

## ORIGINAL ARTICLE

# Impact of an Intervention Package for Preventing Anemia Among Adolescent Girls in Selected High Schools of Bangalore District

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## Abstract

**Background:** Anemia is the deficiency of red blood cells or hemoglobin leading to reduced oxygen transport in the body. It is a significant public health concern, particularly among adolescent girls, due to their increased iron needs during menstruation, periods of growth and pregnancy.

**Objective:** The study was conducted to assess the levels of knowledge among adolescent girls regarding the prevention of anemia in selected high schools in Bengaluru district.

**Methods:** A quasi experimental approach with pretest - posttest design was adopted. Forty adolescent girls were selected through convenient sampling method using non-probability sampling approach.

**Result:** During the initial assessment, in the experimental group, 13 (65%) adolescent girls had inadequate knowledge, while remaining 7 (35%) had moderate knowledge. In the control group, 16 (80%) adolescent girls had inadequate knowledge and 4 (20%) had moderate knowledge. In the experimental group, the pretest mean knowledge score regarding anemia prevention was 11.1 (30.8%), while the posttest mean score was 14.38 (58%), resulting in an improvement with an average enhancement score of 10.2 (28.3%). The study found a significant enhancement in the post-intervention knowledge levels regarding prevention of anemia among adolescent girls in the experimental group, at a 5% level of significance.

**Conclusion:** The results of the study indicate that the intervention was effective in bringing about improvement in knowledge of anemia of the participants in the experimental group. A significant enhancement in knowledge was noticed in the intervention group compared to the control group, highlighting the efficacy of a holistic approach to anemia prevention.

**Keywords:** Adolescent, Anemia, Socioeconomic status, Prevention

## Introduction

Anemia is defined as the lack of red blood cells or hemoglobin, leading to fatigue and weakness. Prevention of anemia involves addressing the underlying causes, which can include, nutritional deficiencies, chronic illnesses or genetic conditions.<sup>1</sup>

Anemia is a significant global public health issue that has an impact on social, economic, and health development worldwide. Although it can affect anyone at any point of life, teenage girls are more likely to experience it. Anemia among adolescent girls can be attributed to the increased nutritional requirements, physical growth, reproductive maturation, and cognitive changes, occurring during this stage of life. It is considered that with increasing age, females are more prone to anemia than males.<sup>2</sup>

Anemia is a frequent health issue among adolescents, affecting their growth, development, and overall well-being. During adolescence, the body undergoes maturation, leading to increased nutritional needs. Anemia in this age group often occurs due to nutritional deficiencies, particularly iron. However, it can also be influenced by other factors such as menstrual blood loss in females or dietary habits.<sup>3</sup>

Globally, anemia is considered one of the major health concerns among adolescent girls, due to the increased iron requirements during growth and the onset of menstrual cycle. In India, for instance, about 50% of adolescent girls are reported to suffer from iron deficiency anemia. Anemia among adolescent girls can lead to fatigue, weakness, reduced cognitive skills and physical activity. This impacts their academic performance and physical growth.<sup>4,5</sup>

Rebar M *et al.*, studied the awareness and practice regarding iron deficiency anemia and its prevention among adolescent girls. The cross-sectional research study was undertaken among 237 girls who were school going adolescents. The subjects were selected using non-probability consecutive sampling technique. This study results revealed that 11% of subjects had good awareness, while 17% had poor awareness. About three percent of the subjects had good practice while 13% had poor practice pertaining to iron deficiency anaemia and its prevention. Based on this study observations, it was concluded that the samples were less aware, with poor practices regarding iron deficiency anemia and its prevention. They opined that interventional measures can help improve their practice and awareness.<sup>6</sup>

## Objectives

1. To evaluate the pre-intervention knowledge levels of adolescent girls regarding the prevention of anemia in both experimental and control groups.
2. To evaluate the impact of intervention package on the degree of knowledge of the adolescent girls in both experimental and control groups regarding the prevention of anaemia.
3. To determine the association of pre-intervention knowledge scores and specific demographic characteristics of adolescent girls in both experimental and control groups.

