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Life style risk factors of Iron deficiency Anemia among adolescents' girls

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Abstract: Adolescence is a journey from the world of the child to the world of the adult. Adolescence is very important since it is the time in life when major physical, psychological and behavioural changes take place. The potential synergistic effects of unhealthy lifestyle behaviours on the risk of chronic conditions as iron deficiency anaemia and health outcomes among adolescents' girls are a key issue for their health. ***Aim:*** this study aimed to identify the life style risk factors of iron deficiency anemia among adolescents' girls. ***Design:*** A case control study design ***Setting:*** the study was accompanied at one school from urban and eight from rural preparatory school girls. ***Subjects:*** The total number of the randomly selected girls was 240 preparatory school girls (120 girl students as cases who have anemia and the same number of non-anemic girls recruited in control group). ***Tool****:* data was collected using one tool entitled adolescent girl's structured interview questionnaire ***Results:*** according to multivariate analysis logistic regression the factors which showed significant relation to students with iron deficiency anemia were many. Concerning factors related to demographic characteristic, father's occupation, Underachiever students, Mother's education, Place of residence, and low monthly family income. Moreover factors related to sleeping pattern and activity practices included physical inactivity, absence of nap sleep hours. With respect to risk factors related to student's feeding practices, the observable risk factor for iron deficiency anemia was not consumed snacks. Additionally other factors were found as not eating daily breakfast, eating less than 2 meals/day and time of drinkingtea. ***Conclusions & Recommendations:*** There is significant association of iron deficiency anemia with adolescents' girls'some socio-demographic characteristics and their activities related to life style. Subsequently, there is requisite to increase awareness of anemia among adolescent girls and their parents.

Key words: life style risk factors, Iron Deficiency Anemia, adolescents' girls.

INTRODUCTION

Anemia is a disorder described by decline in the number of red blood cells and/or hemoglobin (Hb) concentration. Anemia is a universal public health disorder affecting both developing and developed countries and has chief magnitudes for human health as well as social and economic development. It affects 24.8% of the world residents. [1, 2] The load of anemia differs with a person's age, sex, altitude, and pregnancy. Anemia may mature at any stage of the life cycle but children and adolescent girls are vulnerable groups for developing anemia. Anemia is a specific concern for adolescent girls i.e., aged 10–19 years as this is a period of intense growth with sophisticated iron requirement. This compounded with frequent menstrual blood losses and inadequate dietary iron intake which results in anemia. [3,4]

In developing countries, low standards of living, low socio -economic conditions, restricted access to food and a lack of knowledge for good dietary practices and personal hygiene donate even more to a high occurrence of iron deficiency and in future anemia. Intestinal parasitic infection, due to poor hygienic conditions, restricts with iron absorption by reducing it, thus growing the prevalence of iron deficiency anemia in the developing world. [5] The badly behaved of anemia in Egypt starts from the early childhood. The results of a survey among infants 6 to 24 months old in Cairo existing that 43% of the infants were anemic. [6] Study done in Egypt (2013) on related knowledge among Egyptian preparatory school girls, discovered that the overall prevalence of anemia among adolescent girls was 34.0%, most of them had moderate anemia at the beginning of the study. [7] Additionally, Another study done on Iron Deficiency Anemia in Adolescent Girls in Rural Upper Egypt at 2015, revealed that (30.2%) of them had iron deficiency anemia and (9.6%) of them on anemic. [8]

Adolescents' nutritional problems may represent a heavy health burden. Likewise, the harmful effects of deficiencies in adolescents are disregarded. Supporting the healthy development of adolescents is one of the peak important investments that any society can make[9, 10]A better considerate of adolescents' diets and eating behaviors is crucial for the design and development of relevant education and other intervention programs. [11] Accordingly, nurse especially school health nurse has an important role in the prevention and management of iron deficiency anemia in adolescent girls, primary prevention of iron deficiency for adolescent girls is through information about healthy diets, including good sources of iron, encourage the students to adopt healthful life style pattern . [12] Thus**, this research was conducted to study** life style risk factors of iron deficiency anemia among adolescents' girls.

RESEARCH QUESTION

1- What are the life style risk factors for iron deficiency anemia among adolescents' girls?

MATERIAL AND METHODS

Material

Study design:

A Case Control study design was utilized to conduct this study.

Study setting:

The study was conducted in Damanhour city as it is the capital of El- Beheira governorate. One to six from the total fifty six preparatory schools at Damanhur City were chosen randomly to be the settings for the study (One urban out of 6 schools namely El Gomhoriagirls prep school and eight schools from rural educational directorates out of fifty governmental preparatory schools namely Omar Noaiem,Zokl, Eflakka, Kom-Elnawam, Zawyet-Ghazal girls school, Zarkon,, Seif El-din El- katteb, Omar Ebn El-khatab).

