



EFFECT OF SUPPLEMENTARY MIX AND NUTRITION EDUCATION ON THE HAEMOGLOBIN STATUS OF TRIBAL ANAEMIC ADOLESCENT GIRLS

Mrs.C.Padmavathi* Dr.V.Saradharamadas**

*Associate Professor, Dept. of Food Service Management and Dietetics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu, India.

**Professor, Dept. of Food Service Management and Dietetics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu, India.

Abstract

Introduction: The main nutritional problems affecting irula adolescents include under nutrition in terms of stunting, thinness, catch-up growth, iron deficiency anaemia, iodine, vitamin A and calcium deficiencies and deficiencies of zinc and folate. **Objectives:** To study the impact of intervention programmes on haemoglobin level of irula tribal anaemic adolescent girls. **Methods:** Two tribal settlements namely Neelampathy (71 families) and Ukkampathy (55 families) of Tholampalayam Panchayat, Karamadai Block, Coimbatore District of Tamil Nadu State were selected for the study. Ninety Irula tribal anaemic adolescent girls who were of mild and moderate anaemics were selected. The intervention programmes were dietary supplementation and nutrition education. Dietary supplementation and nutrition education (Group A: 30), only nutrition education (Group B: 30) and the control group were of 30. The haemoglobin levels of the selected tribal anaemic adolescent girls were assessed before and after 210 days of supplementation mix and 150 days of health and nutrition education intervention. **Results and Conclusion:** The statistical analysis showed that due to the intervention programmes both supplementation and nutrition education there is an improvement in the haemoglobin status among selected tribal anaemic adolescent girls which is significant at one percent level. The mean haemoglobin status among selected tribal anaemic adolescent girls was increased after nutrition education. The difference in increment was significant at one percent level. Thus dietary supplementation and nutrition education did have a positive effect on the iron status.

Key Words: Irula Tribes, Anaemic Adolescent Girls, Haemoglobin, Dietary Supplementation, Nutrition Education.

INTRODUCTION

Health is an essential component for well-being of the human kind and is a positive concept emphasising social and personal resources as well as physical capacities. Health is not just a state, but also a resource for everyday life (WHO, 2005). Healthy diet provide the right balance of carbohydrate, fat and protein to reduce risks for chronic diseases and are a part of a productive life style.

India is the home to large number of indigenous people, who are still untouched by the lifestyle of the modern world. With more than 84.4 million, India has the largest population of tribal people in the world. These tribal people, also known as the *adivasis*, the poorest in the country, who are still dependent on hunting, agriculture and fishing. All tribal people have their own culture, tradition, language and lifestyle (<http://www.ecoindia.com/tribal>).

The word "Tribe" denotes a group of people living in primitive conditions. Around 80 per cent of tribal population is found in Central India. There are around 636 scheduled tribe categories in India (http://www.forests.tn.nic.in/tribaldevelopment/tribaldevelopment_home.html). Adivasi is an umbrella term for a heterogenous set of ethnic and tribal groups claimed to be the aboriginal population of India. They comprise a substantial indigenous minority of the population of India (<http://www.ecoindia.com/tribal>).

Tribal communities lag behind other communities with respect to attainment of income, education, health and other requisites for food and nutrition (Srinivasan and Mohanty, 2004 and Banik et al., 2007).

Irula or Irulas, a scheduled tribe, are one of the major tribes of Tamil Nadu and are distributed in 12 districts. Irulas mainly live in Kanchipuram, Nilgiris and Villupuram districts of Tamil Nadu. Their main occupations are snake and rat catching besides trading in snake skin and forest products such as honey, bee wax and forest wood. The Irula economy began to decline after the laws to prevent snake skin trade and preserve forest regions were enacted.

Adolescence is defined commonly as the time between the onset of puberty and adulthood and it is a very significant phase in human life. Adolescent girls often suffer from anaemia which is detrimental to growth and perpetuates the vicious cycle of malnutrition (Jolly et al., 2008). The main nutritional problems affecting adolescents include undernutrition in terms of stunting, thinness, catch-up growth, iron deficiency anaemia, iodine, vitamin A and calcium deficiencies and deficiencies of zinc and folate (Hart et al., 2003). Iron deficiency anaemia can be associated with low dietary intake of iron, inadequate absorption of iron or excessive blood loss.



Nagda (2004) reported that anaemia is prevalent among more than 80 per cent of tribal children. Iron deficiency is recognized as the major cause of anaemia in tribal communities (Vyas and Choudhry, 2005). Thus, the overall health of the tribal people calls for attention. Due to poor environmental sanitation and unhygienic personal practices, the majority of Irulas are malnourished and this has led to many Irulas becoming chronically ill.

Several intervention programmes have been initiated to combat the micronutrient deficiencies especially iron deficiency anaemia. The most commonly adopted strategy is the dietary supplementation which will be effective, preventive and curative (http://www.who.int/nutrition/publications/micronutrients/guidelines_for_Iron_supplementation.pdf).

A varied array of interventions exist that are designed to prevent and correct iron deficiency anaemia. These include dietary improvement, fortification of foods with iron, iron supplementation, and other public health measures, such as helminth control. All of these approaches improve iron status in some contexts. The amount of iron absorbed from the diet is not sufficient to meet many individual requirements of the population.

