

## Impact of Educational Program on the Improvement of Anemia Due To Menstrual Disorder in Adolescent Girls

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**Abstract:** The prevalence of anemia was estimated to be high (59.3%) among upper Egyptian school children especially adolescent girls with negative impact on both physical and mental health. **The aim** of this study was to assess the impact of Educational Program on improvement of anemia due to menstrual disorder among adolescent girls. **Methods:** A quasi-experimental study was carried out in a secondary school at Assiut city on 393 adolescent girls who were subjected to haemoglobin (Hb) concentration measurement and interviewed for assessment of their socio-economic status (SES), menstrual history, dietary habits, and anemia related manifestations. Educational program was then given to each girl. Post-test evaluation (3 months post counseling) was done to evaluate the impact of counseling program on Hb level, severity of menstrual bleeding, dietary habits and anemia related manifestations. **Results:** Sixty five percent adolescent girls had Hb levels of  $\leq 10\text{gm/dl}$  There were significant associations of excessive menstrual bleeding ( $p=0.0047$ ), use of unbalanced diets ( $p=0.0007$ ), with lower Hb concentration in Univariate analysis. Multi-variate analysis confirmed these significant associations ( $p<0.0001$ ). Educational program given to girls resulted in significant increase in Hb concentration ( $p<0.0001$ ). Post-test evaluation was showed significant improvement of anemia related manifestations ( $p=0.0029$ ). **Conclusions:** The given educational program led to significant decrease in menstrual bleeding and improvement of dietary habits with subsequent increase of Hb concentration and alleviation of anemia related manifestations.

**Keywords:** Adolescent Girls, Menstruation disorder, Anemia, Educational program.

Date of Submission: 26-04-2018

Date of acceptance: 14-05-2018

### Contribution of our paper

What is already known about the topic?

- 1- The Egyptian government and the Student Health Insurance Program (SHIP) began a targeted program to lower anemia rates among school children (boys and girls) through a dynamic school-based program to reduce anemia in preparatory and secondary schools in five governorates in Upper Egypt.
- 2- The program adopted an approach of supplementation and nutrition education. Most students took weekly iron tablet through the nutrition communications activities.
- 3- Unfortunately the used program did not focus on possible methods to reduce the impact of menstrual irregularities in school girls on occurrence of anemia and its related complications.

What the paper adds

- 1- Our study addressed the impact of counseling program on anemia among school girls in Upper Egypt by focusing on both menstrual status and dietary habits.
- 2- This study demonstrates that nurse-led health education of school girls results in:
  - Significant impact on decreasing the amount of menstrual blood loss and improving dietary habits.
  - Significant impact on increasing hemoglobin concentration and subsequent anemia related manifestations.

### I. Introduction

Anemia which is a common public health problem worldwide with detrimental impact on economy, influenced fundamentally women in reproductive age and girls in adolescent age (Atukorala, et al.1994; . Dreyfuss, et al. 2000), that lies between 10 and 19 years (WHO,1986). The worldwide prevalence of anemia was estimated to be 6% in developed countries (Balci et al., 2012), 40% in emerging countries (Benoist, et al.2008), and it was found to be 59.3% among upper Egyptian school children.

Lack of familial understanding of this health problem and its possible causes and consequences is

challenging. Low socio-economic status (WHO, 2014), excessive menstrual bleeding (Alleyne, et al.2008; Rupali and Sanjay, 2015), poor and unhealthy dietary habits (Djokic, et al. 2010), and parasitic infestations (Nematian, et al.2004) are possible factors contributing in development of anemia in adolescent females. Furthermore, obesity is considered as another risk factor of anemia because it may denote consumption of fat rich diets (Hamiel, et al.2003). The detrimental effects of anemia in adolescent girls include poor cognitive development, decreased physical fitness, poor school performance, and adverse pregnancy outcomes in the future (Kaur, et al.2015).

Regarding menstrual blood loss, the average normal amount is about 30-40 ml per menstrual cycle. The National Institute for Health and Care Excellence (NICE) defines heavy menstrual loss as excessive blood loss that interferes with a woman's physical, social, emotional and/or quality of life (Heavy menstrual bleeding; NICE Clinical Guideline, 2007).

