Effectiveness of Beetroot Juice with Lemon and Beetroot Juice without Lemon on Anemia among Adolescent Girls

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Abstract

Introduction: Anemia is most prevalent nutritional problem worldwide and it is mainly caused by iron deficiency**.** Iron is very necessary for many functions in the body including formation of haemglobin, brain development and function, regulation of body temperature, muscle activity and catecholamine metabolism. Lack of iron in blood directly affect immune system, diminishes the number of T-cells and the production of antibodies. Along with the pharmacological therapy, many complementary therapies are also available for treating anemia. Similarly consuming beetroot juice or beet as cooked vegetable in salad is highly beneficial in treating anemia.

Aim of the study: To assess the effectiveness of beetroot juice with lemon and beetroot juice without lemon on anemia among adolescent girls at selected Senior Secondary School, Faridkot.

Material and methods: A quantitative approach with and quasi experimental, pre test-post test research design was selected for the present study. With simple random sampling (60) anemic adolescent girls were selected having Hb value of 9-11 gm/dl. Out of 60 selected anemic adolescent girls, random allocation was done by slip method and 30 each were assigned to experimental group 1 and experiment group 2. Socio demographic data sheet and Hb record sheet was prepared to assess the effectiveness of beetroot juice with lemon and beetroot juice without lemon on anemia among adolescent girls.

Results: Both interventions i.e. beetroot juice with lemon and beetroot juice without lemon were helpful in improving Hb among adolescent girls but comparison of these interventions showed post intervention mean score of beetroot juice with lemon was 11.73 and mean of beetroot juice without lemon was 11.26 which were significant at p value <0.05**.**

Conclusion: Beetroot juice with lemon is an effective intervention to raise the level of Hb and improve the absorption of iron. Adolescent girls can prepare it themselves and the cost is low when compared with other iron rich vegetables.

Keywords Beetroot juice with lemon; Beetroot juice without lemon; Anemia; Adolescent girls.

Introduction

In India, adolescent girls, who constitute a sizeable segment of its population for a vulnerable group and are at greater risk of morbidity and mortality [1]. Adolescent girls are at risk for anemia and malnutrition. Inadequate nutrition during adolescence can have serious consequences throughout the reproductive years of life and beyond. The word adolescence is derived from the latin word, 'adolescere';

meaning "to grow, to mature [2]. Adolescence has been defined by World Health Organization as a period of life spanning the ages between 10-19 years [3]. India's population has reached the 1 billion mark, out of which 21% are adolescents. About 30% of India's population is in age group 10-19 years [4]. Anemia is most prevalent nutritional problem worldwide and it is mainly caused by iron deficiency. Anemia not only affects the present health status of girls but also has deleterious effects in future pregnancy, that puts the women at three times greater risk of delivering low birth weight and nine times higher risk of prenatal mortality, thus contributing significantly for increased infant mortality rate and 30% maternal deaths. The prevalence of anemia is disproportionately high in developing countries, due to poverty, inadequate diet, worm infestation, pregnancy/lactation, poor access to health services [5].

Anemia is a clinical condition that results from an insufficient supply of healthy red blood cells (RBCs) the volume of packed RBC's and/or the quantity of hemoglobin. Hypoxia results because the body's tissues are not adequately oxygenated. Manifestations accompanying anemia are due to the body's response to hypoxia. Haemoglobin (Hb) levels are used to determine the severity of anemia. Client with mild anemia (Hb level of 10-11g/dl) are often asymptomatic. If manifestations do occur, they typically follow strenuous exertion. Clients with moderate (Hb level 6-10g/dl) may suffer from dyspnea, palpitation, diaphoresis with exertion, and chronic fatigue. Some clients with severe anemia (Hb level <6g/dl) such as those with chronic renal failure, may be asymptomatic because their anemia develops gradually [6].

Medical Management includes oxygen therapy, Erythropoietin, Iron Replacement. The oral form of iron should be used because it is inexpensive and convenient. It is usually given for mild forms of anemia. The medication of choice are ferrous sulphate (Feosol) or Ferrous Gluconate (Fergon), 200 to 325 mg orally in 3-4 divided doses a day, with or after meal. Taking iron with vitamin C aids in absorption of iron [7].