OBJECTIVES

The present study was undertaken with the following objectives:

- To observe the nutritional deficiency disorders among the tribal anaemic adolescent girls
- To develop a product suitable for dietary intervention
- To understand their knowledge, attitude, practices and
- To assess the impact of intervention programmes among the tribal anaemic adolescent girls.

MATERIALS AND METHODS

PHASE I: STUDY THE BACKGROUND INFORMATION

A. Selection of Venue And Sample

In selecting the venue, multistage sampling method was followed. In the first stage, state level Tamil Nadu, second stage district level Coimbatore, third stage block level Karamadai, fourth stage Panchayat level Tholampalayam and finally at fifth stage settlements two out of six tribal settlements that are of easy access and convenience were selected.

The maximum tribe settlements are found at the foothills of Tholampalayam Panchayat of Karamadai block, which is 51 kilometres away from Coimbatore, and at an altitude of 372 metres above mean sea level were selected for the study.

According to Khan (2008), sampling method is the process or method of drawing definite number of individuals, cases or observations from a particular universe, selecting part of a total group for investigation. When dealing with people, it can be defined as a set of respondents (people) selected from a larger population for the purpose of a survey.

Two tribal settlements namely Neelampathy (71 families) and Ukkampathy (55 families) of Tholampalayam Panchayat, Karamadai Block, Coimbatore District of Tamil Nadu State were selected for the study. Ninety Irula tribal anaemic adolescent girls who were of mild and moderate anaemics were selected.

B. Collection of data

The background information on the nutritional deficiency disorders among the adolescents of 126 families of irula tribes were collected using a well-framed interview schedule.

PHASE II: ASSESSMENT OF NUTRITIONAL STATUS

A. Clinical Examination

Clinical examination is a commonly used method for assessment of nutritional status of communities, since it is relatively simple in community situation, does not call for sophisticated equipment and helps to reveal the anatomical changes by naked eye. It includes physical examination and medical history (Kenneth, 2002).

Clinical examination was carried out for all the 146 irula tribal anaemic adolescent girls in the age range of 13-18 years, using ICMR clinical assessment proforma with the help of a physician in order to detect the presence of any nutritional clinical symptoms that is related to deficiency of one or more nutrients. The conduct of medical camps was intimated to each settlement by distributing handouts. Screening of the clinical manifestations among all the selected subjects were undertaken by organizing three medical camps in two settlements.

Clinical examination has always been and remains a widely utilized practical direct method for assessment of nutritional status of individual and communities (Jeejeebhoy, 2000). Clinical signs of anaemia for a subsample of 90 tribal adolescent



girls who were studying at Tholampalayam Higher Secondary School from 126 families of two settlements were carefully examined by trained medical practitioners. Assessment by clinical signs was based on examination for changes, believed to be related to inadequate iron intake that can be seen or felt in epithelial tissue, especially pallor of skin and nails, scaly hair, headache, dimness of vision and cheilosis.

B. Biochemical Analysis

Biochemical tests can be conducted on easily accessible body fluids such as blood and urine, which help to diagnose disease at the sub-clinical stage, confirm clinical stage or confirm clinical diagnosis at the stage of the disease (Bamji *et al.*, 2009).

The haemoglobin level was estimated for all the 146 tribal anaemic adolescent girls in the age group of 13-15 and 16-18 years by using cyanmethaemoglobin method for which the blood sample was collected by finger prick. A haemoglobin level of less than 12g/dl, the cut-off point suggested by WHO (2007) for anaemia was chosen as the indicator to identify the mild anaemic (11-11.9g/dl), moderate (8-10.9g/dl), and severe anaemic (<8g/dl) tribal anaemic adolescent girls.

PHASE III: PRODUCT DEVELOPMENT

The creation of products with new or different characteristics offer additional benefits to the customer. Product development may involve modification of an existing product or its presentation, or formulation of an entirely new product (<http://www.businessdictionary.com/definition/product-development.html>).

A. Development of Iron Rich Supplementary Mix

The product development is focused to formulate a supplementary mix rich in iron to promote the haemoglobin level among moderate and mild anaemic tribal adolescent girls. A combination of cereal, pulse, oil seed and jaggery was selected to develop an iron rich mix. The iron rich ingredients such as rice flakes (*Oryza sativa*), whole wheat (*Triticum aestivum*), roasted Bengal gram (*Cicer arietinum*), dry coconut (*Cocos nucifera*), white gingelly seeds (*Sesamum indicum*) and cane jaggery (*Saccharum officinarum*) were included. Each ingredient except jaggery was roasted separately and powdered to improve the sensory attributes. All the powdered ingredients at room temperature were thoroughly mixed.

B. Standardization and Acceptability Test for Supplementary Mix

The United States Department of Agriculture (USDA, 2010), defines a standardized recipe as one that “has been tried, adapted and retried several times for use by a given food service operation and has been found to produce the same good results and yield every time when the exact procedures are used with the same type of equipment and the same quantity and quality of ingredients”. Among the ingredients selected for the supplementary mix five variations with the quantity of 25g, 30g, 35g, 40g and 50g of rice flakes was made and adjusted the other ingredients at various levels to obtain the total amount to 100g. The five varied mixes were standardized and found out the most acceptable best combination of mix to supplement the anaemic adolescent girls. The method of preparation of mix was standardized so that portions obtained each time were consistent in volume, colour, texture and taste along with the time and cost of preparation.

