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A STUDY TO ASSESS THE EFFECTIVENESS OF NUTRITION BALL ON HAEMOGLOBIN LEVEL AMONG ADOLESCENT GIRLS AT SELECTED GOVERNMENT SCHOOL OF VADODARA DISTRICT

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ABSTRACT

Introduction: Anemia is more common in girls because they have an extra loss of iron in the blood through menstrual bleeding. It can affect the adolescent girl's development and school performance. Studies have shown that adolescents with anemia have impaired verbal learning and memory, as well as lower standardized maths scores. There is evidence that correcting the anemia may improve learning. Even before anemia might develop, iron deficiency can cause shortened attention span, alertness, and learning in adolescents. **Aims and Objectives:** This study aimed to evaluate the effectiveness of Nutrition balls as supplements in improving haemoglobin levels. **Material and methods:** 60 subjects were selected by using a probability simple random sampling technique. Adolescent girls who are between the age group of 14 -17

years, haemoglobin level between 9gms/dl-11.9 gms/dl, enrolled in registers and studying in high school from 8th to 10th standard in government high schools of rural area were included. The subjects received oral nutritional supplements (nutrition ball- 150 gms) twice a daily in the morning and evening for 21 days. Bodyweight and haemoglobin levels were assessed before and at the end of 21 days of intervention. **Results:** After 21 days of daily supplementation of nutrition balls (150 gms), researchers observed that there was an effect of nutritional balls on improving haemoglobin level in the experimental group ($t=13.356$, $P < 0.05$). **Conclusion:** A combination of rice flakes and jaggery with amla powder proved to be a better natural food supplement to improve haemoglobin levels among adolescent girls. The advantage of this preparation is that it does not have any significant adverse effects as observed with oral and parenteral iron preparations. It can also be used as a prophylactic strategy to combat iron deficiency in vulnerable populations.

Keyword: Prevalence Nutritional ball, adolescent girl, hemoglobin level rural area

INTRODUCTION

Anemia is more common in girls because they have extra loss of iron in blood through menstrual bleeding. In teenagers, anemia is more common than just being pale and tired. It can affect the adolescent girl's development and school performance. Studies have shown that adolescents with anemia have impaired verbal learning and memory, as well as lower standardized maths scores. There is evidence that, correcting the anemia may improve learning. Even before anemia might develop, iron deficiency can cause shortened attention span, alertness, and learning in adolescents.[1]

Inadequate nutrition, inadequate iron intake, poor iron absorption, increased iron need or chronic blood loss, prolonged iron deficiency during adolescence can have serious consequences throughout the reproductive years of life and beyond.[1] The nutritional anemia in adolescent girls attributes to the high maternal mortality rate, high incidence of low birth weight babies, high peri-natal mortality and the consequent high fertility rates.[1]

Proper nutrition, including adequate iron intake, plays an important part of teenager's growth and development. Girls especially, need to consume more nutritious and iron-rich food because they lose some iron when they go through their monthly cycles.[1]

Rice flakes and Jaggery are rich in iron. 1.49 mg of iron is present in 100 g of rice

flakes and 3 mg of iron /100 g of Jaggery. It is written in Sushrutha Samhita that, the Gud (Jaggery) "purifies the blood, prevents rheumatic afflictions and disorders of bile & has nutritive properties of high order". Rice flakes and jaggery are easily available, accessible and affordable. Rice flakes are also rich in vitamin-C which facilitates iron absorption and also rice flakes and jaggery mixture is an attractive food for the adolescents, usually taken as evening snacks. Iron is an important building block for red blood cells. When the body doesn't have enough iron, it will make fewer red blood cells which is not sufficient. Iron is an important mineral that is essential for the normal functioning of the body and it is helpful in carrying oxygen around the body, ensures a healthy immune system and provides energy for the body and prevents anemia.[1]

The prevalence of anemia is higher among adolescent girls. So many studies had proven that iron deficiency anemia had highest prevalence rate in developing and developed countries among adolescents. In Gujarat, the prevalence of iron deficiency anemia is higher. So many studies had proven that iron supplementation will be increases haemoglobin level, memory, concentration and good academic performance of adolescent girls.

Keeping the above facts in view, the investigators personal observation and experiences motivated the investigators to conduct research on effectiveness of nutritional ball on haemoglobin level among adolescent girls.

REVIEW OF LITERATURE

Sakthibalan M conducted a prospective study on evaluation of efficacy of jaggery and raisins as supplements in iron deficiency anaemia among medical undergraduate students in South India. 50 female medical undergraduate students were randomly received oral nutritional supplement (jaggery balls-5gms and raisins-5gms) once daily in the morning for 8 weeks. After 8 weeks of daily supplementation of jaggery and raisins, researchers observed that there was a significant rise in the mean hemoglobin (Hb) level to 11.79 ± 1.07 ($P < 0.0001$) and also a significant rise in the mean red blood cell count to 4.22 ± 0.30 ($P < 0.0001$) compared to baseline values. The outcome of this study proved the effective role of the nutritional supplementation in improving the Hb status in IDA. It can also be used as a prophylactic strategy to combat iron deficiency in vulnerable population[6].

