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Iron Deficiency Anemia in Infants of Hatta Suburb-UAE

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Abstract

Introduction: Worldwide burden of ID estimated to be 43% globally in 2011 and about 70% in Central and West Africa and 7-9% of USA children ages 1-3 years have iron deficiency (ID). Countries in high caloric nutrition switch have a high prevalence of overweight and obesity, a moderate prevalence of undernutrition and micronutrient deficiencies. Infants and children must obtain 30% of their daily iron from their diet to provide the necessary iron for new muscle cells and RBCs.

Methods: 259 infants visited child health family medicine clinic Hatta Hospital, UAE for 12 months assessment and vaccination from April 2014 to January 2015. Anemia was defined as per World health organization (hemoglobin ≤ 11 gm/dl).

Results: Anemia was found in 99 infants (38.2%), Iron deficiency anemia in 60 (23.2%), thalassemia trait in 12 (4.6%), normocytic anemia in 27 (10.4%) and iron deficiency in 57 (22%). Mild anemia was found 41 infants (61.3%, p value 0.000) in iron deficiency anemia.

Serum iron 49 infants (81.7%, p value 0.000), high RDW 52 (86.7%, p value 0.000), Mentzer index 54 (90%, p value 0.000) and Srivastav index (50%, p value 0.000) significantly detect iron deficiency anemia.

Conclusion: Iron deficiency anemia (23%) in this population are consistent with other reports from region but higher than developed countries. Serum iron, high RDW, Mentzer and Srivastav index were significant in detecting iron deficiency anemia in this study. Microcytosis in the study population apart from iron deficiency anemia could be attributed to alpha thalassemia trait in this population.

Keywords

Iron deficiency, Anemia, Infants

Introduction

Iron deficiency (ID) is the most common micronutrient deficiency in children [1]. Worldwide burden of ID estimated to be 43% globally in 2011 and about 70% in Central and West Africa and 7-9% of USA children ages 1-3 years have ID [2]. ID during fetal development and the first 2 years of life is associated with poor growth and decreases in cognitive, motor, and social emotional development [3,4].

Countries in advanced nutrition switch have a high prevalence of overweight and obesity, a moderate prevalence of undernutrition and micronutrient deficiencies [5]. World Health Organization (WHO) detects deficient and inadequate intakes or status of calcium, iodine, iron, and zinc as well as vitamin A, vitamin D, and folate as commonly reported by many countries in the Middle East region, mostly in children and child-bearing age women [6].

A study done by Hopkin, et al., showed the prevalence of anemia was 23% at 8 months of age, and 18% at 12 months of age [7]. The prevalence of non-anemic iron deficiency may be as high as 30% in toddlers from developed countries [8-10].

According to WHO prevalence of anemia severity describes as mild problem 5%-19.9%, moderate problem 20%-39.9%, and severe problem ≥ 40%; most Arab Middle East countries fall within the category of moderate to severe deficiency [11,12].

IDA was predominant in boys and peak IDA incidence was noted among infants aged 9-12 months. Only 7% patients exhibited symptoms of IDA, while

Kumar et al. Int Arch Nurs Health Care 2019, 5:121

• Page 1 of 5 •

23.6% patients with severe IDA demonstrated classic symptoms/signs of IDA [13].

Anemia is the most prevalent nutritional disorder among children in the Middle East and North Africa region. The prevalence of anemia in children and adolescents ranges from 11.6% in Saudi school-aged children to 37%-52% among Egyptian children aged 12-36 months [14-17].

This rise in the prevalence of anemia is attribute to shifting of food consumption patterns and increases in childhood diarrhea [18].

The purpose of this study was to determine the hematological profile, the frequency and severity of iron deficiency anemia (IDA) in one-year old Emeriti infants of Hatta suburb, UAE.