## Hypothesis

H1: There is a significant enhancement in the post intervention knowledge levels of adolescent girls included in the experimental group.

H2: There is a significant association between pre-intervention knowledge levels and the selected demographic variables of adolescent girls in both experimental and control groups.

## Research Methodology

*Research approach:* Quantitative.

*Research design:* Quasi experimental with pretest - posttest design.

*Dependent variables:* Level of knowledge on prevention of anemia and hemoglobin levels in adolescent girls.

*Independent variables:* Intervention package on prevention of anemia.

*Socio demographic variables:* Age, religion, type of family, educational status, occupation of the father, family income, dietary pattern, source of health information, age at menarche, number of days of menstrual flow.

*Settings:* The study was conducted at selected high schools in rural areas of Bangalore district.

*Sample size:* Based on previous studies and meta-analyses, researchers estimated a minimum sample size of 40.

*Population:* The population consisted of adolescent girls studying at rural high schools.

## Sampling Criteria

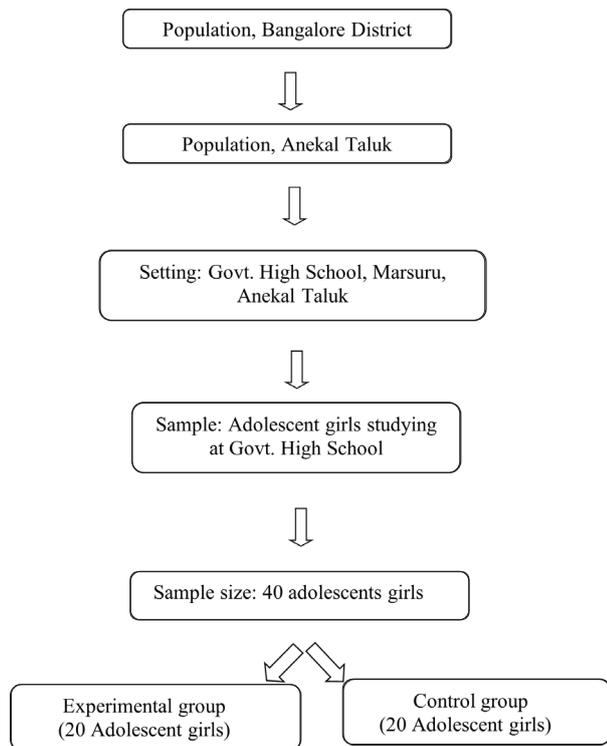
### *Inclusion criteria*

The study included adolescent girls aged 12–16 years who were mildly to moderately anemic, available at the

time of data collection, and willing to participate in the research.

### Exclusion criteria

The study excluded adolescent girls suffering from any systemic disease, those with dysmenorrhea or other menstrual issues, those previously exposed to similar intervention packages, severely anemic individuals, and those undergoing treatment for anemia.



**Figure 1:** Schematic representation of random sampling technique employed

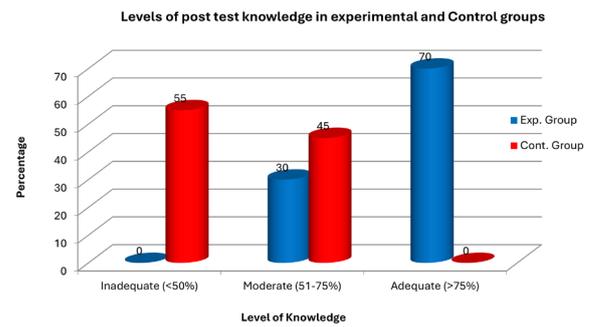
## Results

**Table 1:** Percentage and frequency distribution of adolescent girls according to the levels of pretest knowledge in experimental and control groups (N=40)

Levels of Knowledge	Experimental group		Control group	
	N = 20	%	N = 20	%
Inadequate (<50%)	13	65	16	80
Moderate (51-75%)	7	35	4	20
Adequate (>75%)	0	0	0	0

Table 1 shows that in the experimental group, at the initial assessment, 13 (65%) adolescent girls had inadequate knowledge while the rest of them 7 (35%) had moderate knowledge. In the control group, at the initial assessment, 16 (80%) adolescent girls had inadequate knowledge and the remaining 4 (20%) had moderate knowledge.