Measuring body mass index (BMI) gives an indication about individual nutritional and health status. It was found that malnutrition influences body growth and development, especially during adolescence period (Babitha, 2003). Adolescents girls are susceptible to iron deficiency because of increased iron needs (due to rapid growth), (Wharton,1999), that continue to remain high after menarche, because of menstrual blood loss (Beard,2001). About three fourths of adolescent females do not meet dietary iron requirements, because of improper dietary habits (Centers for Disease Control and Prevention,1998).

Unfortunately, there is a scarcity of data on anemia in adolescents living in developing countries (Tesfaye et al., 2015). Therefore, regarding the high prevalence of anemia in Upper Egypt, so our study addressed this topic. The aim of this study was to evaluate the impact of education program addressing the proper and healthy dietary habits as well as adequate sleeping hours and exercise on increasing Hb level and improvement of anemic manifestations.

## **II. Methods**

**2.1. Study design:** The current research is a quasi-experimental study.

**2.2. Setting:** The current study encompassed adolescent girls in first, second and third grade in one secondary school that is affiliated to Assiut city. The girls were subjected to hemoglobin (Hb) concentration measurement and interviewed for assessment of their body mass index (BMI), socio-economic status (SES), history of parasitic infestation, menstrual history, dietary habits, and anemia related manifestations (pre-test evaluation). An educational education program was then discussed with each girl regarding healthy dietary habits with correction of possible improper dietary factors as well as adequate sleeping hours and exercise. Post-test assessment was then done (3 months post counseling) to reassess amount of menstrual blood loss, dietary habits, Hb level, and anemia related manifestations.

**2.3. Sample:** The prevalence of anemia among upper Egyptian school children is 59.3% ( Salama and Labib, 2016). Sample size was calculated according to the following formula:  $N = Z^2 \times P(1-P) / d^2$  (Danial,1999).At prevalence of 59.3%, confidence level of 95%, and 5% precision, the calculated minimum sample size was 372 girls. The authors obtained a larger sample size of 393 adolescent girls during period of study between December 2015 to March 2016 from 3 classes of grade one, 3 classes of grade two, and 2 classes of grade three. These girls were interviewed to collect socio-demographic, menstrual history, dietary habits, as well as Hb level knowledge.

**2.4. Data collection tools:** Pretest evaluation, the included girls were interviewed to fulfill a questionnaire regarding age, BMI (by assessment of body weight and height), SES (by assessment of family education, occupation and income), amount of menstrual bleeding, dietary habits, and anemia related manifestations. The girls were then subjected to Hb level measurement. The researchers prepared a booklet describing essential basic knowledge for adolescent girls regarding healthy balanced dietary habits, adequate sleeping hours, regular exercises, massage, and vitamin and mineral supplement. The booklet also provided the best practice pathways for managing menstrual pain and symptoms, and for dealing with primary menstrual disorders to prevent school absence and increase school performance. At 3 months post-counseling, the study girls were interviewed to assess the amount of menstrual blood loss, pattern of dietary habits, anemia related manifestations and Hb level measurement.

**BMI assessment:** Height and body weight were measured for each girl, and BMI was calculated. BMI is a person's weight in kilograms divided by the square of their height in meters (Department of Health, 2009). According to WHO classification (WHO,2006), girls with BMI of 18.5 – 24.9 kg/m<sup>2</sup>, 25 – 29.9 kg/m<sup>2</sup>, 30-34.9 kg/m<sup>2</sup>, and  $\geq 35$ kg/m<sup>2</sup> were considered normal, overweight, obese, and very obese respectively.

**SES assessment:** Kuppuswamy's SES scale (Aggarwal, et al. 2005; Guru Raj and Maheshwaran, 2015) was used to measure SES of study women's families, based on household income (12 scores), and education (7 scores) and occupation (10 scores) of the head of the family. It was clarified that due to the steady inflation and consequent fall in the currency value, the changes in the income scale are proportional to the change in the Consumer Price Index for Industrial Workers (CPI-IW). The income groups for the year 2015 were revised to update Kuppuswamy's SES scale. The CPI-IW in 2001 (considered as base income) was 100 and in May, 2016 was 275 (Vasudevan, et al. 2016). So the income scale of 2001 is multiplied by 2.75 to update the scale for 2016. The family income in Rupees for each group was then transformed into Egyptian pounds. The SES classes were then identified as high (total score of 26-29), intermediate (total score of 11-25), and low (total score  $\leq 10$ ).

