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PREVALENCE OF ANEMIA AND ASSOCIATED FACTORS AMONG SCHOOL-AGE CHILDREN IN AL-HARAM ZONE, GIZA GOVERNORATE, EGYPT

By

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ABSTRACT

Background: Anemia in school-age children is an important public health problem, and available data of its prevalence and existing risk factors are essential for planning preventive strategies. Anemia is more prevalent among females as compared with males. It reduces physical work capacity and cognitive function and adversely affects learning and scholastic performance.

Objectives: To determine the prevalence of anemia among male and female school-age children (6-18 years) in Al-Haram, Giza governorate, Egypt, and to identify factors associated with childhood anemia among the participants.

Subjects and methods: A cross-sectional study was conducted on 235 school-age children 6-18 years old (116 males and 119 females) in Al-Haram district, Giza governorate, Egypt. An oral consent was obtained from participants and their relatives. A blood sample was taken from each participant with the aim of providing the prevalence of anemia and associated factors among the study population .

Results: The study revealed that the overall prevalence of anemia was 38.7%. Among males were 23.3%, while 53.8% among females with a statistically significant difference. Regarding family size prevalence of anemia among families (less than five) were 27.1%, while 74.1% in families more than five persons with a statistically significant difference.

The current study revealed that anemia was 64%, 54.5% and 10.1% among children born to illiterate, moderate and high educated fathers respectively. Anemia was 56.4% and 17.4% among children borne to illiterate and moderate educated mothers with a statistically significant difference. Results of the study revealed that anemia was 61.8%, 48.5%, 5.6% and 26.7% among children who born to farmers, merchant, governmental employee and private employee respectively. Regarding mothers job, 41.4%, 33.3% and 20% of children were anemic who born to house wife, merchant and private employee mothers respectively with statistically significant differences. The study revealed that anemia was 66.2% among children who ate meat once weekly, while 38.7% among children who ate meat twice weekly, with statistically significant differences. Anemia was 55% among children who ate vegetables once weekly, 28.8% among who ate vegetables twice, and 15.9% among who ate vegetables three times and more weekly. The current study revealed that anemia was 44.1% among who ate fruits once weekly, 13% among who ate twice weekly, and 11.8% among who ate three times and more weekly .

Recommendations:

- School teachers should give advice to both children and their parents regarding advantages of balanced diet.
- Improvement of dietary habits regarding consumption of animal proteins , fruits and green leafy vegetables should be included in diet plan.
- Health education seminars should be conducted at regular intervals.

- Addition of a health education courses to student's curricula.

Conclusion: The results suggested that there was a need for proper planning and implementation of preventive measures to combat childhood anemia.

Keywords: Prevalence anemia, Egyptian children.

INTRODUCTION

Anemia is a condition characterized by reduction in the number of red blood cells and/or hemoglobin (Hb) concentration *(De L et al., 2011)*. Anemia is a disease having high prevalence worldwide, it can occur at all stages of life mostly in pre-school age of children *(Assis et al., 2004)*. Anemia was defined according to World Health Organization cut-offs as Hb level < 11g/dl for girls and < 12 g/dl for boys *(Garg et al., 2016)*. Anemia is a global public health problem which affects both the developing and the developed countries *(Djokic et al., 2010)*. A participants having red blood count values <4 m/ml were considered anemic. Iron deficiency anemia is more common in developing countries, children and adolescents being at a significantly higher risk *(De Andrade Cairo et al., 2014)*. Anemia is a nutritional problem worldwide and its prevalence is higher in developing countries *(Djokic et al., 2010* and *Hioui et al., 2010)*. Anemia is a public health problem, it affects one quarter of the total population in the world *(WHO, 2008)*. Anemia reduces physical work capacity and cognitive function and adversely affects learning and scholastic performance *(Akramipour et al., 2009)*.

Anemia is a global public health problem affecting both developing and developed countries with its varied adverse consequences on health as well as on the socio-economic development of the counties *(Stevens et al., 2013)*.

