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Quasi Experimental Study to Assess the Effectiveness of Beetroot Juice on Serum Iron, CBC & Clinical Features among Adolescent Girls with IDA in Selected Areas of DNH

Priya Sharma[1]
Assistant Professor
Community Health Nursing
Shri Vinoba Bhave College of Nursing
Silvassa, DNH

Hetal Patel[2]
M. Sc. Nursing Student
Community Health Nursing
Shri Vinoba Bhave College of Nursing
Silvassa, DNH

Amar A. Mulla[3]
Assistant Professor
Child Health Nursing
Shri Vinoba Bhave College of Nursing
Silvassa, DNH.

Sujeeta Malik[4]
Nursing Tutor
Community Health Nursing
Maharaja Agrasen Nursing College
Bahadurgarh, Haryana

Abstract:- Iron deficiency anemia (IDA) is one of the most prevalent nutritional deficiencies in the world, and more than half of the population in India is anaemic. Iron deficiency anaemia cause impaired school performance, decreased work productivity and other adverse outcomes.[1] Adolescence, a period of rapid growth and development, is considered the most nutritionally vulnerable group.[2] The aim of the study was to assess the effectiveness of beetroot juice on serum iron, CBC and clinical features among adolescent girls with iron deficiency anaemia in selected areas of Dadra and Nagar Haveli. A quantitative research approach was used. A Quasi-experimental pre-test post-test design was adopted among 60 adolescent girls with iron deficiency anemia by simple random sampling. The result showed that there is highly significant (p<0.001*) difference between control and experimental posttest level of serum iron and CBC. It shows that after the administration of beetroot juice, there was a significant improvement in the serum iron and CBC level of adolescent girls with at (p<0.001***).The posttest mean for clinical features of experimental group was 2.47 (SD 2.53) Whereas posttest mean for clinical features of control group was 5.87 (SD 2.08). Thus the study concluded that beetroot juice was effective in the adolescent girls with iron deficiency anaemia.**

Keywords:- *Effectiveness; Beetroot Juice; Serum Iron; CBC; Anemia; Adolescent girls.*

I. INTRODUCTION

Health is the fundamental right of each and every individual in all age group e.g. children, adolescent, adult and geriatrics.[1] According to WHO, the 'adolescence' term has been defined as the age between 10 and 19 and 'youth' as between 15 and 24; young people is a term which covers both age group. The term teenage years is used synonymously with adolescence to describe age 13 to 19 years.[3]Adolescents constitute more than 1.2 billion worldwide, and about 21% of Indian population. Morbidity and mortality occurring in this age group is mostly due to preventable causes. This is a vulnerable period in the human life cycle.[2] As adolescent age is the formative years for development, anemia at this stage of life has some long term consequences, such as stunted growth, reduced immunity, menstrual irregularities, later on poor pregnancy outcomes such as intrauterine growth restriction, low birth weight, increased perinatal morbidity and mortality.[2] Priority of adolescent health includes good nutrition, sexual and reproductive health and non communicable disease.[4] According to World health Organization (WHO) the haemoglobin level should be 12gm/dl for adolescent girls, haemoglobin level ranges from 11-11.9 gm/dl is considered as mild anemia, haemoglobin between 8 gm/dl to 10.9 gm/dl is considered as moderate anemia and haemoglobin less than 8 g/dl is considered as severe anemia.[5] Various types of anemia prevalent in India such are Iron deficiency anemia, Thalassemia, Aplastic anaemia, Hemolytic anemia, Sickle cell anemia, Pernicious anaemia. But the iron deficiency anemia is major issues among adolescent girls due to chronic blood loss caused by excessive menstruation. Increased demands for iron, such as children undergoing rapid growth in adolescence.[6] The World Health Organization estimated that about 30% of the world's

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population suffers from anemia.[7] Majority 70% of Indian adolescent girls are anemic (Hemoglobin (Hb) < 12. Studies have revealed that 65 % to 75 % of the adolescent girls in India are anemic.[8] Based on NFHS-4 (2015-2016) data, majority 80.1% Non- pregnant women were anemic whereas 67.9% pregnant women were found to be anemic in Dadra and Nagar Haveli.[9] Though iron and folic acid supplementation remains the corner stone in treatment of anemia nutrition education and food supplementation are long term measures in preventing the recurrence. Food based approaches are gaining high potential for long lasting benefits in improving nutritional status of folate and serum iron status.[10] Beetroot juice will help in treating anemia by increasing the blood count. Beetroot juice is particularly beneficial as an anemia remedy for children and teenagers. According to H. K. Bakhru author of "food that heal." Beetroot strengthens the body"s immune power and has proved to be an excellent remedy for anemia, especially for children and adolescents where other blood forming remedies have failed.[11]

➢ *Purpose of the Study*

The purpose of the study was to find the effectiveness of

➢ *Objectives of the Study*

- Assess effectiveness of beetroot juice on serum iron, CBC and clinical features among adolescent girls in control and experimental group.
- Find association between pretest level of serum iron, CBC and clinical features with selected demographic variables among adolescent girls in control and experimental group.

➢ *Hypotheses*

The hypotheses were tested at 0.05 level of significance.

- **H1:** There will be significant difference in the between the level of serum iron, CBC and clinical features before and after administration of beetroot juice among adolescent girls with iron deficiency anemia in experimental group.

- **H2:** There will be significant association between pretest level of serum iron , CBC and clinical features with selected demographic variables among adolescent girls in experimental and control group.

➢ *Conceptual Framework*

The theoretical frame work for the present study is developed from "Nora J Pender's Health Promotion Model (1982; revised 1996) was designed to be a complementary counterpart to models of health protection".[19]

II. METHODOLOGY

➢ *Research Approach:*

A quantitative approach was used to determine the effectiveness of beetroot juice upon serum iron, CBC and clinical features among adolescent girls with iron deficiency anemia.