Anusuya V conducted a study on effectiveness of amla juice with elemental iron among adolescent girls on iron deficiency anaemia in Govt. Manohara School at Sellur, Madurai. Pre experimental one group pre-test - posttest design was used & 40 subjects were selected by purposive sampling. After obtaining an informed consent from their parents, pre-test was done by using self-administered questionnaire and anaemia symptoms were assessed with observation check list and estimation of haemoglobin by cell count method in the clinical laboratory before and after intervention. The mean pre-test mean score was increased from 9.35 to 10.11. the 't' value 6.05 was much higher than the table value at 0.001 (level of significance at 0.05). The study concluded that amla juice with elemental iron was effective on increasing the haemoglobin level among adolescents' girls.[7]

Achouri I conducted a study to estimate the prevalence of anaemia among school children in Kenitra. The sample represents school children of age ranged between 6-15 years and sample size was 271 school children. The prevalence of anaemia was 16.2%. The mean haemoglobin concentration was 12.53 g/dl in boys and 12.52 g dl in girls. There was a significant relationship between education of the mother and anaemia in children (p= 0.004) but not with the family income. It is concluded that improving the economic status of the family, women education and health education about balanced animal and plant food consumption are recommended strategies to reduce the burden of anaemia.[6]

Limna. M conducted a study on effect of rice flakes and jaggery mixture consumption on haemoglobin level among adolescent girls. Forty two adolescent girls were screened, among which thirty subjects were purposively selected from the population as per the inclusion criteria. The present study revealed that rice flakes and jaggery mixture was effective in improving haemoglobin level. There was an association between pre-test level of haemoglobin and subject's age, main source of information on anaemia and history of menstrual irregularities in the last one year. Findings of the study suggested that rice flakes and jaggery mixture can be used as an effective nutritional intervention programme in improving haemoglobin level.[1]

Rathi, R conducted a study to assess the effectiveness of nutrition ball to increase haemoglobin level among adolescent girls with anaemia. The research design was true experimental design. The sample size was 60

was drawn from simple random sampling technique. The blood haemoglobin level among anaemic adolescent girls was assessed by using haemometer. The data gathered were analyzed by descriptive and inferential statistical method. Study findings revealed that the mean score on level of anaemia was 9.8 in pre test and 12.4 in post-test in experimental group. The Paired't' value was 9.25 which is significant at $p > 0.05$. It shows that nutrition ball was effective in improving the level of haemoglobin. The study inference revealed that regular practice of nutrition ball could bring out desired increasing in the haemoglobin level among adolescent girls with anaemia.[5]

A Chellamani conducted a quasi-experimental study to evaluate the effectiveness of nutrition ball on haemoglobin level among adolescent girls with iron deficiency anaemia at selected industry Hostel in Madurai. A quantitative approach, one group pre-test and post-test design was adapted.. A sample size of 60 adolescent girls with iron deficiency anaemia selected by non-probability purposive sampling technique was used to collect the samples. It reveals that the 't' value 18.48 was much higher than the table value at 0.001 (pre-test level of significance was 0.05). The mean post-test score of haemoglobin level will be significantly higher than their mean test score of haemoglobin leve1[4].

STATEMENT OF THE PROBLEM

"A study to assess the effectiveness of nutrition ball on haemoglobin level among adolescent girls at selected Government school of Vadodara District.'

OBJECTIVES:

- To assess and compare the pre-test and post -test level of haemoglobin among adolescent girls in experimental and control groups.
- To find out the effectiveness of nutrition ball on haemoglobin level among adolescent girls with anaemia in experimental group.
- To determine the association between the pre-test haemoglobin level among adolescent girls with their selected demographic variables in experimental and control groups.

ASSUMPTIONS

- Adolescent girls are prone to develop anaemia due to menstruation, insufficient iron in the diet and poor absorption of iron in the body.
- Dietary intake of iron supplement in form of nutrition ball will improve the haemoglobin level among adolescent girls

HYPOTHESES

- **H_1 :** There will be a significant difference between the pre-test and post-test haemoglobin level among adolescent girls in experimental and control groups.
- **H_2:** There will be a significant effectiveness of nutrition ball on haemoglobin level

among adolescent girls in experimental group and control groups.

- **H_3:** There will be significant association in the pre-test haemoglobin level among adolescent girls with the selected demographical variables.

METHODOLOGY

The Pre experimental design -Pre-test and Post-test control group design was adopted. The study was carried out at Government Higher Secondary School rural areas of Dabhoi Taluka, Vadodara District. 60 subjects were selected by using a probability simple random sampling technique. Adolescent girls who are between the age group of 14 -17 years, hemoglobin level between 9gms/dl-11.9 gms/dl, enrolled in registers and studying in high school from 8th to 10th standard in government high schools of rural area were included. Adolescent girls who are taking iron supplements. On treatment for anemia, on medical treatment, having an irregular menstrual cycle, sick during the data collection period, unreachable in spite of two school visits, having iron intolerance, having a history of juvenile diabetes, and having indigestion were excluded. Formal written permission was obtained from the Headmaster/mistress from the schools.

The data collection was carried out from 10th July 2021 – 31st July 2021. The Investigators introduced themselves and explained the purpose of the study, written consent from the parents and assent from the subjects was obtained with their anonymity and confidentiality of data. The data gathering was carried out with the demographic variables that have been collected with the use of a self-administered questionnaire and assessments were done for symptoms of anaemia with observation checklist and pretests including estimation of haemoglobin level among adolescent girls were tested by Digital haemoglobin meter method. On the first day-night deworming was done by Tab. Albendazole 400mg per sample was given. The next day onwards the nutrition ball was given to the samples two times per day for 21 days.