The sensory characteristics of colour and appearance, taste, texture, flavor and overall acceptability of five mixes were assessed by 30 taste panel members using a five point score to find out the suitable combination of ingredients for the supplementation. The maximum desirable and acceptable amount of supplementary mix for a day’s serving was identified by undertaking quantity acceptability trial test among adolescent girls. It is identified that the quantity of upper limit consumption of mix was 50g.

C. Analysis of nutrients of standardized supplementary mix

The most accepted standardized supplementary mix was selected for analysing iron as well as energy, protein, carbohydrate, fat, calcium, dietary fibre, moisture, ash, total carotene, thiamine, riboflavin, niacin, folic acid and vitamin C using the standard procedures in order to understand the total nutritional contribution.

PHASE IV: INTERVENTION PROGRAMMES

A. Ethical issue

Institutional Human Ethics Committee, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, reviewed, approved the study protocol.

B. Selection of Subsample

A sub sample of 90 moderate and mild anaemic adolescent tribal girls in the age group of 13 to 18 years out of 146 adolescents were selected on the voluntary basis for dietary and health nutrition education interventions. Further the tribal anaemic adolescent girls were divided into two groups constituting 30 in control and 60 in experimental group. The experimental group was divided into two groups comprising 30 each in experimental group A and B. Experimental group A



was for dietary and health nutrition education intervention and experimental B was only for health nutrition education intervention.

C. Dietary Intervention

Healthy generations are possible to be created by strengthening the adolescent girls who will be the future mothers. In the past decade, the widespread prevalence of anaemia in adolescent girls the greatest nutritional problem in India is gaining increasing recognition (Devaney, 2005). In the present study it was identified that iron deficiency anaemia was more common among adolescents especially girls of 13 to 17 years. It is essential to improve the haemoglobin status of anaemic subjects by increasing the total iron intake (Khanduri *et al.*, 2000). One way to improve the absorption of iron food is to increase the intake of vitamin C (Konje *et al.*, 2001). The most accepted standardized and the low cost iron rich mix was used for supplementation for a period of seven months to increase the level of haemoglobin status of anaemic adolescent girls.

Before initiating supplementation, as per the recommendation of the physician, deworming tablet (Albendazole 400mg) was administered to the sub-sample of 30 moderate and mild anaemic tribal adolescents in experimental group A for an effective absorption of iron.

Once in a week the supplementary mix (10½ kg) was prepared by the investigator in the food laboratory, packed in an airtight container and delivered to the headmistress of the school. Under the supervision of the headmistress, the supplementary mix in powder form was distributed to the subjects of experimental group A (50g) during mid-morning for a period of seven months. During weekends and on holidays it was packed and distributed to the subjects. Amla (*Emblica officinalis*), a berry found in abundance in tropical countries and a rich source of vitamin C (600mg/100g) was selected to enhance the iron absorption. One amla fruit weighing 25 to 30g containing 150 to 180mg vitamin C was given along with the supplement every day.

D. Health and Nutrition Education Intervention

The aim of the health and nutrition education is to guide people to choose optimum and balanced diets and thereby promote good dietary habits. Isobel (2008) opined that nutrition education is any combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food nutrition behavior conducive to health and well-being. Nutrition education was imparted in local language to the selected 60 tribal anaemic adolescent girls in experimental group on principles of foods and nutrition, the basic food groups, importance of healthy and balanced diets, nutritive value of foods, conservation of nutrients while cooking, personal hygiene, kitchen garden, low cost recipes and the nutrients related to anaemia by using pamphlets and charts. Pamphlets were distributed and charts were displayed on the walls of the classrooms and at prominent and common places where people were meeting together for some talks. Demonstration of inexpensive, nutritious recipes prepared with locally available foodstuffs was undertaken. Nutrition education was given three times a week for two hours for a period of five months following a lesson plan to experimental groups of tribal anaemic adolescent girls in the school premises.

PHASE V: IMPACT OF INTERVENTION PROGRAMMES

A. Clinical Signs and Symptoms of Nutritional Deficiencies

The signs and symptoms of nutrient deficiencies among all the subsamples were assessed with the help of a physician after supplementation and nutrition education intervention.

B. Haematological Parameters

The haemoglobin level of the selected tribal anaemic adolescent girls were assessed before and after 210 days of supplementation mix and 150 days of health and nutrition education intervention.

C. Nutrition Knowledge Score

A detailed questionnaire constituting 91 questions were framed to assess the dietary Knowledge, Attitude and Practices (KAP) of 60 tribal anaemic adolescent girls before and after imparting health nutrition education.

In order to assess the health nutrition practices, the details of questions related to methods of cooking and importance of personal hygiene were included. Score was allotted for each question giving equal weightage. In the case of yes/no questions the correct alternative was given full scores and the other was awarded zero score. The knowledge scores of pre and post intervention programme were analyzed statistically to understand improvement of the KAP level of all the selected tribal anaemic adolescent girls.



D. Analysis of Data

Data are the basic input to any decisions making process. The process of statistical data gives importance to the study. After data collection, proper tools and techniques should be used for classification and analysis and interpretation of data (Ader, 2008).

Data collected were classified, tabulated and analysed. The statistical tools used for analysis were mean, standard deviation, percent correlation analysis, 't' test and results were interpreted.

Results and Discussion

1. Clinical Examination

The clinical signs and symptoms of selected 146 tribal anaemic adolescent girls (13-15 and 16-18 years) are showcased in Table I.

