Prevalence of iron deficiency anaemia among children under the age of 5 years in paediatric hospitals- Benghazi, Libya

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ABSTRACT:

Iron deficiency anaemia is the most common form of anaemia. This study was undertaken to highlight the prevalence of iron deficiency anaemia among children aged less than 5 years. A total of 220 children aged less than 5 years - attended at the haematology laboratory of Children Hospital, Benghazi Libya - were enrolled in the study. The prevalence of iron deficiency anaemia was estimated. Our study showed that 109 (49.5%) of all children were anaemic and of them, 57 children (52.3 %) were moderately anaemic. This work concluded that there is a high prevalence of anaemia among Libyan children under the age of 5 years.

Keywords: *iron deficiency anaemia, children, Libya.*

INTRODUCTION:

Iron deficiency anaemia IDA is a common type of anaemia in which blood lacks adequate healthy red blood cells. Red blood cells carry oxygen to the body's tissues. IDA has been described as the most common nutritional deficiency in the world [1,2]. Iron deficiency is a major health problem worldwide and especially in developing countries. IDA has adverse effects on the development of children. It has also been documented as the commonest cause of nutritional anaemia in infancy and childhood [3 4,5,6]. About 1.2 billion people worldwide demonstrate varying levels of iron deficiency [7]. The prevalence of iron deficiency anaemia is almost the same between boys and girls, however, maternal anaemia during pregnancy and lack of breastfeeding increases its incidence among children [8]. Prevalence rates vary among countries; it affects 2.4 million children in the *USA*, [9], 5.4% children in *Spain*, [10] , 14.0% in *Estonia*, [11] , 30.8% under five *Brazilian* children [12] and 22.3% under-five *Nigerian* children [13].

METHODS:

The study group was selected among patients who attended the haematology laboratory Children Hospital, Benghazi Libya, during the period from December 2013 to May 2014. The study was composed of 220 children aged less than 5 years. The selection was first based on the results of their complete blood count (Sysmex). Their haemoglobin level was below 12g /dl and had low MCV and MCH. Their iron status was measured using (Vitros system) and concentration of serum ferritin was measured using (Cobas integral system). Only those who met our inclusion criteria, were selected for this study as the anaemic group. Causes of iron deficiency were then investigated when indicated and as far as our facilities permitted.

RESULTS:

For the purpose of this study, a total of 220 children patients -attending children hospital in Benghazi - were investigated. All these patients were found to have low MCV and Hb and therefore were subjected to further testing regarding iron status and ferritin. Of all the collected cases, 37 patients were found to have laboratory evidence of iron deficiency (16 males and 21 females). Other types of anaemia group comprised 74 children (36 males and 38 females). The remaining 109 cases of iron deficiency anaemia (54 males and 55 females), met our inclusion criteria and therefore included in this study.

In this study the prevalence of Iron Deficiency Anaemia IDA among children was 49.5%, while 16.8% were iron deficient without anaemia ID, and 33.6% had other types of anaemias. (Figure1)

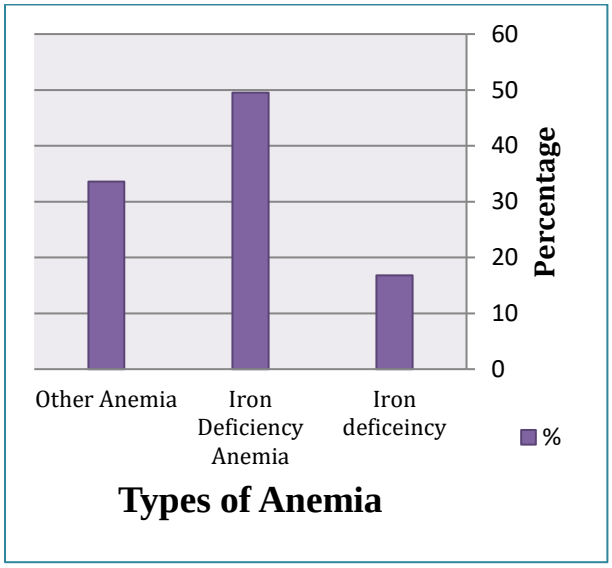


Figure 1: Distribution of ID, IDA and other types of anaemia in children less than 5 years.