The samples were administered with rice flakes and jaggery mixture which was made in the form of 150g ladoo which contained

2.82 mg iron. This was provided for adolescent girls in the morning and evening as snacks per day for a period of 21 days. It was prepared by the researcher themselves from 117 kg of rice flakes and 73 kg of jaggery by mixing it well and dividing 150 g of each portion in the common balance. After that prepare 150g of 1260 balls. The researcher closely monitored the samples for ensuring timely consumption of rice flakes and jaggery mixture on a daily basis and post-test was done after 21 days of intervention by Digital hemoglobin meter method. The collected data was optimized and analyzed by using descriptive statistics and inferential statistics. About 10 to 20 minutes was spent by each subject for assessment each time. The obtained data were analyzed using SPSS-20 software. More specifically, descriptive statistics (frequency and percentage, mean, standard deviation) were used to describe the subjects' characteristics and to know the level of hemoglobin. A Chi-square test was used in order to find out the association between the level of hemoglobin and selected socio-demographic variables. The level of significance was set at $p<0.05$. The paired "t"-test was used to know the effectiveness of the nutrition balls on hemoglobin level

RESULTS

The systematic organization and synthesis of research data and in quantitative studies, the testing of hypothesis using those data (Polit &Beck,2011).

This chapter deals with the analysis and interpretation of data collected from 60 adolescent girls divided into Experimental and Control group at Government Higher Secondary School, Dabhoi Taluka Vadodara District, on the effectiveness of Nutrition ball administration to the adolescent girls between the ages of 13-17 years who had Haemoglobin level with mild level (11-11.9 g/dl) and moderate level (8-10.9mg/dl). The data were coded and analyzed as per objectives of the study under the following headings.

SECTION A: Distribution of demographic variables of the adolescent girls in experimental group and control group.

SECTION B: Assess the pre-test and post-test level of Haemoglobin of the adolescent girls in Experimental group and Control group.

SECTION C: To evaluate the effectiveness of Nutrition ball administration of the adolescent girls in Experimental group and Control group.

SECTION D: Find out the association between post-test level of Haemoglobin among adolescent girls with their selected

demographic variables in Experimental and Control group.

SECTION- A

DESCRIPTION OF SAMPLES ACCORDING TO THEIR DEMOGRAPHIC VARIABLES

Table -1 shows that the majority of the subjects in the experimental group is 16 (53.3%) belongs to the age group 15-16 years where as 14 (46.7%) of the subjects belongs to the age group of 13-14 years, whereas the majority of the subjects in the control group is 18 (60%) belongs to the age group of 15-16 years and 12 (40%) of the subjects belongs to the age group of 13-14 years.

According to class wise the majority of the subjects in the experimental group is 13 (43.3%) belongs to the class 10^{th}, 11 (36.7%) of the subjects belongs to class 9^{th} and 6 (20.0%) of the subjects belongs to class 8^{th}. Whereas the majority of the subjects in the control group is 18 (60%) belongs to the class 9^{th}, 7 (23.3%) of the subjects belongs to class 10^{th} and 5 (16.7%) of the subjects belongs to class 8^{th}.

With respect to religion, both in the experimental and control group the whole subjects were in Hindu religion 30 (100%) each, whereas in the Muslim and Christian there were no any subjects 0 (0.0%) in both experimental and control group.

In relation to the education status of mother, majority of the subjects in the experimental group is 10 (63.3%) belongs to primary education, 9 (30%) belongs to secondary education, 2 (6.7%) Higher secondary education and 0 (0%) belongs to no formal education and degree and above. Whereas the majority of the subjects in the control group is 14 (46.7%) belongs to primary education, 9 (30.0%) belongs to no formal education, 7 (23.3%) belongs to secondary education and no any subjects belongs to Higher secondary education and degree and above.

In relation to the education status of father, majority of the subjects in the experimental group is 13 (43.3%) belongs to primary education and secondary education, 2 (6.7%) belongs to no formal education and higher secondary education and 0 (0%) belongs to degree and above. Whereas the majority of the subjects in the control group is 11 (36.7%) belongs to primary education, 10 (33.3%) belongs to secondary education, 6 (20.0%) belongs to no formal education, 3 (10.0%) belongs to higher secondary education and 0 (0%) belongs to degree and above.

Table -2 shows that the majority of the subjects (occupation status of mother) in the experimental group is 11 (36.7%) belongs to

daily wages and private employee, 7 (23.3%) belongs to housewife and 1 (3.3%) self-employee and 0 (0%) belongs to government employee. Whereas the majority of the subjects in the control group is 12 (40.0%) belongs to housewife, 11 (36.7%) belongs to daily wages, 6 (20.0%) belongs to self-employee, 1 (3.3%) belongs to gov. employee and 0 (0%) belongs to private employee.

In relation to the occupation status of father, majority of the subjects in the experimental group is 10 (33.3%) belongs to private employee, 7 (23.3%) belongs to self-employee, 6 (20.0%) daily wages 0 (0%) belongs to government employee. Whereas the majority of the subjects in the control group is 11 (36.7%) belongs to self-employee, 8 (26.7%) belongs to daily wages, 7 (23.3%) belongs to private-employee, 4 (13.3%) belongs to government employee.

In relation to the type of family, majority of the subjects in the experimental group is 24 (80.0%) belongs to the joint family, 6 (20%) belongs to extended family and 0 (0%) belongs to nuclear family. Whereas the majority of the subjects in the control group is 19 (63.3%) belongs to joint family, 8 (26.7%) belongs to nuclear family and 3 (10%) belongs to extended family.

In relation to the type of diet, majority of the subjects in the experimental group is 16 (53.3%) belongs to vegetarian diet and 14 (46.7%) belongs to mixed diet. Whereas the majority of the subjects in the control group is 20 (66.7%) belongs to vegetarian diet and 10 (33.3%) belongs to mixed diet.