Table I, Clinical Signs and Symptoms of the Adolescents

S.No	Clinical symptoms of nutritional deficiency	Female (N: 146)	
		N	%
1	Deficient subcutaneous fat	106	72.6
2	Lack of interest in surrounding	93	63.7
3	Red and/ or raw/ Glazed tongue	29	19.9
4	Angular Stomatitis	21	14.4
5	Bitot's spots	52	35.6
6	Dental caries	82	56.2
7	Loose teeth	39	26.8
8	Dry/ or rough skin	119	81.5
9	Fluorosis	41	28.1
10	Worm infestation (Local skin manifestation, itchy rash)	25	17.1
11	Vitamin C deficiency (Swollen gums and nose bleeding)	102	69.9
12	Thin brown hair	73	50.0
13	Hair with lack of shine and luster	21	14.4
14	Easily pluckable hair	13	8.9
15	Mud colour nails	11	7.5
16	Cracks and redness on the lips	29	19.9

From the table I, it was inferred that 63.7 per cent had lost interest in surrounding, 14.4 per cent had hair with lack of shine and luster, 69.9 per cent had vitamin C deficiency and 72.6 per cent had deficient subcutaneous fat. The mud colour nails in females were found among 7.5 per cent, 14.4 per cent had angular stomatitis, 17.1 per cent had worm infestation, 19.9 per cent had cracks and redness on the lips.

2. Mapping of Anaemia among Adolescent Girls by Biochemical Analysis

The anaemic status of selected tribal adolescent girls aged 13-15 and 16-18 years are shown in Table II and Figure 1.

Table II, Anaemic Status of Selected Tribal Adolescent Girls, (N:146)

Age (years)	Anaemic					
	Mild (11-11.9g/dl)		Moderately (8-10.9g/l)		Severely (<8g/dl)	
	No.	%	No.	%	No.	%
13 – 15 (n: 58)	34	58.6	22	38.0	2	3.4
16 – 18 (n: 88)	63	71.6	20	22.7	5	5.7

All the adolescent girls in the study group were found to be anaemic. It is obvious that both in the 13-15 years and 16-18 years maximum of 58.6 per cent and 71.6 per cent were mild anaemic respectively. Followed by this moderate anaemia was noted among 38 per cent of the 13-15 years adolescent girls and 22.7 per cent among 16-18 year adolescent girls. A minimum of 3-6 per cent of the adolescent girls were affected by severe anaemia.

Phase III

A. Quality Assessment of Supplementary Mix

The quality assessment of supplementary mix was carried out under the following aspects.



1. Composition of selected five mixes

The composition of selected five mixes used for standardization is shown in Table III.

Table III, Composition of Mixes Used for Standardisation (100g)

Ingredients (g)	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Rice flakes (<i>Oryza sativa</i>)	25	30	35	40	50
Whole wheat (<i>Triticum aestivum</i>)	20	15	15	10	10
Roasted Bengal gram (<i>Cicer arietinum</i>)	10	15	10	15	10
Dry coconut (<i>Cocos nucifera</i>)	15	10	10	10	10
White gingelly seeds (<i>Sesamum indicum</i>)	15	15	10	10	10
Cane jaggery (<i>Saccharum officinarum</i>)	15	15	20	15	10

The mix with 40g rice flakes, 10g whole wheat, 15 roasted bengal gram, 10g dry coconut, 10g white gingelly seeds, 15g cane jaggery had the highest score and was confirmed as the most acceptable combination. Hence the combination of mix 4 with a ratio of 4:1:1.5:1:1:1.5 was chosen for supplementation of dietary intervention programme.

2. Acceptability of the supplementary mixes

The mean scores of sensory characteristics of five mixes are shown in Table IV.

Table IV, Acceptability of the Supplementary Mixes(N: 30)

Sensory characteristics	Maximum scores	Mean scores				
		Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Colour and Appearance	5	4.1	3.9	4.2	4.5	3.8
Taste	5	3.9	4.1	3.8	4.3	4.1
Texture	5	3.8	3.8	3.7	4.2	3.9
Flavour	5	3.7	3.5	3.8	4.0	3.9
Overall acceptability	5	4.0	3.9	3.9	4.5	3.9
Total	25	19.5	19.2	19.4	21.5	19.6

The total mean scores obtained for five mixes were 19.5, 19.2, 19.4, 21.5 and 19.6. Mix 4 was highly acceptable and the score obtained was 21.5 and this was selected for supplementation as it secured the highest score. The overall acceptability score for mix 4 was 4.5 followed by 4 for mix 1 and the mean score for mix 2, mix 3 and mix 5 was 3.9 each.

3. Composition and cost of the accepted mix

The composition and cost of the most accepted iron rich supplementary mix are shown in Table V.

Table V, Composition and Cost of the Most Accepted Iron Rich Supplementary Mix (100g)

Food stuffs	Quantity (g)	Cost
Rice flakes (<i>Oryza sativa</i>)	40	1.60
Whole wheat (<i>Triticum aestivum</i>)	10	0.29
Roasted Bengal gram (<i>Cicer arietinum</i>)	15	0.99
Coconut dry (<i>Cocos nucifera</i>)	10	1.40
White gingelly seeds (<i>Sesamum indicum</i>)	10	1.40
Jaggery cane (<i>Saccharum officinarum</i>)	15	0.60
Total	100	6.28

The cost of gingelly seeds and coconut dry for 10g each was `1.40 which was the highest among the selected ingredients. Rice flakes costed only `1.60 for 40g. Cost of roasted Bengal gram was 0.99 paise for 50g and jaggery cane costed 0.60 for 15g. Thus the total food cost of the most accepted iron rich supplementary mix for 100g was `6.28. The cost includes only the cost of ingredients if it is made by the individuals.