The prevention includes consuming iron rich food, consuming nutritious source of vitamin C in each meal for a better absorption of iron (eg. Orange, grapes, tomato, lime), adding red meat, fish, chicken to one's daily diet, consumption of nuts as dried berries, raisins, daily consumption of an iron tablet from the end of 4th month of pregnancy to 3 months after delivery, consuming iron drops simultaneously with use of supplementary feeding upto the end of 2 years of age among children [8]. Refraining from drinking tea, coffee with or immediately after one's meal, Correction of proper eating habits (consumption of inedible material such as soil or ice) which are symptoms of iron deficiency, Consultation with physician and nutrition therapist for early prevention and treatment [9]. According to H.K Bahru author of 'food that heal', Beetroot juice is particularly beneficial as an anemia remedy for children and teenagers. Easton Patrick (2011) says that consuming beetroot juice or beet as cooked vegetable in salad is highly beneficial in treating anemia. Nirman Walker (2010), in fresh vegetables and fruit juice, claims that beets build red corpuscles and add tones to blood so that it increases haemoglobin level in blood. Many studies proved that beetroot contributes to improve the haemoglobin level in blood. The cost is low when compared with other iron rich vegetables [10].

Also, beetroot is rich in Vitamin A, B1, B2, B6, folic acid, B12 and C. Some of mineral properties are folic acid, Potassium, Calcium, Sodium, Magnesium, Iron, phosphorous and many antioxidants. The benefits of beetroot juice relates mostly to its great reputation as a strong blood builder and purifier because it optimizes the utilization of oxygen stimulating RBC production [11].

Statement of the Problem

A quasi experimental study to assess the effectiveness of beetroot juice with lemon and beetroot juice without lemon on anemia among adolescent girls at selected Senior Secondary Schools, Faridkot.

Objectives of the Study

1. To assess the prevalence of anemia among adolescent girls.
2. To assess the level of Hb of adolescent girls before intervention.
3. To assess the level of Hb after administration of beetroot juice with lemon and beetroot juice without lemon.
4. To find the association of level of Hb with selected socio demographic variables.

Research Hypothesis

H_0: There is no significant difference in post level of Hb between experimental group 1 (Beetroot juice with lemon) and experiment group 2 (Beetroot juice without lemon)

Methodology

Research Approach and Design

Quantitative research approach and quasi experimental study with pre test- post test design was used for the study.

Research setting

The study was conducted in Mahatma Gandhi Memorial School of Faridkot, which is a private co-educational senior secondary school. Majority of the students in this school comes from nearby villages.

Study Population

Adolescent Girls of 12-17 years studying in selected Senior Secondary School, Faridkot.

Sample size and Sampling technique

Sixty (60) anemic adolescent girls having 9-11 gm/dl Hb were selected by Simple Random Sampling (Lottery Method). Random allocation of study subjects was done by slip method and 30 adolescent girls were assigned to each group i.e. experimental group 1 and 2.

Research Tool

The research tool consists of following parts:

Part I: Socio- demographic profile of the respondent: It has total fourteen socio demographic items which were age, class of study, educational status of father, educational status of mother, father's occupation, mother's occupation, family monthly income, religion, residence, dietary pattern, type of family, number of family members, number of siblings and age at menarche.

Part II: Tool to record HB level: This includes a Performa for pre-intervention and post-intervention Hb assessment by using Hb meter.

Part III: Procedure for Hb estimation: Hb assessment of the adolescent girls was done using Hb meter.

Ethical Consideration

Ethical committee of University College of Nursing and Baba Farid University of Health Sciences gave ethical approval for the study to be conducted. Permissions were taken from the school authorities to conduct the study. Apart from this, written informed consents were taken from each study subject and their parents. Confidentiality and privacy of the study subjects was taken care of.

