IJNH

Original Article

A Quasi Experimental Study to assess the Effectiveness of Administration of Pomegranate Arils on Elevation of Hemoglobin Level among Adolescent Girls Staying in Selected Hostel

Deepali Ugle[1], Avani Bhanage[2], S. S. Ugle[3], Arundhati Gurav[1], Ekta Shinde[1]

[1]Department of Obstetrics and Gynacological Nursing, Maratha Vidya Prasarak Samaj's, Institute of Nursing Education, Adgaon, Nashik, Maharashtra, India, [2]Department of Child Health Nursing, Maratha Vidya Prasarak Samaj's, Institute of Nursing Education, Adgaon, Nashik, Maharashtra, India, [3]Department of Biochemistry, Maharashtra Institute of Medical Science and Research, Latur, Maharashtra, India

Abstract

Aim and Objectives: The aim of this study was to study the effectiveness of administration of pomegranate arils on elevation of hemoglobin level among adolescent girls staying in selected hostel. The objectives are as follows: Assessment of hemoglobin level before administration of pomegranate arils. (1) Assessment of hemoglobin level after administration of pomegranate arils. (2) To evaluate the effectiveness of administration of pomegranate arils on elevation of hemoglobin level among adolescent girls. (3) To find out an association between pre-intervention and post-intervention hemoglobin level with selected demographic variables.

Methods: Quasi experimental one group pre-test and post-test research design was used. Before the collection of data researcher was obtained permission from competent authority of the selected hostel and informed assent/consent was taken from the parent and participants. A total 100 samples were selected as per inclusion criteria; those are hemoglobin less than and near to 12 g/dl. Pre-test was conducted to assess the hemoglobin level of adolescent girls using biochemical assessment – Sahli's method on day "1." On the next day, deworming done, next day morning administration of pomegranate arils of 100 g for a period of 30 days to adolescent girls. After, 30 days post-test, hemoglobin estimation was done.

Result: The before administration of pomegranate arils mean score was 10.41 and after administration of pomegranate arils mean score was 11.02. The calculated value is 28.3 at 99° of freedom which is higher than the tabulated value that is 1.66 at 5% level of significance. Hence, it was statistically interpreted that (H_0) null hypothesis was rejected and H_1 accepted which state that the pomegranate arils were effective on elevation of hemoglobin level of adolescent girls.

Conclusion: The researcher tries to improve hemoglobin level among adolescent girls by administering pomegranate arils 100 g up to 30 days.

Keywords: Adolescent girls, anemia, hemoglobin, pomegranate arils

Introduction

Data from journal of health action (2018) reveals that the rich source of iron and Vitamin C is pomegranate. It helps in improving the blood flow in body and is also very effective in treating anemic symptoms such as weakness, dizziness, exhaustion, and even loss of hearing. Vitamin C also plays a big role in the absorption of iron. Eat citrus fruits other Vitamin C rich foods. Bananas and beetroot both are rich in iron and both Vitamin B_{12}, both essential to preventing and curing anemia. Beetroot strengthens the body's immune system, and it is an excellent remedy for anemia, especially in the case of children and teenagers.[1]

A data published in International Journal of Community Medicine and Public Bhopal, (2018) says that, according to the

Access this article online
Website: http://innovationalpublishers.com/Journal/ijnh
ISSN No: 2454-4906
DOI: 10.31690/ijnh.2021.v07i01.002

Address for Correspondence:
Ms. Ekta Shinde, Department of Obstetrics and Gynacological Nursing, Maratha Vidya Prasarak Samaj's, Institute of Nursing Education, Adgaon, Nashik, Maharashtra, India. E-mail: meetes8@gmail.com

WHO, adolescent age group is defined as life span between 10 and 19 years. This period is characterized by rapid physical, psychological, and cognitive development. The prevalence of anemia among adolescent is 27% in developing countries and 6% in developed countries. As adolescent age is the formative years for development, anemia at this stage of life has some long-term consequences, such as a stunted growth, poor school performance, reduced immunity, menstrual irregularities, later on poor pregnancy outcomes such as intrauterine growth restriction, low birth weight, increased perinatal morbidity, and mortality. Anemia is common during adolescent girls due to demand of increased growth and menstrual blood loss.[2]