4. Nutrient contribution of the most accepted supplementary mix

The nutrient contribution of most accepted supplementary mix is shown in Figure 2.

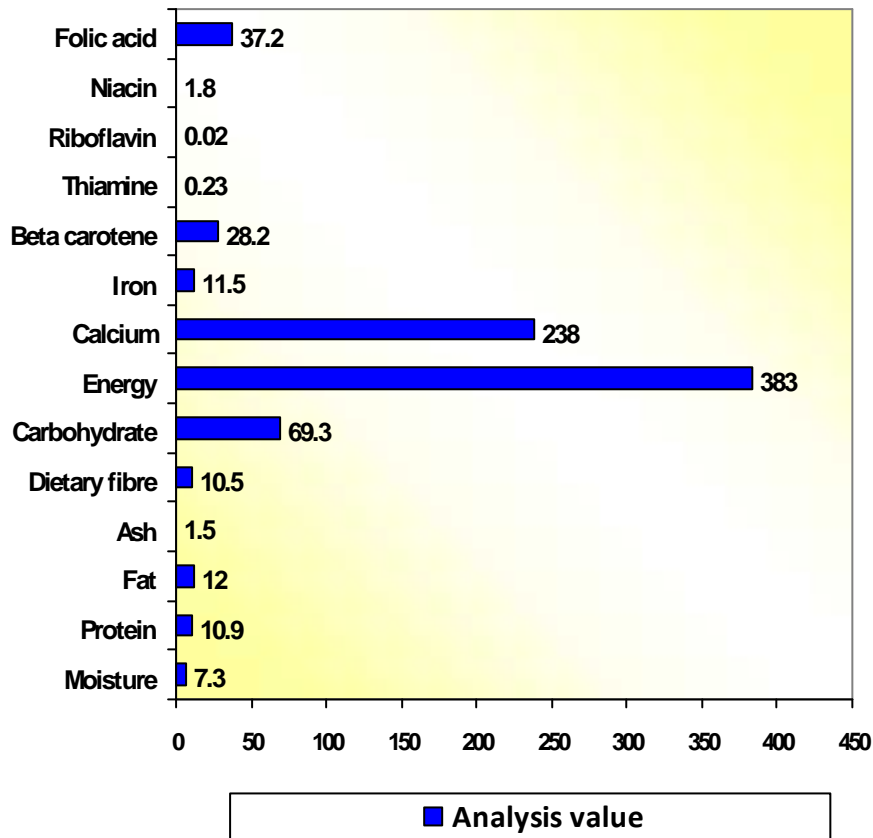


Figure 2: Nutrient Contribution of the Most Accepted Supplementary Mix

The accepted supplementary mix of 100g provided 11.5mg of iron. The analysed energy value was 383 kcal. The analysed value of protein was 10.9g, fat 12g, dietary fibre 10.5g, beta carotene 28.2 g and thiamine 0.23mg. The analysed value of folic acid was 37.2 g and carbohydrate 69.3g. Amla (*Emblica officinalis*), a berry found in abundance in tropical countries and a rich source of vitamin C (600mg/100g) was selected to enhance the iron absorption. One amla fruit weighing 25 to 30g containing 150 to 180mg vitamin C was given along with the supplement every day.

Phase IV

A. Impact of Intervention Programmes

The supplementation and nutrition education intervention programmes were undertaken to improve the nutritional status of selected tribal anaemic adolescent girls. The impact of intervention programmes were assessed in terms of clinical signs and symptoms of nutritional deficiencies, biochemical parameters such as haemoglobin level and health and dietary knowledge, attitude and practice of tribal anaemic adolescent girls. The results are furnished below:

