Effects of Various Interventions to Prevent and Control Anaemia among School Going Adolescent Girls of Bareilly District

Tanwar H[1]; Mathur RN[2]; Mathur M[3]

[1]*Geetanjali Medical Collage, Udaipur, India.*

[2]*Department of Community Medicine, National Institute of Medical Sciences and Research, India.*

[3]*Senior Medical Office, CHC Shahpura, India.*

*Corresponding Author(s): Roopali Nath Mathur

Assistant Professor, Department of Community Medicine, National Institute of Medical Sciences and Research, Jaipur, Rajasthan 303 121, India.

Email: roopalinath@yahoo.co.in

Abstract

Introduction: Adolescent is defined by WHO as a person between 10-19 years of age. Anemia in India primarily occurs due to iron deficiency and is the most widespread nutritional deficiency disorders in the country today. Adolescent girls in particular are more vulnerable to anemia due to rapid growth of the body and loss of blood during menstruation.

Objective: To know the prevalence of anemia in school going adolescent girls and to compare the improvement in Hemoglobin status after Iron Folic Acid, Iron Folic Acid+Albendazole, only Albendazole and only Vitamin-C supplementation.

Methodology: The study was conducted in urban and rural areas of Bareilly among school going adolescent girls during the period of October 2015 to September 2016. Selection of study participants was done via multi stage sampling.

Results & Conclusion: It has been observed by Post-Hoc analysis that among all the interventional groups Iron folic acid with Albendazole supplementation is most effective for control of anemia among all the other groups followed by Iron folic acid supplementation and the least effective was Health Education for the control of anaemia in urban area where as Vitamin-C supplementation was found more effective then Iron Folic Acid supplementation in rural area of Bareilly.

Introduction

The word adolescence is derived from the Latin word, 'adolescere'; meaning, "to grow, to mature". Adolescent is defined by WHO as a person between 10-19 years of age [1]. The world is home to 1.2 billion individuals [2] aged 10-19 years and India has the largest national population of adolescents (243 million), followed by China (207 million), United States (44 million), Indonesia and Pakistan (both 41 million) [3]. The world's adolescent population is facing a series of serious nutritional challenges which are not only affecting their growth and development but also their livelihood as adults. Yet, adolescents remain a largely neglected, difficult- to- measure and hard-to-reach population, in which the needs of adolescent girls in particular, are often ignored [4]. Anaemia in India primarily occurs due to iron deficiency and is the most widespread nutritional deficiency disorders in the country today. According to NFHS-III, data over 55 percent of both adolescent boys and girls are anaemic. Adolescent girls in particular are more vulnerable to anaemia due to rapid growth of the body and loss of blood during menstruation. According to NFHS-III almost 53.9% of adolescent girls aged 15-19 years suffer from some form of anaemia. More than 39% adolescent girls (15-19 years) are mildly anaemic while 15% and 2% suffer from moderate and severe anaemia respectively [5].

Objective: To compare the improvement in Haemoglobin status after Iron Folic Acid, Iron Folic Acid+Albendazole, only Albendazole and only Vitamin-C supplementation.

Materials and methods

The present interventional study was conducted in urban and rural areas of Bareilly among school going adolescent girls during the period of October 2015 to September 2016. All the school going adolescent girls aged 10-19 years were included in the study after taking written informed consent from their parents and school principals. All the school going adolescent girls whose parents were not willing to give consent, who didn't wanted to participate in the study and all those who were likely to transfer during the study period were not included in the study. A total of 400 adolescent girls were included in the study by taking 53% as prevalence of anaemia according to NFHS-3 data and 10% of dropout rate. Selection of study participants was done via multi stage sampling that was applied in urban and rural areas of Bareilly. 10% of 70 wards in urban areas i.e. 7 wards and 10% of 15 blocks in rural area i.e. 2 were selected by lottery method. In each selected ward of urban area all the schools were listed. 10% of schools in each ward were selected which came out as round off 1 school in each ward i.e. total 7 schools were selected. In rural blocks, 10% of schools from each block was selected randomly which came out as 1 school from each block were selected randomly for the study. Selec-