There was no significant statistical difference between males and females (Chi-square test = 0.449, P value = 0.799). Regarding ID, is more prevalent in females than in males (56.8 % and 43.2 % respectively). With IDA, there was no significant difference between females and males (50.5% and 49.5 respectively), as well as with the other types of anaemia (females, 51.4% and males, 48.6%). (Figure2 & Table 1)

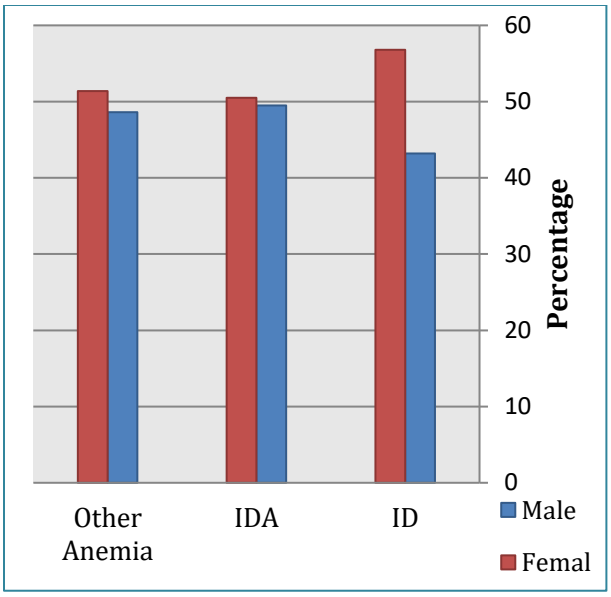
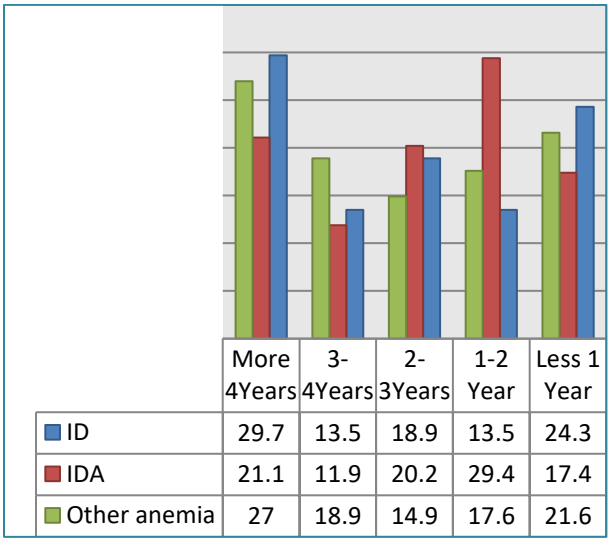


Figure 2: Distribution of ID, IDA and other types of anaemia in children according to gender.

		Gender		Total
		male	Female	
Iron Deficiency	Count	16	21	37
	% within **X**	43.2 %	56.8 %	100.0 %
Iron Deficiency Anaemia	Count	54	55	109
	% within **X**	49.5 %	50.5 %	100.0 %
Other Types Of Anaemia or other Diseases	Count	36	38	74
	% within **X**	48.6 %	51.4 %	100.0 %
Total	Count	106	114	220
	% within **X**	48.2 %	51.8 %	100.0 %

Table 1: Distribution of ID, IDA and other types of anaemia in children according to gender.

There was no statistically significant differences between age groups (P value = 0.387), however, IDA was more frequent in children aged 1 to 2 years 29.4% , ID was more frequent in children aged more than 4 years 29.7% , and other types of anemia were also more frequent in children aged more than 4 27.0%. (Figure 3)



	More 4Years	3-4Years	2-3Years	1-2 Year	Less 1 Year
ID	29.7	13.5	18.9	13.5	24.3
IDA	21.1	11.9	20.2	29.4	17.4
Other anemia	27	18.9	14.9	17.6	21.6

Figure 3: Distribution of ID , IDA and other types of anemia in children according to age. There is no statistically significant differences between groups of the ages.