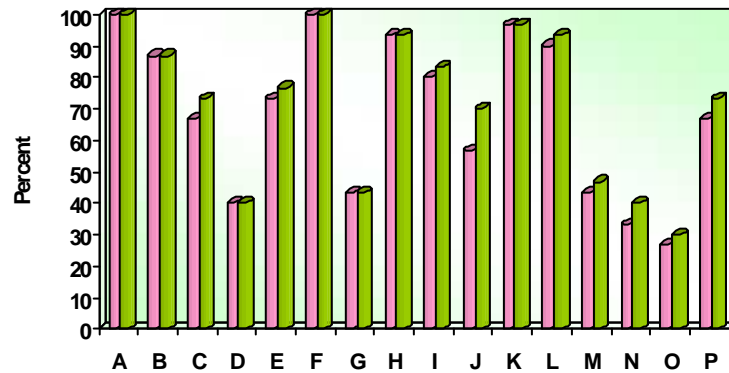
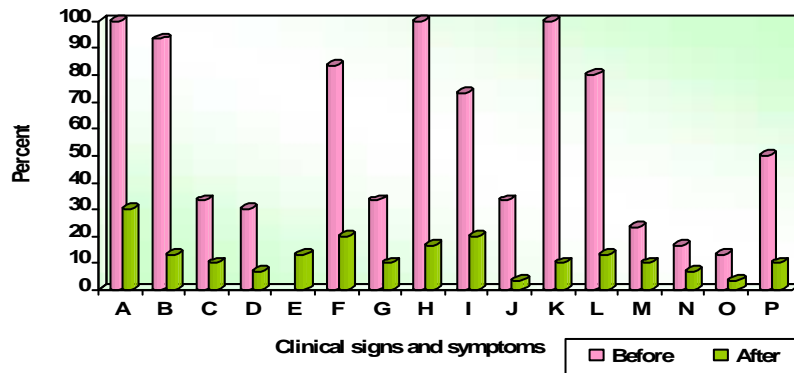
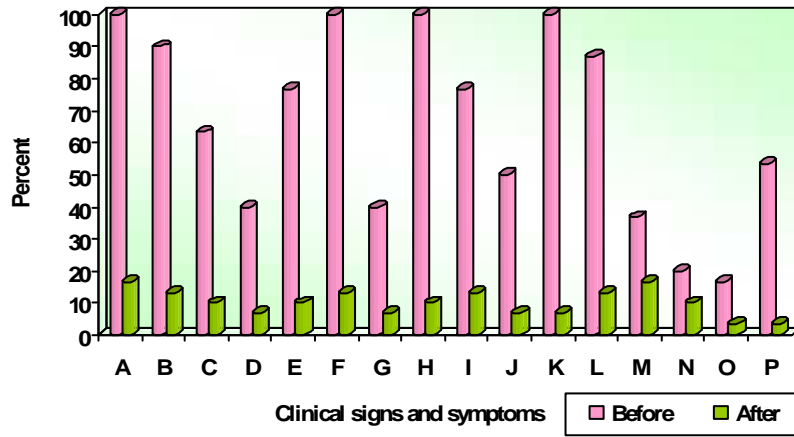
1. Clinical Signs and Symptoms

Studies revealed that most of the tribal population are still suffering from nutritional deficiency diseases. The present study also showed as much as deficiencies and the clinical signs and symptoms of selected tribal anaemic adolescent girls are showcased in Figure 3.

Though the clinical problems of deficient subcutaneous fat, dental caries or vitamin C deficiency of swollen gums and nose bleeding, dry/ or rough skin were observed among all the selected tribal anaemic adolescent girls the intervention programme helped to improve the status among 70-90 per cent. Lack of interest in surrounding, and thin brown hair were reduced to 13.3 per cent after intervention programme as against 87-93 per cent. Vitamin A and B deficiency symptoms like Bitot's spots, red and/or raw/ glazed tongue and angular stomatitis were not noticed among 40-50 per cent after education.



There was no improvement in the case of control group. It is encouraging to realize the importance of nutrition intervention programme for underprivileged groups.



- | | | | |
|-------------------------------|--|-----------------------------------|--------------------------|
| A. Deficient subcutaneous fat | B. Lack of interest in surrounding | C. Red and/ or raw/ Glazed tongue | D. Angular Stomatitis |
| E. Bitot's spots | F. Dental caries | G. Loose teeth | H. Dry/ or rough skin |
| I. Fluorosis | J. Worm infestation (Local skin manifestation, itchy rash) | | K. Vitamin C deficiency |
| L. Thin brown hair | M. Hair with lack of shine and luster | | N. Easily pluckable hair |
| O. Mud colour nails | P. Cracks and redness on the lips | | |

Figure 3: Clinical Signs and Symptoms of Selected Anaemic Tribal Adolescent Girls



2. Haematological Status

a. Haemoglobin level

Impact of intervention programmes on haemoglobin status among selected tribal anaemic adolescent girls shown in Table VI.

Table VI, Impact of Intervention Programmes on Haemoglobin Status among Selected Tribal Adolescent Girls(N: 90)

Haemoglobin status (g/dl)	Mean \pm SD		't' value
	Before	After	
Supplementation and education (n:30)	9.89 \pm 1.19	12.37 \pm 0.46	16.38**
Only education (n:30)	9.69 \pm 1.15	12.6 \pm 0.34	14.46**
Control (n:30)	10.26 \pm 1.03	10.24 \pm 1.04	1.56 ^{NS}

**Significant at 1% level; NS-Not significant

It is clear from the statistical analysis that due to the intervention programmes both supplementation and nutrition education there is an improvement in the haemoglobin status among selected tribal anaemic adolescent girls which is significant at one per cent level.

The mean haemoglobin status among selected tribal anaemic adolescent girls who received nutrition education alone was found to be normal level after nutrition education. The difference in increment was significant at one per cent level.

Thus, this study points out that there is an improvement in the haemoglobin status of adolescents after the administration of iron rich supplement mix as the anaemic adolescent's haemoglobin level was improved from 9.89 \pm 1.19 to 12.37 \pm 0.46g/dl after the iron supplement mix.

3. Health and dietary knowledge, attitude and practices of anaemic adolescent girls

The impact of intervention programmes on health and dietary knowledge, attitude and practice of anaemic adolescent girls is depicted in Table VII and Figure 4.

