, dental caries, anaemia

### **Introduction**

Adolescent girls form an important vulnerable sector of population that constitute about one-tenth of Indian population. Under-nutrition among adolescents is a serious public health problem, especially in developing countries (FAO, 1993) Early adolescence is the critical period of rapid physical growth and changes in body composition, physiology and endocrine in the life cycle after the first year.

Nutritional adequacy is one of the key elements for support of growth and maintenance of adolescents (Awasthi and Kumar, 1999) <sup>[1]</sup> Due to inadequate intake of nutrient in diet like energy, protein, vitamin iron and calcium etc. various deficiency disorders occur <sup>[3]</sup>

India holds 87 % of anaemic Adolescents. Prevention and control of iron deficiency required the combined approach of dietary improvement, fortification of a common staple food when feasible and appropriate iron supplements of Adolescent girls.

Indians mainly depend on the staple food for their livelihood. Therefore the staple food must be balanced in nutrient content. Maize is one of the staple cereal food in the country which has been improved for quality protein.

Keeping in view the nutritional requirement of Adolescent girls, an impact study of Quality Protein Maize based food on their nutritional status has been carried out.

### **Material and Methods**

To carry out the study, the product was developed for supplementation. The stages involved

### **Correspondence**

Sarita Srivastava  
Department of Home Science,  
B.R.A. Bihar University,  
Muzaffarpur, Bihar, India

for development of food were:

### Selection of food materials

**Cereals-Quality Protein Maize** recently developed with balanced amino acid composition has been chosen for the development of supplementary food. Ragi one of the most common millet in the state has been taken as a rich source of calcium, thus, Quality Protein Maize and Ragi were selected for the development of supplementary food for Adolescent girls.

**Pulses- Green gram**, the most commonly consumed pulse in the state was selected to increase the Protein content of food for Adolescent girls.

**Oil seeds- Gingelly seeds** were selected to further enrich the food with nutrients including essential fatty acids.

**Green Leafy Vegetables –Amaranthus** was selected to enrich the Iron content.

**Sugars –Jaggary** was included for taste.

### Processing of food materials

Processing methods applied for food materials were soaking, alkali processing, germination and roasting. The different processing methods were applied to different food materials.

**Maize:** Quality Protein Maize was procured from the Department of Plant Breeding, Rajendra Agricultural University, Pusa. After cleaning the maize grains were soaked for 5 minutes in double the amount of one per cent Lime water. Heat treatment was given to it for 30 minutes. Then it was kept overnight. Next morning the grains were washed four times and sun dried. After drying the grains were roasted till the desired flavor was obtained.

**Ragi:** Ragi grains were collected from the farmers. These were first cleaned to remove dust particles and then they were subjected to roasting process. Malting has been done by soaking the Ragi in double the amount of water for 24 hours. Then the soaked Ragi grain were kept on gunny bag and covered with another gunny bag for 24 hours. Water was sprinkled over it and again were covered with gunny bag for 72 hours. After sprouting it was sundried. After drying it was roasted till desirable flavor was obtained.

**Gingelly seeds:** Gingelly seeds were washed, dried and roasted to improve digestibility and palatability.

**Amaranthus-** Amaranthus was cleaned, washed, blanched and dried in the sunlight.

### Preparation of food for Adolescent girls

Ingredients used for evolving the supplementary food for the Adolescent girls were: Quality Protein Maize, 60g; Green gram, 22.5g; Ragi, 10.5g; Gingelly seeds, 10g; Amaranthus, 5g and Jaggery, 60g.

All the processed ingredients were powdered in a dry grinder and mixed thoroughly. Jaggery syrup was prepared. The powdered mix was added with continuous stirring and then removed from oven. When it was warm it was made into specific shapes.

Impact of supplementation of Quality Protein Maize based food was carried out in Muzaffarpur District, Bihar. A total of six hundred Adolescent girls were selected among whom 300 served as control and 300 as experimental group in whom supplementation was done.