Study subjects:

Girl students who are enrolled in the first grade of the selected schools were selected randomly to be included in the study. The total number of girl students at the selected schools was 1220 students. Twenty five percent out of the diagnosed girls students with Iron Deficiency Anemia (Hg level less than 11.5 g/dl) were selected randomly as **cases** for the study (based on school health records results of Hg estimation that were done during routine screening test which was carried out by school health insurance or by family health centers). On the other hand, the selection of **control group** was done from those who have Hg level ≥ 11.5g/dl. The whole number of the nominated girls was 240 adolescents' girl (120 girl student as cases /anemic and the exact number of girls engaged in control group/ non-anemic) they were randomly selected.

Inclusion criteria

- Girl students with hemoglobin concentration < 11.5 g/dl were considered as cases; Controls were selected from those who had a hemoglobin concentration ≥ 11.5 g/dl [(13)].

Study tool:information was collected using one study tool:-

Tool (I):Adolescent girls structured interview questionnaire: It includes two parts:-

Part I:- Socio-demographic data: As age, place of residence, student's birth order, parent's educational level, parent's occupation, and scholastic achievement from students' school records.

Part II:life style practices of adolescent girl student's:

- ***Adolescents' girl feeding practices:***As number of meals daily, taking breakfast, snacks intake, drinking tea, fresh vegetables eating and time of fruit eating.
- ***Adolescents' girl activities practices:***Sleeping patterns and activity practices, It included: physical exercises, sport activities, sleeping patterns, TV viewing and computer using.

Part III: Anthropometric measurements for anemic students:

Anthropometric measurements were obtained using standardized techniques and calibrated tools, height was measured using a non- stretching measuring tape, in centimeters to the nearest 0.1 cm, weight was measured using a standardized weighing scale, in kilograms to the nearest 0.5 kg, and Body Mass Index (Kg/m^2) was calculated using standardized weighting and height chart.

BMI percentiles for age and sex:

The recent WHO 2007 child growth standards [(14)] were used instead of WHO International classification of underweight, overweight and obesity according to BMI [(15)]by means of it more specific for the definition of overweight and obesity. Experts classify BMI-for-age at or above the 95^{th} percentile as obese and between the 85^{th} and less than 95^{th} percentile as overweight, the values between 5^{th} and less than 85^{th} percentiles considered as normal/ average weight and finally, the values less than 5^{th} percentile were used to determine underweight.

METHODS

- Official letters from Faculty of Nursing were directed to the directorate of selected governmental preparatory schools in Damanhour city to let know them about the study aims and to search for their permission to demeanor the study in these schools.
- Meetings were held with the directors of the selected schools to explain the aim of the study, set the date and time of data collection, assure them that collected data were used only for the study purpose, and to gain their approval and cooperation during data collection.
- Tool was developed by the researchers after reviewing recent literature in order to collect the required data from the studied students and revised by Jury composed of (3) experts in the field of Community Health Nursing and Pediatric nursing for content validity and their suggested modifications were done in view of that.
- The Pilot study was carried out on a sample of 24 students; they were selected from El-Taaon preparatory school and Omar Ebn El-Khatab preparatory school, these schools not involved in study sample. The data obtained from the pilot study were analyzed. Based on the findings of the pilot study, some questions were explained and few others added.
- The data was collected individually from the students in selected schools at suitable time after a brief explanation of the purpose and the nature of the research.
- At the beginning of the interview with each student, the researchers were clarifying the purpose of interview, and ensure the anonymity and confidentiality of the collected data.
- Weight was measured by a standardized weighing scale, in kilograms to the nearest 0.5 kg and height was measured by a non- stretching measuring tape, in centimeters to the nearest 0.1 cm, to calculate (BMI) based on WHO 2007 growth reference for school-aged children and adolescents.
- The structured Interview time took approximately from 30 to 45 minutes for each student.
- Data about the Hemoglobin results of students were obtained from their school health records.
- Data about students' scholastic achievements were obtained from their school records.
- Data was collected by the researchers over during academic year(2017-2018).