In relation to the number of family members, majority of the subjects in the experimental group is 19 (63.3%) belongs to 3 members in the family, whereas 8 (26.7%) subjects were belongs to 4 members in the family, 3 (10.0%) belongs to 2 members in the family, 0 (0%) belongs to 5 and >5 members in the family. Whereas the majority of the subjects (no. of family members) in the control group is 11 (36.7%) belongs to 3 members in the family, whereas 8 (26.7%) belongs to 4 members in the family, 6(20.0%) belongs to 5 members in the family, 5(16.7%) belongs to >5 members in the family, 0(0%) belongs to 2 members in the family.

Table -3 shows that the majority of the subjects (age of menarche) in the experimental group is 15 (50.0%) belongs to 13 years, whereas 8 (26.7%) belongs to 14 years and 7 (23.3%) belongs to 12 years. Whereas the majority of the subjects in the control group is 21 (70.0%) belongs to 13

years, whereas 6 (20.0%) belongs to 14 years, 3(10%) belongs to 12years.

In relation to history of menstrual bleeding, majority of the subjects in the experimental group is- 24 (80.0%) belongs to normal and regular, whereas 6 (20.0%) belongs to menorrhagia, 0 (0%) belongs to polymenorrhea and irregular menstrual cycle. Whereas the majority of the subjects in the control group is 20 (66.7%) belongs to normal and regular, whereas 10 (33.3%) belongs to menorrhagia, 0 (0%) belongs to Polymenorrhea and irregular menstrual cycle.

In relation to the duration of menstrual days, majority of the subjects in the experimental group is 17 (56.7%) belongs to 4-5 days, whereas 9 (30.0%) belongs to >5 days and 4 (13.3%) belongs to 2-3 days. Whereas the majority of the subjects in the control group is 21 (70.0%) belongs to 4-5 days, whereas 8 (26.7%) belongs to >5 days, 1 (3.3%) belongs to 2-3 days.

In relation to the menstrual flow, majority of the subjects in the experimental group is 26 (86.7%) belongs to moderate, whereas 3 (10.0%) belongs to heavy and 1 (3.3%) belongs to scanty. Whereas the majority of the subjects in the control group 27 (90.0%) belongs to moderate, whereas 21 (3.3%) belongs to heavy and 2 (6.7%) belongs to scanty.

In relation to the how many times drink tea/coffee a day, majority of the subjects in the experimental group 16 (53.3%) belongs to twice a day, whereas 14 (46.7%) belongs to once a day and 0 (0%) belongs to more than twice a day. Whereas the majority of the subjects in the control group is 19 (63.3%) twice a day, whereas 7 (23.3%) belongs to once a day and 4 (13.3%) belongs to more than twice a day.

Table -4 shows that the majority of the subjects (when was the last deworming drug taken) in the experimental group is 16 (53.3%) belongs to before 6months, whereas 14 (46.7%) belongs to before 3 months and 0 (0%) belongs to before 1 month and not at all. Whereas the majority of the subjects in the control group is 11 (36.7%) belongs to before 3months, whereas 10 (33.3%) belongs to before 6 months and 5 (16.7%) belongs to not at all and 4 (13.3%) belongs to before 1 month.

In relation to the History of Peptic Ulcer / Gastritis / Surgery and Medicine, the majority of the subjects in the experimental group is 30 (100%) belongs to no, whereas 0 (0%) belongs to yes. Whereas the majority of the subjects in the control group 29 (96.7%) belongs to no, whereas 1 (3.3%) belongs to yes.

In relation to height in cm, majority of the subjects in the experimental group is 13 (43.3%) belongs to 141-145cm, whereas 9 (30,0%) belongs to 146-150cm, 6 (20.0%) belongs to 136-140cm and 2 (6.7%) belongs to 151-155cm.Whereas the majority of the subjects in the control group is 12 (40.1%) belongs to 146-150cm, whereas 9 (30.0%) belongs to 141-145cm, 8 (26.6%) belongs to 136-140cm and 1 (3.3%) belongs to 151-155cm.

In relation to the weight in kg, majority of the subjects in the experimental group is 18 (60.0%) belongs to 36-40kg, whereas 7 (23.0%) belongs to 31-35kg, 5 (17.0%) belongs to 41-45kg and 0 (0%) belongs to 46-50kg. Whereas the majority of the subjects in the control group is 22 (73.4%) belongs to 36-40kg, whereas 4 (13.3%) belongs to 41-45kg, 3 (10.0%) belongs to 46-50kg and 1 (3.3%) belongs to 31-35kg.

In relation to the whether taken treatment for anaemia, majority of the subjects in the experimental group is 30 (100%) belongs to no, whereas 0 (0%) belongs to yes. Whereas the majority of the subjects (whether taken treatment for anaemia) in the control group is 30 (100%) belongs to no, whereas 0 (0%) belongs to yes.

SECTION-B

ASSESS THE PRE-TEST AND POST-TEST LEVEL OF HAEMOGLOBIN OF THE ADOLESCENT GIRLS IN EXPERIMENTAL GROUP AND CONTROL GROUP.

Table -5 shows that the majority of the subjects in the experimental group (pre-test) is 24 (80.0%) belongs to the moderate anemia whereas 6 (20.0%) of the subjects belongs to the age group of mild anemia. Whereas the majority of the subjects in the control group is 25 (83.3%) belongs to moderate anemia whereas 5 (16.7%) belongs to mild anemia.

Table -6 The majority of the subjects in the experimental group (post-test) is 22 (73.0%) belongs to the moderate anemia whereas 8 (27.0%) of the subjects belongs to the age group of mild anemia. Whereas the majority of the subjects in the control group is 24 (80%) belongs to moderate anemia whereas 6 (20%) belongs to mild anemia.