Table VII, Impact of Supplementation and Education on Mean Score of Knowledge, Attitude and Practice among Selected Tribal Anaemic Adolescent Girls

(n:90)

Details	Experimental Group A (n:30)			Experimental Group B (n:30)			Control (n:30)		
	Mean \pm SD		't' value	Mean \pm SD		't' value	Mean \pm SD		't' value
	Before	After		Before	After		Before	After	
Knowledge	11.97 \pm 1.79	29.07 \pm 2.26	5.67**	11.53 \pm 1.72	33.33 \pm 2.14	40.28**	8.93 \pm 2.53	8.83 \pm 2.49	0.82 ^{NS}
Attitude	11.70 \pm 1.82	21.43 \pm 2.13	31.73**	12.00 \pm 2.17	23.30 \pm 1.95	19.17**	8.60 \pm 2.63	8.83 \pm 2.56	0.92 ^{NS}
Practice	11.87 \pm 1.68	20.53 \pm 1.36	39.13**	10.37 \pm 1.87	21.20 \pm 1.32	25.24**	8.00 \pm 2.89	8.17 \pm 2.59	1.54 ^{NS}

** Significant at 1% level; NS-Not significant

The analysis of data explicit that the iron rich supplementation as well as nutrition education enhanced the nutritional knowledge, attitude and practices. The mean scores for knowledge, attitude and practice after intervention were greater than the initial score. The difference of knowledge, attitude and practice on the nutrition and health aspects were found to be significant at one per cent level among tribal anaemic adolescent girls.

With regard to the impact of nutrition education alone, there is an increment in the nutritional knowledge of tribal adolescent girls. This increment in knowledge is statistically proved that it is significant at one per cent level and with regard to attitude on nutrition among the selected adolescent girls was higher after nutrition education. This difference was significant at one per cent level indicating that the nutrition education had paved the way to increase the nutritional attitude of adolescent girls. Evaluation on nutritional practices among selected tribal anaemic adolescent girls revealed that there is a wide difference in the nutritional practices before and after nutrition and it is significant at one per cent level.

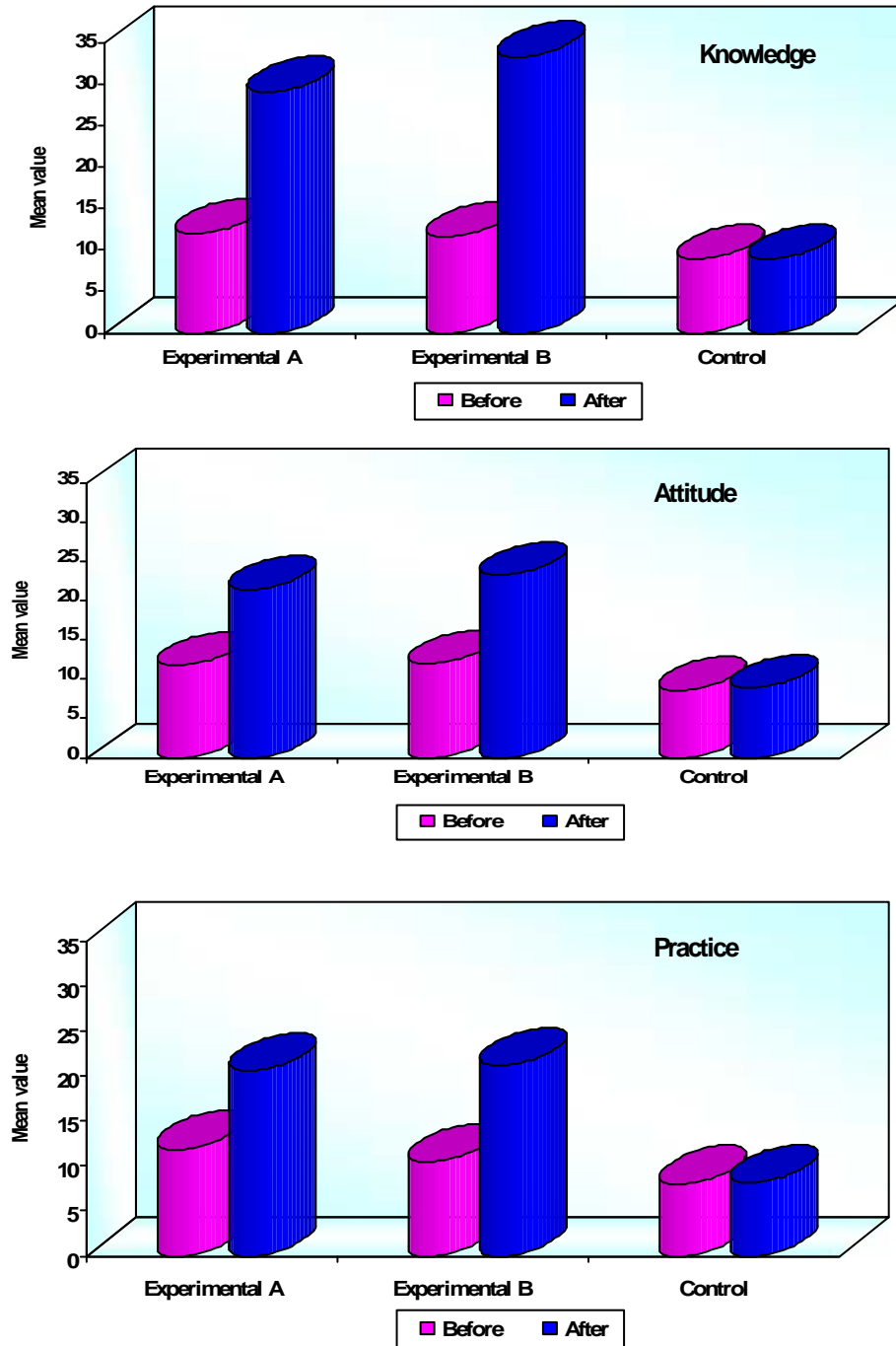


Figure 4: Impact of Supplementation and Education on Mean Score of Knowledge, Attitude and Practice among Selected Tribal Adolescent Girls

In control group there was no significant changes with regard to knowledge, attitude and practice among the selected tribal adolescent girls.