Statistical analysis:

- After data collection, the collected data was coded and transferred into especially designed format to be suitable for computer feeding.
- Data was entered into and analyzed using the statistical package of social science (**SPSS**) version 20.
- After data entry, data was checked and revised through frequency analysis, cross tabulation, and manual revision to discover any error during data entry.
- Variables were analyzed using the descriptive statistics which included: percentages, frequencies, range (minimum and maximum), arithmetic mean, and standard deviation (**SD**).
- The level of significance selected for this study was **$p \leq 0.05$**.
- Chi square test (X^2) was used for testing the relationship between categorical variables.
- Two sample t-tests is a parametric test for comparing means of two independent groups. It is used for continuous variables
- Linear Regression Model was used to indicate the predictors of iron deficiency anemia, the model was statistically significant **($p \leq 0.05$)**, and also factor was considered a risk factor for IDA if **OR> 1**, where as if **OR < 1** these factors play as a protective factors for IDA.
- Graphs were done for data visualization by using Microsoft Excel program.

Ethical considerations:

- Written informed consent obtained from the director of each selected school included in the study after explanation of the aim of the study and assure them that collected data will be used only for the study purpose.
- Each director of selected schools informed about the date and the time of data collection.
- Confidentiality and anonymity of individual response was guaranteed through using a code numbers instead of names.

RESULTS

Table (1) displays Socio demographic characteristics of adolescent girls (anemic and non- anemic). Concerning age, it ranged from 11 -14 years with a mean age of (12.6 ± 1.23) for anemic students. Where, non-anemic students were ranged from 11-15 years with a mean of(14.1 ± 1.39). More than half (51.7%) of anemic students and more than one third (34.1 %) of non –anemic students were aged between 12 to less than 13 years, with a statistically significant difference between both groups(= 7.50, p= 0.0235).

Regarding the place of residence, the majority of anemic and non- anemic students (96.7%, 80.8 %) respectively were living in rural areas while the minority (3.3%) of anemic students and less than fifth (19.2%) of non- anemic students were living in urban areas, with a statistically significant difference between both groups (= 15.04, p<0.0001).

Concerning students' birth order, show that around one third (29.1%, 27.5 % respectively) of anemic students were ranked as the first or second child compared to more than one third(36.6%, 33.3% respectively) of non- anemic students. No statistically significant difference between both groups (= 4.61, P=0.099).

Additionally, this table displays fathers' education; it was evident that highest percent (38.3 %, 41.7% respectively) of fathers had secondary school education among anemic and non- anemic students. On the other hand, around one tenth (18.3%, 15% respectively) of both anemic and non- anemic students' fathers were illiterate. No statistically significant difference between both groups (=1.26 P= 0.867).

As regard mothers' education, it shows the highest percent was observed that mothers who had secondary education among anemic and non- anemic students (42.5%, 48.3% respectively). One quarter (25%) of anemic students' mothers were illiterate compared to only (7.5%) of non-anemic students' mothers. A statistically significant difference between both groups (= 13.93, p= 0.0075).

In relation to fathers' and mothers' occupation, it shows that less than two thirds (65%) of anemic students' fathers were work increased to (93.4%) of non- anemic students' fathers were work. Moreover, more than one third (32.5%) of anemic students' fathers were not working. However, a minority of non- anemic students' fathers were not working (5%).With a statistically significant difference between both groups (= 30.48, p= 0.00001).

Pertaining to mothers' occupation, table depicts that around three quarters (73.3%) of anemic groups' mothers were working compared to around two thirds (63.3%) of non-anemic groups' mothers. Also, one quarter (25%) of anemic groups' mothers were not working compared to more than one third (34.1%) of non-anemic groups' mothers. No statistically significant difference between both groups (= 2.78, p= 0.248.)

As regard to academic achievement among studied groups, this table revealed that more than one third (38.3%) of anemic group obtained good score, but half (50 %) of non-anemic group obtained very good score in school report, with a statistically significant difference between both groups (=84.25, P=<0.00001).

Table (1): Socio demographic characteristics of anemic and non- anemic adolescentgirls.

Socio-demographic characteristics	Anemic students (n=120)		Non-anemic students (n=120)		Chi square Test (P value)
	No.	%	No.	%	
Age (years)					
11-	3	2.5	4	3.3	7.50
12-	62	51.7	41	34.1	0.0235*
13y and more	55	45.8	75	62.6	
Min. – Max.	11-14		11-15		
Mean ± SD.	12.6±1.23		14.1±1.39		
Place of residence	4	3.3	23	19.2	15.04
Urban	116	96.7	97	80.8	0.0001*
Rural					
Student's birth order					
First	35	29.1	44	36.6	4.61
Second	33	27.5	40	33.3	0.099
Third or more	52	43.3	36	30.1	
Monthly family income	20	16.7	40	33.4	
Enough	20	16.7	16	13.3	
Didn't enough	80	66.7	64	53.3	8.88
Didn't know					0.011*
Father education	22	18.3	18	15	1.26
Illiterate	23	19.1	20	16.7	0.867
Primary	46	38.3	50	41.7	
Secondary	26	21.7	30	25	
Higher	3	2.5	2	1.6	
Dead					
Father occupation:	78	65	112	93.4	30.48
Working	39	32.5	6	5	0.00001*
Non –working	3	2.5	2	1.6	
Dead					
Mother education	30	25	9	7.5	13.93
Illiterate	8	6.6	10	8.3	0.0075*
Primary	51	42.5	58	48.3	
Secondary	29	24.2	40	33.3	
Higher	2	4	3	2	
Dead					
Mother occupation:	88	73.3	76	63.3	2.78
Working	30	25	41	34.1	0.248
Non –working	2	4	3	2	
Dead					
Scholastic achievement	7	5.8	42	35	84.25
Excellent	30	25	60	50	0.00001*
Very good	46	38.3	18	15	
Good	23	19.2	0	0	
Satisfactory	14	11.7	0	0	
Poor					