A. Research Design:

A quasi-experimental pretest posttest design with one group experimental and one group control group was adopted for this study to evaluate the effectiveness of beetroot juice upon serum iron, CBC and clinical features among adolescent girls with iron deficiency anemia.

Symbolic Presentation of Research Design:

Group	Pretest	Treatment	Posttest
Experimental	O_1	X	O_2
Control	O_1		O_2

Table 1

Key:

O_1: Pretest assessment of serum iron, CBC and clinical features in Experimental & control group.

X_1: Nursing Intervention- Administration of beetroot provided to adolescent girls in experimental group.

O_2: Posttest assessment of serum iron, CBC and clinical features in Experimental & control group.

B. Variables:

1. **Independent variable:** administration of beetroot juice.
2. **Dependent variable:** Level of Serum Iron, CBC and clinical features
3. **Demographical variables:** Age, educational class, type of family, religion, diet, have you attained menarche, regularity of menstruation, family monthly income.

C. Research Settings:

The study was conducted in Dadra and Nagar Haveli. The experimental group was selected from Galonda village and control group from Athola village.

➢ *Population*

The population for the study consisted of adolescent girls with iron deficiency anemia in the age group of 13-17years.

- *Target population:*

In this study, target population is 13-17 years adolescent girls with iron deficiency anemia residing in Dadra and Nagar Haveli.

- *Accessible population*

In the present study, the accessible population is 13-17 years of adolescent girls with iron deficiency anemia residing in government residential hostels of Dadra and Nagar Haveli.

➢ *Sample*

In this study, samples were the adolescent girls in the age group of 13-17 years residing at residential hostels of selected government schools of Tokarkhada and Kharedapada, Dadra and Nagar Haveli.

➢ *Sample Size:*

In the present study the sample size was 60 adolescent girls in the age group of 13- 17 years having iron deficiency anemia divided into two groups as 30 adolescent girls in control group and 30 adolescent girls in experimental group.

➢ *Sampling Technique:*

The present study adopted a probability sampling technique to select the adolescent girls in the age group of 13-17 having iron deficiency anemia. Lottery technique was employed to select the sample.

➢ *Development of Tool*

The following steps were adopted in the development of the tool:

1. Review of literature
2. Discussion with experts
3. Development of blue prints
4. Construction of structured Clinical Features Rating Scale

➢ *Description of Tool:*

Data collection tool consists of three parts as follow:

- *PART 1: Demographic Characteristics:*

Demographic Characteristics will be developed by the investigator for the purpose of collecting background information of the sample. It consist nine (9) items such as age, educational class, have you attained menarche, age of menarche, regularity of menstruation, monthly family income, type of family, religion and diet

- *PART 2: Self – Structured Clinical Features Rating Scale*

It contains the Self-structured clinical features observation rating scale. The tool has 20 items. The scale had three points scale that is always, sometimes and never. All the clinical features were observed by the researcher and were given rating accordingly. The scoring for the same was done as always= 2, sometimes = 1 score and never = 0. Based on the score of the rating scale the following categories of anemia were made:

CATEGORY	SCORE	PERCENTAGE
a) No anemia	0	0
b) Mild anemia	1-13	1-33%
c) Moderate anemia	14-27	34-68%
d) Severe anemia	28-40	69-100%

Table 2

- *PART 3: Blood investigations:*

It contains values of Serum iron and CBC (haemoglobin, hematocrit, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and red cell distribution width (RDW) level.

III. RESULTS

This section deals with the description of demographical variables of adolescent girls with iron deficiency anemia which is explained in frequency and percentage distribution and presented in table 3.

S. No	Sample Characteristics	Experimental group (n=30)		Control group (n=30)	
		(f)	(%)	(f)	(%)
1	**Age (in years)**				
	13 – 14	2	6.7	2	6.7
	14 – 15	14	46.7	14	46.7
	15 – 16	4	13.3	4	13.3
	16 - 17	10	33.3	10	33.3
2	**Religion**				
	Hindu	25	83.3	27	90
	Muslim	0	0	0	0
	Christian	5	16.7	3	10
	Others	0	0	0	0
3	**Educational status**				
	8^{TH}	0	0	0	0
	9^{TH}	9	30	17	56.7
	10^{TH}	0	0	0	0
	11^{TH}	21	70	13	43.3
4	**Monthly family income**				
	<5001	4	13.3	5	16.7
	5001-10000	23	76.7	24	80
	10001-15000	3	10	1	3.3
	>15000	0	0	0	0

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5	**Types of family**				
	Joint family	25	83.3	25	83.3
	Nuclear family	5	16.7	5	16.7
6	**Do you attain menarche?**				
	Yes	30	100	30	100
	No	0	0	0	0
6.1	**Age at menarche:**				
	12	14	46.7	14	46.7
	13	10	33.3	10	33.3
	14	6	20	6	20
	15	0	0	0	0
	>15	0	0	0	0
6.2.	**Menstrual regularity**				
	Regular	24	80	23	76.7
	Irregular	6	20	7	23.3
7	**Types of diet.**				
	Vegetarian	11	36.6	10	33.3
	Non-vegetarian	19	63.7	20	66.7

Table 3:- Frequencies and Percentage Distribution of Samples based on Demographic Variables.
n = 60

Table 3 depicts that majority of the subjects of control group 46.7 % belongs to age group of between 14-15 years in control and experimental group.70% and 56.7% studying in 11th and 9th class respectively, 83.3% and 90 %of belongs to Hindu religion, 63.3% and 66.7% were non vegetarian in control and experimental group.100% of attained menarche, 46.7% attained menarche at 12 years of age, 80% of menstrual regularity, 83.3% of belongs to joint family in both control and experimental group.

