Effectiveness of long term community based nutrition intervention for prevention and management of anaemia among adolescent girls

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ABSTRACT

High prevalence of iron deficiency anaemia among adolescent girls is a matter of great concern because of double demand of growth and activity. Therefore, the present study was conducted among 200 unmarried adolescent girls(10-18 yrs) with an objective to assess the prevalence of anemia and to improve the dietary behavior and reduce iron deficiency anaemia through nutrition intervention. The effectiveness of nutrition intervention was evaluated through various parameters *viz.* Body Mass Index (BMI), haemoglobin (Hb) level, food frequency and knowledge, attitude and practice (KAP) scores. Nutrition intervention was imparted to the subjects for a period of one year. Consequently, the average Hb level of the subjects increased significantly ($p \leq 0.01$) from 8.55 to 10.66 g/dl. A significant ($p \leq 0.01$) increase in BMI i.e. 17.7 to18.8 Kg/m^2 was also found in the selected subjects. Further, Nutrition education also showed a significant improvement ($p \leq 0.01$) in the food frequency of the entire Hb forming food items as well as KAP scores among adolescent girls.

Key words: Adolescent girls, Body Mass Index, Food frequency, Haemoglobin, Nutrition intervention.

INTRODUCTION

Iron deficiency is the foremost cause of anemia in the world, and continues to be the most prevalent nutritional anemia in developing countries (Obai *et al.,* 2016; Okafor *et al.,* 2017). Two billion people over 30 per cent of the world's population are anaemic. The prevalence of anaemia in India is 55.6 per cent. In Punjab, the situation is on the troublesome front, wherein 80.2 per cent of the children in the age group of 6 month to 3 years, 38.4 per cent young women and 41.6 per cent pregnant women were recorded as suffering from anaemia (NFHS-III, 2007). High prevalence of anemia among adolescent girls is a matter of great concern because of double demand of growth and activity (Sunitha and Gururaj, 2014; Jadhav, 2016).

Diet plays a major role in the promotion of health and well being of an individual (Brown *et al.,* 2015) and nutrition awareness is a key element in promoting sustainable healthy behaviour (Mishra, 2014). Nutrition education, being a practical approach, may serve as one of the important strategies to combat iron deficiency anaemia in adolescent girls, stressing the importance of haemopoitic nutrients and consumption of green leafy vegetables which are excellent source of iron and micronutrients (Sajjan *et al.,* 2011; Percy and Mansour, 2017).Therefore, the present study was planned to assess the prevalence of anemia among adolescent girls (10-18 yrs) and to improve the dietary behavior and reduce iron deficiency anaemia among adolescent girls through nutrition intervention.

MATERIALS AND METHODS

Selection of locale and subjects: A cluster of villages, namely, *Mansoora, Jodhan, Shehzaad, Chhokra, Rattna* and *Dollon Kalan* of *Pakhowal* block of Ludhiana, located at a distance of 15-25 km from the working centre were identified and selected. The information on the number of households and total population was collected.A door-to-door survey was conducted to identify the subjects. A total 200 adolescent girls (10-18 yrs.) were selected from these villages for detailed study and treated as experimental group (Group E). A total 100 adolescent girls were treated as control group(Group C) from Village *Daad* of *pakhowal* block of Ludhiana district. The time period spent to accomplish the present study was two years.

Data collection: A benchmark survey of the selected subjects was conducted to collect information pertaining to their general profile, socio-economic status, anthropometric measurements (height and weight), and clinical history using a pre-tested interview schedule.

Nutrition intervention Development of educational material: Health education material with a holistic approach covering various aspects *viz.* Balanced diet, hygiene and sanitation, importance of green leafy vegetables, anemia-its causes and prevention, dietary guidelines for adolescent girls, iron and vitamin c rich recipes, sprouting- its importance, method and products and fermentation- its importance, method and products, was developed in the form of posters, booklet, folder and recipe book. Nutrition

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intervention was imparted to the subjects for a period of one year.

Interventions

- Deworming tablets were given to the 200 adolescents girls (experimental).
- An extensive extension approach was adopted to disseminate nutrition education through live demonstrations, trainings, workshops and camps.
- A two-day training programme and demonstration on recipes developed from green leafy vegetables was conducted for the Self-Help Groups, and community workers.
- A one-day workshop on management of anaemia through consuming green leafy vegetables was organized for adolescent girls.
- Training camps including lectures on given topics, demonstrations on standardized recipes and exhibitions were organized for young girls and women.
- Two medical camps under the supervision of medical officer of primary health centre were organized.
- To increase availability of iron rich leafy vegetables women and school children were provided with kitchen gardening kits including seeds of fenugreek, spinach, chinese sarson, corainder leaves, radish, carrots and turnip leaves.
- The community garden was developed in high school, *anganwadi* centre of Mansura village. The fruit plants like lemon, amla and guava were also distributed and planted in the school premises.