**2.5. Procedure:** This study was conducted by four researchers, one with doctoral degree of obstetric and gynecological nursing, another with doctoral degree of Women Health Nursing and two with doctoral degree of pediatric nursing. Each adolescent girl was interviewed for 20 minutes.

**2.6. Ethical considerations:** The current study was approved by local ethical committee of faculty of nursing, Sohag University, Egypt.

**2.7. Statistical analysis:** Socio-demographic data, as well as data of dietary habits, menstrual history and Hb level were tabulated where, medians and percentages were used. Evaluation of association of Hb level and possible factors that might affect it (Univariate analysis) as well as Pretest/posttest data comparison were done using Fisher's exact test. Multivariate analysis was done using forward stepwise linear regression.

### III. Results

The median age of girls in the current study, was 15 years (range; 14-17 years). The majority of our girls had intermediate SES (67%), and normal BMI (61%), complained of excessive MC (67%), suffered from  $\geq 4$  anemic related manifestations (58%) and consumed unhealthy diets with  $\geq 4$  improper dietary factors (60%). Distribution of girls according to Hb level showed that 39.5%, 25.5%, and 35% of girls showed marked (Hb  $< 8$  gm/dl), intermediate (Hb between 8 – 10 gm/dl) and mild (Hb between 10 – 12 gm/dl) anemia respectively (Table 1). Univariate analysis evaluating risk factors that might affect the development of anemia was done and showed all studied factors significantly affected Hb level, namely BMI ( $p < 0.0001$ ), SES ( $p < 0.0001$ ), MC bleeding ( $p = 0.0047$ ), parasitic infestation ( $p = 0.0026$ ), and number of improper dietary factors ( $p = 0.0007$ ) (Table 2).

Multivariate analysis using forward stepwise linear regression was done and revealed that among the risk factors that significantly affected Hb level, excessive menstrual bleeding ( $p < 0.0001$ ; B: 0.5; 95% confidence interval for B: 0.321 – 0.679), low SES ( $p < 0.0001$ ; B: -0.33; 95% confidence interval for B: -0.470 – -0.187), and consumption of unhealthy diets with  $\geq 4$  improper dietary factors ( $p < 0.0001$ ; B: -0.14; 95% confidence interval for B: -0.211 – -0.074), were independent risk factors that significantly affected development of anemia (Table 3). Moreover, there was significant association ( $p < 0.0001$ ) between Hb level and number of anemia related manifestations (Table 4). In post-test setting (Tables 5-7), there were significant favorable impact of the given educational education program on both Hb level ( $p < 0.0001$ ), and the number of anemia related manifestations ( $p = 0.0029$ ). Univariate analysis showed also that amount of MC bleeding ( $p = 0.0047$ ), and number of improper dietary factors ( $p = 0.0007$ ) significantly influenced Hb level. There was also significant association ( $p < 0.0001$ ) between Hb level and number of anemia related manifestations.

**Table [1]:** Characteristics of the included girls

Variable	NO	%
<b>Age</b> median range	15 years 14 – 17 years	
<b>SES</b> *low *intermediate *high	56 263 74	14.2 66.9 18.8
<b>BMI</b> *normal (18.5-25) *overweight (25-30) *mild obesity (30-35) *marked obesity (>35)	238 81 56 18	60.6 20.6 14.2 4.6
<b>MC</b> *normal *excessive	128 265	32.6 67.4
<b>Improper dietary factors</b> *2 factors *3 factors *≥4 factors	73 84 236	18.6 21.4 60
<b>Parasitic infestation</b> *yes *no	83 310	21.1 78.9
<b>Hemoglobin (Hb) level</b> *<8gm/dl *Between 8 – 10gm/dl *Between 10 – 12gm/dl	155 100 138	39.4 25.4 35.2
<b>Anemic manifestations</b> *0,1 (no or one symptom) *2,3 (2 or 3 symptoms) *≥4 (more than 4 symptoms)	56 109 228	14.2 27.7 58.1
<b>Total</b>	393	100