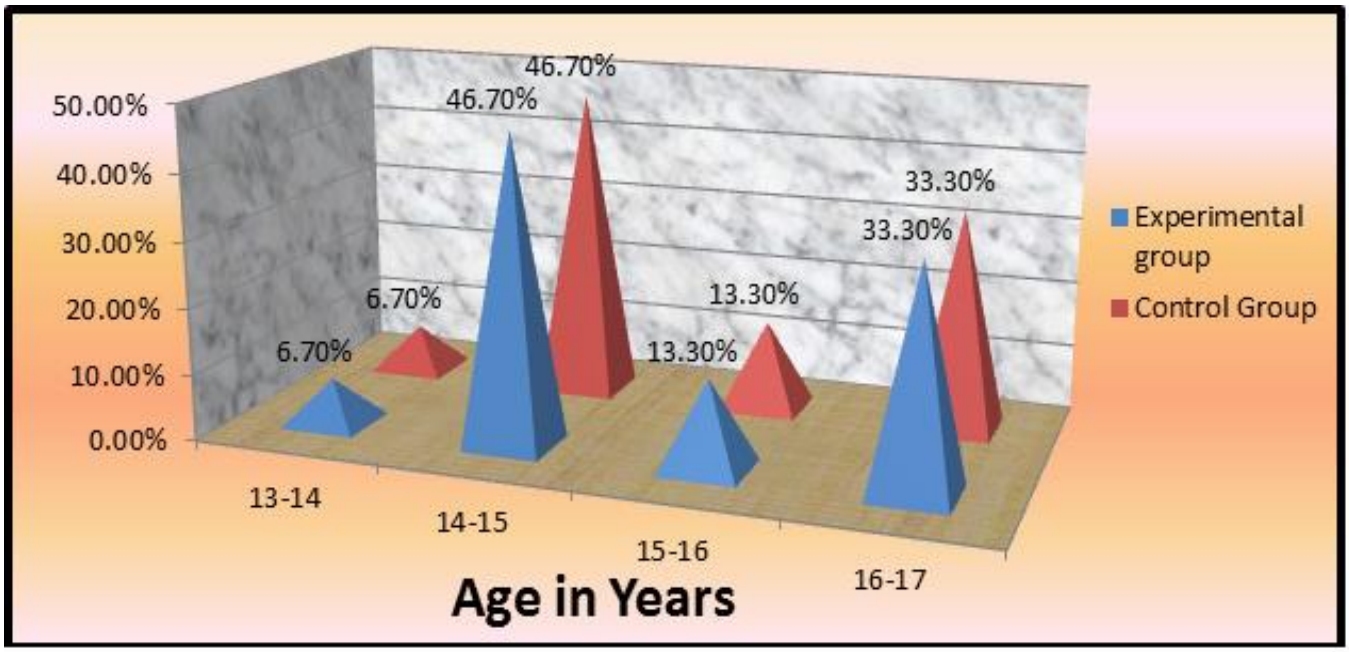

Fig 1:- Diagrammatic presentation of distribution of samples based on Age in years.

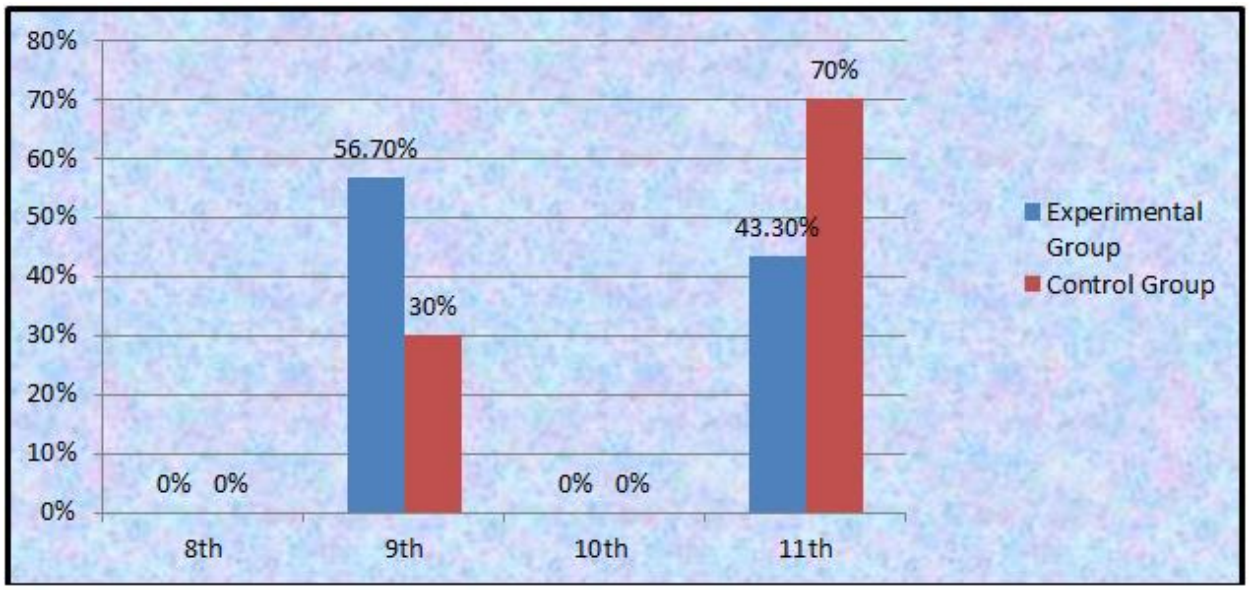

Fig 2:- Diagrammatic presentation of distribution of samples based on Educational Class.