A report card on adolescent published in (2012) by WHO/UNICEF/UNC, anemia affects 1.62 billion people globally, in which 24.8% are anemic adolescents. Iron deficiency anemia is a significant and an important issue in children between 10 and 20 years, which affects more than 15% of adolescents. Anemia is one of the most common health problems in India which is much more prevalent in the rural than in the urban areas. Nutrition is one of the significant indicators of the health and the overall status of adolescents. Adolescence is a period of transition between childhood and adulthood, which is a golden period, period of dreams, and a period to live out their role models, a time of rapid physical, cognitive, social, and emotional maturation as the boy prepares for manhood, and the girl prepares for womanhood. In this period, adolescence begins with the gradual appearance of secondary sex characteristics at about 11–12 years and cessation of body growth occurs at 18–20 years.[3]

A report published in dietary guidelines for Indians, (2011), says that citrus fruits are high in Vitamin C, which is a nutrient known to significantly increase iron absorption. Iron rich food with food high in Vitamin C, it can increase body absorption of the iron by up to 20 times. Citrus fruits such as grapefruit, lemon, orange, guava, papaya, and pomegranates are notably high in Vitamin C. Among the vegetables high in vitamin C are broccoli, cauliflower, cabbage, potatoes, and tomatoes.[4]

Materials and Methods

Study design and setting

In the view of the nature of the problem and to accomplish the objectives of the study, a one group pre-test and post-test quasi experimental research design was used. In this study, biochemical assessment was used for checking hemoglobin level of adolescent girls. Data were collected from the adolescent girls between December 24, 2019, and January 26, 2020. The study was conducted at selected hostel of Nashik city, Maharashtra.

Sample size and sampling method

The sample size selected for this study was 100 adolescent girls who fulfilled the sampling criteria, and who are willing to participate in the study.

Convenient sampling technique was used. In convenient sampling, which is non-probability purposive sampling technique, subjects were selected due to their convenient accessibility and proximity to the researcher.

Data collection tool and technique

In this study, tool consists of two sections:

1. Section A: Demographic data of adolescent girls.
2. Section B: Estimation of hemoglobin level (in g/dL) by biochemical assessment method.
    - Section A: Demographic data of adolescent girls.

It consisted of seven items regarding demographic variables of the adolescent girls that were developed to collect the background information of adolescent girls.

The items included in the demographic variable were age (in year), religion, educational qualification, dietary pattern, family income monthly (in Rs.), pattern of menstrual cycle, and duration of menstrual bleeding (in days).

- Section B: Estimation of hemoglobin level (in g/dl) by biochemical assessment method.

It consisted of participant's assessment of hemoglobin level (g/dL) before intervention and after intervention.

Scoring

Researcher had stated about right to withdrawal from the study at any time during the study, by the sample.

Researcher has explained about purpose of hemoglobin estimation and following steps of procedure:

1. In pre-test, hemoglobin estimation will be done by invasive method.
2. If hemoglobin less than and near to 12 g/dL. You have to undergo deworming by oral intake of tablet albendazole 400 mg at once.
3. You have to eat 100 g of pomegranate arils for a period of 30 days.
4. After that to do post-test hemoglobin estimation by invasive method.

Data management and analysis

The data obtained were planned to be analyzed based on objectives of the study using descriptive and inferential statistics. The data were arranged in master sheet. Description of the subject with respect to demographic variables was presented using frequency and percentage. Data were presented in tables and graphs; the level of hemoglobin was grouped from mild-to-severe anemia that is mild (11 g/dL–11.9 g/dL), moderate anemia (8 g/dL–10.9 g/dL), and severe anemia (<8 g/dL) [Table 1]. Mean standard deviation and mean score was used to evaluate the effectiveness of pomegranate arils on elevation of hemoglobin level. Paired *t*-test was used to evaluate the effectiveness of pomegranate arils on elevation of hemoglobin level. The association between pre-intervention and post-intervention hemoglobin level of adolescent girls with selected demographic variables was tasted using Chi-square test.