Procedure of Data Collection

Haemoglobin of all the adolescent girls was assessed using Hb meter. Simple Random Sampling (Lottery Method) was used to select study subjects. Random allocation of study subjects was done by slip method and they were assigned to experimental group 1 and experiment group 2. Intervention was given to both the groups. For experimental group 1, fresh beetroot was cut into in to small pieces which were grinded well. Then 30 ml of boiled cool water was added to 30 ml of beetroot pulp and 10 grams sugar with 7-8 drops of lemon was added to the mixture. 60 ml of beetroot juice was given for 20 days between 10-11:30 am once a day to adolescent girls. Similar mixture was prepared without adding lemon and given to adolescent girls of experimental group 2 for 20 days between 10-11:30 am once a day.

Data Analysis: The analysis was done using descriptive statistics like frequency and percentage. Inferential statistics i.e. Paired t-test, Unpaired t-test and Chi Square. S.P.S.S. version 20 was used to analyze the data. p value ≤ 0.05 was considered significant.

Results

Table 1 shows that as per socio demographic variables, both groups were comparable, as chi square value of all variables was found to be non-significant.

Table 2 depicts that less than half i.e. 41.6% of adolescent girls had normal Hb (≥ 12 gm/dl). Slightly more than one third i.e. 36.4% had mild anemia (Hb10-11.9 gm/dl), followed by 19.3% girls had moderate anemia (Hb7-9.9 gm/dl) and remaining 2.8% girls had severe anemia (Hb < 7 gm/dl). Prevalence of anemia among adolescent girls was 58.4%.

Fig. 1 depicts the pre mean level of Hb in both the groups. In experimental group 1, the pre mean level of Hb is 10.21 ± 0.561 and in experiment group 2 it is 10.26 ± 0.650 at df=58, t value=2.98 and p-value=0.76 which is non significant. This means that there is no difference in the pre mean level of Hb in both the groups.

Table 1: Frequency and Percentage distribution of Sample Characteristics   N = 60

Variables under study	Experimental Group 1		Experiment Group 2		Total		χ^2
	n	%	n	%	n	%	
Age (in years)							χ^2=1.875
12-14	12	20.0	18	30.0	30	50.0	df=1
15-17	18	30.0	12	20.0	30	50.0	p=0.171
Class of Study							
6th-7th	5	8.3	6	10.0	11	18.3	
8th-9th	15	25.0	14	23.3	29	48.3	χ^2=10.571
10th-11th	8	13.3	7	11.7	15	25.0	df=9
12th	2	3.4	3	5.0	5	8.4	p=0.306
Father's Educational Status							
Illiterate	5	8.3	6	10.0	11	18.3	
Upto Middle	8	13.3	7	11.7	15	25.0	χ^2=7.274
Upto Matric	7	11.7	10	16.6	17	28.3	df=16
Upto Senior Secondary	7	11.7	6	10.0	13	21.7	p=0.968
Graduation and above	3	5.0	1	1.7	4	6.7	
Mother's Educational Status							
Illiterate	13	21.6	7	11.7	20	33.3	
Upto Middle	6	10.0	8	13.4	14	23.4	χ^2=13.252
Upto Matric	5	8.4	10	16.6	15	25.0	df=12
Upto Senior Secondary	4	6.7	5	8.3	9	15.0	p=0.351
Graduation and above	2	3.3	-	-	2	3.3	
Occupation Status of father							
Unemployed	-	-	-	-	-	-	
Self-Employed	13	21.6	7	11.7	20	33.3	
Farmer	1	1.6	1	1.7	2	3.3	χ^2=9.498
Government Service	5	8.4	3	`5.0	8	13.4	df=16
Private Service	3	5.0	8	13.3	11	18.3	p=0.892
Laborer	8	13.4	11	18.3	19	31.7	
Occupation Status of mother							
Housewife	25	41.7	24	40.0	49	81.7	
Self-Employed	3	5.00	3	5.0	6	10.0	χ^2=2.700
Government Service	-	-	-	-	-	-	df=4
Private Service	-	-	-	-	-	-	p=0.609
Laborer	2	3.3	3	5.00	5	8.3	
Family Monthly Income (in Rupees)							
≤ 10,000	12	20.0	14	23.4	26	43.4	χ^2=6.161
10,001-20,000	9	15.0	7	11.6	16	26.6	df=9
20,001-30,000	8	13.3	8	13.3	16	26.6	p=0.724
30,001-40,000	1	1.7	1	1.7	2	3.4	
> 40,000	-	-	-	-	-	-	
Religion							
Sikh	14	23.4	11	18.3	25	41.7	χ^2=0.433
Hindu	16	26.6	19	31.7	35	58.3	df=1
Muslim	-	-	-	-	-	-	p=0.510
Christian	-	-	-	-	-	-	
Residence							
Urban	29	48.4	30	50.0	59	98.4	-
Rural	1	1.6	-	-	1	1.6	
Dietary Pattern							
Vegetarian	22	36.7	21	35.0	43	71.7	χ^2=6.699