SECTION–C

EFFECTIVENESS OF NUTRITION BALL ADMINISTRATION OF THE ADOLESCENT GIRLS IN EXPERIMENTAL GROUP AND CONTROL GROUP.

Table- 7 shows that the Mean score was 9.80 for post-test and Standard Deviation was 1.095. The mean score was 9.53 for pre-test and Standard Deviation was 0.900.

Table-8 shows that the mean score was 11.47 for post-test and standard deviation was 0.730. The mean score was 9.93 for pre-test and Standard Deviation was 0.640.

SECTION D

FIND OUT THE ASSOCIATION BETWEEN POST- TEST LEVEL OF HAEMOGLOBIN OF CONTROL GROUP WITH THEIR SELECTED DEMOGRAPHIC VARIABLES

Table-9 shows that the calculatedχ^2values were less than the table value in terms of age, standard of class, education status of mother, education status of father and occupation of mother. Since no significant association was found to exist between level of haemoglobin and selected socio demographic variables. Hence the research hypothesis H_1 stated that there is no significant association between the level of haemoglobin and selected socio demographic variables was rejected.

Table -10 shows that the calculated χ^2 values were less than the table value in terms of occupation of father, types of family, types of diet, number of family member and age of menarche. Since no significant association was found to exist between level of haemoglobin and selected socio demographic variables. Hence the research hypothesis H_1 stated that there is a significant association between the level of haemoglobin and selected socio demographic variables was rejected.

Table-11 shows that the calculated χ^2 values were less than the table value in terms of history of menstrual bleeding, duration of menstrual days, menstrual flow, how many times you are drinking coffee or tea per day and when was the last de-worming drug taken. Since no significant association was found to exist between level of haemoglobin and selected socio demographic variables. Hence the research hypothesis H_1 stated that there is a significant association between the level of haemoglobin and selected socio demographic variables was rejected.

Table-12 shows that the calculated χ^2 values were less than the table value in terms of history of Peptic ulcer/Gastritis/Surgery and Medicine, Height in Cms, Weight in Kgs. Since no significant association was found to exist between level of haemoglobin and selected socio demographic variables. Hence the research hypothesis H_1 stated that there is a significant association between the level of haemoglobin and selected socio demographic variables was rejected.

FIND OUT THE ASSOCIATION BETWEEN POST- TEST LEVEL OF HAEMOGLOBIN OF EXPERIMENTAL GROUP WITH THEIR SELECTED DEMOGRAPHIC VARIABLES

Table-13 shows that the calculated χ^2 values were less than the table value in terms of age,

standard of class, education status of mother, education status of father and occupation of mother. Since no significant association was found to exist between level of haemoglobin and selected socio demographic variables. Hence the research hypothesis H_1 stated that there is no significant association between the level of haemoglobin and selected socio demographic variables was rejected.

Table-14 shows that the calculated χ^2 values were less than the table value in terms of occupation of father, types of family, types of diet, number of family member and age of menarche. Since no significant association was found to exist between level of haemoglobin and selected socio demographic variables. Hence the research hypothesis H_1 stated that there is a significant association between the level of haemoglobin and selected socio demographic variables was rejected.

Table-15 shows that the calculated χ^2 values were less than the table value in terms of history of menstrual bleeding, duration of menstrual days, menstrual flow, how many times you are drinking coffee or tea per day and when was the last de-worming drug taken. Since no significant association was found to exist between level of haemoglobin and selected socio demographic variables. Hence the research hypothesis H_1 stated that there is a significant association between the level of haemoglobin and selected socio demographic variables was rejected.

Table-16 shows that the calculated χ^2 values were less than the table value in terms of height in cms and weight in Kgs. Since no significant association was found to exist between level of haemoglobin and selected socio demographic variables. Hence the research hypothesis H_1 stated that there is a significant association between the level of haemoglobin and selected socio demographic variables was rejected.

Table 1: Frequency and percentage distribution of demographic variables among experimental and control group (n_1=30),(n_2=30)

Sr. No	Demographic Variables	Experimental Group		Control Group	
		Frequency	Percentage	Frequency	Percentage
1.	Age in years				
	a. 13-14 years	14	46.7	12	40.0
	b. 15-16 years	16	53.3	18	60.0
2.	Standard of class				
	a. 8th Std	6	20.0	5	16.7
	b. 9th Std	11	36.7	18	60.0
	c. 10th Std	13	43.3	7	23.3
3.	Religion				
	a. Hindu	30	100.0	30	100.0
	b. Muslim	0	0	0	0

	c. Christian	0	0	0	0
4	Education status of Mother				
	a. No formal education	0	0	9	30.0
	b. Primary education	10	63.3	14	46.7
	c. Secondary Education	9	30.0	7	23.3
	d. Higher secondary education	2	6.7	0	0
	e. Degree and above	0	0	0	0
5.	Education status of Father				
	a. No formal education	2	6.7	6	20.0
	b. Primary education	13	43.3	11	36.7
	c. Secondary Education	13	43.3	10	33.3
	d. Higher secondary education	2	6.7	3	10.0
	e. Degree and above	0	0	0	0

Table 2: Frequency and percentage distribution of demographic variables among experimental and control group (n_1=30),(n_2=30)