Results

Demographic data of the subject in frequency and percentage

About 69% of adolescent girls were of 18–19 years of age and 31% of adolescent girls were of 17–18 years of age, 94% adolescent girls were Hindu by religion, 3% were Muslim by religion and 3% were Christian by religion, 72% of adolescence girls take mixed diet and remaining 28% of adolescent girls taking vegetarian diet, 35% of adolescent girls family monthly income were from Rs. 10,001–15,000, 31% of adolescent girls family monthly income was from Rs. 20,001 to above, 28% of adolescent girls family monthly income was from Rs.15,001 to 20,000 and 6% of adolescent girls family monthly income was from Rs. 5,000–10,000, 67% of adolescence girls having regular pattern of menstrual cycle, and they experienced abdominal pain, back pain and 33% of adolescent girls have irregular pattern of menstrual cycle, and they experienced abdominal pain, weakness, fatigue, and irritation, 52% of adolescent girls duration of menstrual bleeding were 5–7 days, and they experienced the weakness, fatigue, and irritation. About 48% of adolescent girls duration of menstrual bleeding was 1–4 days, and they experienced the abdominal pain, back pain, and irritation [Table 2].

Table 2 shows that most of the 69% of adolescent girls were in the age group of 18–19 years. Majority of 94% adolescent girls were Hindu by religion. Most of the 72% of adolescence girls taking mixed diet. Majority 35% of adolescent girls family monthly income were from Rs. 10,001 to 15,000. Most of the 67% of adolescence girls having regular pattern of menstrual cycle, and they experienced abdominal pain and back pain. Majority 52% of adolescent girls duration of menstrual bleeding were 5–7 days, and they experienced the weakness, fatigue, and irritation.

Table 1: According to the World Health Organization 2011, anemia can be classified into three grades

Classification	Hemoglobin level (g/dL)
Mild Anemia	12 g/dL–11.9 g/dL
Moderate Anemia	8 g/dL–10.9 g/dL
Severe anemia	<8 g/dL

Table 2: Demographic data of the subjects in frequency and percentage (*n*=100)

Demographic data of subjects	Frequency	Percentage
Age of adolescent girls (in years)		
17–18 years	31	31
18–19 years	69	69
Religion of adolescent girls		
Muslim	3	3
Hindu	94	94
Christian	3	3
Dietary pattern of adolescent girls		
Vegetarian	28	28
Mixed diet	72	72
Family income monthly (In Rs)		
5000–10,000	6	6
10,001–15,000	35	35
15,001–20,000	28	28
20,001 and above	31	31
Pattern of menstrual cycle		
Regular	67	67
Irregular	33	33
Duration of menstrual bleeding (In days)		
1–4	48	48
5–7	52	52

Assessment of hemoglobin level (g/dL) before administration of pomegranate arils among adolescent girls staying in selected hostel

About 66% of adolescent girls hemoglobin level range from 8 g/dL to 10.9 g/d which comes under moderate anemia and 34% of adolescent girls hemoglobin level range from 11 g/dL –to 11.9 g/dL, which comes under mild anemia [Table 3].

Part-A

Section II: (A) Assessment of hemoglobin level (g/dL) before administration of pomegranate arils among adolescent girls staying in selected hostel.

Table 3 revels that in before administration of pomegranate arils, 66% of adolescent girls hemoglobin level range from 8 g/dL to 10.9 g/dL, which comes under moderate anemia and 34% of adolescent girls hemoglobin level range from 11 g/dL to 11.9 g/dL, which comes under mild anemia.

Assessment of hemoglobin level (g/dL) after administration of pomegranate arils among adolescent girls staying in selected hostel

About 45% of adolescent girls hemoglobin level range from 8 g/dL to 10.9 g/dL, which comes under moderate anemia, 41% of adolescent girls hemoglobin level range from 11 g/dL to 11.9 g/dL, which comes under mild anemia and 14% of adolescent girls achieved normal hemoglobin level [Table 4].

Part-B

Section II: (B) Assessment of hemoglobin level (g/dL) after administration of pomegranate arils among adolescent girls staying in selected hostel.

Table 4 shows that 45% of adolescent girls hemoglobin level range from 8 g/dL to 10.9 g/dL, which comes under moderate anemia, 41% of adolescent girls hemoglobin level range from 11 g/dL to 11.9 g/dL, which comes under mild anemia, and 14% of adolescent girls achieved normal hemoglobin level.

Comparison of hemoglobin level (g/dL) before administration and after administration of pomegranate arils among adolescent girls staying in selected hostel

Before administration of pomegranate arils, 34% of adolescent girls hemoglobin level range from 11 to 11.9 g/dL, which comes under mild anemia, while after administration of pomegranate arils, 14% of adolescent girls achieved normal hemoglobin level, that is, more than 11.9 g/dL.