Clinical Parameters	Experimental pre test		Experimental post test		Mean difference	't'-value	P-value
	Mean	SD	Mean	SD			
Serum iron	**36.3**	**14.3**	**39.07**	**14.6**	**2.76**	7.87	P<0.001***
Hemoglobin	**10.83**	**0.71**	**11.26**	**0.69**	**0.43**	7.13	P<0.001***
Hematocrit	**34.94**	**2.69**	**36.67**	**2.91**	**1.73**	11.59	P<0.001***
Mean corpuscular volume (mcv)	**73.7**	**4.88**	**75.25**	**4.98**	**1.55**	10.89	P<0.001***
Mean corpuscular haemoglobin(MCH)	**23.16**	**1.6**	**24.31**	**1.65**	**1.15**	7.34	P<0.001***
Mean Corpuscular haemoglobin concentration(MCHC)	**31.11**	**2.09**	**32.4**	**2.21**	**1.37**	8.26	P<0.001***
Red cell Distribution Width(RDW)	**17.5**	**2.89**	**18.78**	**3.02**	**1.27**	9.58	P<0.001***

*-P<0.05,significant and **-P<0.01 &***-P<0.001, Highly significant

Table 4:- Effectiveness of beetroot juice on serum iron and CBC among adolescent girls with iron deficiency anemia in Experimental Group.
n= 30

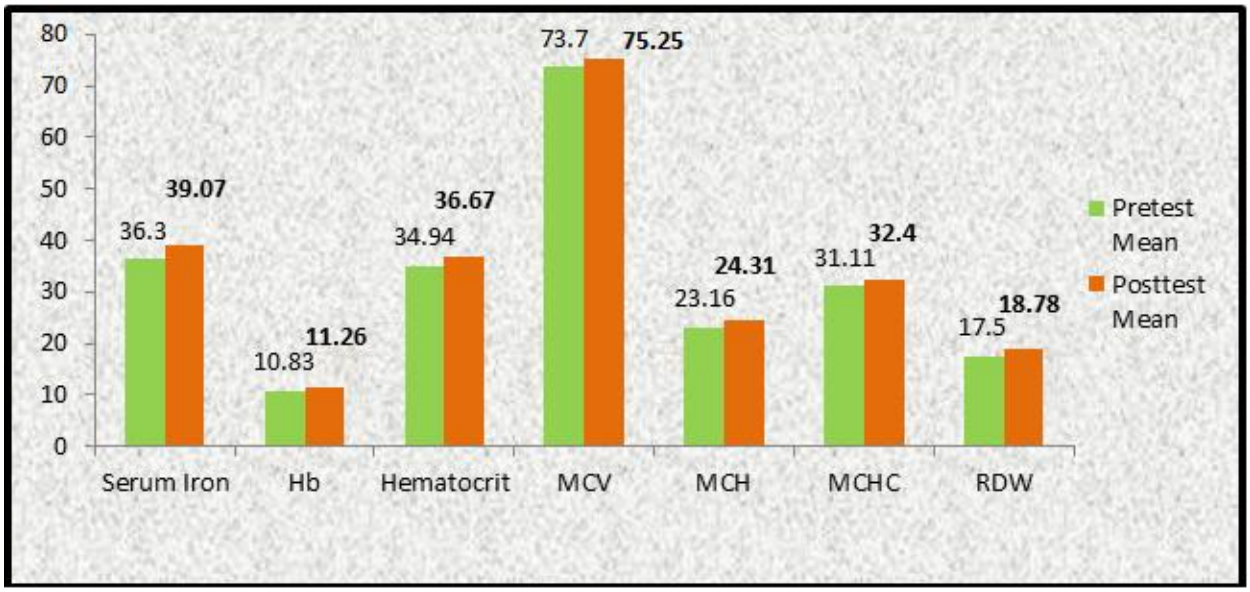

Fig 3:- Diagrammatic presentation of Pretest Mean & Posttest Mean of Clinical Paramters in Experimental Group.

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	Experimental pre test		Experimental post test		Mean difference	't'-value	P-value
	Mean	SD	Mean	SD			
Clinical feature scale (sign and symptom)	**5.87**	**2.15**	**2.47**	**2.53**	**3.4**	5.57	P<0.001***

*-P<0.05,significant and **-P<0.01 &***-P<0.001, Highly significant

Table 5:- Effectiveness of beetroot juice on clinical features among adolescent girls with iron deficiency anemia in Experimental Group (n= 30)

Clinical Parameters	Control pre test		Control post test		Mean difference	't'-value	P-value
	Mean	SD	Mean	SD			
Serum iron	35.4	14.69	35.56	14.6	0.17	0.86	0.393
Hemoglobin	10.79	0.77	10.79	0.79	0.003	0.205	0.839
Hematocrit	35.13	2.38	35.17	2.34	0.037	0.71	0.482
Mean corpuscular volume (mcv)	73.86	4.16	73.99	4.26	0.13	1.39	0.174
Mean corpuscular haemoglobin(MCH)	23.66	1.45	23.7	1.49	0.04	1.25	0.221
Mean Corpuscular haemoglobin concentration(MCHC)	31.21	2.33	31.25	2.31	0.04	1.33	0.195
Red cell Distribution Width(RDW)	17.1	2.96	17.12	2.95	0.02	2.26	**0.03***

*-P<0.05 ,significant and **-P<0.01 &***-P<0.001 , Highly significant

Table 6:- Effectiveness of beetroot juice on serum iron, CBC and clinical features among adolescent girls with iron deficiency anemia in Control Group. (n= 30)

	Control pre test		Control post test		Mean difference	't'-value	P-value
	Mean	SD	Mean	SD			
Clinical feature scale (sign and symptom)	**5.7**	**2.13**	**5.87**	**2.08**	**0.17**	**1.97**	**0.057**

*-P<0.05 ,significant and **-P<0.01 &***-P<0.001 , Highly significant

Table 7:- Effectiveness of beetroot juice on serum iron, CBC and clinical features among adolescent girls with iron deficiency anemia in Control Group. (n= 30)