Figure 2 demonstrate the percentage and frequency distribution of adolescent girls according to the levels of posttest knowledge in experimental and control groups



**Figure 2:** Post-test knowledge levels in experimental and control groups

Table 2 and 3 depicts the mean, SD and improvement in knowledge scores regarding anemia prevention among adolescent girls. In the experimental group, the mean pretest score was 11.1 (30.8%), the mean posttest score was 4.38 (58%), and the enhancement average score was 10.2 (28.3%).

### Testing of Hypothesis

In order to evaluate the knowledge levels of the sample, the following research hypothesis was formulated.

#### Research hypothesis-1

$H_1$ : There is a significant enhancement in the post intervention knowledge levels of adolescent girls in the experimental group.

#### Null hypothesis-1

$H_{01}$ : There is no significant enhancement in the post intervention knowledge levels of adolescent girls in the experimental group.

Table 2 shows that the stated objective was achieved and the formulated hypothesis ( $H_1$ ) has been accepted. Hence, the study found a significant enhancement at 5% level in the post intervention knowledge levels of adolescent girls in the experimental group regarding anemia prevention.

Table 3 reveals the mean, SD and improvement in knowledge scores regarding the prevention of anemia among adolescent girls. With regard to pre-test and post-test knowledge scores of adolescent girls regarding anemia prevention in the control group, the average score in pre-test was 9.6 (26.6%), post-test was 7.9 (21.9), and the enhancement score was 1.55 (4.30%), with  $P>0.05$ .

Thus, the knowledge scores of adolescent girls before and after the test on prevention of anemia did not change significantly in the control group.

**Table 2:** Mean, SD, and mean percentage of pretest, posttest and enhancement scores and statistical significance in the experimental group (N=40)

S/N	Domain	Pre test				Post test			Enhancement			Paired t value	P value
		Max. score	Mean	SD	Mean %	Mean	SD	Mean %	Mean	SD	Mean %		
1.	General Information on anemia	9	2.6	2.11	28.8	5.6	1.5	62.2	3.0	2.37	33.3	5.65	<0.05
2.	Causes & risk factors	4	1.2	1.01	30	2.8	0.8	70	1.5	1.23	37.5	5.45	<0.05
3.	Signs and Symptoms	4	1.2	1.10	30	2.2	1.2	55	1.0	1.9	25	2.35	<0.05
4.	Diagnostic Evaluation	2	0.9	1.05	45	1.3	0.5	65	0.4	1.3	20	1.37	<0.05
5.	Management of anemia	6	2.2	1.47	36.6	3.4	1.4	56.6	1.2	2.0	20	2.68	<0.05
6.	Prevention of anemia	11	2.7	2.34	24.5	5.8	1.5	24.5	3.0	2.62	27.2	5.11	<0.05
	Overall	36	11.1	7.91	30.8	21.2	4.38	58.8	10.2	9.1	28.3	5.01	<0.05

\* Significant at 5% level for 19 df (i.e.  $P < 0.05$ )**Table 3:** Mean, SD, and mean percentage of pretest, posttest and enhancement scores and statistical significance in the control group (N=40)

S/N	Domain	Pre test				Post test			Enhancement			Paired t value	P value
		Max. score	Mean	SD	Mean %	Mean	SD	Mean %	Mean	SD	Mean %		
1.	General Information on anemia	9	1.9	1.84	21.1	1.95	1.8	21.6	0.75	2.4	8.3	1.39	<0.05
2.	Causes & risk factors	4	1.1	1.03	27.5	1.15	0.9	28.7	0.4	1.5	10.0	1.19	<0.05
3.	Signs and Symptoms	4	1.2	1.32	30	0.8	1.05	20	0.25	1.8	30.0	0.6	<0.05
4.	Diagnostic Evaluation	2	1.6	1.56	80	0.2	0.44	10	0.45	1.11	80.0	1.8	<0.05
5.	Management of anemia	6	1.4	1.09	23.3	1.9	1.29	31.6	0.15	1.27	23.3	0.52	<0.05
6.	Prevention of anemia	11	2.2	1.47	20	1.8	2.3	16.3	1.2	1.7	20.0	3.1	<0.05
	Overall	36	9.6	6.19	26.6	7.9	6.7	21.9	1.55	1.94	4.30	2.01	<0.05