tion of classes, sections and adolescents were again randomly selected till the required sample size was attained. Selected adolescents in urban and rural areas were divided into 5 groups (A,B,C,D and E) with 40 students in each group. Group-A served as a group in which health education regarding diet i.e. intake of green leafy vegetables, intake of jaggery, fruits and personal hygiene was given, Group-B was the group in which Iron and Folic Acid supplementation was done, Group-C was the group in which Iron Folic Acid and Albendazole supplementation was done, Group-D was the group in which only Albendazole supplementation was done and Group-E was the group in which only vitamin-C supplementation was done. Schedule was prepared before undertaking the study. Both Open and Close-ended, pretested semi-structured interview schedule which was pretested by carrying out pilot study with a sample of 40 subjects (10% of total sample size) was done to check the feasibility of the study. Those 40 subjects were not included in the study. Data was collected after taking clearance from the institutional ethical committee. The students who failed to bring the signed consent forms for the consecutive three days or whose parents didn't gave consent for their children to participate in the study were excluded from the study. For assessment of haemoglobin level, two blood samples were taken from the study participant's one at the start of the study i.e. Baseline sample and other at the end of intervention. Two millilitres of blood was collected in vacuum tubes containing Ethylene Diamine Tetra Acetic Acid (EDTA) and was used for estimating haemoglobin. The tube used was Vacolect having vacuum inside to facilitate drawing of the blood sample. Participant was allowed to leave the place after five minutes if she did not report any problems such as pain, blood oozing or giddiness. The blood tubes were stored in the vaccine carrier and brought to the Central Laboratory of the Rohilkhand Medical College and Hospital, Bareilly, for analysis. Analysis of Haemoglobin was done by cynaemeth haemoglobin method.

Cut off limits for Anaemia [6]:

	Normal Haemoglobin Level(gm/dl)
Non-pregnant Women	≥12
Pregnant Women	≥11
Men	≥13

Anaemia was classified as [6]:

Anaemia Severity	Haemoglobin Level(g/dl)
Mild	10.0-10.9
Moderate	7.0-9.9
Severe	4-6.9
Very Severe	<4.0

Observations and Results

Table 1: Mean of pre and post intervention hemoglobin within different interventional groups.

Interventional Groups		Pre interventional Haemoglobin	Post interventional Haemoglobin	Mean Difference
Health Education	Mean	9.917	9.716	-0.201
	N	80	80	
	Std. Deviation	2.2901	2.3205	
IFA	Mean	10.016	11.354	1.338
	N	80	80	
	Std. Deviation	2.3655	2.2191	

IFA+alb	Mean	9.981	12.136		2.155
	N	80	80		
	Std. Deviation	2.0170	2.0103		
Albendazole	Mean	10.000	10.585		0.585
	N	80	80		
	Std. Deviation	1.5148	1.5775		
Vitamin C	Mean	10.570	11.490		0.92
	N	80	80		
	Std. Deviation	1.2269	1.2846		

Table 1 The mean of pre and post interventional hemoglobin within different interventional groups and it has been found that among all the interventions iron folic acid with albendazole is the most effective intervention for the control of anaemia with mean difference of 2.155 followed by iron folic acid supplementation with mean difference of 1.338, Vitamin-C with mean difference of 0.92, Albendazole with mean difference of 0.585. It has been observed that Health education is ineffective intervention because of decrease in post-interventional hemoglobin level as compare to pre-interventional hemoglobin with mean difference of -0.201.

Table 2: Comparison of pre and post interventional means of hemoglobin levels.