Objectives of the Study:

1. To estimate the prevalence of anemia among school-age children, in Giza Governorate, Egypt.

2. To identify factors associated with childhood anemia among the participants.

SUBJECTS AND METHODS

A cross-sectional analytic study was conducted in a randomly selected school-age children 235 person (6-18 years old) during the period from (April 15 to November 25, 2018). A self-designed study questionnaire was used to collect socio-demographic data and blood samples were obtained from each participant to determine RBCs and hemoglobin values using cell counter. Hemoglobin below 11g/dl and 12 g/dl were considered as anemic for girls and boys respectively, RBCs count below 4 million per cubic milliliter was considered anemic for both sexes *(Garg et al., 2016)*.

Statistical analysis: Data were collected, revised, coded and entered to Statistical Package for Social Sciences (SPSS) version 20. Chi-square test, Fisher's exact test and independent sample T test were used for comparison between relative frequencies. P value < 0.05 was considered significant.

Ethical considerations: The purpose of the study and procedures were explained to all participants and their relatives and

an oral consent to participate in the study was obtained.

RESULTS

The overall prevalence of anemia was 38.7%, 23.3% of males and 53.8% of females were suffering from anemia with a statistically significant difference (P <0.00). 42.3% of age group "6-11 years" and 35.5% of age group "12-18 years" with a statistically significant difference (P <0.01). 27.1% of family size less than 5 persons, while 74.1% of family size 5 and more persons were suffering from anemia with statistically significant difference (P <0.00) (Table 1).

Table (1): Prevalence of anemia by some demographic factors among school-age children in Giza Governorate

Groups / Parameters	Normal		Anemic		Total		P Value
	No.	%	No.	%	No.	%	
Gender							
▪ Males	89	76.7	27	23.3	116	49.4	<0.00
▪ Females	55	46.2	64	53.8	119	150.6	
Age group							
▪ 6 - 11 y.	64	57.7	47	42.3	111	47.2	<0.01
▪ 12 - 18 y.	80	64.5	44	35.5	124	52.8	
Family size							
▪ Less than 5	129	72.9	48	27.1	177	75.3	<0.00
▪ 5 and more	15	25.9	43	74.1	58	24.7	
Total	144	61.3	91	38.7	235	100	

X2 test was used.

Mean red blood cells count among males were 4.83 + 0.738, while among females were 4.117 + 0.626 with a statistically significant difference (P <0.001). Mean Hb value among males were 13.270 + 2.117, while among females were 11.194 + 1.660 with a statistically significant difference (P <0.001). No statistically significant difference in red blood cells count among both age groups (6-11 years and 12-18 years). Mean Hb value in age group 6-11 years was 11.907 + 1.918, while in age group 12-18 years was 12.497 + 2.330 with a statistically significant difference (P <0.03) (Table 2).

Table (2): Characteristics and hematological parameters (RBCs milliom/ml and Hb g/dl) of school-age children in Giza Governorate

Characteristics / Parameters	Min.	Max.	Mean	St. dev.	No. (235)	P Value
Gender						
RBCs						
▪ Males	3.2	5.9	4.83	0.738	116	< 0.001
▪ Females	2.6	5.3	4.117	0.626	119	
Hb value						
▪ Males	9.30	16.7	13.270	2.117	116	< 0.001
▪ Females	7.30	14.6	11.194	1.660	119	
Age group						
RBCs						
▪ 6 - 11 y.	2.8	5.8	4.376	0.722	111	0.079
▪ 12 - 18 y.	2.6	5.9	4.552	0.805	124	
Hb value						
▪ 6 - 11 y.	8.4	16.0	11.907	1.918	111	0.03
▪ 12 - 18 y.	7.3	16.7	12.497	2.330	124	

Independent sample t-test was used.

The study revealed that 64% of children were anemic who born to illiterate fathers, 54.5% of children were anemic who born to moderately educated fathers and 10.1% of children were anemic who born to fathers having high education level with a statistically significant difference (P <0.001) . 56.4% of children were anemic who born to illiterate mothers and 17.4% of children were anemic who born to moderately educated mothers with a statistically significant difference (P <0.001) (Table 3).

Table(3): Prevalence of anemia among school-age children by father's and mother's education in Giza Governorate.