Study Methods

All infants attended child health family clinic Hatta Hospital-UAE, for one-year assessment and vaccination from April 2014 to January 2015 were included in the study and infants who were not underwent laboratory test were excluded. After history, physical examination conducted by family physician, laboratory test such as complete blood count (CBC), serum ferritin (Fe), serum Iron were advised and follow up appointment given after 4 weeks to review lab test.

Anemia was defined as: Hemoglobin ≤ 11 gm/dl [19].

Anemia severity classified according to WHO guideline as:

1. Mild anemia: Hemoglobin 10-11 gm/dl

2. Moderate anemia: Hemoglobin 7-9.9 gm/dl

3. Severe anemia: hemoglobin < 7 gm/dl

Iron deficiency anemia defined as; low hemoglobin (≤ 11 gm/dl), low MCV (≤ 70 fl) with low serum ferritin (as per laboratory reference, some cases mentioned 4.01 and in other 61) or serum iron (< 43), high red cell distribution width (RDW) ≥ 15%.

Thalassemia trait defined as low hemoglobin (≤ 11 gm/dl), low MCV (≤ 70 fl) with normal serum ferritin or serum iron, high RBC mass, low RDW < 15%.

Iron deficiency was defined as normal hemoglobin with low serum ferritin or serum iron level.

Three index were used to differentiate Iron Deficiency Anemia with thalassemia trait.

	Formula	IDA	Thalassemia Trait
Mentzer index	MCV/RBC	> 13	< 13
RDWI	MCV × RDW/RBC	> 220	< 220
Srivastava index	MCH/RBC	> 3.8	< 3.8

All data entered into SPSS software version 24. Mean and Standard Deviation was taken for variables such as Hemoglobin, MCV, RBC mass, MCH, RDW, Serum iron, Serum ferritin and frequency of variables such as anemia, anemia severity, anemia types, Microcytosis, Serum iron, serum ferritin, RDW, RBC mass, Mentzer index, RDWI index, Srivastava index.

Chi-square test was used to differentiate quantitative variables (anemia severity, RBC mass, RDW, Mentzer index, RDWI index, Srivastava index) in Iron deficiency anemia and thalassemia trait. P value of < 0.05 considered as significant. Prior approval taken from ERC committee and department head of facility.

Results

Total 320 infants attended child health family clinic Hatta Hospital-UAE, for one-year assessment and vaccination from April 2014 to January 2015, out of these 259 did laboratory test. Mean and Standard Deviation of variables (Hemoglobin, MCV, RBC mass, MCH, RDW, Serum iron, Serum ferritin) were calculated as shown in Table 1.

Anemia was found in 99 infants (38.2%), Iron deficiency anemia in 60 (23.2%), Thalassemia trait in 12 (4.6%) and normocytic anemia in 27 (10.4%). Iron deficiency was found in 57 infants (22%). Details of frequency of quantitative variables (anemia, anemia severity, anemia types, Microcytosis, Serum iron, serum ferritin, RDW, RBC mass, Mentzer index, RDWI index, Srivastava index) are shown in Table 2. Details of frequency of anemia variables shown in Table 3 and type of anemia shown in Figure 1.

Among iron deficiency anemia most infants had mild anemia 41 (61.3%, p value 0.000). Serum iron was significantly low in iron deficiency anemia 49 infants (81.7%, p value 0.000) as compare to serum ferritin

Table 1: Mean and standard deviation data.

Variables	Minimum	Maximum	Mean	Standard Deviation (SD)
Hemoglobin level	7.70	14.60	11.4402	1.08568
MCV value	50.00	84.00	69.3977	6.61783
RBC mass	3.90	55.00	5.2372	3.14462
MCH value	13.50	29.20	22.6494	2.72338
RDW value	11.70	23.40	15.6610	1.98865
Serum Iron	10.00	137.00	53.3923	24.03063
Serum Ferritin	2.20	99.00	31.3398	18.11658

Kumar et al. Int Arch Nurs Health Care 2019, 5:121

• Page 2 of 5 •

Table 2: Frequency of variables (Total 259).