X^2: Chi-Square test

*: Statistically significant at $p \leq 0.05$

Table (2) reveals the distribution of the studied adolescent girl's students (anemic and non- anemic) according to their feeding pattern. Regarding the number of meals/ day, more than half (54.2%) of non- anemic students and only just one tenth (14.2%) of anemic students reported that they had three meals/day, with a statistically significant difference between both groups (χ^2=50.71, P<0.00001).

Furthermore, it was found that more than half (54.2%) of non- anemic students taking breakfast daily compared to less than one tenth (11.7%) of anemic students. However, more than half (55%) of anemic students and only (3.3%) of non- anemic students didn't take breakfast. A statistically significant difference was found between both groups with respect to intake of breakfast (χ^2=89.17, P<0.00001).Regarding taking of fast food, it was found that 45%, 52.2% respectively of anemic and non- anemic students reported sometimes intake of fast food while about half (49.2%) of anemic group and nearly two fifth (36.7%) of non- anemic group were always take fast food, with no statistically significant difference between both groups (χ^2=4.68, P<0.096).

The table (2) also depicts that majority of anemic students (79.2%) and non- anemic students (92.5%) always had snacks, while a minority of both anemic and non- anemic groups (20.8 % &7.5 %respectively) had no snacks, with a statistically significant difference between both groups (χ^2=8.77, P<0.003).

It is also worth mentioning that half (50%) of anemic students drinking tea, compared to less than fifth (19.1%) of non- anemic students, with a statistically significant difference between both groups (χ^2=25.90, P<0.00001). Concerning the time of tea drinking, more than two third (61.7%) of anemic students had drinking tea after eating food directly compared to only approximately one quarter (24.1%) of non- anemic students, with a statistically significant difference between both groups (χ^2=36.43, P<0.00001).

The table (2) also reveals that more than one quarter (28.3%) of anemic students didn't eat fresh vegetables, compared to approximately half (44.2%) of non- anemic students always eating fresh vegetables with a statistically significant difference between both groups (χ^2=16.28,

P<0.00029). Regarding time of eating fruits, 56.7% of anemic students eating it immediately after a meal compared to more than three quarters (75.8%) of non-anemic students eating it later after a meal, with a statistically significant difference between both groups (□□=87.03, P<0.00001).

Table (2): Feeding pattern of anemic and non- anemic adolescent girls.

Feeding pattern	Anemic students		Non- anemic students		Chi square Test (P value)
	No.	%	No.	%	
Number of meals /day	**(n = 120)**		**(n = 120)**		50.71 0.00001*
One meal	15	12.5	0	0	
Two meals	88	73.3	55	45.8	
Three meals or more					
Mean ± SD.	17	14.2	65	54.2	
	2.22±0.36		2.85±0.41		t = 6.85 0.002*
Taking breakfast	**(n = 120)**		**(n = 120)**		89.17 0.00001*
Daily	14	11.7	65	54.2	
Sometimes	40	33.3	51	42.5	
Never	66	55	4	3.3	
Taking fast food	**(n = 120)**		**(n = 120)**		4.68 0.096
No					
sometimes	7	5.8	13	10.8	
always	54	45	63	52.5	
	59	49.2	44	36.7	
Taking snacks	**(n = 120)**		**(n = 120)**		8.77 0.003*
No					
Yes	25	20.8	9	7.5	
	95	79.2	111	92.5	
If yes[#]	**(n= 95)**		**(n= 111)**		
Juice					
Vegetable – fruits	42	44.2	29	26.1	2.65 0.214
Sweets	30	31.6	22	19.8	
Nutes	18	18.9	60	54.1	
Other	6	6.3	22	19.8	
	7	7.4	6	5.4	
Drinking tea	**(n = 120)**		**(n = 120)**		25.90 0.00001*
Daily	60	50.0	23	19.1	
Sometimes	33	27.5	60	50	
Never	27	22.5	37	30.8	
Timing of drinking tea	**(n = 99)**		**(n = 83)**		36.43 0.00001*
Before meal	5	5	5	6	
After meal directly	61	61.7	20	24.1	
After meal >2 hours	20	20.2	52	62.7	
During the meal	13	13.1	6	7.2	
Eating fresh vegetables	**(n = 120)**		**(n = 120)**		16.28 0.00029*
Always					
Sometimes	31	25.8	53	44.2	
Never	55	45.8	55	45.8	
	34	28.3	12	1.0	
Time of fruit intake	**(n = 120)**		**(n = 120)**		87.03 0.00001*
Immediate after intake of meal	68	56.7	19	15.8	
Late after a period of intake the meal	19	15.8	91	75.8	
Never	33	27.5	10	8.3	