Clinical Parameter	Control Posttest		Experimental posttest		Mean difference	„t"-value	P-value
	Mean	SD	Mean	SD			
Serum iron	35.56	14.6	39.07	14.6	3.51	7.87	p<0.001**
Hemoglobin	10.79	0.79	11.26	0.69	0.47	7.13	p<0.001**
Hematocrit	35.17	2.34	36.67	2.91	1.5	11.59	p<0.001**
Mean corpuscular volume (MCV)	73.99	4.26	75.25	4.98	1.26	10.88	p<0.001**
Mean corpuscular haemoglobin(MCH)	23.7	1.49	24.31	1.65	0.61	7.33	p<0.001**
Mean Corpuscular haemoglobin concentration(MCHC)	31.25	2.31	32.4	2.21	1.15	8.26	p<0.001**
Red cell distribution width(RDW)	17.12	2.95	18.78	3.02	1.66	9.58	p<0.001**

*-P<0.05 significant and **-P<0.01 &***-P<0.001 , Highly significant

Table 8:- Effectiveness of Beetroot Juice on Serum Iron and CBC among Adolescent Girls with Iron Deficiency Anemia n= (30+30=60)

Above table results showed that beetroot juice is effective in improving the levels of Sr. Iron and CBC among adolescent girls with iron deficiency anemia as expressed in calculated 't'-value 11.59 (Hematocrit), 10.88 (MCV), 8.26 (MCHC) respectively which is found highly significant at the level of $p \leq 0.001$. Hence research hypothesis is accepted.

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Clinical Parameter	Control group posttest		Experimental group Posttest		Mean difference e	„t"-value	p-value
	Mean	SD	Mean	SD			
Clinical Features	5.87	2.08	2.47	2.53	**3.4**	**5.68**	**p<0.001*** **

*-P<0.05 significant and **-P<0.01 &***-P<0.001, Highly significant

Table 9:- Effectiveness of Beetroot Juice on Clinical Features among Adolescent Girls with Iron Deficiency Anemia n=(30+30=60)

Table no 5. depicts that beetroot juice is effective in improving the clinical features of iron deficiency anemia among adolescent girls as expreesed in calculated„t"-value 5.68 which is found highly significant at the level of $p \leq 0.001$. Hence research hypothesis is accepted.

Demographic Variable	Control group						Experimental group					
	≤median		>median		χ2 (df)	*p*-value	≤median		>median		χ2 (df)	*p*-value
	f	%	F	%			f	%	f	%		
Age(in years)												
13-14	0	0	2	6.7			0	0	2	6.7		
14-15	8	26.7	6	20	6.46	0.09	7	23.3	7	23.3	4.60	0.204 NS
15-16	1	3.3	3	10	(df=3)	NS	1	3.3	3	10	(df=3)	
16-17	8	26.7	2	6.7			7	23.3	3	10		
Educational status												
9th	6	20	3	10	0.526	0.469	8	26.7	9	30	0.13	0.713
11th	11	36.7	10	33.3	(df=1)	NS	7	23.3	6	20	(df=1)	NS
Have you attained menarche						1						1
Yes	17	56.7	13	43.3	0	NS	15	50	15	50	0	NS
Age at menarche												
12	9	30	5	16.7		0.084	9	30	5	16.7	3.81	*0.149*
13	7	23.3	3	10	4.96	NS	5	16.7	5	16.7	(df=2)	*NS*
14	1	3.3	5	16.7	(df=1)		1	3.3	5	16.7		
Menstrual regularity												
Regular	14	46.7	10	33.3	0.14	0.713	12	40	11	36.7	0.18	0.666
Irregular	3	10	3	10	(df=1)	*NS*	3	10	4	13.3	(df=1)	*NS*
Monthly family income												
<5001	2	6.7	2	6.7	0.903	0.637	2	6.7	3	10	1.37	
5001-10000	14	46.7	9	30	(df=2)	NS	13	43.3	11	36.7	(df=2)	0.505
10001-15000	1	3.3	2	6.7			0	0	1	3.3		NS
Type of family												
Joint family	14	46.7	11	36.7	0.027	0.869	12	40	13	43.3	0.24	0.624
Nuclear family	3	10	2	6.7	(df=1)	*NS*	3	10	2	6.7	(df=1)	*NS*
Religion												
Hindu	15	50	10	33.3	0.67	0.410	13	43.3	14	46.7	0.37	0.543
Christian	2	6.7	3	10	(df=1)	*NS*	2	6.7	1	3.3	(df=1)	*NS*
Diet												
Vegetarian	4	13.3	7	23.3	2.91	0.088	7	23.3	3	10	2.40	0.121
Non Vegetarian	13	43.3	6	20	(df=1)	*NS*	8	26.7	12	40	(df=1)	*NS*

*-P<0.05 significant and **-P<0.01 &***-P<0.001 , Highly significant

Table 10:- Association between serum iron and demographic variables among control and experimental group. n=(30+30=60)