### Result and Discussion

The Adolescent girls selected for the supplementation study aged between 10-18 years.

### Health and nutritional status of Adolescent girls of control and experimental group

Health and nutritional status of Adolescent girls of control and experimental group were determined by the body weight, clinical examination and other problems associated to Adolescents. The difference in the body weight of Adolescent girls compared to the standard has been presented in Table 1.

**Table 1:** The Mean Body Weight of the Selected Adolescent Girls

Percentage of lowered body weight compared to the standard	Control group (n=300)		Experimental group (n=300)	
	N	%	N	%
0 - 5	20	6.6	30	10.0
5.1 - 10	40	13.3	40	13.3
10.1 - 15	60	20.0	90	30.00
15.1 - 20	80	26.6	100	33.3
20.1 - 25	50	16.6	30	10.0
25.1 - 30	50	16.6	10	3.3

It is discouraging to note that the selected Adolescent girls were showing lesser body weights than the standards. In control group 26.6 percent of Adolescent girls were lower in their body weight by 15.1 to 20 per cent than the standard. Among the experimental group, 33 per cent Adolescent girls were the lower body weight by 15.1 to 20 per cent than the standard.

The poor nutritional status definitely affects their health inviting many problems. Some problems can be known by interviewing the Adolescent girls and some by examining them clinically.

**Table 2:** Problems encountered by the selected Adolescent girls

Problems	Control group (n = 300)				Experimental group (n = 300)			
	Present		Absent		Present		Absent	
	N	%	N	%	N	%	N	%
Constipation	130	43.3	170	56.6	130	43.3	170	56.6
Diarrhoea	50	16.6	250	83.3	40	13.3	260	86.6
Dysentery	10	3.3	290	96.6	50	16.6	250	83.3
Fever	40	13.3	260	86.6	30	10	270	90

**Table 3:** Anthropometric measurements of the Adolescent Girls Before and After Supplementation

Variables	Control group (n = 300)			Experimental group (n = 300)		
	Initial	Final	t- value	Initial	Final	t-value
Weight(kg)	49.97	55.39	7.14*	51.75	58.14	39.22**
MUAC (cm)	24.61	25.27	11.67*	24.92	26.07	10.25*

\* Significant at 5% level

\*\* Significant at 1% level

The various problems and diseases encountered during the period of Adolescence by the control and experimental group are presented in Table III.

Constipation, diarrhoea, dysentery and fever were the common problems of the Adolescent girls. Majority of them (from both the control groups) were suffering from constipation (43.3 per cent). Diarrhoea was also found in 16.6 per cent and 13.3 per cent in control and experimental group respectively. Dysentery was observed among 3.3 per cent and 16.6 per cent in control and experimental group respectively.

## Impact of Supplementation on Nutritional Status of Adolescent Girls

Impact of supplementation on the nutritional status of Adolescent girls was studied in terms of anthropometric measurements, haemoglobin level and prevalence of anaemia (Barbera and Clemente, 2005)<sup>[2]</sup>

### Antropometric measurements of Adolescent girls

The anthropometric measurements i.e. weight and mid upper arm circumference of the selected subjects of both the groups after intervention trial are presented in Table IV. The mean weight of Adolescent girls after supplementation was 42.39kg whereas initial was 39.27kg. The result was statistically significant at 1 per cent level.

Mid upper arm circumference (MUAC) was also increased during the course of supplementation.

### Mean haemoglobin level

Mean haemoglobin level of Adolescent girls of both the groups are presented in Table IV. The mean difference in haemoglobin level before and after supplementation of food among Adolescent girls of experimental group as found to be 1.4g/dl while only 0.23g/dl increment was observed among the Adolescent girls of control group.