X^2: Chi-Square test: independent sample to test
*: Statistically significant at $p \leq 0.05$

Table (3) shows the distribution of the studied adolescent girl's students (anemic and non- anemic) according to their daily activity practices. The table shows that**,** more than half (55.8%) of the anemic students were not practicing any sporting activities, while the more than three quarter (78.5 %) of non- anemic students were practicing it, with a statistically significant difference between both groups (□□ = 50. 09, p= <0.00001). only 9.4% of anemic students and around one third (38.1%) of non- anemic students were practicing sport for once per week. However, sport activities of either twice or more times per week were reported by 41.6% of anemic students and 39% of non- anemic students, with a statistically significant difference between both groups (□□=17.85, P= 0.0001).

Table (3): Daily activity practices (sports) of anemic and non- anemic adolescent girls.

Sport activities	Anemic		Non- anemic		Chi square Test (P value)
	No.	%	No.	%	
Practice Physical sport activity	**(n = 120)**		**(n = 120)**		50.09 0.00001*
No	67	55.8	15	12.5	
Yes	53	44.2	105	78.5	
Frequency of practicing sport activities / week	**(n = 53)**		**(n = 105)**		17.85 0.0001*
Daily	26	49.0	24	22.9	
Once per week	5	9.4	40	38.1	
Two or more per week	22	41.6	41	39	
The way of going daily to school by:	**(n =120)**		**(n =120)**		1.12 0.2907
Walking	105	87.5	110	91.7	
Using transportation	15	12.5	10	8.3	

χ^2 and p values for **Chi square test**

*: Statistically significant at $p \leq 0.05$

Table (4) depicts the distribution of the studied adolescent girl's students (anemic and non- anemic) according to their sleeping pattern. It is obvious from the table that sleeping hours/night ranged from 4 to10 hours among anemic students group and from 5 to 12 hours among non- anemic group with a mean of 6.95 ± 1.65 and 8.22 ± 2.01 hours respectively, with a statistically significant difference between both groups (P<0.003). Concerning presence of sleep problems, the majority (82.5%) of anemic students had sleep problems compared to half (50 %) of non- anemic students, with a statistically significant difference between both groups ((=28.34, P<0.00001).

Table (4): Sleeping pattern of anemic and non- anemic adolescent girls.

Sleeping pattern.	Anemic students		Non- anemic students		Test (P value)
	No.	%	No.	%	
Night sleep hours	**(n = 120)**		**(n = 120)**		T=3.01 p 0.003*
Min- Max	4.0 – 10.0		5.0 – 12.0		
Mean ± SD.	6.95±1.65		8.22±2.01		
Nap (day time nap) sleep hours					T=2.65 P 0.021*
Min- Max	1.0 – 3.0		1.0 - 3.0		
Mean ± SD.	1.69±0.72		2.33±0.68		
Encountered sleeping problems	**(n = 120)**		**(n = 120)**		χ^2= 28.34 0.00001*
No	21	17.5	60	50	
Yes	99	82.5	60	50	

X^2: Chi-Square test t: independent sample to test *: Statistically significant at $p \leq 0.05$

Table (5) portrays the distribution of the studied adolescent girl's students (anemic and non- anemic) according to watching television and computer using. It is clear from the table that, the majority (97.5% &95.8%respectively) of anemic and non- anemic students were like watching T.V. Additionally, 79.1% and 78.3%respectively of anemic and non- anemic students liked computer or cellular phone. No statistically significant difference between both groups

Table (5): Using of television and computer among anemic and non- anemic adolescent girls.