Groups / Parameters	Normal No.	Normal %	Anemic No.	Anemic %	Total No.	Total %	P Value
Father's education							
▪ Illiterate	9	36.0	16	64.0	25	10.7	
▪ Moderate	55	45.5	66	54.5	121	51.5	< 0.001
▪ High	80	89.9	9	10.1	89	37.9	
Mother's education							
▪ Illiterate	58	43.6	75	56.4	133	56.6	
▪ Moderate	76	82.6	16	17.4	92	39.1	<0.001
▪ High	10	100	0	0.0	10	4.3	
Total	144	61.3	91	38.7	235	100	

Fisher's Exact test and X2 test were used.

The current study revealed that 61.8% of children who born to farmer fathers were anemic, 48.5% of children who born to merchant fathers were anemic, while 5.6% of children who born to governmental employee fathers were

anemic, 26.7% of children who born to private employee fathers were anemic and 100% of children who born to daily laborer fathers were anemic with a statistically significant difference (P <0.001). 41.4% of children were anemic who born to house wife mothers, while 33.3% of children were anemic who born to merchant mothers and 20% of children were anemic who born to private employee mothers with a statistically significant difference (P <0.015) (Table 4).

Table(4): Prevalence of anemia among school-age children by father's and mother's job in Giza Governorate.

Groups / Parameters	Normal No.	Normal %	Anemic No.	Anemic %	Total No.	Total %	P Value
Father's job							
▪ Farmer	26	38.2	42	61.8	68	28.9	
▪ Merchant	34	51.5	32	48.5	66	28.1	< 0.001
▪ Governmental employee	51	94.4	3	5.6	54	23.0	
▪ Private employee	33	73.3	12	26.7	45	19.1	
▪ Daily laborer	0	0.0	2	100	2	0.9	
Mother's job							
▪ House wife	119	58.6	84	41.4	203	86.4	
▪ Merchant	12	66.7	6	33.3	18	7.7	< 0.015
▪ Governmental employee	9	100	0	0.0	9	3.8	
▪ Private employee	4	80	1	20.0	5	2.1	
Total	144	61.3	91	38.7	235	100	

Fisher's Exact test was used.

The study showed that 66.2% of children were anemic whom eating meat once weekly, 38.7 % of children were anemic whom eating meat twice weekly and no one of children were anemic whom eating meat three times and more weekly with a statistically significant difference (P <0.001). Regarding eating vegetables weekly 55% of children were anemic whom eating vegetables once weekly, 28.8% were anemic whom eating vegetables twice weekly and 15.9% were anemic whom eating vegetables three times and more weekly with a statistically significant difference (P <0.001). As regard eating fruits 44.1% of children were anemic whom eating fruits once weekly, 13% of children were anemic whom eating fruits twice weekly and 11.8% of children were anemic whom eating fruits three times and more weekly with a statistically significant difference (P <0.001) (Table 5).

Table(5): Prevalence of anemia among school-age children by frequency of eating meat, vegetables and fruits per week in Giza Governorate.

Groups / Parameters	Normal No.	Normal %	Anemic No.	Anemic %	Total No.	Total %	P Value
Meat eating/week							
▪ At most once	23	33.8	45	66.2	68	28.9	
▪ Twice	73	61.3	46	38.7	119	50.6	< 0.001
▪ Three and more	48	100	0	0.0	48	204	
Vegetables eating/week							
▪ At most once	50	45.0	61	55.0	111	47.2	
▪ Twice	57	71.2	23	28.8	80	34.0	< 0.001
▪ Three and more	37	84.1	7	15.9	44	18.7	
Fruits eating/week							
▪ At most once	109	55.9	86	44.1	195	83.0	
▪ Twice	20	87.5	3	13.0	23	9.8	< 0.001
▪ Three and more	15	88.2	2	11.8	17	7.2	
Total	144	61.3	91	38.7	235	100	

Chi-square test was used.

DISCUSSION

A cross-sectional study was carried out in five preparatory schools for girls (aged from 12-17 years) in five different villages in El-Minia governorate at Upper Egypt. In the period from September 2014 to May 2015, the sample size was 800 girls. The study revealed that 39.9% were anemic *(Suzan et al., 2016)*. This study is consistent with our study (the overall prevalence of anemia was 38.7%).

A cross-sectional descriptive study was conducted in a randomly selected Girls Education Initiative Schools in three Egyptian governorates (Fayoum, Beni Suef and Minia), pupils aged 6-19 years, and the overall prevalence of anemia was 59.3%. The prevalence is higher than results of our study *(Rasha et al., 2016)*.