The severity of iron deficiency without anemia (ID) had been classified according to Hb levels, Hb 10.9 to 10 g/dl -mild anemia- was detected in 18 children (48.6%), while Hb 9.9 to 7 g/dl -moderate anemia- was observed in 15 children (40.5%), and Hb < 7 g/dl -severe anemia- in 0 children (0.0%). Hb ≥ 11g/dl was considered non anemic in 4 children (10.8%). The results are shown Figure 4 and Table 2.

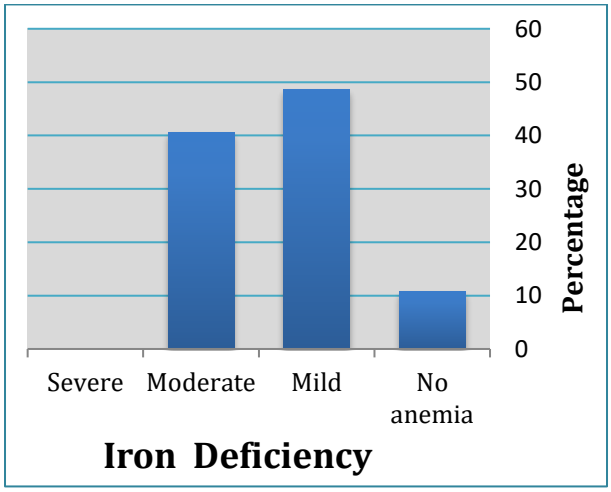


Figure 4 : Classification of Iron Deficiency in children according to Hb levels.

		Hb				
		No anemic Hb≥11 g/dl	**Mild Hb10 9-10 g/dl**	**Moder ate Hb 9.9 – 7 g/d**	**Sev re Hb ≤ 7 g/dl**	To tal
Iron Deficie ncy	Cou nt	4	18	15	0	37
	% with in X	10.8 %	48.6 %	40.5 %	0.0 %	100 %
Iron Deficienc y Anemia	Cou nt	12	28	57	12	109
	% with in X	11.0 %	25.7 %	52.3 %	11.0 %	100 %
Other types of anemia or other disease s	Cou nt	51	15	8	0	74
	% with in X	68.9 %	20.3 %	10.8 %	0.0 %	100 %
Total	Cou nt	67	61	80	12	220
	% with in X	30.5 %	27.7 %	36.4 %	5.5 %	100 %

Table 2 : Classification of Iron Deficiency Anemia(IDA),Iron Deficiency (ID) and other types of anemia in children according to Hb levels.

The severity of IDA had been classified according to Hb levels, Hb 10.9 to 10 g/dl -mild anaemia- was detected in 28 children (25.7%), while Hb 9.9 to 7 g/dl -moderate anaemia- was observed in 57 children (52.3%), and Hb < 7 g/dl -severe anaemia- was found in 12 children (11.0%). Hb ≥ 11g/dl was considered non-anaemic in 12 children (11.0%). The results are shown in Figure 5 and Table 2.

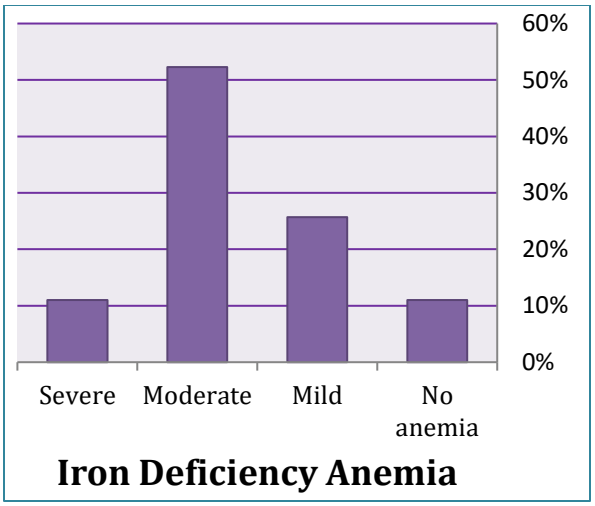


Figure 5 : Classification of Iron Deficiency Anemia in children according to Hb levels.