TV and computer using.	Anemic students		Non- anemic students		Chi square Test (P value)
	No.	%	No.	%	
Watching Television	**(n = 120)**		**(n = 120)**		0.52 0.472
No	3	2.5	5	4.2	
Yeshjjhj	117	97.5	115	95.8	
If Yes: Frequency of television watching	**(n = 117)**		**(n = 115)**		7.0 0.03
Daily	100	85.5	92	80	
Some days per week	10	8.5	21	19.3	
Once per week	7	5.9	2	1.7	
Using of computer or cellular phone	**(n = 120)**		**(n = 120)**		0.16 0.6904
No	25	20.9	28	23.3	
Yes	95	79.1	94	78.33	
If Yes: Frequency of using computer or cellular phone	**(n = 95)**		**(n = 94)**		X^2= 1.12 0.7710
Daily	50	52.6	54	57.4	
Some days per week	30	31.6	24	25.5	
Only on week end	11	11.6	13	13.8	
Seldom used	4	4.2	3	3.2	

X^2: Chi-Square test*: Statistically significant at $p \leq 0.05$

Figure (1): Distribution of anemic students according to their BMI. Around half (45%) of anemic students had underweight, while less than one fifth (18.3%) of them were overweight. Obesity was found among less than tenth (5%) of students.

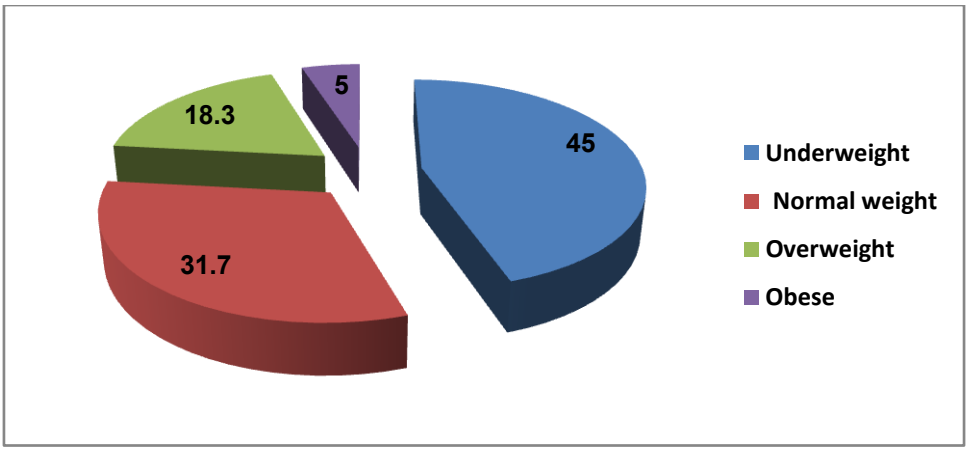

Figure (1): Distribution of anemic students according to their BMI

The multivariate analysis for the different risk factors which affect on iron deficiency anemia was shown in **table (6)**, according to the model, factor was considered a risk factor for IDA if OR> 1, while if OR < 1 these factors play as a protective factors for IDA.

The factors which showed significant relation to students with iron deficiency anemia were many. Concerning factors related to demographic characteristic, father's occupation especially students with not worked fathers occurrence of IDA was (OR=1.98, P<0.013), Underachiever students (OR = 2.11, p= <0.011). Mother's education (OR = 0.96, p = 0.028), Place of residence or rural residence (OR = 1.89, p = 0.017), and low monthly family income (OR = 3.003, p = 0.030)

The table also shows that factors related to sleeping pattern and activity practices included physical inactivity **(**OR=0.108, p<0.001), absence of nap sleep hours (OR=0.571, p=0.014).

With respect to risk factors related to student's feeding practices, the observable risk factor for IDA was not consumed snacks (OR=1.92, p<0.035). Additionally other factors were found as not eating daily breakfast (OR=2.16, p=0.011), eating less than 2 meals/day (OR=1.94, p=0.036), time of drinking tea (OR=0.625, p=0.020).

Table (6): Multivariate analysis logistic regression for factor affecting iron deficiency anemia in adolescent girl's students:

Risk factors for iron deficiency anemia	P	OR	95% CI	
			LL	UL
Factors related to demographic characteristics				
• Father's occupation	0.013*	1.98	0.21	0.98
• Underachiever students	0.011*	2.11	0.106	0.76
• Mother's education	0.028*	0.96	0.11	0.98
• Place of residence	0.017*	1.89	0.03	0.72
• Monthly family income	0.030*	3.003	1.112	8.10
Factors related to sleeping pattern and activities Practices				
• Physical activity exercises	<0.001*	0.108	0.042	0.27
• Nap sleep hours	0.014*	0. 571	0.365	0.89
Factors related tofeeding pattern				
• Absence of snacks intake	0.035	1.92	0.265	0.96
• Not eating breakfast	0.011*	2.16	0.152	0.78
• Eating less than 2 meals/day	0.036*	1.94	0.361	0.75
• Time of tea drinking	0.020*	0.625	0.421	0.93