**Table [2]:** Univariate analysis of the impact factors affecting Hb level in the pre-test evaluation

Variable	Hemoglobin (Hb) level			P value
	<8gm/dl (n=155)	Between 8 –10 gm/dl (n=100)	Between 10 –12 gm/dl (n=138)	
	NO (%)	NO (%)	NO (%)	
<b>BMI</b> *normal: 18.5-25 (n=238) *overweight: 25-30 (n=81) *mild obesity: 30-35 (n=56) * marked obesity: >35 (n=18)	74 (31) 45 (55.6) 27 (48.2) 9 (50)	82 (34.5) 9 (11.1) 0 9 (50)	82 (34.5) 27 (33.3) 29 (51.8) 0	p<0.0001
<b>SES</b> I (n=56) II (n=263) III (n=74)	9 (16.1) 100 (38) 46 (62.2)	19 (33.9) 81 (30.8) 0	28 (50) 82 (31.2) 28 (37.8)	p<0.0001
<b>MC blood loss</b> *normal (n=128) *excessive (n=265)	36 (28.1) 119 (44.9)	36 (28.1) 64 (24.2)	56 (43.8) 82 (30.9)	p=0.0047
<b>Parasitic infestation</b> *yes (n=83) *no (n=310)	46 (55.4) 109 (35.1)	18 (21.7) 82 (26.5)	19 (22.9) 119 (38.4)	p=0.0026
<b>Improper dietary factors</b> *2factors (n=73) *3factors (n=84) *≥4factors (n=236)	18 (24.7) 28 (33.3) 109 (46.2)	18 (24.7) 19 (22.6) 63 (26.7)	37 (50.6) 37 (44.1) 64 (27.1)	p=0.0007

**Table [3]:** Multi-variate analysis of the independent factors affecting Hb level in pre-test evaluation

Variable	Unstandardized coefficients		Significance	95% confidence interval for B	
	B	Std. error		Lower limit	Upper limit
<b>Menstrual cycle blood loss</b>	0.5	0.091	p<0.0001	0.321	0.679
<b>SES</b>	-0.33	0.072	p<0.0001	-0.470	-0.187
<b>Improper dietary factors</b>	-0.14	0.035	p<0.0001	-0.211	-0.074

**Table [4]:** Relation between Hb level and associated anemic manifestations in pre-test evaluation

Variable	Hemoglobin (Hb) level			P value
	<8gm/dl (n=155)	Between 8 –10 gm/dl (n=100)	Between 10 –12 gm/dl (n=138)	
	N0 (%)	N0 (%)	N0 (%)	
<b>Anemic manifestations</b>				p<0.0001
*0,1 manifestation (n=56)	0	9 (9)	47 (34)	
*2,3 manifestations (n=109)	46 (29.7)	36 (36)	27 (19.6)	
*≥4 manifestations (n=228)	109 (70.3)	55 (55)	64 (46.4)	

**Table [5]:** pre-test versus post-test (3 months after counseling) evaluation regarding Hb level and associated anemic manifestations

	Pre-test evaluation NO (%)	Pre-test evaluation NO (%)	P value
<b>Hb level</b>			p<0.0001
<8gm/dl	155 (39.4)	132 (33.6)	
Between 7 –10 gm/dl	100 (25.4)	107 (27.2)	
Between 10 –12 gm/dl	138 (35.2)	121 (30.8)	
>12 gm/dl	0	33 (8.4)	
<b>Anemic manifestations</b>			p=0.0029
*0,1 manifestation	56 (14.3)	65 (16.5)	
*2,3 manifestations	109 (27.7)	147 (37.4)	
*≥4 manifestations	228 (58)	181 (46.1)	

**Table [6]:** Univariate analysis of the impact factors affecting HB level in the post-test evaluation

Variable	Hemoglobin (Hb) level				P value
	<8gm/dl (n=132)	Between 8 –10 gm/dl (n=107)	Between 10 –12 gm/dl (n=121)	>12 gm/dl (n=33)	
	N0 (%)	N0 (%)	N0 (%)	N0 (%)	
<b>MC</b>					p<0.0001
*normal (n=152)	20 (13.2)	46 (30.3)	56 (36.8)	30 (19.7)	
*excessive (n=241)	112 (46.5)	61 (25.3)	65 (27)	3 (1.2)	
<b>Improper dietary factors</b>					p<0.0001
*0,1 factor (n=66)	9 (13.6)	6 (9.1)	19 (28.8)	32 (48.5)	
*2factors (n=50)	6 (12)	18 (36)	25 (50)	1 (2)	
*3factors (n=59)	19 (32.2)	21 (35.6)	19 (32.2)	0	
*≥4factors (n=218)	98 (45)	62 (28.4)	58 (26.6)	0	