The severity of other types of anaemia had been classified according to Hb levels, Hb 10.9 to 10 g/dl -mild anaemia- was detected in 15 children (20.3%), while Hb 9.9 to 7 g/dl -moderate anaemia -was observed in 8 children (10.8%), and Hb < 7 g/dl -severe anaemia- in 0 children (0.0%). Hb ≥ 11g/dl was considered non-anaemic in 51 children (68.9%). The results are shown in Figure 6 and Table 2

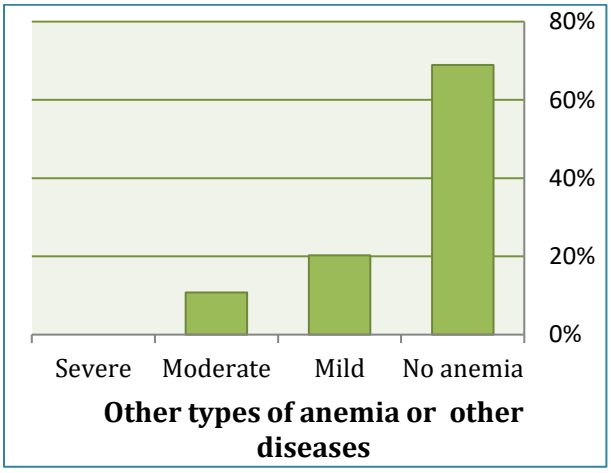


Figure 6: Classification of Other types of anaemia in children according to Hb levels.

These results indicate that there is statistically significant relationship between severity of anaemia in the study group (Chi- square test = 94.951, P value = 0.000, P value < 0.05).

Statistical diagnosis of the iron deficiency anaemia

We can primarily diagnose anaemia through statistical formula (Discriminate analysis), compensation in the first and Second equations can allow the lab technician to decide if the child was suffering from iron deficiency anaemia or iron deficiency without anaemia or another type of anaemia as shown in Figure 7 and Table 3 that will be accomplished by comparing the results from the first table to the constants of the different variables in Figure 8 and Table 4.

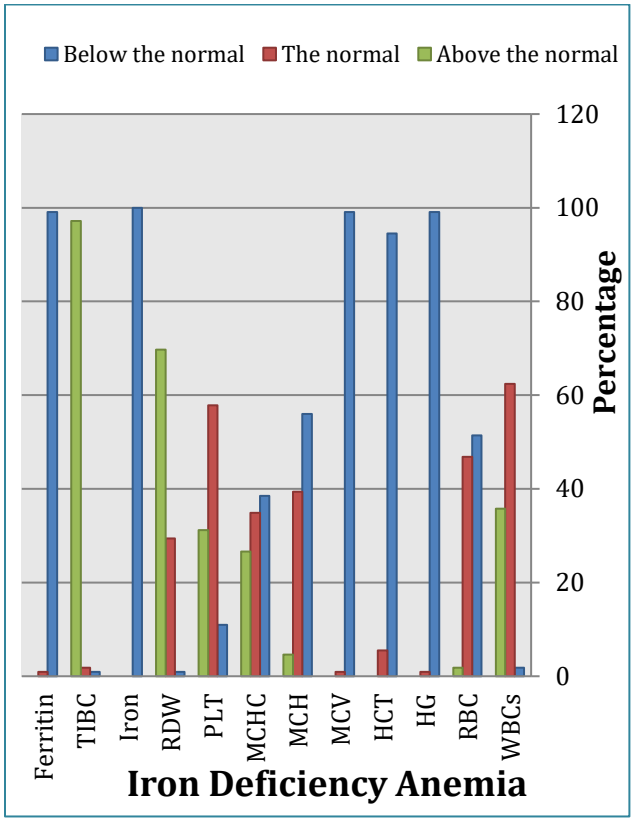


Figure 7: Relation between variables in the children less than 5 years for Iron Deficiency anaemia.