Thus the dietary practices and health status of selected tribal anaemic adolescent girls was improved after health and nutrition education intervention programme and there was a significant improvement in the knowledge, attitude and practices. Haematological picture also showed improvement and is statistically significant.



CONCLUSION

Clinical problems of deficient subcutaneous fat, dental caries, vitamin C deficiency, dry or rough skin among all the selected tribal anaemic adolescents were improved through intervention programmes. Vitamin A and B deficiency symptoms like bitot's spots, red and/or raw/glazed tongue and angular stomatitis were not noticed among 40-50 per cent after education. The intervention programmes helped the adolescent tribes to understand the need for healthy balanced diet to promote health which in turn made them to practice a wise dietary pattern and promoted nutritional contributions. There was an improvement in the haemoglobin status of tribal anaemic adolescent girls after the administration of formulated iron rich supplementary mix. Dietary practices and health status of selected tribal anaemic adolescent girls was improved after health and nutrition education intervention programme. The analysis of data explicit that the iron rich supplementation as well as nutrition education enhanced the nutritional knowledge, attitude and practices. The mean scores for knowledge, attitude and practice after intervention were greater than the initial score. The difference of knowledge, attitude and practice on the nutrition and health aspects were found to be significant at one per cent level among tribal anaemic adolescent girls.

REFERENCES

1. Ader, H.J., 2008, Phases and initial steps in data analysis. In H.J. Ader and G.J. Mellenbergh (Eds.) (with contributions by D.J. Hand), *Advising on Research Methods: A consultant's companion*. Huizen, the Netherlands: Johannes van Kessel Publishing, Pp.333-356.
2. Bamji, M.S., Krishnaswamy, K. and Brahmam, G.N.V., 2009, *Text book of human nutrition*, 3rd edition, Oxford and IBH Publishing Company Pvt. Ltd., New Delhi, Pp.148, 152, 264.
3. Banik, S.D., Bose, K., Bisai, S., Bhattacharya, M., Das, S., Jane, A. and Purkait, P., 2007, Undernutrition among adult Dhimals of Naxalbari, West Bengal; Comparison with other tribes of eastern districts, *Food Nutr. Bull.*, Vol.28, No.3, Pp.348-352.
4. Devaney, B., 2005, *Nutrition Education: A state of the art review: Nutrition Policy Discussion, Paper, 1*, Rome, FAO (ACC/SCN secretariat).
5. Hart, K.H., Herriot, A., Bishop, J.A. and Triby, 2003, Promoting healthy diet and exercise patterns amongst primary school children; a qualitative investigation of parental perspectives. *J.Hum.Nutr.Diet.*, Vol.16, Pp.89-96.
6. Jeejeebhoy, K.N., 2000, *Nutritional assessment*, Nutrition, Vol.16, No.7/8, Pp.586-587.
7. Jolly, L., McCain, M. and Kriss Etherton, P.M., 2008, The evidence for dietary prevention and treatment of cardiovascular disease. *J.Am.Diet.Assoc.*, Vol.108, Pp.287-331.
8. Kenneth, D., 2002, *Clinical laboratory medicine*, 2nd Edition, Pippin Cott, Williams and Wilkits, Philadelphia, P.441.
9. Khan, J.A., 2008, *Research Methodology*, APH Publishing Corporation, New Delhi, P.75.
10. Khanduri, D. and Wolfsdorf, J.I., 2000, Diabetes mellitus in children and adolescents, *Arch Med. RCS*, Vol.36, P.281.
11. Konje, L., Ahouyel, P., Hercberg, S. and Dallon geville, J., 2001, Fruit and vegetables consumption and risk of coronary heart disease: A meta analysis of cohort studies *J.Nutr.*, Vol.136, P.2588.
12. Nagda, B.L., 2004, Tribal population and health in Rajasthan, *Stud. Tribes Tribals*, Udaipur, Vol.2, No.1, Pp.1-8.
13. Srinivasan, K. and Mohanty, S.K., 2004, Deprivation of basic amenities by caste and religion; empirical study using NFHS data, *Economic and Political Weekly*, Pp.728-735.
14. USDA, 2010, *Benefits of standards and standardization*, Co-operation Platform for Research and Standards (COPRAS project), Access by <http://www.answers.com/topic/standardization>.
15. Vyas, S. and Choudhry, M., 2005, Prevalence of anaemia in tribal school children, *Journal of Human Ecology*, Vol.17, Pp.289-291.
16. WHO, 2005, *Micronutrient deficiency, Battling iron deficiency anaemia: the challenge available from* <http://www.who.int/nut/ida.htm>. Accessed on April, 22, 2008.
17. WHO, 2007, *Haemoglobin concentrations for the diagnosis of anaemia and assessment of anaemia and assessment of severity*, Vitamin and Mineral Nutrition Information System.

Websites

- <http://www.ecoindia.com/tribal>.
- <http://www.forests.tn.nic.in/tribaldevelopment/tribaldevelopmenthome.html>.
- <http://www.ecoindia.com/tribal>.
- http://www.who.int/nutrition/publications/micronutrients/guidelines_for_Iron_supplementation.pdf.
- <http://www.businessdictionary.com/definition/product-development.html>.