**Table [7]:** Relation between Hb level and associated anemic manifestations in post-test evaluation

Variable	Hemoglobin (Hb) level				P value
	<8gm/dl (n=155)	Between 8 –10 gm/dl (n=100)	Between 10 –12 gm/dl (n=138)	>12 gm/dl (n=33)	
	N0 (%)	N0 (%)	N0 (%)	N0 (%)	
<b>Anemic manifestations</b>					p<0.0001
*0,1 manifestation (n=65)	0	6 (9.2)	38 (58.5)	21 (32.3)	
*2,3 manifestations (n=147)	54 (36.7)	46 (31.3)	38 (25.9)	9 (6.1)	
*≥4 manifestations (n=181)	78 (43.1)	55 (30.4)	45 (24.9)	3 (1.6)	

#### IV. Discussion

Assessment of hemoglobin concentration is an essential screening to identify anemic individuals and to determine the severity of anemia. The majority of girls in the current study had Hb levels  $\leq 10$ gm/dl (65%), with median Hb level of 9 gm/dl, which was lower than that found in adolescent girls by most of the reported studies (Singh, et al.2013; Rupali, and Sanjay, 2015).

This difference could be explained on the ground that, univariate and multi-variate analyses confirmed

that excessive menstrual bleeding and use of unbalanced diets, which were evident in the vast majority of girls in the present study, significantly affected the development and severity of anemia. Furthermore, both analyses showed that low SES was associated with lower HB concentration in the current study. This is confirmed by reported studies (Salama, and Labib, 2016; Goyal, et al.2016), where SES was proved to have a significant impact on development of anemia.

Anemia has detrimental effects on both physical and mental health. The degree of Hb concentration is associated with severity of the related manifestations, including pallor, oral mucosal ulceration, tachypnea, hair and nail brittleness, easy fatigability, dizziness, and lack of concentration (Butensky, et al.2008). These manifestations in adolescent females could result in unsatisfactory school attendance and performance. Therefore, it is crucial to identify anemic adolescent girls and to give them a counsel program addressing the proper dietary procedures as well as adequate sleeping hours, exercise, and massage, in order to increase hemoglobin concentration and alleviate anemia related manifestations (Parker, et al.2006)

In the present study, education program was given to each girl addressing balanced diets with identification and correction of faulty dietary habits as well as sufficient sleeping hours and regular exercise. Three months later, post-test evaluation of hemoglobin concentration as well as of anemia related risk factors such as menstrual blood loss and dietary habits was done to evaluate the impact of the given education program on correction of defective habits and improving anemia. Moreover, anemia related manifestations were also assessed.

Our results revealed that, education program was associated with significantly increasing hemoglobin concentration, with 8% of girls became non-anemic at 3 month post counseling and this was associated with significant improvement of anemia related manifestations. This could be attributed to the significant decrease in menstrual blood loss as well as significant improvement in dietary habits with significant decreasing in faulty dietary factors in the post-test evaluation possibly due to education program.

Our results are confirmed by many reported studies (Wang, 2013; Kaur, et al.2015), that clarified the significant impact of menstrual bleeding and dietary habits on hemoglobin level and anemia related manifestations. To conclude, education program is pivotal and crucial to clarify the proper dietary habits, the proper ways to deal with excessive menstrual bleeding. Furthermore, it encourages frequent consumption of meat, fish, poultry and consumption of vitamin C sources with meals to enhance iron absorption (Alton, 2005)

### **Acknowledgements**

The authors received no financial or other support for the research reported in this manuscript.

### **Conflict of Interest**

The authors have no conflicts of interest to disclose.

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Amany A. Ahmed. "Impact of Educational Program on The Improvement of Anemia Due To Menstrual Disorder In Adolescent Girls". IOSR Journal of Nursing and Health Science (IOSR-JNHS) , vol. 7, no.3 , 2018, pp. 60-66.