Variables under study	Experiment Group 1		Experiment Group 2		Total		χ²
	n	%	N	%	n	%	
Non-Vegetarian	3	5.0	5	8.3	8	13.3	df=4
Eggetarian	5	8.3	4	6.7	9	15.0	p=0.153
Type of Family							
Nuclear	21	35.0	18	30.0	39	65.0	χ²=2.745
Joint	6	10.0	5	8.3	11	18.3	df=4
Extended	3	5.0	7	11.7	10	16.7	p=0.601
Number of Family Members							
Two	-	-	-	-	-	-	-
Three	-	-	1	1.6	1	1.6	
More than three	30	50.0	29	48.4	59	98.4	
Number of Siblings							
None	-	-	1	1.6	1	1.6	χ²=7.898
One	8	13.3	7	11.7	15	25.0	df=6
Two	18	30.0	16	26.7	34	56.7	p=0.246
More than Two	4	6.7	6	10.0	10	16.7	
Age of Menarche (in years)							χ²=2.039
10-12	14	23.3	13	21.7	27	45.0	df=1
13-15	16	26.7	17	28.3	33	55.0	p=0.153

Table 2: Frequency and Percentage distribution of prevalence of anemia among adolescent girls (WHO classification of anemia)   N= 291

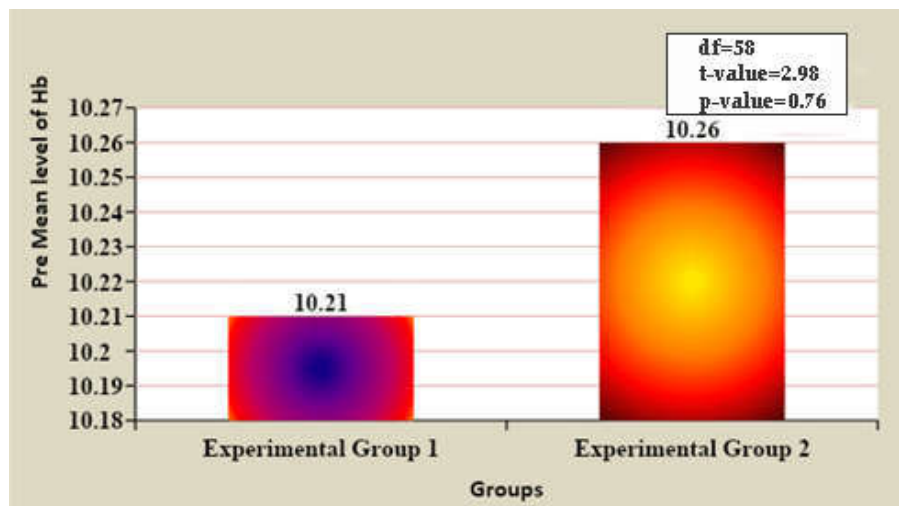| Level of Anemia	Hb (g/dl)	n	%
Normal	≥12	121	41.6
Mild Anemia	10-11.9	106	36.4
Moderate Anemia	7-9.9	56	19.2
Severe Anemia	<7	8	2.8
Total		291	100.0

Fig. 1: Pre mean level of Hb among experiment group1 and experiment group 2

Table 3: Frequency and percentage distribution of level of Hb after administration of beetroot juice with lemon (experimental group 1) and beetroot juice without lemon (experiment group 2).   N=60

