



RESEARCH ARTICLE

IRON DEFICIENCY ANEMIA AMONG SCHOOL AGE CHILDREN IN KSA

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Abstract

Background: Iron-deficiency anemia is the most common cause of anemia worldwide; it affects about half of school-age children around the world.

Objectives: to identify prevalence of iron deficiency and iron deficiency anemia in relation nutritional habits among school students and to identify common signs and symptoms of iron deficiency anemia.

Methods: This is a cross sectional study conducted in a representative sample of schools in KSA during the period from 1 January to 31 July 2020. Data collected by filled a predesigned online questionnaire, included questions about socio-demographic characteristics of the children, nutritional habits and risk factors, causes and complications of anemia.

Results: the study included 1558 school student, 89.8% were females, and 79.6% aged more than 15 years. 26.8% of the studied students had iron deficiency anemia. There was a significant correlation between iron deficiency anemia and age, sex, educational level ($P < 0.05$). It was most prevalent among females more than 15 years. The most common manifestations were easy fatigability 63.8%, drowsiness 52.5%, loss of concentration 45.6%, continuous headache 43.6%, fainting attacks 41.2%, tachycardia 34.3%, joint pain 33.8%, chest pain 19.7% and back pain in 18.9%. The majority (74.3%) takes oral treatment containing iron and 34.5% had vitamin C of cases. Improvement occurred in 53.5% of cases.

Conclusion: in our study, the total prevalence of iron deficiency anemia was 26.8%. It was most prevalent among females more than 15 years. In spite of treatment, only 53.5% of cases were improved. So we recommend nutritional education to all levels of school children and their mothers. Schools must keep the mid-day school meal rich in iron and vitamin C sources.

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Introduction:-

Anemia is a problem characterized by reduction of the number of red blood cells or decrease in blood hemoglobin concentration [1]. Iron deficiency is the world's most common nutrient deficiency, and a major risk to public health in both developing and industrialized countries. More than one billion people of different age groups around the world are affected [2]. About 1.62 billion people worldwide are affected by anemia that accounts for more than 24.8% of the world's population and 30 to 50% of anemia were caused by iron deficiency [3]. Studies have shown that rapid physical and physiological development makes children of school age more vulnerable to anemia, particularly IDA [4]. Anemia affects 45.7% to 49.1% of school-age children around the world, according to the WHO report [3].

The cause of iron-deficiency anemia varies based on age, gender, and socioeconomic status. Iron deficiency may result from insufficient iron intake, decreased absorption, or blood loss. Iron-deficient anemia is most often from blood loss, especially in older patients. The main risk factors for iron deficiency among young children in developing countries are malnutrition (low intake) and high requirement of iron during child growth. Risk factors also include malaria, renal disease and dietary deficiency [5]. Infection with schistosomiasis, hookworm infection, and inherited diarrhea disorders was associated with the risk of developing anemia [6]. Socio-economic factors such as poor sanitation, low income, monotonous diet, parent education levels and neighborhood factors are also associated with anemia prevalence [7].

Anemia in schoolchildren leads to reduced disease resistance, increased vulnerability to infection, poor cognitive development, impaired physical development, poor school performance and reduced capacity for function with country social and economic development impaired [8]. While ID cannot be isolated as the only problem that causes deficient initial reading skills (DIRS), it should be considered one of the elements involved in learning deficiency. Faced with this reality, investigations should be undertaken to analyze and reduce the effects of ID [9].

The load of iron deficiency anemia in school students appears high especially among school girls those between 10-12 years of age. Unhealthy feeding habits of high fast food intake with low intake of vegetables and fruits appear to be prevalent among school girls [10].

Laboratory evaluation will identify anemia. Hemoglobin indices in iron deficiency will demonstrate low mean corpuscular hemoglobin and mean corpuscular hemoglobin. Serum levels of ferritin, iron, and transferrin saturation will be decreased [11]. The treatment of iron-deficient anemia includes treating the underlying cause, such as gastrointestinal bleeding, and oral iron supplementation. Iron supplementation should be taken without food to increase absorption [12].