\*Non-significant at 5% level for 19 df (i.e.  $P > 0.05$ )**Table 4:** Association between the pretest knowledge scores and specific demographic characteristics of the subjects in the experimental group (N=40)

Sl. No	Demographical variables	Sample (N)		Knowledge levels of respondents				$(\chi^2)$ - value
		N	%	$\leq$ Median		$\geq$ Median		
1.	<b>Age (in years)</b>							5.04 df=2, S
	12 years	0	0	0	0	0	0	
	13 years	0	0	0	0	0	0	
	14 years	7	35	4	33.3	3	37.5	
	15 years	5	25	5	41.6	0	0	
	16 years	8	40	3	25	5	62.5	
2.	<b>Dietary pattern</b>							2.96, df=1, S
	Vegetarian	7	35	6	50	1	12.5	
	Non-vegetarian	0	0	0	0	0	0	
	Mixed	13	75	6	50	7	87.5	

3.	<b>Type of family</b>							2.68, df=1, S
	Single parent	02	10	2	16.6	0	0	
	Nuclear family	07	35	5	41.6	2	25	
	Joint family	11	55	5	41.6	6	75	
	Extended family	0	0	0	0	0	0	
4.	<b>Religion</b>							0.07, df=1, NS
	Hindu	19	100	11	91.6	8	100	
	Muslim	1	0	1	8.4	0	0	
	Christian	0	0	0	0	0	0	
	Others	0	0	0	0	0	0	
5.	<b>Fathers' educational level</b>							2.40, df=4, S
	Non-formal education	3	15	1	8.4	2	25	
	Primary education	9	45	5	41.6	4	50	
	Secondary education	1	5	1	8.4	0	0	
	10 +2 [PUC]	6	30	4	33.3	2	25	
	Graduation	1	0	1	8.4	0	0	
6.	<b>Mothers' educational level</b>							2.58, df=4, S
	Non-formal education	3	15	2	16.6	1	12.5	
	Primary education	4	20	3	25	1	12.5	
	Secondary education	3	15	1	8.4	2	25	
	10 +2 [PUC]	7	35	5	41.6	2	25	
	Graduation	3	15	1	8.4	2	25	
7.	<b>Occupation of the father</b>							1.,6 df=2, NS
	Farmer	8	40	6	50	2	25	
	Government	0	0	0	0	0	0	
	Private	5	25	2	16.6	3	37.5	
	Self-employed	7	35	4	33.3	3	37.5	
8.	<b>Occupation of the mother</b>							3.06, df=2, S
	Farmer /House wife	13	65	6	50	7	87.5	
	Government	0	0	0	0	0	0	
	Private	1	5	1	8.4	0	0	
	Self-employed	6	30	5	41.6	1	12.5	
9.	<b>Monthly family income</b>							1.13, df=2, NS
	Below 10000	5	25	4	33.3	1	12.5	
	10001 -20000	13	65	7	58.3	5	62.5	
	20001-30000	2	10	1	8.4	1	12.5	
	Above 30000	0	0	0	0	0	0	
10.	<b>Size of the family</b>							0.77, df=3, NS
	2-3 members	4	20	3	25	1	12.5	
	4-5 members	11	55	6	50	5	62.5	
	5-6 members	3	15	2	16.6	1	12.5	
	7 & above	2	10	1	8.4	1	12.5	