Before administration of pomegranate arils, 66% of adolescent girls hemoglobin level range from 8 g/dL to 10.9 g/dL, which comes under moderate anemia, while after administration

of pomegranate arils, 41% of adolescent girls achieved hemoglobin level range from 11 to 11.9 g/dL, which comes under mild anemia.

After, administration of pomegranate arils, 45% of adolescent girls hemoglobin level range from 8 to 10.9 g/dL which comes under moderate anemia [Table 5].

Part-C

Section II: (C) Comparison of hemoglobin level (g/dL) before administration and after administration of pomegranate arils among adolescent girls staying in selected hostel.

Table 5 revels that, before administration of pomegranate arils, 34% of adolescent girls hemoglobin level range from 11 to 11.9 g/dL which comes under mild anemia, while after administration of pomegranate arils, 14% of adolescent girls achieved normal hemoglobin level, that is, more than 11.9 g/dL.

Before administration of pomegranate arils, 66% of adolescent girls hemoglobin level range from 8 g/dL to 10.9 g/dL, which comes under moderate anemia, while after administration of pomegranate arils, 41% of adolescent girls achieved hemoglobin level range from 11 to 11.9 g/dL which comes under mild anemia.

After administration of pomegranate arils, 45% of adolescent girls hemoglobin level range from 8 to 10.9 g/dL which comes under moderate anemia.

Table 3: Assessment of hemoglobin level before administration of pomegranate arils among adolescent girls (*n*=100)

Classification	Level of hemoglobin (g/dL)	Before administration	
		Frequency	Percentage
Mild	11 g/dL–11.9 g/dL	34	34
Moderate	8 g/dL–10.9 g/dL	66	66
Severe	<8 g/dL	00	0

Table 4: Assessment of hemoglobin level after administration of pomegranate arils among adolescent girls (*n*=100)

Classification	Level of hemoglobin (g/dL)	After administration	
		Frequency	Percentage
Normal	>11.9 g/dL	14	14
Mild	11 g/dL–11.9 g/dL	41	41
Moderate	8 g/dL–10.9 g/dL	45	45
Severe	<8 g/dL	0	0

Effectiveness of administration of pomegranate arils on hemoglobin levels (g/dL) among adolescent girls

Before administration of pomegranate arils, mean score was 10.41 and after administration of pomegranate arils, mean score was 11.02.

The calculated value is 28.3 at 99° of freedom which is higher than the tabulated value that is 1.66 at 5% level of significance. Hence, it was statistically interpreted that (H_0) null hypothesis was rejected and H_1 accepted, which state that the pomegranate arils were effective on elevation of hemoglobin level of adolescent girls [Table 6].

Section III: Effectiveness of administration of pomegranate arils on hemoglobin level (g/dL) among adolescent girls staying in selected hostel.

Table 6 reveals effectiveness of administration of pomegranate arils on hemoglobin level among adolescent girls.

Before administration of pomegranate arils, mean score was 10.41 and after administration of pomegranate arils, mean score was 11.02.

The calculated value is 28.3 at 99° of freedom which is higher than the tabulated value that is 1.66 at 5% level of significance. Hence, it was statistically interpreted that (H_0) null hypothesis was rejected and H_1 accepted which state that the pomegranate arils were effective on elevation of hemoglobin level of adolescent girls.

Association of demographic variable with the pre-intervention and post-intervention hemoglobin level (g/dL) of adolescent girls

The Chi-square test was used to see the association between the demographic variables with the pre-intervention level of hemoglobin (g/dL). The obtained Chi-square value that is 11.84, 7.79 and 5.76 of pre-intervention level of hemoglobin with selected demographic variables that are age (in years), patterns of menstrual cycle, and duration of menstrual bleeding (in days) were found significant at 5% level of significance, which was statistically accepted and other demographic variables were not having significant that is religion, dietary pattern, and family income monthly (in Rs.).