OR: Odds ratio OR>1: Risk factors for IDA OR<1: Protective factors for IDA
CI: Confidence interval
LL: Lower limit
UL: Upper Limit
*: Statistically significant at $p \leq 0.05$

DISCUSSION

Adolescents are mainly vulnerable to emerging anemia because of rapid growth, weight gain, and blood volume expansion and additionally because of onset of menstruation. In girls, middle adolescence growth happens earlier (i.e., during 12-15 yrs) than in boys (i.e., during 13-16 yrs).Adolescent girls form a vital segment of the population and set up, as it were, the vital “bridge” between the current generation and the next.[16]In many developing countries, one half all children and adolescents miss the mark to achieve their full genetic growth potential due to the combined effects of insufficient nutrition and frequent disorder. Moreover, due to defective dietary habits, unawareness, and with a multitude of social customs and beliefs mentioned against women, the prevalence of malnutrition surrounded by girls remains quite high. Anemia not only affects the present health status, but also has

deleterious effects in the future. Learning, cognitive function, and scholastic performance is also severely affected.[17] Hence , this study aimed to identify the life style risk factors of iron deficiency anemia among adolescents' girls.

The current study gives a clear picture of 120 anemic adolescent girl's students as the mean age of the anemic students was12.6 ± 1.23 years. Most of them aged 12 up to 13 years and more. This go in line with the study conducted in schools of El-Behira Governorates (2015) [18] to study the nutritional practices and iron deficiency-related knowledge of preparatory school girls. The study showed that the prevalence of anemia increases with age and becomes maximum (65%) in the age group 12-13 years. It may be attributed to that it is a critical and distinct developmental period of life characterized by significant changes in physical development, emotions, cognition, behavioral and requires increased nutritional demands, and also the similarity of data because the studies done in the same governorate with similar population characteristics.

Mother education is almost certainly the most significant factor for iron deficiency anemia. There is a strong connection between maternal education and children's health. Children born to educated women suffer less from malnutrition which manifests as underweight, wasting, stunting in children and adolescents.[19,20] In the current study, statistical significant difference was found between mother's education and occurrence of iron deficiency anemia. Data revealed that students with low educated mothers were 0.96 times more likely to be anemic as compared to students of better educated mothers. Other studies have found a strong link between maternal education and child nutritional status including study done by Bbaale (2014).[21] This is since educated women are more likely to get married to men with higher education and higher income; and to live in better neighborhoods, which have influence on child health and survival. In a contrary of the results of current study, the study done in Morocco (2015) [22] among school students revealed that no significant relationship between prevalence of iron deficiency anemia, and education level of their mothers.

Academic dropout today is one of the major concerns of families and one of the major issues in each country's educational system as well. Anemia, and especially iron deficiency anemia is one of the common problems among students which can have a negative impact on their academic performance and productivity.[23] The relationship between academic performance and anemia was very significant in this study as anemic students were 2.11 times to be underachiever as compared to non- anemic students, this can be explained by the fact that the first body functions that are affected by iron deficiency are brain enzymes that are related to behavior and cognition.[24] This result is congruent with the result of study done by Jauregui (2014) [25] who concluded that there is a significant relation between Hb level and academic performance. On the other hand, results of previous studies were inconsistent with the result of Ferrari et al (2011)[26] who concluded that neither educational performance nor intelligence showed significant associations with the iron status among European adolescents.

Contrariwise, girls suffer from anemia mostly due to poor diet. The current study reveals that, about half of anemic students showed under body-weight. Overweight girls were less anemic than the underweight ones. In the same way, Ausk et al (2008) advocated that overweight and obese people are less likely to be anemic compared to normal and underweight people.[27]

Physical activity can increase total Hb and red cell mass, which improves oxygen-carrying capacity. [28] The possible underlying mechanisms are suggested to come mainly from bone marrow, including stimulated erythropoiesis with hyperplasia of the hematopoietic bone marrow, improvement of the hematopoietic microenvironment induced by exercise training, and hormone- and cytokine-accelerated erythropoiesis. [29] Anemia is one of the greatest common medical conditions in chronic disease. Physical activity training might be a promising, additional, safe and economical method to help improve anemia. [30]This is confirmed by the finding that the performance of sport activities is considered a protective factor for the prevalence of anemia, while adolescent girls who were performing sports were about 0.11 times protective to had IDA compared to whose that were not practicing sports regularly. These finding are also supported by similar studies that support significant relation between practicing sport and IDA. [31, 32]