Sr. No	Demographic Variables	Experimental Group		Control Group	
		Frequency	Percentage	Frequency	Percentage
6.	Occupation status of mother				
	a. Housewife	7	23.3	12	40.0
	b. Daily wages	11	36.7	11	36.7
	c. Self-employee	1	3.3	6	20.0
	d. Govt. Employee	0	0	1	3.3
	e. Private employee	11	36.7	0	0
7.	Occupation status of father				
	a. Govt. Employee	0	0	4	13.3
	b. Private Employee	10	33.3	7	23.3
	c. Self-Employee	7	23.3	11	36.7
	d. Daily Wages	6	20.0	8	26.7
	e. Unemployed	7	23.3	0	0
8.	Types of Family				
	a. Nuclear	0	0	8	26.7
	b. Joint	24	80.0	19	63.3
	c. Extended	6	20.0	3	10.0
9.	Type of diet				
	a. Vegetarian	16	53.3	20	66.7
	b. Mixed diet	14	46.7	10	33.3
10.	Number of Family Members				
	a. 2	3	10.0	0	0
	b. 3	19	63.3	11	36.7
	c. 4	8	26.7	8	26.7
	d. 5	0	0	6	20.0
	e. >5	0	0	5	16.7

Table 3: Frequency and percentage distribution of demographic variables among experimental and control group (n_1=30), (n_2=30)

Sr. No	Demographic Variables	Experimental Group		Control Group	
		Frequency	Percentage	Frequency	Percentage
11.	Age of menarche				
	a. 12	7	23.3	3	10.0
	b. 13	15	50.0	21	70.0
	c. 14	8	26.7	6	20.0
12.	History of menstrual bleeding				
	a. Normal & regular	24	80.0	20	66.7
	b. Menorrhagia	6	20.0	10	33.3
	c. Polymenorrhea	0	0	0	0
	d. Irregular menstrual cycle	0	0	0	0
13.	Duration of menstrual days				
	a. 2-3 days	4	13.3	1	3.3
	b. 4-5 days	17	56.7	21	70.0
	c. >5 days	9	30.0	8	26.7
14	Menstrual flow				
	a. Heavy	3	10.0	21	3.3
	b. Moderate	26	86.7	27	90.0
	c. Scanty	1	3.3	2	6.7
15.	How many times drink Tea / Coffee per day?				
	a. Once a day	14	46.7	7	23.3
	b. Twice a day	16	53.3	19	63.3
	c. More than twice a day	0	0	4	13.3

Table 4: Frequency and percentage distribution of demographic variables among experimental and control group. (n_1=30),(n_2=30)

Sr. No	Demographic Variables	Experimental Group		Control Group	
		Frequency	Percentage	Frequency	Percentage
16.	When was the last de-worming drug taken?				
	a. Before 1 month	0	0	4	13.3
	b. Before 3 month	14	46.7	11	36.7
	c. Before 6 month	16	53.3	10	33.3
	d. Not at all taken	0	0	5	16.7
17.	History of Peptic Ulcer / Gastritis / Surgery and Medicine.				
	a. Yes	0	0	1	3.3
	b. No	30	100.0	29	96.7
18.	Height in Cm				
	a. 136-140	6	20.0	8	26.6
	b. 141-145	13	43.3	9	30.0
	c. 146-150	9	30.0	12	40.1
	d. 151-155	2	6.7	1	3.3
19.	Weight in Kg				
	a. 31-35	7	23.0	1	3.3

	b. 36-40	18	60.0	22	73.4
	c. 41-45	5	17.0	4	13.3
	d. 46-50	0	0	3	10.0
20.	Whether Taken treatment for anemia?				
	a. Yes	0	0	0	0
	b. No	30	100.0	30	100.0

Table-5 : Frequency and percentage distribution of Pre-test level of Haemoglobin level of adolescent girls experimental and control group (n_1=30),(n_2=30)

Sr. No	Level of Anaemia	Experimental Group		Control Group	
		Frequency	Percentage	Frequency	Percentage
1.	Mild anaemia	6	20.0	5	16.7
2.	Moderate anaemia	24	80.0	25	83.3

Table 6: Frequency and percentage distribution of Post-test level of Haemoglobin level of adolescent girls in experimental and control group (n_1=30),(n_2=30)

Sr. No.	Level of Anaemia	Experimental Group		Control Group	
		Frequency	Percentage	Frequency	Percentage
1.	Mild Anaemia	8	27.0	6	20
2.	Moderate Anaemia	22	73.0	24	80

Table 7: Compare the pre-test and post-test scores of haemoglobin of the adolescent girls in Control group (n_2=30)

S.No	Test	Mean	Standard deviation	Mean difference	't' Value	Table Value	Inference
1.	Pre-test	9.53	.900	0.27	2.804	2.045	Significant P<0.05
2.	Post test	9.80	1.095				

Table 8: Compare the pre-test and post-test scores of haemoglobin of the adolescent girls in Experimental group (n_1=30)

S.No	Test	Mean	Standard deviation	Mean difference	't' Value	Table Value	Inference
1.	Pre-test	9.93	.640	1.54	13.356	2.045	Significant P<0.05
2.	Post test	11.47	.730				

Table 9: Association between pre-test levels of haemoglobin of control group with their selected demographic variables (n_2=30)

Sr No	Demographic variables	Mild	Moderate	Chi-square
1	Age in years			
	a. 13-14 years	2	10	χ^2 =0.988 df =1, NS
	b. 15-16 years	1	17	
2	Standard of class			
	a. 8th Std	1	4	χ^2 = 1.358 df =2 NS
	b. 9th Std	2	16	
	c. 10th Std	0	7	
3	Education status of mother			
	a. No formal education	1	8	χ2 =1.076[a] df =2 NS
	b. Primary education	2	12	
	c. Secondary Education	0	7	
4	Education status of father			
	a. No formal education	1	5	χ2 = 2.559[a] df =3 NS
	b. Primary education	2	9	
	c. Secondary Education	0	10	
	d. Higher secondary education	0	3	