Effectiveness of nutrition intervention: The following parameters were measured before and after the study to evaluate the effectiveness of nutrition intervention.

Body Mass Index (BMI): BMI was calculated based on the height and weight of the subjects as per the formula (Anonymous, 2005) given below:

$BMI (Kg/m^2) = Weight (kg)/Height (m^2)$

Haemoglobin (Hb): Blood samples were collected with the help of technician and Hb level of all the subjects was measured by the cynomethaglobin method (Dacie and Lewis 1974).

Frequency of food consumption: Information regarding frequency of commonly consumed foods rich in iron and vitamin C for the last one month was collected by administering food frequency questionnaire (FFQ). The pre-testing of 20 adolescent girls for food-frequency questionnaire was done and the modification of the performa was completed accordingly. The frequency of food consumption was quantified by a score system i.e. 10- thrice in a day, 9- twice in a day, 8- daily, 7- thrice in a week, 6-

twice in a week, 5-weekly, 4- thrice in a month, 3- twice in a month, 2- monthly, 1- occasionally and 0- never. The mean frequency was calculated for each food item consumed by each subject.

Knowledge, attitude and practice: Nutrition knowledge of the subjects was assessed by using questionnaire based on knowledge, attitudes and practices (KAP). For evaluating the questionnaire, one score was awarded for each correct and zero for each wrong answer. The gain in knowledge was calculated using the following equation:

Gain in knowledge = score of post-test - score of pre-test
Quantum of improvement = Post test score / Pre test score

Statistical analysis: The data was analyzed statistically using appropriate statistical tools such as mean and percentage. To test the significance, student's t-test was applied using Statistical Package for the Social Sciences (SPSS) version 16.0 on all the parameters.

RESULTS AND DISCUSSION

The data on socio economic profile of adolescent girls revealed that majority of the subjects were in the age group of 13-15 years who were educated upto 10th standard. About one-fourth of the experimental subjects belonged to farming families. Amongst those, half of the experimental families were found to have an empty space in their houses which was used by animal rearing and kitchen gardening (10 %). One previous study conducted in rural Punjab reported that the prevalence of anaemia was considerably higher among children of women with no education, among the scheduled castes and tribes and among children from households in the lower wealth quintiles (Desai and Chaudhry, 1993; Verma *et al.,* 1999; Li *et al.,* 2005 and Nead *et al.,* 2004).

Body Mass Index: The mean BMI was significantly ($p \leq 0.01$) higher among girls of group E, whereas in group C, non-significant result was found among girls (10, 12 and 14 years). The overall mean BMI of subjects increased from 17.7 to 18.8 Kg/m^2 in group E and 17.4 to 18.1 Kg/m^2 in group C after nutrition intervention (Table 1).

According to BMI classification (WHO, 2004), the majority of the subjects in group E were found underweight (< 18.5 kg/m^2) i.e. 67.6 and 50.3 per cent before and after nutrition intervention, respectively. The corresponding figures in the normal category (18.5-24.99 kg/m^2) were 30.3 and 45.4 percent, respectively. The same trend was observed in the subjects of group C i.e. 70.6 and 55.3 percent of the subjects were found underweight followed by 28.3 and 42.3 percent normal before and after nutrition intervention, respectively. The findings of the study were in concordance with previous studies which concluded that the prevalence of anaemia was decreased with an increase in the nutritional status of the subjects (Gawarikar *et al.,* 2002; Sidhu, 2002 and Passi and Malhotra, 2007)

Table-1: Body Mass Index of adolescent girls before and after nutrition counseling

Age (yrs.)	Group E (n=185)			Group C (n=85)		
	Before	After	t-value	Before	After	t-value
10	17.6±0.7	18.3±1.0	1.6[NS]	12.5±2.0	13.6±1.4	1.8 [NS]
11	16.3±0.7	17.8±0.7	4.2*	16.9±0.7	18.1±0.5	3.0*
12	17.3±0.5	18.6±0.5	5.6*	16.4±0.7	17.0±0.6	1.2 [NS]
13	17.8±0.4	18.7±0.4	4.0*	17.8±0.5	18.6±0.6	5.6*
14	18.5±0.6	19.4±0.6	4.8*	18.0±0.6	18.3±0.5	1.2 [NS]
15	17.8±0.5	18.9±0.4	7.7*	18.0±0.9	19.0±0.8	3.3*
16	18.1±0.5	19.1±0.4	4.8*	17.6±0.5	18.2±0.5	3.5*
17	18.0±0.5	19.1±0.5	4.3*	-	-	-
Overall mean	17.7±0.2	18.8±0.2	12.6*	17.4±0.3	18.1±0.3	6.4*