	Mean	N	Std. Deviation	Std. Error Mean	t-value	Sig. (2-tailed)
Hemoglobin pre-intervention	10.097	400	1.9394	0.0970	-61.950	0.0001
Hemoglobin post-intervention	11.056	400	2.0868	0.1043	-70.351	0.0001

Table 2 The statistical comparison between the means of pre and post hemoglobin levels among the 400 adolescent girls by paired t-test and it shows highly statistically significant difference between both the means.

Table 3: Multiple intergroup comparison of post-interventional Hemoglobin.

Interventional groups			Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	Health Education.	IFA	-1.53875*	0.05928	<0.001	-1.6553	-1.4222
		IFA+Alb.	-2.35625*	0.05928	<0.001	-2.4728	-2.2397
		Alb.	-0.78625*	0.05928	<0.001	-0.9028	-0.6697
		Vit.C	-1.12125*	0.05928	<0.001	-1.2378	-1.0047
	IFA (Iron Folic Acid)	Health Education.	1.53875*	0.05928	<0.001	1.4222	1.6553
		IFA+Alb.	-0.81750*	0.05928	<0.001	-0.9340	-0.7010
		Alb.	0.75250*	0.05928	<0.001	0.6360	0.8690
		Vit.C	0.41750*	0.05928	<0.001	0.3010	0.5340
	IFA+Alb. (Iron Folic Acid+ Albendazole)	Health Education.	2.35625*	0.05928	<0.001	2.2397	2.4728
		IFA	0.81750*	0.05928	<0.001	0.7010	0.9340
		Alb.	1.57000*	0.05928	<0.001	1.4535	1.6865
		Vit.C	1.23500*	0.05928	<0.001	1.1185	1.3515
	Alb. (Albendaz-ole)	Health Education	0.78625*	0.05928	<0.001	0.6697	0.9028
		IFA	-0.75250*	0.05928	<0.001	-0.8690	-0.6360
		IFA+Alb.	-1.57000*	0.05928	<0.001	-1.6865	-1.4535
		Vit.C	-0.33500*	0.05928	<0.001	-0.4515	-0.2185

	Health Education.	1.12125*	0.05928	<0.001	1.0047	1.2378
Vitamin-C	IFA	-0.41750*	0.05928	<0.001	-0.5340	-0.3010
	IFA+Alb.	-1.23500*	0.05928	<0.001	-1.3515	-1.1185
	Alb.	0.33500*	0.05928	<0.001	0.2185	0.4515

Table 3 The comparison of means of all the study participants in different interventional groups i.e. Health education group, Iron folic acid supplementation group, Iron folic acid with Albendazole supplementation group, Albendazole supplementation group and Vitamin-C supplementation group by Post-Hoc ANOVA and the observation states that the maximum mean difference is present between the Iron folic acid with Albendazole supplementation and Health Education group, which is of 2.35625 followed by Iron folic acid supplementation and Health education group, which is of 1.53875, Vitamin-C supplementation and Health education group which is of 1.12125 and Albendazole supplementation and Health education group, which is of 0.78625. It has been observed that among all the interventional groups Iron folic acid with Albendazole supplementation is most effective for control anemia among all the other groups followed by Iron folic acid supplementation and the least effective was only Health Education intervention for the control of anemia.

Table 4: Multiple inter group comparison of post interventional hemoglobin in Urban area of Bareilly.