**Table 4:** Mean Haemoglobin level of Adolescent Girls Before and After Supplementation

Groups	Haemoglobin level(g/dl)			
	Initial	Final	Difference	t-value
Control (N=300)	8.31	8.54	0.23	3.52*
Experimental (N=300)	8.64	10.04	1.40	13.06**

\*\*Significant at 1% level

**Table 5:** Prevalence of Anaemia among the Adolescent Girls of Control and Experimental Group

Classification	Control group (n = 300)		Experimental group (n = 300)	
	N	%	N	%
Normal (>12g/dl)	00	0	10	3.3
Mild anaemia (10-11.9g/dl)	10	3.3	9	30.0
Moderate anaemia (8-9.9g/dl)	210	70	200	66.6
Severe anaemia (<8g/dl)	80	26.6	0	0

### Prevalence of Anaemia

Prevalence of anaemia among the control and experimental group of Adolescent girls is presented in Table V. After biochemical assessment adolescent girls of control group were found to be suffering from anaemia. The percentage of adolescent girls with moderate anaemia was maximum that was 70.

The percentage of severe anaemic adolescent girls was 26.6 and mild anaemic 3.3. After intervention 66.6 per cent of adolescent girls become moderate anaemic, 30 per cent mild anaemic and 3.3 per cent in normal category. A shifting trend in the level of haemoglobin was found after supplementation of food. The number of severe anaemic Adolescent girls shifted to normal, mild and moderate anaemic category.

### Summary and conclusion

The mean weight of the adolescent girls in the control group after intervention trial was 44.39 kg whereas the initial weight was 40.97kg. In the experimental group the mean weight increased to 58.14kg from the initial value of 51.75kg (t value 39.22). The MUAC increment in experimental group was also

more than the control group. The mean difference in haemoglobin level before and after supplementation increased markedly in experimental group. That was 1.4g/dl while only 0.23g/dl increment was observed in control group.

A change in haemoglobin level has been seen after intervention with supplementary food to adolescent girls. Around 13.3 per cent of severe anaemic adolescents and 80 per cent moderate anaemic adolescent girls shifted to mild anaemic and normal. There was no case of severe anaemia found after supplementation. A shifting trend in the level of haemoglobin was found after supplementation.

If such supplementation trial with locally available nutritious foods be continued to adolescent girls, the health status of adolescent girls can be improved to a great extent.

### Acknowledgement

The authors are thankful to Dr. S.G. Sharma, Chairman, Department of Biochemistry Dr. O.P. Pandey, Assistant Professor, Department of Biochemistry, Dr. Usha Singh, Assistant professor Department of Foods and Nutrition, R.A.U., Pusa and Dr. Sushila Singh, Reader, Department of Home Science, M.D.D.M. College, Muzaffarpur.

### References

1. Awasthi N, Kumar AR. Nutritional status of hill primary school children. *Indian J Nutr Diet.* 1999; 36:453-459.
2. Barbera AR, Clemente G. Bioaccessibility of minerals in school meals: comparison between dialysis and solubility methods. *Food Chem.* 2005; 92:481-489.
3. Camara F, Amaro Kotecha M, Patel PV, Karkar RZ, Nirupam PDS. Impact evaluation of adolescent girls anaemia reduction programme, Vadodara District, Government Medical College, Vadodara, 2002.
4. Food Standards Programme. Codex Alimentarius commission. Recommended International Standards for Foods for Infants and children. Rome: Food and Agricultural Organization, 1993.
5. Kaur S, Kapil U, Singh P. Pattern of chronic diseases amongst adolescent obese children in developing countries. *Curr Sci.* 2005; 88:1052-6.
6. Kotecha PV, Patel RZ, Karkar PD, Nirupam S. Impact evaluation of adolescent girls anaemia reduction programme, Vadodara District, Government Medical College, Vadodara, 2002.
7. Kapoor G, Aneja S. Nutritional disorders in adolescent girls. *Indian Pediatr.* 1992; 29:969-73.
8. Kurz KM. Adolescent nutritional status in developing countries. *Proc Nutr Soc India.* 1996; 55:321-31.