Variable	No.	Percentage
Anemia (Hemoglobin ≤ 11 gm/dl)	99	38.2%
Microcytic Anemia		
Iron deficiency anemia (IDA)	60	23.2%
Thalassemia Trait	12	4.6%
Normocytic anemia	27	10.4%
Anemia severity		
Mild (10-11 gm/dl)	79	30.5%
Moderate (7-9.9 gm/dl)	20	7.7%
MCV		
Microcytosis (≤ 70 fl)	133	51.4%
Normal (> 70 fl)	126	48.6%
Serum Iron		
Low (< 43 ug/dl)	103	39.8%
Normal/high (> 43 ug/dl)	156	60.2%
Serum Ferritin		
Low (< 61 ng/ml)	109	42%
Normal/high (> 61 ng/ml)	150	58%
RBC mass		
High (≥ 5 10^6/ul)	153	59%
Low (< 5 10^6/ul)	106	41%
Red cell Distribution Width (RDW)		
High (≥ 15%)	159	61.4%
Low (< 15%)	100	38.6%
Iron deficiency	57	22%
Mentzer Index (MI index)		
> 13	207	79.9%
< 13	52	20.1%
Srivastav Index (SI index)		
> 3.8	202	78%
< 3.8	57	22%
RDWI Index		
> 220	116	45%
< 220	143	55%

Table 3: Frequency of variables in anemia.

Variables	Anemia (99 cases)		
	No.	%	P value
MCV			
Microcytosis (≤ 70 fl)	72	72.7%	0.000
Normal (> 70 fl)	27	29.3%	
Anemia severity			
Mild (10-11 gm/dl)	79	79.8%	0.000
Moderate (7-9.9 gm/dl)	20	20.2%	
Anemia types			
Iron deficiency anemia (IDA)	60	60.6%	
Thalassemia Trait	12	12.1%	0.000
Normocytic anemia	27	27.3%	
Serum Iron			
Low (< 43 ug/dl)	63	63.6%	0.000
Normal/high (> 43 ug/dl)	36	36.4%	
Serum Ferritin			
Low (< 61 ng/ml)	47	47.5%	0.196
Normal/high (> 61 ng/ml)	52	52.5%	
RBC mass			
High (≥ 5 10^6/ul)	51	51.5%	0.068
Low (< 5 10^6/ul)	48	48.5%	
Red cell Distribution Width (RDW)			
High (≥ 15%)	73	73.7%	0.002
Low (< 15%)	26	26.3%	
Mentzer Index (MI index)			
> 13	92	93%	0.000
< 13	7	7%	
Srivastav Index (SI index)			
> 3.8	62	62.6%	0.000
< 3.8	37	37.4%	
RDWI Index			
> 220	53	53.5%	0.026
< 220	46	46.5%	

Figure 1: Anemia types.

Kumar et al. Int Arch Nurs Health Care 2019, 5:121

• Page 3 of 5 •
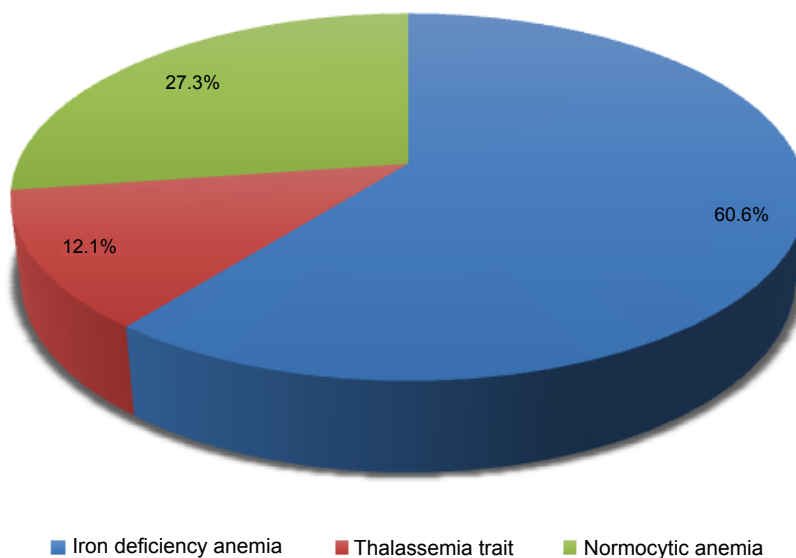
Table 4: Frequency of variables in iron deficiency anemia.