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Demographic Variable	Control group						Experimental group					
	≤median		>median		χ2 (df)	*p*-value	≤median		>median		χ2 (df)	*p*-value
	F	%	f	%			f	%	f	%		
1.Age(in years)												
13-14	2	6.7	0	0			2	6.7	0	0		
14-15	10	33.3	4	13.3	6.22	0.101	9	30	5	16.7	1.52	
15-16	3	10	1	3.3	(df=3)	NS	2	6.7	2	6.7	(df=3)	0.678 NS
16-17	3	10	7	23.3			6	20	4	13.3		
Educational status												
9th	6	20	3	10	0.238	0.626	6	2	3	10	0.23	0.626
11th	12	40	9	30	(df=1)	NS	13	40	9	30	(df=1)	NS
Have you attained menarche												
Yes	18	60	12	40	0	1 NS	18	60	12	40	0	1 NS
Age at menarche												
12	8	26.7	6	20			8	26.7	6	20		
13	6	20	4	13.3	0.158	0.924	6	20	4	13.3	0.158	0.924
14	4	13.3	2	6.7	(df=2)	NS	4	13.3	2	6.7	(df=2)	NS
Menstrual regularity												
Regular	**15**	50	9	30	0.312	0.576	15	50	9	30	0.315	0.576
Irregular	**3**	10	3	10	(df=1)	NS	3	10	3	10	(df=1)	*NS*
Monthly family income												
<5001	2	6.7	2	6.7	0.23	0.897	2	6.7	2	6.7	0.23	0.897
5001-10000	14	46.7	9	30	(df=2)	NS	14	46.7	9	30	(df=2)	NS
10001-15000	2	6.7	1	3.3			2	6.7	1	3.3		
Type of family												
Joint family	16	53.3	9	30	1	0.317	16	53.3	9	30	1	0.317
Nuclear family	2	6.7	3	10	(df=1)	NS	2	6.7	3	10	(df=1)	NS
Religion												
Hindu	15	50	10	33.3	0	1	17	56.7	10	33.3	0.015	0.900
Christian	3	10	2	6.7	(df=1)	NS	2	6.7	1	3.3	(df=1)	*NS*
Diet												
Vegetarian	9	30	2	6.7	3.45	0.063	8	26.7	2	6.7	1.79	0.180 NS
Non Vegetarian	9	30	10	33.3	(df=1	NS	11	36.7	9	30	(df=1)	

*-P<0.05 significant and **-P<0.01 &***-P<0.001 , Highly significant

Table 11:- Association between hemoglobin and demographic variables among control and experimental group n=(30+30=60)

Demographic Variable	Control group						Experimental group					
	≤median		>median		χ2 (df)	*p*-value	≤median		>median		χ2 (df)	*p*-value
	f	%	f	%			f	%	f	%		
Age(in years)												
13-14	1	3.3	1	3.3			2	6.7	0	0		
14-15	6	20	8	26.7	0.69	0.877 NS	6	20	8	26.7	2.56	0.464 NS
15-16	2	6.7	2	6.7	(df=3)		2	6.7	2	6.7	(df=3)	
16-17	6	20	4	13.3			6	20	4	13.3		
Educational status												
9th	5	16.7	4	13.3	0.159	0.690	9	30	8	26.7	0.0023	0.961
11th	10	33.3	11	36.7	(df=1)	*NS*	7	23.3	6	20	(df=1)	*NS*

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Have you attained menarche Yes	15	50	15	50	0 (df=1)	1 NS	16	53.3	14	46.7	0 (df=1)	1 NS
Age at menarche 12 13 14	7 5 3	23.3 16.7 10	7 5 3	23.3 16.7 10	0.01 (df=2)	0.9 NS	8 5 3	26.7 16.7 10	6 5 3	20 16.7 10	0.158 (df=2)	0.924 NS
Menstrual regularity Regular Irregular	12 3	40 10	12 3	40 10	0 (df=1)	1 NS	12 4	40 13.3	11 3	36.7 10	0.05 (df=1)	0.818 NS
Monthly family income <5001 5001-10000 10001-15000	2 12 1	6.7 40 3.3	2 11 2	6.7 36.7 6.7	0.38 (df=2)	0.828 NS	2 13 1	6.7 43.3 3.3	3 11 0	10 36.7 0	1.24 (df=2)	0.538 NS
Type of family Joint family Nuclear family	13 2	43.3 6.7	12 3	40 10	0.24 (df=1)	0.624 NS	15 1	50 3.3	10 4	33.3 13.3	2.67 (df=1)	0.102 NS
Religion Hindu Christian	14 1	46.7 3.3	11 4	36.7 13.3	2.16 (df=1)	0.142 NS	16 0	53.3 0	11 3	36.7 10	3.81 (df=1)	0.051 NS
Diet Vegetarian Non vegetarian	4 11	13.3 36.7	7 8	23.3 26.7	1.29 (df=1	0.256 NS	7 9	23. 30	3 11	10 36.7	1.67 (df=1	0.196 NS

*-P<0.05 significant and **-P<0.01 &***-P<0.001, Highly significant

Table 12:- Association between hematocrit and demographic variables among control and experimental group n= (30+30=60)

Control group							**Experimental group**					
Demographic Variable	**≤median**		**>median**		**χ2 (df)**	***p*-value**	**≤median**		**>median**		**χ2 (df)**	***p*-value**
	f	**%**	**f**	**%**			**f**	**%**	**F**	**%**		
Age(in years) 13-14 14-15 15-16 16-17	1 5 3 6	3.3 16.7 10 20	1 9 1 4	3.3 30 3.3 13.3	2.54 (df=3)	0.468 NS	1 7 2 5	3.3 23.3 6.7 16.7	1 7 2 5	3.3 23.3 6.7 16.7	0 (df=3)	1 NS
Educational status 9th 11th	3 13	10 40	6 9	20 30	1.428 (df=1)	0.232 *NS*	8 7	26.7 23.3	9 6	30 20	0.135 (df=1)	*P*=0.713 *NS*
Have you attained menarche Yes	15	50	15	50	0	1 NS	15	50	15	50	0	1 NS

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Age at menarche 12 13 14	6 5 4	20 16.7 13.3	8 5 2	26.7 16.7 6.7	0.95 (df=2)	0.621 NS	6 3 6	20 10 20	8 7 0	26.7 23.3 0	7.88 (df=2)	**0.019* S**
Menstrual regularity Regular Irregular	12 3	40 10	12 3	40 10	0 (df=1)	1 *NS*	13 2	43.3 6.7	10 5	33.3 16.7	1.67 (df=1)	0.195 *NS*
Monthly family income <5001 5001-10000 10001-15000	3 9 3	10 30 10	1 14 0	3.3 46.7 0	5.09 (df=2)	0.079 NS	4 10 1	13.3 33.3 3.3	1 14 0	3.3 46.7 0	3.47 (df=2)	0.177 NS
Type of family Joint family Nuclear family	14 1	46.7 3.3	11 4	36.7 13.3	2.16 (df=1)	0.142 NS	13 2	43.3 6.7	12 3	40 10	0.24 (df=1)	0.624 NS
Religion Hindu Christian	13 2	43.3 6.7	12 3	40 10	0.24 (df=1)	0.624 NS	13 2	43.3 6.7	14 1	46.7 3.3	0.37 (df=1)	0.543 NS
Diet Vegetarian Non Vegetarian	5 10	16.7 33.3	6 9	20 30	0.14 (df=1)	0.705 NS	2 13	6.7 43.3	8 7	26.7 23.3	5.4 (df=1)	**0.020* S**