		<b>Attained menarche at</b>						
11.	10-11 years	3	15	2	16.6	1	12.5	8.03 df=3, S
	12-13 years	7	35	6	50	1	12.5	
	14-15 years	6	30	4	33.3	2	25	
	16 years and above	4	20	0	0	4	50	
		<b>Regular menstrual cycle</b>						
12.	20 days	0	0	0	0	0	0	1.48, df=1, S
	28 days	18	90	10	83.3	8	100	
	40 days	2	10	2	16.6	0	0	
	60 days	0	0	0	0	0	0	
		<b>Days of menstrual flow</b>						
13.	≤ 2 days	0	0	0	0	0	0	2.33, df=3, NS
	3-5 days	18	90	11	91.6	7	87.5	
	5-7 days	2	10	1	8.4	1	12.5	
	Above 7 days	0	0	0	0	0	0	
		<b>Source of health information</b>						
14.	Print media/Newspaper/Books	1	5	0	0	1	12.5	1.23, df=3, NS
	Relatives & friends	9	45	6	50	3	37.5	
	Health personnel	3	15	2	16.6	1	12.5	
	All of the above	7	35	4	33.3	3	37.5	

S-Significant at 5% level ( $P < 0.05$ ); NS - Not significant at 5% level ( $P > 0.05$ )

### Research hypothesis 2

H2- A significant association exists between pre-intervention knowledge levels and the selected demographic variables of adolescent girls in both control and experimental groups.

H02- A significant association exists between pre-intervention knowledge levels and the demographic characteristics of adolescent girls in both control and experimental groups.

The results of Chi square analysis ( $\chi^2$ ) presented in Table 4 indicates a significant association between knowledge levels and age, dietary pattern, type of family, fathers' educational level, mothers' educational level, age at which menarche was attained and regular menstrual flow.

The data shows that the stated objective was achieved and the formulated hypothesis (H2) has been accepted. Hence, a significant association between pre-intervention knowledge levels and the selected demographic characteristics of adolescent girls was noted in both experimental and control groups.

The findings of the study align with global research on anemia, which is a significant public health issue affecting both human health and socio-economic development. Anemia is more prevalent among adolescent females, but is preventable and treatable. Iron deficiency is recognized as the most common cause. It remains a major health concern, with a prevalence rate of 59.1% among adolescent girls according to the National Family Health Survey (NFHS 2019-2021).

Research was conducted in November 2023, involving a sample of 50 adolescent girls selected through a simple random sampling technique in the Mehrauli community area of Delhi. A descriptive research design was employed, and data were collected utilizing the same random sampling technique. The findings indicated that 46.48% of participants had an average knowledge score, highlighting a knowledge deficit regarding anemia and its prevention. The calculated Chi-square value revealed no statistically significant association between the level of knowledge and demographic variables, as evidenced by a  $P$  value  $< 0.05$ .<sup>7</sup>

## Discussion

The intervention package, which included education on nutrition, dietary supplementation (e.g., beetroot juice), and health awareness sessions, significantly improved the knowledge about anemia among adolescent girls in the selected high schools.

The findings are consistent with other studies that highlight the effectiveness of multi-component interventions in reducing anemia prevalence among adolescents. Studies stated that interventions combining nutrition education with dietary supplementation can significantly improve hemoglobin levels.

Anemia is a serious public health problem and the second most common contributing factor for years lost by adolescents to disability and death. A study conducted on the prevalence of anemia among adolescent girls reported that 48.63% (n = 124) were affected. The majority of girls aged 12 to 18 years (55.64%, n = 69) had mild anemia. Out of 255 girls, 188 (73.73%) were in the early adolescent age group (10-14 years). The prevalence of anemia was higher (52.24%) among late adolescents and those from low socioeconomic background. A significant correlation was observed between anemia and factors such as nutritional management, dietary changes, and helminth control. Ensuring compliance with iron and folic acid supplementation can play a critical role in preventing anemia among adolescent girls to a great extent.<sup>8</sup>

## Conclusion

The study evaluated the knowledge levels of adolescent girls regarding anemia prevention, revealing that educational intervention significantly improved their understanding. It found that anemic girls had lower awareness of anemia and personal hygiene practices compared to their non-anemic peers. Furthermore, iron-rich food consumption was inadequate in both groups. The high prevalence of mild anemia and insufficient iron intake among participants underscores the need for targeted public health interventions. Identifying the burden of anemia in adolescent girls is essential for bridging gaps in public health programs and designing

effective strategies to reduce anemia prevalence. Long-term studies are recommended to assess the lasting impact of such interventions and their broader contribution to anemia prevention and adolescent health.

## Conflicts of Interest

Nil

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