Adolescent girls are the vulnerable group to anemia because of increased iron requirements to support their rapid growth and mental development and replenish loss due to menstruation *(Sachan et al., 2013)*.

A cross-sectional study was done on 200 adolescent girls attending to the Biochemistry Clinical Laboratory of Indira Gandi Institute of Medical Sciences, Panta, Bihar, India for a period of 6 months (April 2015-October 2015), revealed that 50% were anemic *(Rekha et al., 2017)*. It is higher than that obtained in our study.

A school based cross-sectional study was conducted in Dembia District from March 1 to April 30, 2017. Revealed that the overall prevalence of anemia among adolescent girls (aged 15-19 years) was 25.5% *(Kedir et al., 2017)*. It was inconsistent with that obtained in our study.

A cross-sectional study was conducted among 408 school adolescents in Bonga Town, Southwest Ethiopia, from March 15, 2014 to May 25, 2014 revealed that the overall prevalence of anemia was 15.2% *(Melkam et al., 2015)*. It was also inconsistent with that obtained in our study.

In the present study, we observed prevalence of anemia was 64% among children born to illiterate fathers, 54.5% among whom born to moderate educated fathers and 10.1% among whom born to high educated fathers. These results were higher than that obtained by *Melkam et al. (2015)*, which revealed that the anemia was 38.8% among children whom born to illiterate fathers, 12.3% among whom born to primary educated fathers, 8.6% among whom born to secondary educated fathers and 6.5% among whom born to highly educated fathers .

In a study conducted by *Rasha et al. (2016)*, revealed that anemia was 58.9% among children born to illiterate fathers, while 37.4% among children born to educated fathers. These results were lower than that obtained in our study.

In the current study anemia was 56.4% among children born to illiterate mothers, this result was near to that obtained by *Rasha et al. (2016)*, which revealed that anemia was 58.9% among children born to illiterate mothers. In this study anemia was 17.4% among children born to moderate educated mothers. This result was much lower than that obtained by *Rasha et al. (2016)*, which revealed that anemia was 58.7% among children born to educated mothers .

A cross-sectional study was conducted on school adolescents in Bonga Town, Southwest Ethiopia, revealed that anemia was 12.7% among children born to housewife mothers, 21.1% among children born to merchant mothers and 15.4% among whom born to employed mothers *(Melkam et al., 2015)*. These results were much lower than that obtained in the current study, which revealed that anemia was 41.4% among children born to house wife mothers, 33.3% among whom born to merchant mothers and 20% among children born to private employee mothers. Anemia was 30.4% among children born to farmers, 10.3% among whom born to merchant fathers and 13.7% among whom born to employed fathers *(Melkam et al., 2015)*. These results were much lower than that obtained in the current study.

A cross-sectional study was conducted on school adolescents in Bonga Town, Southwest Ethiopia, revealed that anemia was 15.4% among children eating meat less than two times weekly and 12.8% among whom eating meat two times and more weekly *(Melkam T et al., 2015)*. Another study was conducted on adolescents aged 12-19 years old in Denizli, Turkey, revealed that anemia was 87% among children eating meat once weekly and 13% among whom eating meat twice and more weekly *(Isik Y, et al., 2012)*. Results of these studies were inaccordance with that obtained in our study .

A cross-sectional study was carried among adolescent girls 10-19 years residing in an urban area in Mumbai, India, revealed that anemia was 91.5% among adolescents eating fruits once weekly and was 71.6% among whom eating fruits twice and more weekly. Anemia was 90.9% among whom eating green leafy vegetables once weekly and 74.8% among whom eating green leafy vegetables twice and more weekly *(Srinivas et al., 2015)*. These results were much higher than that obtained in current study.

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انتشار فقر الدم والعوامل المرتبطة به بين الأطفال في سن المدرسة، في منطقة الهرم ـ محافظة الجيزة ـ مصر

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خلفية البحث: فقر الدم عند الأطفال في سن المدرسة (6-18 سنة) هو مشكلة صحية عامة مهمة والبيانات المتاحة عن انتشاره وعوامل الخطر ضرورية لتخطيط استراتيجيات وقائية منه. فقر الدم أكثر انتشارًا بين الإناث مقارنةً بالذكور، فهو يقلل من قدرة العمل البدني والوظيفة الإدراكية ويؤثر سلبًا على التعلم والأداء الدراسي.