A previous study conducted in Saudi Arabia to assess the prevalence of iron deficiency and iron deficiency anemia in relation to variables such as: age, weight, height, mother's education, number of family members, and nutritional habits among female elementary school children (age 6 -12 years) in the western province of Saudi Arabia. Overall, the prevalence of iron deficiency and iron deficiency anemia in this study was 23.0%. Data showed that the majority of anemia cases in this study were normocytic type. Anemia was more prevalent among students of age 10-12 years as compared to younger age group. In addition, there was no relationship between iron deficiency anemia and number of family members or mother's education. Anemic students were not aware of their nutritional habits [12].

Few population-based studies have been conducted in Saudi Arabia specially on iron deficiency anemia in school girls; therefore, there is a need for a detailed analysis of nutritional habits and common signs and symptoms in this age group in the different geographical regions of the country such as Riyadh, Makkah and Madinah Munawara.

Objective:-

The aim of this study is to identify prevalence of iron deficiency and iron deficiency anemia in relation nutritional habits among school students and to identify common signs and symptoms of iron deficiency anemia.

Participants and Methods:-

This is a cross sectional study conducted in a representative sample of schools in KSA in KSA during the period from 1 January to 31 July 2020. Data collected by filled a predesigned online questionnaire, included questions about socio-demographic characteristics of the children, including age, number of children in the family, mothers'

education, father's education, nutritional habits of children and anemia presence among children. In addition, the questionnaire included inquiries about risk factors, causes, and complications of anemia.

Statistical analysis:

Data was compiled and analyzed using statistical package for the social sciences (SPSS, version 16) and results were analyzed with frequencies and Chi-squared test as appropriate. P value considered significant if <0.05 .

Ethical consideration:

Ethical approval was obtained from King Fahd Medical City in Riyadh. The questionnaire contains a brief introduction to explain the aim of the study to the participant mothers. Participants will be informed that participation is completely voluntary. No names were recorded on the questionnaires. All questionnaires were kept safe.

Result:-

Table (1): illustrate sex, age, educational level of the studied population. 89.8% of students were females, 79.6% of students aged more than 15 years, 83.4% of participants were secondary students, 27% were obese and 14.1% were underweight. 26.8% of cases had iron deficiency anemia.

Table (2): discuss relation between Iron deficiency anemia and sex, age, educational level of the studied population. there was a significant correlation between Iron deficiency anemia and age, sex, educational level ($p < 0.05$). It was most prevalent among children more than 15 years and among females.

According to Table (3): manifestation of Iron deficiency anemia, the most common were easy fatigability 63.8%, drowsiness 52.5%, loss of concentration 45.6%, continuous headache 43.6%, fainting attacks 41.2%, tachycardia 34.3%, joint pain 33.8%, chest pain 19.7% and back pain 18.9%.

Table (4): illustrate dietary habits of Iron deficiency anemia cases. 62.4% of cases had drugs in form of tablets of capsules. Improvement occurred in 53.5% of cases.

Table (5): shows treatment and improvement of Iron deficiency anemia cases. The majority 74.3% had drugs containing iron and 34.5% had vitamin C.

Table 1:- Sex, age, educational level of the studied population (N=1558).

Sex	Frequency	Percent
Female	1399	89.8
Male	159	10.2
Age group		
<10	27	1.7
10-15	291	18.7
>15	1240	79.6
Educational level		
Primary	38	2.4
Preparatory	221	14.2
Secondary	1299	83.4
Complaining from malnutrition		
No	853	54.7
Obese	420	27.0
Morbid obese	45	2.9
Underweight	219	14.1
Severely underweight	21	1.3
Iron deficiency anemia		
Yes	417	26.8
No	586	37.6
Don't know	555	35.6

Table 2:- Relation between Iron deficiency anemia and sex, age, educational level of the studied population (N=1558).