Variables	Function	
	1	2
Age	0.046	0.066
WBC	- 0.187	- 0.002
RBC	- 0.011	0.469
HG	0.310	- 0.600
HCT	- 0.027	- 0.026
MCV	0.408	0.662
MCH	- 0.239	- 0.302
MCHC	0.026	0.276
PLT	0.052	- 0.096

RDW	0.013	- 0.275
Iron	0.361	0.760
TIBC	- 0.505	0.318
Ferritin	0.428	- 0.657

Table 3: The statistic equations first and Second.

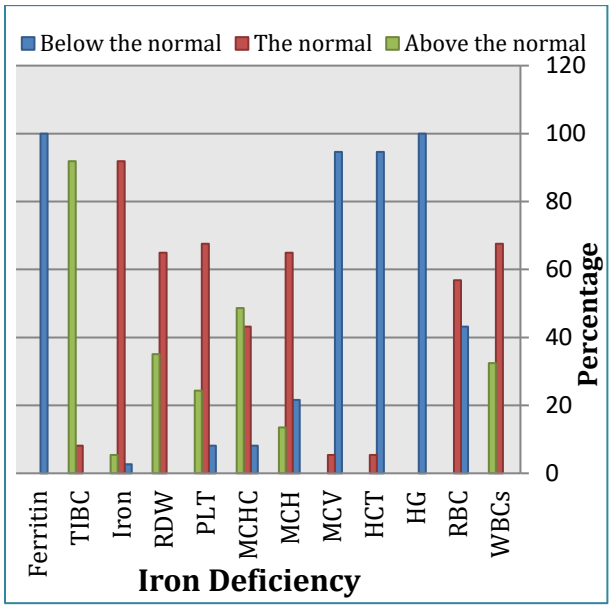


Figure 8: Relation between variables in the children less than 5years for Iron Deficiency without anaemia.

	Function	
	1	2
Iron Deficiency	- 0.108	1.392
Iron Deficiency Anaemia	-1.364	- 0.299
Other Anaemia or other Diseases	2.063	- 0.255

Table 4: Statistical diagnosis of the iron deficiency anaemia. (Functions at Group Centroids).

Example: - In the case of the compensation in the first and second equation is the following as: -

$\mathbf{D_1}$ = 0.046(Age) – 0.187(WBC) – 0.011(RBC) + 0.310(Hb) – 0.027(HCT) + 0.408(MCV) – 0.239(MCH) + 0.026(MCHC) + 0.052(PLT) + 0.013(RDW) + 0.361(Iron) – 0.505(TIBC) + 0.428(Ferritin)

$\mathbf{D_2}$ = 0.066(Age) – 0.002(WBC) + 0.469(RBC) – 0.600(Hb) – 0.026(HCT) + 0.662(MCV) – 0.302(MCH) + 0.276(MCHC) – 0.096(PLT) – 0.275(RDW) + 0.760(Iron) + 0.318(TIBC) – 0.657(Ferritin)

Thus, the result is comparing with the results in Table 4 This is regarding to the first equation $\mathbf{D_1}$(Discriminant 1) and second equation $\mathbf{D_2}$ (Discriminant 2).

DISCUSSION:

Iron deficiency anaemia develops when body stores of iron drop too low to support normal red blood cell production. In this study, the prevalence of IDA for children less than 5 years, was 109 (49.5%). While for those children with ID, it was 37 (16.8 %) and for the other types of anaemia, was 74 (33.6 %). Our results was higher than that performed in *Tunisia* where a survey covering 955 children under the age of five years, showed that 29% of children suffered from anaemia, about 70% of them were iron deficient [14]. In *Brazil*, the National Survey of Child and Woman Demography and Health identified a prevalence of anaemia of 20.9% in children aged less than 59 months, and the highest prevalence was in children aged less than 24 months (24.1%) followed by children aged 24-59 months (19.5%) [15]. Our children had met our inclusion criteria (low MCV, MCH, Hb, serum iron and serum ferritin) and therefore diagnosed as having IDA. Our results were similar to those obtained in Ethiopia, where more than four out of ten children were anaemic (44%) [16]. In Brazil population, IDA exists in many regions, with high prevalence in children under the age of 5 (33.8, 46.7, 31.4, 36.3 and 46.4% were observed in Piauí, Pernambuco, Sergipe, and Paraíba states and Salvador, respectively) [17]. Probably the reason of the high prevalence of IDA in children less than 5 years is the lack of early detection of iron deficiency stores before reaching the stage of anaemia.