Lifestyle as watching television and using a computer are increasingly common sedentary behaviors. [33] Whether or not prolonged screen time increases the risk for diseases remains uncertain. According to the 2010 American Time Use Survey, people aged ≥ 15 years watched television an average of 2.7 h per day making it the most common leisure activity and highly risk factor for occurrence of diseases. [34] In relation to student's hobbies, like watching television and computer& phone usage, the most percent of anemic and non – anemic students were watched T.V daily and using of cellular phone but there is a no statistically significant difference between both groups. In contrary of the results of the current study ,Djokic et al (2010) who reported that lifestyle practices as watching T.V and using mobile phone independently predicted anemia in his study sample. [35]

Poor eating routines are the main reason for the high rates of anemia among adolescents in Egypt. [18] Their daily iron requirements are not met by the typical diet because of an inadequate intake of iron-rich foods and foods that enhance iron absorption, and/or additional intake of inhibitors of iron absorption, such as tea .[36]The results of the present study indicated that, approximately tenth of anemic adolescents girls students consume three meals per day and the majority of them skipped one or two meals. This may be attributed to adolescents' unaccustomed way of taking their breakfast or dinner with their family. Additionally, parents' deficiency of awareness regarding adolescents' nutritional requirements. [2] Thus, nutrition education and counseling should be provided to them, and emphasis should be placed on choosing nutrient-dense foods rather than nutrient-empty foods.

It is noteworthy that, the majority of anemic adolescent girls' students in the current study omitted or sometimes skipping breakfast. The result also revealed that the adolescent girls students who hadn't consumed breakfast were 2.16 times to had IDA compared to those that consume daily breakfast. On the contrary, an Egyptian study done by El-GilanyA, et al (2011) reported that 71.6% of the adolescents consumed breakfast daily, [37] but the Egyptian Population Council Survey of young people in Egypt (SYPE) (2014) reported that only 57% of the adolescents consumed daily breakfast, and only 3.5% of the respondents omitted the meal. [38] Gaza study reported almost the same finding (62%). [39] Undesirable food pattern, hunger and lack of school breakfast and snacks in most of schools could be behind the main reasons for this problem. [40]On the other hand, adolescents stated lack of time and poor appetite in the morning as the two most common reasons for missing breakfast. [41] In addition to, early school activities and irregular schedule that were mentioned in other study. [42] So all these reasons must be considerate in order to help improve nutritional status and prevent IDA among adolescent girls.

Additionally the intake of fast food was not considered a risk factor for IDA among adolescent girl's students from this study finding. Another study of Cynthia J et al (2013) disagreed with these results as it confirmed that with increasing dependence on foods outside the home, there was less motivation to make healthy food choices. [43]

The drinking of tea immediately after meals was a common practice among by the anemic adolescent girls. This is a public habit in Egypt as many families would enjoy having a glass of minted tea immediately after meals. Tea drinking is well documented as one of the main factors that inhibit iron absorption, [44] this is confirmed by the finding that anemia was less prevalent among persons who never drink tea. Tea consumption in the studied subjects is relatively high, which may contribute to the inhibition of iron absorption in poor families that depends on a plant- based diet. Also, a finding of Frank S (2016) [45] was in line with the present study, which revealed that most of iron deficiency anemic cases drink tea immediately after meals.

All nutritional problems that appeared among students in this study could have been prevented or minimized if the role of school nurse in assessment and education activated, as there are not sufficient dietitians and nutritionists available to serve the all-inclusive schools. That means that nurses often fill the role of nutrition evaluators and educators. The nurse is the logical person to provide nutritional information because nurses are the primary interface between the student and the school.[46]Nutrition education by school nurse will involve teaching the student about the risks of IDA, importance of nutrition, providing educational materials as brochures, pamphlets, or distribution of healthy meals that reinforce messages about healthy eating, teaching adolescents skills essential for making dietary change, and providing information on how to sustain eating behavior change.[47]To sum up, all efforts must be done by governmental and nongovernmental organizations, community leaders, social workers, school teachers and the community at large in order to make the adolescent girl's student more conscious about risk factors for IDA, their healthy nutrition, and less favorable to iron deficiency anemia.

CONCLUSION AND RECOMMENDATION

There is significant association of anemia with some socio-demographic characteristics and activities of life style among adolescents' girls. Subsequently, there is essential to increase awareness of anemia in adolescent girls and their parents. Additionally, Information, Education and Communication (IEC) activities regarding promotion of healthy nutritional practices should be implemented. Promotion of appropriate utilization of iron and folic acid supplementation via weekly Iron and Folic Acid Supplementation (WIFS) are suggested.

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