5	**Occupation of mother**			
	a. Housewife	**2**	**10**	**$\chi 2 = 1.380$ df = 3 NS**
	b. Daily wages	**1**	**10**	
	c. Self employee	**0**	**6**	
	d. Gov. Employee	**0**	**1**	

Table 10: Association between pre-test levels of haemoglobin of control group with their selected demographic variables (n_2=30)

Sr No	Demographic variables	Mild	Moderate	Chi-square
1	**Occupation of father**			
	a. Govt. Employee	**0**	**4**	**χ^2 =0.653 df =3**
	b. Private Employee	**1**	**6**	
	c. Self Employee	**1**	**10**	
	d. Daily Wages	**1**	**7**	
2	**Type of family**			
	a. Nuclear	**0**	**8**	**χ^2 = 2.710 df =2 NS**
	b. Joint	**2**	**17**	
	c. Extended	**1**	**2**	
3	**Type of diet**			
	a. Vegetarian	**2**	**18**	**$\chi 2$ =0.689 df = 1**
	b. Mixed diet	**1**	**9**	
4	**Number of family member**			
	a. 3	**0**	**11**	**$\chi 2$ = 2.130 df =3 NS**
	b. 4	**1**	**7**	
	c. 5	**1**	**5**	
	d. >5	**1**	**4**	
5	**Age at menarche**			
	a. 12	**0**	**3**	**$\chi 2$ = 1.429 df =2 NS**
	b. 13	**3**	**18**	
	c. 14	**0**	**6**	

Table 11: Association between pre-test levels of haemoglobin of control group with their selected demographic variables (n_2=30)

Sr No	Demographic variables	Mild	Moderate	Chi-square
1	**History of menstrual Bleeding**			
	a. Normal & regular	**1**	**19**	**χ^2 =1.667 df =1, NS**
	b. Menorrhagia	**2**	**8**	
2	**Duration of menstrual days**			
	a. 2-3 days	**0**	**1**	**χ^2 = 0.172 df =2 NS**
	b. 4-5 days	**2**	**19**	
	c. >5 days	**1**	**7**	
3	**Menstrual flow**			
	a. Heavy	**0**	**1**	**$\chi 2$ =0.370 df =2 NS**
	b. Moderate	**3**	**24**	
	c. Scanty	**0**	**2**	
4	**How many times you are drinking coffee or tea per day**			
	a. Once a day	**1**	**6**	**$\chi 2$ = 0.593 df =2 NS**
	b. Twice a day	**2**	**17**	
	c. More than twice a day	**0**	**4**	
5	**When was the last de-worming drug taken**			
	a. Before 1 month	**1**	**3**	**$\chi 2$ = 3.889 df =3 NS**
	b. Before 3 month	**0**	**11**	
	c. Before 6 month	**2**	**8**	
	d. Not at all taken	**0**	**5**	

Table 12: Association between pre-test levels of haemoglobin of control group with their selected demographic variables (n_2=30)

Sr No	Demographic variables	Mild	Moderate	Chi-square
1	History of Peptic ulcer/Gastritis/Surgery and medicine			
	a. Yes	0	1	χ^2 =0.115
	b. No	3	26	df =1
2	Height in Cms			
	a. 136-140	1	13	χ^2 = 0.238
	b. 141-145	2	14	df =1 NS
3	Weight in Kgs			
	a. 31-35	3	24	χ2 =0.370
	b. 36-40	0	3	df = 1

Table 13: Association between pre-test levels of haemoglobin of experimental group with their selected demographic variables (n_1=30)

Sr No	Demographic variables	Mild	Moderate	Chi-square
1	Age in years			
	a. 13-14 years	2	12	χ^2 =0.107
	b. 15-16 years	3	13	df =1
2	Standard of class			
	a. 8th Std	0	6	χ^2 =1.603
	b. 9th Std	2	9	df =2
	c. 10th Std	3	10	NS
3	Education status of mother			
	a. No formal education	0	0	
	b. Primary education	3	16	χ2 =0.611
	c. Secondary Education	2	7	df =2
	d. Higher secondary education	0	2	NS
	e. Degree and above	0	0	
4	Education status of father			
	a. No formal education	0	2	
	b. Primary education	3	10	χ2 = 1.200
	c. Secondary Education	2	11	df =3
	d. Higher secondary education	0	2	NS
	e. Degree and above	0	0	
5	Occupation of mother			
	a. Housewife	2	5	
	b. Daily wages	2	9	χ2 = 1.387
	c. Self employee	0	1	df = 3
	d. Gov. Employee	0	0	NS
	e. Private employee	1	10	

Table 14: Association between pre-test levels of haemoglobin of experimental group with their selected demographic variables (n_1=30)

Sr No	Demographic variables	Mild	Moderate	Chi-square
1	Occupation of father			
	a. Govt. Employee	0	0	
	b. Private Employee	0	10	χ^2 = 5.486
	c. Self Employee	1	6	df =3
	d. Daily Wages	1	5	NS
	e. Unemployed	3	4	
2	Type of family			
	a. Nuclear	0	0	χ^2 = 1.500

	b. Joint	3	21	df =1
	c. Extended	2	4	NS
3	Type of diet			
	a. Vegetarian	1	15	$\chi 2 = 2.679$
	b. Mixed diet	4	10	df = 1, NS
4	Number of family member			
	a. 2	0	3	$\chi 2 = 8.779$
	b. 3	1	18	df = 2, NS
	c. 4	4	4	
5	Age at menarche			
	a. 12	0	7	$\chi 2 = 4.020$
	b. 13	2	13	df =2
	c. 14	3	5	NS