Brotanek stated that there is no statistically significant relation between gender and IDA, ID or other types of anaemia [8]. This statement was also supported by studies conducted in Lao People's Democratic Republic in 2011 and Morocco in 2010 [18,19]. On the other hand, Tengco from Philippines and Ekwoch from Nigeria , reported that anaemia is more common in male children [20,21]. Our results proved that Iron Deficiency was higher in females than males (56.8 % and 43.2 % respectively) and there was no statistically significant difference between females and males for IDA (50.5% and 49.5 respectively). So, there may be some discrimination between boys and girls. Other cultural factors that may contribute to sex related differences in the prevalence of iron-deficiency anaemia [22].

In our study, there was no statistically significant relation between age and IDA, ID and other types of anaemia . However, IDA is more common in children aged (1-2 years) and ID and other anaemia were more frequent in children aged (more than 4 years). This is similar to the results obtained from the US that showed the prevalence of iron deficiency anaemia in infants of 1-2 years old [23] ; and also, from Nigeria, that proved the prevalence of iron deficiency anaemia among the age group 13- 23months [21] as well as from Brazil, that revealed the prevalence of anaemia

in children aged less than 24 months [15]. In Cuba, the Prevalence was higher in children aged 6–23 months than in those aged 24–59 months in the study conducted from 2005 -2011 [8]. The prevalence of IDA in the first 2 years of life could be related to the body needs during that period of life. Iron requirements are related to growth velocity and so requirement per kg of body weight decreases with age. The prevalence of the problem in under-24-month-old children is likely to be a combined result of the increased iron requirements due to rapid growth, low availability of foods rich in iron, and lack of diet variety. Exclusive breastfeeding is recommended in the first two years of child life. Iron intake is likely to improve with age as a result of a more varied diet, including the introduction of meat and other iron containing foods. Other possible reasons could be related to the low economic status, as well as the diversity of the culture of the child nutrition, maternal anaemia during pregnancy, and low birth weight [24].

Pica, a term used to describe an abnormal or unusual craving for foods or other substances, is associated with iron deficiency. This condition is found most often in children and women in underdeveloped countries or in poor rural areas. It can occur in the presence of adequate or excessive iron stores. An increase in tissue retention of iron without the ability for it to be reutilized in the hemopoietic process produces the same effect as iron deficiency [25].

According to the World Health Organization (WHO) classification, the prevalence of anaemia in Iran is in the moderate category [22]. In Cuba, iron deficiency anaemia is the main specific nutritional problem, classified as moderate in children aged <5 years [26]. In Ethiopia, about 21% of children were mildly anaemic, 20% were moderately anaemic, and 3% were severely anaemic [16]. In Sudan the iron deficiency anaemia among children under three years was 86% of all anaemia children, 64% of them were severely anaemic [27]. Based on the WHO expert group, the severity of anaemia have been classified into four types based on hemoglobin levels: no anaemia (Hb ≥ 11 g/dl), mild (HG; 10 to 10.9 g/dl), moderate (HG;9.9 to 7 g/dl), and severe (Hb ≤ 7 g/dl). In IDA about half of the cases 52.3 % had moderate anaemia while 25.7% had mild anaemia and 11.0% had severe anaemia and no anaemia. In ID we found about half of the cases 48.6% had mild anaemia, while 40.5% had moderate anaemia and 10.8% had no anaemia. But other types of anaemia were more than half of the cases 68.9% had no anaemia while 20.3% had mild anaemia and only 10.8% had moderate anaemia. This complicates our efforts to detect iron deficiency at an early stage since mild and to some extent moderate iron deficiency subjects do not have troublesome clinical symptoms and therefore escape medical attention. The very low incidence of severe iron deficiency may reflect the natural pattern of this disease in our community. It indicates that IDA is due to some lack of iron or improper feeding habits rather than to total deprivation. This emphasis our need to make iron supplemented foods widely available or rather to enrich popular foods like bread with iron.

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