Level of Hb (mg/dl)	Experiment Group 1 n=30			Experiment Group 2 n=30			Total		
	f	%		f	%		f	%	
9-10	1	1.6		5	8.4		6	10.0	
10.1-11	8	13.4	Mean=11.7 Sd=0.87	11	18.4	Mean=11.2 Sd=1.01	19	31.8	Mean=11.5 Sd=0.97
11.1-12	15	25		10	16.6		25	41.6	
>12	6	10		4	6.6		10	16.6	

Table 4: Comparison of post mean level of Hb among experimental group 1 (Beetroot juice with lemon) and experiment group 2 (Beetroot juice without lemon)

N=60

Group	Post Mean ± SD	df	t-value	p-value
Experimental Group 1 (n=30)	11.73 ± 0.878	58	2.18	0.03**
Experimental Group 2 (n=30)	11.26 ± 1.011			

= significant at p< 0.05 level

Table 3 depicts that after interventions in both groups, only 6 (10.0%) anemic adolescent girls were in range 9-10 gm/dl (1 in experimental group 1 and 5 in experiment group 2). Slightly less than one third i.e. 19 (31.8%) were those with Hb range 10.1-11 gm/dl (8 in experimental group 1 and 11 in experimental group 2). 25 (41.6.%) with Hb level between 11.1-12 gm/dl (15 in experimental group and 10 in experimental group 2). Only 10 (16.6%) had Hb range >12 (6 in experimental group and 4 in experimental group 2).

Table 4 depicts the post mean level of Hb in both the groups. In experimental group 1, the post mean level of Hb is 11.73 ± 0.878 and in experiment group 2 it is 11.26 at df=58, t value=2.18 and p-value=0.03 which is significant. This means that there is difference in the post mean level of Hb.

Findings related to association of level of Hb with Sample Characteristics

It was found that age and class of study were found statistically significant with p value 0.034 and 0.019. That means Hb is more at less age as 22 adolescent girls had Hb between 10.1-11 gm/dl whereas only 14 were there in age group between 15-17 years. 14 girls in 8th-9th class and only 2 girls in 12th class, had Hb between 10.1-11 gm/dl and. A statistically non-significant association was found between other variables like father's educational status, mother's educational status and occupation status of father, occupation status of mother, family monthly income, religion, residence, dietary pattern, type of family, number of family members number of siblings and age of menarche at p value > 0.05.

Discussion

The present study depicts that 58.4% adolescent girls were found to be anemic. 36.4% had mild anemia, 19.3% had moderate anaemia 2.8% had severe anemia and 41.6% had normal Hb. This finding is supported by a study conducted by *S Kaur, PR Deshmukh and BS Garg (2002)* [12] which concluded that prevalence of anemia was found to be 59.8%. 38.4% had mild anemia, 20.8% had moderate anemia, 0.6% had severe anemia and 40.2% had normal Hb.

The present study results show that beetroot juice is effective remedy so as to increase the haemoglobin fast in the body due to its high content of beta carotene and iron. It treats anemia by increasing blood count and improving blood circulation and oxygen carrying capacity of erythrocytes. This finding is supported by a study conducted by *Priya N Gayathri, Malavizhi M (2013)* [10] in which during beetroot juice was administered, there was highly significant improvement in Hb level after administration of beetroot juice.

Present study revealed that beetroot juice with lemon was more effective than beetroot juice without lemon. There was statistically significant association between the post levels among both the groups. This can be by prevention of the formation of insoluble and unabsorbed iron compounds and reduction of ferric to ferrous iron. Similarly *Teucher, Olivares (2004)* [13] revealed that ascorbic acid is the most efficient enhancer of non-heme iron absorption. The iron absorption enhancing effect of ascorbic acid is more potent than that of other organic acids due to its inability to reduce ferric to ferrous iron.

Conclusion

The intervention beetroot juice with lemon or without lemon was helpful in raising Hb among anemic adolescent girls. Post intervention mean of beetroot juice with lemon was 11.73 ± 0.878; similarly mean of beetroot juice without lemon was 11.26 ± 1.011 with df 58 and p-value 0.03 which was significant. Thus, it is evident from the results that beetroot juice with lemon is more effective in improving anemia among adolescent girls than beetroot juice without lemon. This remedy is easy to prepare and cost effective too.

Conflict of interest – Nil

Source of funding - Self

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