Table-15 Association between pre-test levels of haemoglobin of experimental group with their selected demographic variables (n_1=30)

Sr No	Demographic variables	Mild	Moderate	Chi-square
1	History of menstrual Bleeding			
	a. Normal & regular	4	20	$\chi^2 = 0.998$
	b. Menorrhagia	1	5	df =1
2	Duration of menstrual days			
	a. 2-3 days	2	2	$\chi^2 = 4.824$
	b. 4-5 days	1	16	df =2
	c. >5 days	2	7	NS
3	Menstrual flow			
	a. Heavy	1	2	$\chi 2 = 0.831$
	b. Moderate	4	22	df =2, NS
	c. Scanty	0	1	
4	How many times you are drinking coffee or tea per day			
	a. Once a day	4	10	$\chi 2 = 2.679$
	b. Twice a day	1	15	df =1, NS
5	When was the last de-worming drug taken			
	a. Before 3 month	4	10	$\chi 2 = 2.679$
	b. Before 6 month	1	15	df =1, NS

Table 16: Association between pre-test levels of haemoglobin of experimental group with their selected demographic variables (n_1=30)

Sr No	Demographic variables	Mild	Moderate	Chi-square
1.	Height in Cm			
	a. 136-140	5	19	$\chi^2 = 1.500$
	b. 141-145	0	6	df =1, NS
2.	Weight in Kgs			
	a. 31-35	3	21	$\chi 2 = 1.500$
	b. 36-40	2	4	df = 1, NS

DISCUSSION

In this study, subjects who satisfied the inclusion and exclusion criteria were recruited and all of them completed the study procedure. It was observed during screening that the subjects between the ages of 13-17 years who had haemoglobin level with mild level (11-11.9 g/dl) and moderate level (8-10.9mg/dl). Table 1 to 4 shows the baseline demographic data of the subjects.

In present study, researchers observed a significant increase in the haemoglobin level after 21 days of supplementation with nutrition ball and amla powder among adolescent girls. Further, there were also no documented adverse effects during the entire study period.

As good as observations were noted in other studies in which sugarcane molasses, fish, iron-fortified rice, and other iron fortified supplements were used to improve haemoglobin level and also overcome iron deficiency anemia (IDA)[7-17.]

A study done in Brazil among preschool children aged 2–3 years it was observed that consumption of jaggery as a sweetener in fruit juices for 12 weeks significantly increases the haemoglobin level and hematocrit level.[18] Significant improvement in haemoglobin level after 3–6 months intervention with food supplements was also demonstrated by Siva et al. and Mohamed Ali et al.[19]

Similarly, children in rural areas of Shimoga, Karnataka, were supplemented with ironfortified biscuits achieved significant increase in the mean haemoglobin level [20]

However, in the present study, researchers noticed a significant improvement in the haemoglobin level with 21 days of twice a day intervention with nutrition ball and amla powder. Although iron deficiency is attempted to treat by various supplementations, rice flakes and jaggery could be a cost-effective alternative in developing country like India.

A study conducted by Jain et al. showed that molasses contains iron and other nutrients such as sulfur, fructose, and copper which increases the iron absorption making it very good dietary supplement for improve haemoglobin level and also treat iron deficiency anemia (IDA) [21]

In the present study, nutrition ball and amla powder also contain ascorbic acid (Vitamin-C) which is an iron absorption enhancer. A study conducted by Sachdev et al. showed preventing childhood anemia by routine addition of multi micronutrients to iron-folate supplementation appears unjustified currently.[22]

However, our supplement (nutrition ball and amla powder) can very well be advised, as the nutrition balls are edible loveable essence and can be consumed by both school going children and adults. Iron supplements (tablets, capsules, and syrup) improve haemoglobin level and reduce the prevalence of iron deficiency anemia (IDA) but reported that rise in the risk of side effects such as constipation and abdominal pain.[23-24]

There was no adverse effect associated with intake of nutrition ball and amla powder in our study population, and this might improve the compliance among the community people.

The small number of participants may partially limit the significant findings of this study and larger studies are required to put into effect these original results. More research, product development, and evidence of safety and efficacy of nutrition ball and amla powder in improve haemoglobin level and can provide tasty and cost-effective dietary supplement, particularly for children and adolescents at rural areas. In adding up, there are few challenges to be faced, such as competition for raw material from refined rice flakes, jaggery and amla powder manufacturers, and quality control that need to be overcome.

CONCLUSION

The outcome of this study proved the effective role of the nutritional supplementation in improving the haemoglobin status among adolescents' girls. Combination of rice flakes and jaggery with amla powder proved to be a better natural food supplement to improve haemoglobin level among adolescents' girls. The advantage of this preparation is that it does not have any significant adverse effects as observed with oral and parenteral iron preparations. It can also be used as a prophylactic strategy to combat iron deficiency in vulnerable population. Further studies can be planned to compare this nutritional supplement with oral iron therapy. Similar studies in school going children with longer follow-up time, to evaluate the efficacy of this nutritional supplement is necessary.

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Conceptualization & Supervision: Mr. Adithya.S. Methodology, Formal analysis and investigation: Mr. Adithya.S, Dr. Sheetal Chaya, Ms. Anjali. S. Panicker, Mr. Kshitij Mayavanshi, Ms. Priya Joshi & Ms. Pratima Ninama. Writing - original draft preparation: Mr. Adithya.S.; Writing - review and editing: Mr. Adithya.S, Ms. Anjali. S. Panicker, Mr. Kshitij Mayavanshi, Ms. Priya Joshi & Ms. Pratima Ninama

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