Values are expressed as mean ±SE,*Significant at 1% level of significance, NS-No significant differences

Table-2: Impact of nutrition intervention on mean haemoglobin level of selected adolescent girls

Parameter	Reference value	Before	After	t-value
Group E (n=185)	12@	8.55±0.12	10.66±0.08	23.48*
Group C (n=85)	12@	9.21±0.16	9.85±0.15	5.37*

@ WHO (2001),*Significant at 1% level of significance

Table-3: Impact of nutrition intervention on prevalence of anaemia among selected adolescent girls

Categories of anaemia with haemoglobin level (g/dl)	Group E (n=185)				Group C (n=85)			
	Frequency Before	Percentage After	Frequency Before	Percentage After	Before	After	Before	After
Severe (<7)	42	0	22.7	0	5	2	5.8	2.3
Moderate (7-9.9)	97	53	52.4	28.6	44	41	51.7	48.2
Mild (10-11.9)	39	99	21.1	53.5	33	36	38.8	42.3
Normal (>12)	7	33	3.8	17.8	3	6	3.5	7.0

Table-4: Clinical history of adolescent girls

Clinical history	Group E(N=203)		Group C(n=100)	
Whether monthly periods started?				
	No.	Percentage	No.	Percentage
YES	129	63.5	62	62.0
NO	74	36.5	38	38.0
If yes age at menarche				
10	2	1.0	0	0
11	6	3.0	9	9.0
12	29	14.3	17	17.0
13	51	25.1	18	18.0
14	29	14.3	16	16.0
15	8	4.0	2	2.0
16	2	1.0	0	0
Don't know	2	1.0	0	0
Do you have regular periods				
YES	124	61.1	57	57.0
NO	79	38.9	43	43.0
Did you check your Hb in last 6 months				
YES	13	6.4	4	4.0
NO	190	93.6	96	96.0
If yes, hb value				
<7	0	0	0	0
7-9.9	5	38.5	0	0
10-11.9	7	53.8	2	50.0
>12	0	0	0	0
Don't know	1	7.7	2	50.0
Have you taken deworming tablet during last 6 months				
YES	23	11.3	3	3.0
NO	180	88.7	97	97.0

Table-5: Food frequency of adolescent girls before and after nutrition counseling

Food frequency	Group E (n=185)		Group C (n=85)	
	Before	After	Before	After
Combination of cereal, millet, pulse				
Fermented	0	0	0.16	0.16
Non-fermented	0	1.67	3.45	3.50
Sprouts				
Staples	0	0	0	0
Snacks (in salads)	0	1.54	0.58	0.58
Vegetable, salad, pulses				
Using lemon	0.51	6.37	6.60	3.45
With no lemon	1.59	0	0.58	0.58
Non-veg item				
Eggs	0.67	0.85	1.20	1.20
Fish	0.09	0.09	0	0
Mutton, chicken etc.	0.24	0.27	0.28	0.28
Nuts and dry fruits				
Almond	1.75	1.04	0.97	3.55
Cashew nuts	0.33	0	0.10	0.10
Dates	0.04	2.32	0.97	1.45
Dried figs	0.03	0	0.05	0.05
Garden cress seeds	0	0	0.97	0.97
Gingelly seeds	0.08	3.24	2.28	3.09
Groundnut	0.37	5.69	5.45	4.24
Raisins	0	1.33	1.12	1.12
Walnut	0.22	0.22	0.17	0.17
Green leafy vegetables				
Amaranath	0.14	0	0	0
Bathua leaves	3.17	5.04	4.24	4.87
Bengal gram leaves	0	0.38	0.14	0.14
Cabbage	0.74	4.06	2.30	2.28
Colocasia leaves	0	0.82	0.11	0.11
Coriander leaves	1.17	5.79	4.69	5.45
Drumstick leaves	0	0.06	0.09	0.09
Fenugreek leaves	3.66	5.24	2.81	3.03
Mint	0	1.59	0.30	0.30
Mustard leaves	3.72	4.95	4.52	4.90
Radish leaves	0.09	0.98	0	0
Spinach	1.76	4.95	4.52	4.92
Turnip greens	0	2.01	0.43	0.43
Fruits				
Amla	0.46	3.87	3.50	3.72
Guava	1.38	5.17	4.24	4.72
Lemon	0.08	6.14	2.92	2.92
Orange	0	0.04	0	0
Tamarind	0	3.43	2.30	2.30
Tomato (ripe)	0.93	1.5	1.36	1.58
Zizypus (ber)	0	0.41	0.16	0.16