Interventional groups		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Health Education	IFA	-1.095*	0.364	0.003	-1.81	-0.38
	IFA+Alb.	-2.162*	0.364	<0.001	-2.88	-1.44
	Alb.	0.137	0.364	0.706	-0.58	0.86
	Vit.C	-0.960*	0.364	0.009	-1.68	-0.24
IFA	Health Education	1.095*	0.364	0.003	0.38	1.81
	IFA+Alb.	-1.067*	0.364	0.004	-1.79	-0.35
	Alb.	1.233*	0.364	0.001	0.51	1.95
	Vit.C	0.135	0.364	0.711	-0.58	0.85
IFA+Alb.	Health Education	2.162*	0.364	<0.001	1.44	2.88
	IFA	1.067*	0.364	0.004	0.35	1.79
	Alb.	2.300*	0.364	<0.001	1.58	3.02
	Vit.C	1.202*	0.364	<0.001	0.48	1.92
Alb.	Health Education	-0.137	0.364	0.706	-0.86	0.58
	IFA	-1.233*	0.364	0.001	-1.95	-0.51
	IFA+Alb.	-2.300*	0.364	<0.001	-3.02	-1.58
	Vit.C	-1.097*	0.364	0.003	-1.82	-0.38
Vit.C	Health Education	0.960*	0.364	0.009	0.24	1.68
	IFA	-.135	.364	.711	-.85	.58
	IFA+Alb.	-1.202*	.364	.001	-1.92	-.48
	Alb.	1.097*	.364	.003	.38	1.82

*The mean difference is significant at the 0.05 level.

Table 4 shows the comparison of means of all the study participants in different interventional groups i.e. Health education group, Iron folic acid supplementation group, Iron folic acid with Albendazole supplementation group, Albendazole supplementation group and Vitamin-C supplementation group by POST-HOC ANOVA among the 200 urban participants and the observation states that the maximum mean difference is present between the Iron folic acid with Albendazole supplementation and Health education group which is of 2.162 followed by Iron folic acid supplementation and Health education group which is of 1.095, Vitamin-C supplementation and Health education group which is of 0.960 and Albendazole supplementation and Health education group which is of 0.137. It has been observed that among all the interventional groups Iron folic acid with Albendazole supplementation is most effective for control of anemia among all the other groups followed by Iron folic acid supplementation and the least effective was Health Education for the control of anaemia in urban area of Bareilly.

Table 5: Multiple inter group comparison of post interventional hemoglobin in rural area of Bareilly.

Interventional groups		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Health Education	IFA	-2.18000*	.46900	<0.001	-3.1050	-1.2550
	IFA+Alb.	-2.67750*	.46900	<0.001	-3.6025	-1.7525
	Alb.	-1.87500*	.46900	<0.001	-2.8000	-.9500
	Vit.C	-2.58750*	.46900	<0.001	-3.5125	-1.6625
IFA	Health Education	2.18000*	.46900	<0.001	1.2550	3.1050
	IFA+Alb.	-.49750	.46900	.290	-1.4225	.4275
	Alb.	.30500	.46900	.516	-.6200	1.2300
	Vit.C	-.40750	.46900	.386	-1.3325	.5175
IFA+Alb.	Health Education	2.67750*	.46900	<0.001	1.7525	3.6025
	IFA	.49750	.46900	.290	-.4275	1.4225
	Alb.	.80250	.46900	.089	-.1225	1.7275
	Vit.C	.09000	.46900	.848	-.8350	1.0150
Alb.	Health Education	1.87500*	.46900	<0.001	.9500	2.8000
	IFA	-.30500	.46900	.516	-1.2300	.6200
	IFA+Alb.	-.80250	.46900	.089	-1.7275	.1225
	Vit.C	-.71250	.46900	.130	-1.6375	.2125
Vit.C	Health Education	2.58750*	.46900	<0.001	1.6625	3.5125
	IFA	.40750	.46900	.386	-.5175	1.3325
	IFA+Alb.	-.09000	.46900	.848	-1.0150	.8350
	Alb.	.71250	.46900	.130	-.2125	1.6375

*The mean difference is significant at the 0.05 level.

Table 5 shows the comparison of means of all the study participants in different interventional groups i.e. Health education group, Iron folic acid supplementation group, Iron folic acid with Albendazole supplementation group, Albendazole supplementation group and Vitamin-C supplementation group among the 200 adolescent girls belonging to rural area and the observation states that the maximum mean difference is present between the Iron folic acid with Albendazole supplementation and Health education group which is of 2.67750 followed by Vitamin-C supplementation and Health education group which is of 2.58750, Iron folic acid supplementation and Health education group which is of 2.18000 and Albendazole supplementation and Health education group which is of 1.875. It has been observed that among all the interventional groups Iron folic acid with Albendazole supplementation is most effective for control of anemia among all the other groups followed by Iron folic acid supplementation and the least effective was only Albendazole supplementation for the control of anemia in rural area of Bareilly.