The Chi-square test was used to see the association between the demographic variables with the post-intervention level of hemoglobin (g/dL). The obtained Chi-square value is 7.75 and 7.64 of post-interventional level of hemoglobin with selected demographic variables that are family income monthly (in Rs)

Table 5: Comparison of hemoglobin level before and after administration of pomegranate arils among adolescent girls (*n*=100)

Classification	Level of Hemoglobin (g/dL)	Before administration		After administration	
		Frequency	Percentage	Frequency	Percentage
Normal	>12	0	0	14	14
Mild	11–11.9	34	34	41	41
Moderate	8–10.9	66	66	45	45
Severe	<8	0	0	0	0

Table 6: Effectiveness of administration of pomegranate arils on hemoglobin levels (g/dL) among adolescent girls (*n*=100)

Hb (g/dL)	Mean	SD	*t*-value	Degree of freedom	S/NS
Before administration of pomegranate arils	10.41	0.955	28.03 (P<0.05)	99	Highly Significant
After administration of pomegranate arils	11.02	0.859			

*Significant, **Not significant (t=28.3, table value $t_{(99)}$=1.66, P<0.05)

and pattern of menstrual cycle were found significant at 5% level of significance, which was statistically accepted and other demographic variables were not having a significant association that is age (in years), religion, dietary pattern, and duration of menstrual bleeding (in days).

Discussion

Jyoti and Deepali Deo (2017), a community-based study, conducted on the Silent Burden of Anemia among the Rural Adolescent Girls, Maharashtra. The objective of this study was to find out prevalence of anemia and associated epidemiological factors in relation to anemia among rural adolescent girls. Results of the study shows that mean age of adolescent girls was 13.77 ± 2.42. Among the 480 adolescent girls covered in the study, 72.5% were found to be anemic. The prevalence of mild and moderate anemia among adolescent girls was 34.19% and 65.81%, respectively.[5]

Chandrakumari *et al*. (2019), a cross-sectional study was carried outto find out the prevalence of anemia among adolescent girls, Tamil Nadu, India. The study conducted among 255 adolescent girls. Results and discussion of this study were overall prevalence of anemia that was found to be 48.63% (n = 124). The majority of the anemic girls (55.64%, n = 69) were having mild degree of anemia. Among 255 girls, 188 (73.73%) were from the early adolescent age group (10–14 years). Prevalence of anemia (52.24%) was high among the late adolescents and those belonging to low socioeconomic class.[6]

Agrawal (2016) conducted the study on effect of Pomegranate Juice on Rise of Hemoglobin Level in Own Blood Sample, Durg, Chhattisgarh. The main purpose of study is the use of locally available iron-rich foods to prevent anemia. In the present study, effect of juice of pomegranate on rise of hemoglobin was observed because the concentration of hemoglobin in red blood cells is a more sensitive and direct indicator of anemia. In this project work 100 gm, juice of pomegranate was consumed daily in every morning. After every week of consumption, the Hb% was determined by Sahli's Hemoglobino meter (Acid Hematin Method). The whole process was repeated thrice at the same time to get accuracy in results. To observe the actual effect of pomegranate on rise of Hb%, the initial value of Hb was recorded just before starting consumption (at 0 week) and also 1 week after stopping consumption (i.e., reading shown against 7th week in Tables 2-6) of pomegranate juice. Discussion in the present investigation, hemoglobin percentage observed at zero periods (means before consumption of pomegranate) was 11.5 %. When the regular consumption of 100 g of pomegranate juice was started, an increase in hemoglobin with an average of 0.5 % per week was observed. The Hb % remains constant in 7th week when consumption was stopped. Juice of pomegranate was observed beneficial to increase hemoglobin % up to 3% because it not only contains iron but also high in Vitamin C (nutrition and you.com) which increases absorption of non-heme iron up to 6 folds (Hallberg, 1981). Reports obtained from pathology laboratory also showed the increase in Hb% by 2.6 g and, thus, supports the role of pomegranate juice in improving hemoglobin level in blood.[7]

Conclusion

The quasi experimental study was effective for increasing hemoglobin level of adolescent girls by administering pomegranate arils 100 g up to 30 days and, mainly, reduces the problems which are related to menstrual cycle and reproductive health of adolescent girls.

Acknowledgment

I am forever thankful to my all teachers and my parents. I express my gratitude to all those who have helped me directly and indirectly to make the fruition of this study possible.

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How to cite this article: Ugle D, Bhanage A, Ugle SS, Gurav A, Shinde E. A Quasi Experimental Study to assess the Effectiveness of Administration of Pomegranate Arils on Elevation of Hemoglobin Level among Adolescent Girls Staying in Selected Hostel. Innov J Nurs Healthc. 2021;7(1):7-11.