*-P<0.05 significant and **-P<0.01 &***-P<0.001 , Highly significant

Table 13:- Association between MCV and demographic variables among control and experimental group n=(30+30=60)

Demographic Variable	**Control group**						**Experimental group**					
	≤median		**>median**		**χ^2 (df)**	***p*-value**	**≤median**		**>median**		**χ^2 (df)**	***p*-value**
	F	**%**	**f**	**%**			**f**	**%**	**f**	**%**		
Age(in years) 13-14 14-15 15-16 16-17	0 7 2 7	0 23.3 6.7 23.3	2 7 2 3	6.7 23.3 6.7 10	3.48 (df=3)	0.323 NS	2 12 2 6	6.7 40 6.7 20	0 2 2 4	0 6.7 6.7 13.3	3.84 (df=3)	0.278 NS
Educational status 9th 11th	4 12	13.3 40	5 9	16.7 30	0.408 (df=1)	0.523 *NS*	14 8	46.7 26.7	3 5	10 16.7	1.635 (df=1)	0.201 *NS*
Have you attained menarche Yes	16	53.3	14	46.7	0	1 NS	22	73.3	8	26.7	0	1 NS
Age at menarche 12 13 14	8 5 3	26.7 16.7 10	6 5 3	20 16.7 10	0.15 (df=2)	0.926 NS	9 7 6	30 23.3 20	5 3 0	16.7 10 0	2.82 (df=2)	0.244 NS
Menstrual regularity Regular Irregular	13 3	43.3 10	11 3	36.7 10	0.03 (df=1)	0.855 *NS*	18 4	60 13.3	5 3	16.7 10	1.22 (df=1)	0.269 *NS*
Monthly family income <5001 5001-10000 10001-15000	1 12 3	3.3 40 10	3 11 0	10 36.7 0	3.93 (df=2)	0.140 *NS*	4 17 1	13.3 56.7 3.3	1 7 0	3.3 23.3 0	0.55 (df=2)	0.758 *NS*

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Type of family												
Joint family	13	43.3	12	40	0.107 (df=1)	0.743 *NS*	18	60	7	23.3	0.134 (df=1)	0.712 *NS*
Nuclear family	3	10	2	6.7			4	13.3	1	3.3		
Religion												
Hindu	15	50	10	33.3	2.67 (df=1)	0.102 *NS*	15	50	10	33.3	2.67 (df=1)	0.102 *NS*
Christian	1	3.3	4	13.3			1	3.3	4	13.3		
Diet												
Vegetarian	5	16.7	6	20	0.432 (df=1)	0.510 *NS*	5	16.7	5	16.7	4.18 (df=1)	**0.041* S**
Non Vegetarian	11	36.7	8	26.7			17	56.7	3	10		

*-P<0.05 significant and **-P<0.01 &***-P<0.001 , Highly significant

Table 14:- Association between MCH and demographic variables among control and experimental group n=(30+30=60)

Demographic Variable	Control group						Experimental group					
	≤median		>median		χ2 (df)	*p*-value	≤median		>median		χ2 (df)	*p*-value
	f	%	f	%			f	%	f	%		
Age(in years)												
13-14	1	3.3	1	3.3			1	3.3	1	3.3		
14-15	10	33.3	4	13.3	6.15 (df=3)	0.104 NS	13	43.3	1	3.3	16.98 (df=3)	**0.001* S**
15-16	1	3.3	3	10			0	0	4	13.3		
16-17	9	30	1	3.3			9	30	1	3.3		
Educational status												
9th	6	20	3	10	0.068 (df=1)	0.794 *NS*	14	46.7	3	10	0.709 (df=1)	0.400 *NS*
11th	15	50	6	20			9	30	4	13.3		
Have you attained menarche												
Yes	21	70	9	30	0	1 NS	23	76.7	7	23.3	0	1 NS
Age at menarche												
12	10	33.3	4	13.3	1.63 (df=2)	0.442 NS	11	36.7	3	10	0.43 (df=2)	0.808 NS
13	8	26.7	2	6.7			8	26.7	2	6.7		
14	3	10	3	10			4	13.3	2	6.7		
Menstrual regularity												
Regular	17	56.7	7	23.3	0.03 (df=1)	0.842 NS	18	60	5	16.7	0.14 (df=1)	0.708 NS
Irregular	4	13.3	2	6.7			5	16.7	2	6.7		
Monthly family income												
<5001	2	6.7	2	6.7	3.43 (df=2)	0.180 NS	2	6.7	3	10	8.62 (df=2)	**0.013* S**
5001-10000	18	60	5	16.7			21	70	3	10		
10001-15000	1	3.3	2	6.7			0	0	1	3.3		
Type of family												
Joint family	17	56.7	8	26.7	0.287 (df=1)	0.593 NS	19	63.3	6	20	0.037 (df=1)	0.842 NS
Nuclear family	4	13.3	1	3.3			4	13.3	1	3.3		
Religion												
Hindu	17	56.7	8	26.7	0.286 (df=1)	0.593 NS	20	66.7	7	23.3	1.01 (df=1)	0.314 NS
Christian	4	13.3	1	3.3			3	10	0	0		
Diet												
Vegetarian	8	26.7	3	10	0.06 (df=1	0.804 NS	7	23.3	3	10	0.37 (df=1	0.543 NS
Non Vegetarian	13	43.3	6	20			16	53.3	4	13.3		