الهدف من البحث: يهدف البحث لتحديد مدى انتشار فقر الدم بين الأطفال الذكور والإناث في سن المدرسة في منطقة الهرم، محافظة الجيزة، مصر. وتحديد العوامل المرتبطة بفقر الدم بين المشاركين.

طرق وأشخاص البحث: أجريت دراسة مقطعية على 235 طفلاً في سن المدرسة تتراوح أعمارهم بين 6-18 سنة (116 ذكور و 119 إناث) في منطقة الهرم، محافظة الجيزة، مصر. تم الحصول على موافقة شفهية من المشاركين وأقاربهم. وتم أخذ عينة دم من كل مشارك بهدف معرفة معدل انتشار فقر الدم والعوامل المرتبطة به بين مجتمع الدراسة.

النتائج: كشفت الدراسة أن معدل انتشار فقر الدم الكلي 38.7٪." بين الذكور كان 23.3٪، في حين أنه 53.8٪ بين الإناث" مع وجود فرق ذو دلالة إحصائية. فيما يتعلق بمعدل انتشار فقر الدم بين الأطفال في الأسر التي تقل عن خمسة أفراد بلغ 27.1٪، في حين أنه بلغ 74.1٪ بين الأطفال في الأسر الأكثر من خمسة أفراد مع وجود فرق ذو دلالة إحصائية.

كما أظهرت الدراسة الحالية أن فقر الدم كان 64٪، 54.5٪ و 10.1٪ بين الأطفال المولودين لآباء أميين، ومتعلمين تعليماً متوسطاً ومتعلمين تعليماً عاليا

على التوالي. وكان فقر الدم 56.4٪ و 17.4٪ بين الأطفال المولودين للأمهات أميات ولأمهات متعلمات تعليماً متوسطاً مع وجود فرق ذو دلالة إحصائية. وكشفت نتائج الدراسة أن فقر الدم كان 61.8٪، 48.5٪، 5.6٪ و26.7٪ بين الأطفال الذين ولدوا لمزارعين، وتجار، موظفين حكوميين وموظفين بالقطاع الخاص على التوالي. فيما يتعلق بعمل الأمهات 41.4٪، 33.3٪ و 20٪ من الأطفال يعانون من فقر الدم الذين ولدوا لأمهات ربات بيوت، ولأمهات يعملن بالتجارة ولأمهات موظفات بالقطاع الخاص مع وجود فرق ذو دلالة إحصائية. وكشفت الدراسة أن فقر الدم كان 66.2٪ بين الأطفال الذين يتناولون اللحوم مرة واحدة أسبوعياً، في حين أنه 38.7٪ بين الأطفال الذين يتناولون اللحوم مرتين أسبوعياً، مع وجود فرق ذو دلالة إحصائية. وكان فقر الدم 55٪ بين الأطفال الذين يتناولون الخضروات مرة واحدة أسبوعياً، 28.8٪ بين الذين يتناولون الخضروات مرتين و 15.9٪ بين الذين يتناولون الخضروات ثلاث مرات وأكثر أسبوعياً. كشفت الدراسة الحالية أن فقر الدم كان 44.1٪ بين الذين يتناولون الفواكه مرة واحدة أسبوعياً ، و13٪ من الذين يتناولون الفواكه مرتين أسبوعياً و 11.8٪ بين الذين يتناولون الفواكه ثلاث مرات وأكثر أسبوعياً.

توصيات البحث:

- يجب على معلمي المدارس تقديم المشورة إلى كل من الأطفال وأولياء أمورهم فيما يتعلق بمزايا النظام الغذائي المتوازن.

- تحسين العادات الغذائية فيما يتعلق بتناول البروتينات الحيوانية والفواكه والخضروات الورقية وينبغي أن تدرج في خطة النظام الغذائي.

- ينبغي عقد حلقات دراسية للتثقيف الصحي على فترات منتظمة.

- إضافة دورات تثقيفية صحية إلى مناهج الطلاب.

الخلاصة: أشارت نتائج الدراسة إلى أن هناك حاجة إلى التخطيط والتنفيذ المناسب للتدابير الوقائية لمكافحة فقر الدم في مرحلة الطفولة.