Discussion

Anaemia prevalence of more than 40% has been defined as a problem of severe public health significance by WHO for epidemiological mapping. In the present study a very highly significant increase between pre and post interventional hemoglobin has been observed (0.5250) in Iron folic acid with albendazole supplemented group followed by Only Iron folic acid supplemented, Vitamin C supplemented and only albendazole supplemented group. A similar significant changes were also observed by Rachna Bhoite et al., [7] (2011) in Vadodara who reported a significant increase in the iron folic acid with deworming group. The increase in mean hemoglobin between the iron folic acid and micro nutrients supplemented which also includes vitamin c group was not significant in the study conducted by Sitti Patimah et al., [8] (2013) in Indonesia which is contrary to the present study as the result is statistically significant. The present study is also contradictory to the study conducted in Bangladeshi girls by Khan M.A. et al., [9] (2004) in which micronutrients supplementation for six months were done and it resulted in a non-significant rise in the pre and post interventional hemoglobin. Ahmed et al., [10] (2005) in Bangladesh also showed the increase in mean hemoglobin after IFA supplementation 2 times a week in week 26 of intervention. The results from the study conducted by Mohan Joshi et al., [11] (2013) in adolescent girls selected from urban slum population of metropolitan city of Nagpur reported the mean rise of hemoglobin in daily and weekly IFA supplementation group is 1.04±0.7 gm/dl with in span of 3 months, which is similar to the present study.

References

1. World Health organization. Adolescent Health and Development. 2015.

2. United Nations, Department of economic and social affairs, population division, world population prospects: The 2008 revision. 2012.

3. The state of the world's children 2011-Adolescence an age of opportunity. UNICEF .Available from www.unicef.org. 2015.

4. Operational framework, Weekly iron & Folic Acid Supplementation Program for Adolescents-MOHFW. Available from www.mohfw.org. 2015.

5. Frith-Terhune AL, Cogswell ME, Khan LK, Will JC, Ramakrishnan U. Am J Clin Nutr. 2000; 72: 963-968.

6. Historical review. Iron deficiency anaemia. British journal of haematology. 2003; 122: 554-562.

7. Bhoite R, Iyer U. Effect of deworming vs iron folic acid supplementation plus deworming on growth, Hemoglobin level and physical work capacity of school children. Indian Pediatrics. 2012; 49: 659-661.

8. Patimah S, Hadju V, Taha AR. the efficacy of multiple micronutrient supplementation on improvement of hemoglobin and serum feritin level in adolescent girls with anaemia. International Journal of Scientific and Research Publications, 2014; 4: 1-8.

9. Khan MA, Farhana Haseen F, Jalal C SB, Rahman M, Akter S, et al. Effects of a Multiple Micronutrient Beverage Supplement on Haematologic, Iron, Vitamin-A and Growth Status and Cognitive Development and School Performance among Adolescent Girls in Bangladesh. BRAC. Research and Evaluation Division 75 Mohakhali, Dhaka-1212. 2014.

10. Ahmed F, Khan MR, Akhtaruzzaman M, Karim R, Marks GC, et al. Efficacy of twice-weekly multiple micronutrient supplementation for improving the hemoglobin and micronutrient status of anemic adolescent schoolgirls in Bangladesh. Am J Clin Nutr. 2005; 82: 829-835.

11. Joshi M, Gumashta R. Weekly iron folate supplementation in adolescent girls-An effective nutritional measure for the management of iron deficiency anaemia. Global Journal of health sciences. 2013; 5:188-194.