*-P<0.05 significant and **-P<0.01 &***-P<0.001 , Highly significant

Table 15:- Association between MCHC and demographic variables among control and experimental group n=(30+30=60)

Demographic Variable	Control group ≤median f	%	>median F	%	χ2 (df)	*p*-value	Experimental group ≤median f	%	>median f	%	χ2 (df)	*p*-value
Age(in years)												
13-14	1	3.3	1	3.3			2	6.7	0	0		
14-15	7	23.3	7	23.3	0.267	0.966 NS	9	30	5	16.7	7.85	**0.049* S**
15-16	2	6.7	2	6.7	(df=3)		4	13.3	0	0	(df=3)	
16-17	6	20	4	13.3			3	10	7	23.3		
Educational status												
9th	6	20	3	10	0.918	0.334 *NS*	12	40	5	16.7	1.83	*P*=0.176 *NS*
11th	10	33.3	11	36.7	(df=1)		6	20	7	23.3	(df=1)	
Have you attained menarche												
Yes	16	53.3	14	46.7	0	1 NS	18	60	12	40	0	1 NS
4.Age at menarche												
12	5	16.7	9	30	4.09	0.129 NS	9	30	5	16.7	0.63	
13	6	20	4	13.3	(df=2)		5	16.7	5	16.7	(df=2)	0.728 NS
14	5	16.7	1	3.3			4	13.3	2	6.7		
Menstrual regularity												
Regular	14	46.7	10	33.3	1.205	0.272 *NS*	17	56.7	6	20	7.95	**0.005* S**
Irregular	2	6.7	4	13.3	(df=1)		1	3.3	6	20	(df=1)	
Monthly family income												
<5001	2	6.7	2	6.7	0.244	0.885 *NS*	4	13.3	1	3.3	1.84	0.398
5001-10000	12	40	11	36.7	(df=2)		13	43.3	11	36.7	(df=2)	*NS*
10001-15000	2	6.7	1	3.3			1	3.3	6	0		
Type of family												
Joint family	13	43.3	12	40	0.107	0.743 *NS*	14	46.7	11	36.7	1	0.317
Nuclear family	2	10	2	6.7	(df=1)		4	13.3	1	3.3	(df=1)	*NS*
Religion												
Hindu	12	40	13	43.3	1.714	0.190 *NS*	15	50	12	40	2.22	0.136
Christian	4	13.3	1	3.3	(df=1)		3	10	0	0	(df=1)	*NS*
Diet												
Vegetarian	4	13.3	7	23.3	2.009	0.156 *NS*	5	16.7	5	16.7	0.625	0.429
Non Vegetarian	12	40	7	23.3	(df=1)		13	43.3	7	23.3	(df=1)	*NS*

*-P<0.05, significant and **-P<0.01 &***-P<0.001 , Highly significant

Table 16:- Association between RDW and demographic variables among control and experimental group n=(30+30=60)

Demographic Variables	Control group ≤Median F	%	>Median f	%	χ2 (df)	*p*-value	Experimental group ≤ Median f	%	>Median f	%	χ2 (df)	*p*-value
Age(in years)												
13-14	2	6.7	0	0			2	6.7	0	0		
14-15	10	33.3	4	13.3	0.89	0.827 NS	9	30	5	16.7	1.54	0.672 NS
15-16	3	10	1	3.3	(df=3)		3	10	1	3.3	(df=3)	
16-17	8	26.7	2	6.7			8	26.7	2	6.7		
Educational status												
9th	6	20	3	10	0.718	0.397 *NS*	12	40	5	16.7	0.15	0.697 *NS*
11th	17	56.7	4	13.3	(df=1)		10	33.3	3	10	(df=1)	
Have you attained menarche												
Yes	23	76.7	7	23.3	0	1 NS	23	76.7	7	23.3	0	1 NS
Age at menarche												
12	12	40	2	6.7	2.34	0.310 NS	12	40	2	6.7	2.14	0.343 NS
13	6	20	4	13.3	(df=2)		6	20	4	13.3	(df=2)	
14	5	16	1	3.3			4	13.3	2	6.7		

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Menstrual regularity												
Regular	18	60	6	20	0.18	0.666 NS	17	56.7	6	20	0.01	0.896 NS
Irregular	5	16.7	1	3.3	(df=1)		5	16.7	2	6.7	(df=1)	
Monthly family income												
<5001	3	10	1	3.3	0.206	0.902 NS	5	16.7	0	0	4.65	0.098 NS
5001-10000	18	60	5	16.7	(df=2)		17	56.7	7	23.3	(df=2)	
10001-15000	2	6.7	1	3.3			0	0	1	3.3		
Type of family												
Joint family	21	70	4	13.3	4.51	**0.03* S**	20	66.7	5	16.7	3.41	0.065 NS
Nuclear family	2	6.7	3	10	(df=1)		2	6.7	3	10	(df=1)	
Religion												
Hindu	20	66.7	5	16.7	0.931	0.334 NS	21	70	6	20	2.72	0.099 NS
Christian	3	10	2	6.7	(df=1)		1	3.3	2	6.7	(df=1)	
Diet												
Vegetarian	8	26.7	3	10	0.15	0.698 NS	6	20	4	13.3	1.36	0.243 NS
Non Vegetarian	9	50	4	13.3	(df=1)		16	53.3	4	13.3	(df=1)	

*-P<0.05 significant and **-P<0.01 &***-P<0.001 , Highly significant

Table 17:- Association between clinical features and demographic variables among control and experimental pretest group n=(30+30)60

IV. CONCLUSION

The study can be concluded that beetroot juice can be used to improve the serum iron and CBC and helps to reducing clinical features of iron deficiency anemia.

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