		Iron deficiency anemia			Total (N=1558)	P value
		No (n=586)	Don't know (n=555)	Yes (n=417)		
Age group	<10	10	9	8	27	0.006
		1.7%	1.6%	1.9%	1.7%	
	10-15	123	116	52	291	
		21.0%	20.9%	12.5%	18.7%	
	>15	453	430	357	1240	
Sex	Female	489	516	394	1399	0.000
		83.4%	93.0%	94.5%	89.8%	
	Male	97	39	23	159	
		16.6%	7.0%	5.5%	10.2%	
Educational level	Primary	18	10	10	38	0.058
		3.1%	1.8%	2.4%	2.4%	
	Secondary	479	456	364	1299	
		81.7%	82.2%	87.3%	83.4%	
	Preparatory	89	89	43	221	
Complaining of malnutrition	Obese	161	138	121	420	0.003
		27.5%	24.9%	29.0%	27.0%	
	Morbid obesity	16	16	13	45	
		2.7%	2.9%	3.1%	2.9%	
	No	347	305	201	853	
		59.2%	55.0%	48.2%	54.7%	
	Sever underweight	4	11	6	21	
		.7%	2.0%	1.4%	1.3%	
	Underweight	58	85	76	219	
		9.9%	15.3%	18.2%	14.1%	

Table 3:- Manifestations of Iron deficiency anemia (N=417).

Manifestations	No.	%
Fainting attacks	172	41.2
Continuous headache	182	43.6
Tachycardia	143	34.3
Joint pain	141	33.8
Chest pain	82	19.7
Low back pain	79	18.9
Easy fatigability	266	63.8
Loss of concentration	190	45.6
Drowsiness	219	52.5
Menstrual symptoms in females		
Menstrual irregularity	133	31.9
Oligohypomenorrhoea	28	6.7
Sleeplessness	132	31.7
Depression	116	27.8
Digestive symptoms		
Graving of ice and/or mud	143	34.3
Loss of appetite	103	24.7
Diarrhea	21	5.0
Constipation	68	16.3
Dermatologic symptoms		

Pallor	270	64.7
Loss of hair	166	39.8
Fragmentation of nails	19	4.6
Both	168	40.3
Cupping of fingers	101	24.2

Table 4:- Dietary habits of Iron deficiency anemia cases (N=417) .

Frequency of eating poultry or meat	No.	%
< 2 times weekly	88	21.1
> 2 times weekly	242	58.0
Frequency of eating fruits		
< 2 times weekly	143	34.3
> 2 times weekly	107	25.7
Frequency of eating fresh leafy vegetables		
< 2 times weekly	109	26.1
> 2 times weekly	128	30.7
Protein consumption		
Insufficient	232	55.6
Sufficient	163	39.1
Excess	22	5.3
Caffeine and meals		
During meals	47	11.3
Caffeine after meals by half an hour	197	47.2

Table 5:- Treatment and improvement of Iron deficiency anemia cases (N=417).

Treatment	No.	%
Drugs containing iron	310	74.3
Vitamin C	144	34.5
Forms of drugs containing iron		
Syrup	65	15.6
Tablets or capsules	260	62.4
IV injection	33	7.9
All forms	59	14.1
Vitamin C after oral iron	148	35.5
Orange juice	96	23.0
Vitamin C containing drugs	62	14.9
Both Vitamin C containing drugs and Orange juice	12	2.9
Complete course of treatment	154	36.9
Causes of incomplete course of treatment		
Stomach pain or gastritis	56	13.4
Diarrhea	17	4.1
Constipation	79	18.9
Nausea	92	22.1
All of the above	51	12.2
Improvement	223	53.5

Discussion:-

Anemia is a public health problem both in developed and developing countries [13]. It affects the majority of the population of the world in both developed and developing countries with major consequences on human health as well as social and economic development. It is the world's second leading cause of disability of the whole global disease burden [14, 15]. The WHO defines anemia as an Hb concentration 2 SD below the mean Hb concentration for a normal population of the same sex and age range [16]. Iron-deficiency anemia (IDA) is a decrease in the total

hemoglobin (Hb) levels caused by iron deficiency. It is the most common cause of anemia worldwide [17]. In Saudi Arabia the overall country prevalence of iron deficiency anemia was 30–56% [13].

This is across sectional study was conducted among 1558 of the studied population, KSA. The study aimed to identify prevalence of iron deficiency and iron deficiency anemia in relation nutritional habits among school students and to identify common signs and symptoms of iron deficiency anemia.

Anemia among school-aged children is known to be a significant global public health problem affecting 305 million people around the world. In developing countries its prevalence ranges from 29.2% to 79.6% [18].