Biochemical Profile: In the present study, the average Hb levels were 8.55 and 9.21 g/dl in the subjects of group E and C, respectively (Table 2). The corresponding values increased to 10.66 and 9.85 g/dl after nutrition intervention. A highly significant ($p \leq 0.01$) improvement was observed in both the groups, but still the levels were lower than standards (WHO, 2001).This could be due to the nutrition intervention imparted to the subjects. Increase in Hb levels among adolescent girls by health-nutrition education, was also revealed from other studies (Kapur *et al.,* 2003; Laneroll

and Atukorala, 2006; Vir *et al.,* 2008; Kotecha *et al.,* 2009; Patel *et al.,* 2009; Joshi and Gumashta, 2013). As per the classification (Table 3), the majority of the subjects in group E were found in moderate category (52.4 %) followed by severe and mildanaemia (22.7 and 21.7 %, respectively). Whereas, the prevalence of anaemia in the subjects of group C was observed as 51.7 (moderate), 38.8 (mild) and 5.8 (severe) per cent before intervention, respectively. Similar trend was also documented in the previous study (Kaur and Kaur, 2011). In contrast, researchers (Gupta *et al.,* 2011)

Table-6: Gain in KAP scores obtained by the subjects before and after nutrition intervention

Parameters	Group E (n=185)					Group C (n=85)				
	Pre test	Post test	t-value	Gain in scores	Quantum of improvement	Pre test	Post test	t-value	Gain in scores	Quantum of improvement
Knowledge	5.24±2.5	22.1±5.7	27.3*	16.8	4.9	3.8±1.7	4.1±1.8	1.5 NS	0.2	1.1
Attitude	9.2±1.9	19.7±1.4	41.5*	10.5	2.2	9.1±1.9	9.3±1.5	1.5NS	0.2	1.1
Practice	10.0±1.9	13.9±1.6	15.3*	3.9	1.4	11.3±2.0	11.4±1.6	0.9NS	0.1	1.0
Overall Mean	24.4±4.4	55.7±6.9	-	31.3	8.6	24.2±4.2	24.8±3.7	-	1.3	2.3

Values are expressed as mean ±SE, *Significant at 1% level of significance, NS-No significant differences

reported the prevalence of anaemia in young females as 89.5 per cent, which included 49.8 per cent mild, 38.2 per cent moderate and 1.5 per cent severe cases.

Clinical history of adolescent girls: The data of the present study depicted that the most of the subjects i.e. 63.5 and 62.0 percent in group E and C had attained menarche, respectively (Table 4). The onset of the menarche in the most of the cases (25.1 and 18.0 %) was at the age of 13 years in group E and C, respectively. The present study was in line with the findings of the previous studies (Kaur and Kaur, 2011; Jain *et al.,* 2011).The majority of the subjects in group E and C had regular menstrual cycle i.e. 61.1 and 57.0 per cent, respectively. Only 6.4 and 4.0 percent of the subjects in group E and C had undergone Hb level test in the last six months, respectively. It was also observed that 11.3 and 3 percent of the subjects in group E and C had taken deworming tablet during last six months, respectively.

Food frequency: Perusal of the data indicated that nutrition education improved the food frequency scores of the entire Hb forming food items among adolescent girls of group E (Table 5).Similar findings were reported by Biswas *et al.*(1991) in their intervention study involving secondary school students. The present study was also in concordance with earlier studies which reported an increase in consumption of iron rich foods after nutrition intervention (Kaur *et al.,* 2011; Sajjan *et al.,* 2011; Haldar *et al.,* 2012).

KAP scores: A significant (p≤0.01) gain in KAP scores of adolescent girls was observed after the nutrition intervention (Table 6). The quantum of improvement was 4.9 times in Knowledge, 2.2 times in attitude and 1.4 times in practices

and overall improvement was recorded as 8.6 times higher. A highly significant (P≤0.01) improvement in scores in group E might be due to nutrition intervention imparted to the subjects. Likewise, previous studies also revealed a change in health-nutrition behavior among primary school students by health-nutrition education (Haldar *et al.,* 2012; Anderson *et al.,* 2005; Ruzita *et al.,* 2007). Singla *et al.* (2012) also reported an improvement in scores of knowledge, attitudes and practices among adolescent girls of experimental group.

CONCLUSION

The present study concluded that nutrition intervention brought about significant improvement in the haemoglobin level as well as dietary pattern of the adolescent girls. Moreover, all adolescents if given proper guidance and intervention regarding diet, dietary pattern, food choice, cooking practices and lifestyle modifications can result in significant improvements in their knowledge. So, nutrition education is an effective tool in increasing the level of nutrition knowledge as well as nutrient intake.Nutrition Education and supplementation should be a part of education system to improve iron status of adolescents, so that after marriage they can enter a safe pregnancy with no serious mishaps.

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