Our study found that 26.8% of cases had iron deficiency anemia. Similar to our findings, a cross sectional survey was carried out in Riyadh region among 1117 children found that prevalence of anemia was 22.3% [19]. In Jeddah, another study was conducted among 123 female students between the ages of 6 to 12 years old, overall, the prevalence of iron deficiency and iron deficiency anemia was 23% [20]. In accordance to this another community based cross-sectional survey that was carried out in Najran city among 240 subjects that aged 13-19 years old reported that the overall prevalence of anemia among teenagers in Najran was 22.5% [21]. In Egypt, A cross-sectional descriptive study was carried out in Menoufia governorate among 497 students; the prevalence of IDA was 25.6% [22]. However, in Ethiopia, a school based cross-sectional study was conducted among 523 of School Children aged 6–14 years reported; 15.5% of cases had anemia which was lower than our findings [23]. In India, Srivastava et al. found anemia in 37.5% of children [24]. Another study was carried out among 750 children reported high prevalence rate of anemia; more than half (53.6%) were anemic [25].

According to relation between Iron deficiency anemia and sex, age, educational level of the studied population, our study reported that there was a significant correlation between Iron deficiency anemia and age, sex, educational level ($p < 0.05$). It was most prevalent among children more than 15 years and among females. In contrast to our results another study found no statistical significance difference between males and females and prevalence of Iron deficiency anemia ($P > 0.05$) [19]. Also, another study reported that there was no significant difference in the prevalence of IDA between girls and boys [22].

Regarding to manifestation of Iron deficiency anemia, the most common were easy fatigability 63.8%, drowsiness 52.5%, loss of concentration 45.6%, continuous headache 43.6%, fainting attacks 41.2%, tachycardia 34.3%, joint pain 33.8%, chest pain 19.7% and back pain 18.9%. Another study reported that the majority of cases had lack of concentration 86.5% followed by fatigue with any effort 62.2%, dizziness 58.3% and headaches reported by 57.5% [22].

As regards treatment and improvement of Iron deficiency anemia cases our study found that the majority 74.3% had drugs containing iron and 34.5% had vitamin C. 62.4% of cases had drugs in form of tablets of capsules. Improvement occurred in 53.5% of cases.

Conclusion and Recommendations:-

In our study, the total prevalence of iron deficiency anemia was 26.8%. It was most prevalent among females more than 15 years. In spite of treatment, only 53.5% of cases were improved. So we recommend nutritional education to all levels of school children and their mothers. Schools must keep the mid-day school meal rich in iron and vitamin C sources.

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Conflict of interest:

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References:

1. Almaz S (2000) Anemia testing in population-based surveys: General information and guidelines for country monitors and program managers. Calverton, Maryland USA: ORC Macro.

2. Akramipour R., Rezaei M., Rahimi Z. Prevalence of Iron deficiency Anemia among adolescent schoolgirls from Kermanshah, Western Iran. *International Journal of Hematology*. 2008;13(6):352–355. doi: 10.1179/102453308X343383.
3. Benoist BD, McLean E, Egll I, Cogswell M. Worldwide prevalence of anaemia 1993-2005: WHO global database on anaemia. Geneva: WHO global database on anaemia; 2008.
4. Tesfaye M, et al. Anemia and iron deficiency among school adolescents: burden, severity, and determinant factors in Southwest Ethiopia. *Adolesc Health Med Ther*. 2015;6:189–196.
5. Kassebaum NJ, et al. A systematic analysis of global anemia burden from 1990 to 2010. *Blood J*. 2014;123(5):615–624. doi: 10.1182/blood-2013-06-508325. Sanou D, Ngnie-Teta I. Risk factors for anemia in preschool children in Sub-Saharan Africa. Ottawa: Research Gate; 2012. p. 171–89.
6. Semba RD, et al. Diarrhea and fever as risk factors for anemia among children under age five living in urban slum areas of Indonesia. *Int J Infect Dis*. 2008;12:62–70. doi: 10.1016/j.ijid.2007.04.011.
7. Lozoff B., Beard J., Connor J., Barbara F., Georgieff M., Schallert T. Long-lasting neural and behavioral effects of iron deficiency in infancy. *Nutr. Rev*. 2006;64:S34–S43. doi: 10.1301/nr.2006.may.S34-S43.
8. Grantham-McGregor S, Ani C. A review of studies on the effect of iron deficiency on cognitive development in children. *J Nutr*. 2001;131(2):649–666.
9. Brasil. Parâmetros curriculares nacionais: adaptações curriculares. Secretaria de Educação Fundamental, Secretaria de Educação Especial, MEC/SEF/SEESP, Brasília, Brazil, 1998.
10. Gari, Mamdooh. (2009). Prevalence of Iron Deficiency Anemia Among Female Elementary School Children in Northern Jeddah-Saudi Arabia. *Journal of King Abdulaziz University-Medical Sciences*. 15. 10.4197/Med.15-1.6.
11. Mashlab S, Large P, Laing W, Ng O, D'Auria M, Thurston D, Thomson S, Acheson AG, Humes DJ, Banerjee A., Nottingham Colorectal Service. Anaemia as a risk stratification tool for symptomatic patients referred via the two-week wait pathway for colorectal cancer. *Ann R Coll Surg Engl*. 2018 May;100(5):350-356.
12. Desalegn Wolide A, Mossie A, Gedefaw L. Nutritional iron deficiency anemia: magnitude and its predictors among school age children, southwest Ethiopia: a community based cross-sectional study. *PLoS ONE*. 2014;9(12):e114059.
13. Al Hassand N. The prevalence of iron deficiency anemia in a Saudi University female students. *J Microsc Ultrastruct [Internet]*. 2015;3(1):25. Available from: <http://dx.doi.org/10.1016/j.jmau.2014.11.003>
14. McLean E, Cogswell M, Egli I, Wojdyla D, De Benoist B. Worldwide prevalence of anaemia, WHO vitamin and mineral nutrition information system, 1993–2005. *Public health nutrition*. 2008; 12 (4):444–54. pmid:18498676
15. Glazer Y, and, Bilenko N. Effect of iron deficiency and iron deficiency anemia in the first two years of life on cognitive and mental development during childhood in Hebrew. *Harefuah*. 2010; 149 (5):309–14. pmid:20929071
16. World Health Organization. Iron deficiency anemia assessment, prevention and control': a guide for programme managers. Geneva: WHO; 2008.
17. Soliman G, Azmi M, El Said S. Prevalence of anemia in Egypt (Al-Gharbia Governorate). *Egypt J Hosp Med* 2007; 28 :395-305.
18. Djokic D, Drakulovic MB, Radojicic Z, Radovic LC, Rakic L, Kocic S, Davidovic G. Risk factors associated with anemia among Serbian school age children 7-14 years old: results of the first national health survey. *Hippokratia* 2010; 14(4):252-260.
19. Gad, Ashry, et al. "Anemia among primary school children (5-12 years) in Riyadh Region, Saudi Arabia: a community-based study." *Canadian Journal of Clinical Nutrition* (2013).
20. Gari, Mamdooh A. "Prevalence of iron deficiency anemia among female elementary school children in Northern Jeddah, Saudi Arabia." *Journal of King Abdulaziz University-Medical Sciences* 15.1 (2008): 63-75.
21. Aedh, et al. Iron Deficiency Anemia and Associated Risk Factors among Teenagers in Najran, Saudi Arabia. *Int J Med Res Health Sci* 2019, 8(5): 108-114.
22. Abdel-Rasoul GM, El Bahnasy RE, El Shazly HM, Gabr HM, Abdel-Aaty NB. Epidemiology of iron-deficiency anemia among primary school children (6-11 years), Menoufia governorate, Egypt. *Menoufia Med J* 2015;28:663-9.
23. Getaneh Z, Enawgaw B, Engidaye G, Seyoum M, Berhane M, Abebe Z, et al. (2017) Prevalence of anemia and associated factors among school children in Gondar town public primary schools, northwest Ethiopia: A school-based cross-sectional study. *PLoS ONE* 12(12): e0190151. <https://doi.org/10.1371/journal.pone.0190151>
24. Srivastava, A., S.E. Mahmood, P.M. Srivastava, V.P. Shrotriya and B. Kumar, 2012. Nutritional status of school-age children-A scenario of urban slums in India. *Arch. Public Health*, Vol. 70. 10.1186/0778-7367-70-8
25. Jhansi Rani P, Elizabeth Bandrapalli. Study of prevalence of anaemia in school children and factors associated with it. *International Journal of Contemporary Medical Research* 2017;4(9):1902-1905.