Variables	Iron deficiency Anemia (60 infants)		
	No.	%	P value
Anemia severity			
Mild (10-11 gm/dl)	41	68.3%	0.000
Moderate (7-9.9 gm/dl)	19	31.7%	
Serum Iron			
Low (< 43 ug/dl)	49	81.7%	0.000
Normal/high (> 43 ug/dl)	11	18.3%	
Serum Ferritin			
Low (< 61 ng/ml)	33	55%	0.025
Normal/high (> 61 ng/ml)	27	45%	
RBC mass			
High (≥ 5 10^6/ul)	41	68.3%	0.102
Low (< 5 10^6/ul)	19	31.7%	
Red cell Distribution Width (RDW)			
High (≥ 15%)	52	86.7%	0.000
Low (< 15%)	08	13.3%	
Mentzer Index (MI index)			
> 13	54	90%	0.000
< 13	6	10%	
Srivastav Index (SI index)			
> 3.8	30	50%	0.000
< 3.8	30	50%	
RDWI Index			
> 220	22	36.7%	0.183
< 220	38	63.3%	

Table 5: Frequency of variables in thalassemia trait.

Variables	Thalassemia trait (12 infants)		
	No.	%	P value
Anemia severity			
Mild (10-11 gm/dl)	12	100%	0.000
Moderate (7-9.9 gm/dl)	00	0%	
RBC mass			
High (≥ 5)	08	66.7%	0.766
Low (< 5)	04	33.3%	
Red cell Distribution Width (RDW)			
High (≥ 15)	11	91.7%	0.032
Low (< 15)	01	08.3%	
Mentzer Index (MI index)			
> 13	11	91.7%	0.469
< 13	01	08.3%	
Srivastav Index (SI index)			
> 3.8	05	41.7%	0.006
< 3.8	07	58.3%	
RDWI Index			
> 220	04	33.3%	0.556
< 220	08	66.7%	

33 (55%, p value 0.025). RDW was significantly high in 52 (86.7%, p value 0.000). Among indexes, Mentzer and Srivastav index were significant in detecting iron deficiency anemia 54 (90%, p value 0.000) and 30 infants (50%, p value 0.000) respectively, while RDWI index 22 infants (36.7%, p value 0.183) as shown in Table 4.

Srivastav index significantly detect thalassemia trait 30 (50%, p value 0.000) while Mentzer index and RDWI index were not significant in our study. Details of variables among thalassemia trait shown in Table 5.

Discussion

Infants and children must obtain 30% of their daily iron from their diet to provide the necessary iron for new muscle cells and RBCs. Both the United States Department of Health and Human Services and the World Health Organization (WHO) have set goals to reduce ID and iron deficiency anemia (IDA). The WHO priorities have now been adopted as Priority Nutrition Indicators for the United Nation's post-2015 Sustainable Development Goals [20-22].

The principal risk factors associated with IDA were age 6-18 months, male sex, higher birth order, consumption of cow's milk, predominant breastfeeding > 6 months, and/or low iron intake.

Routine screening for ID and IDA between 6-24 months is recommended, especially for children living in areas with a high prevalence of ID. In upper-income countries, a full blood count is obtained, which will give hemoglobin, hematocrit, mean corpuscular volume, and RBC distribution width. In children with IDA, mean corpuscular volume will be decreased and RBC distribution width will most likely be increased. In some settings, ferritin is also measured as part of the screening process. However, ferritin values can be misleading in children living in areas where the infectious disease burden is high because ferritin is also an acute-phase protein.

It is recommended that full-term breastfed infants should start an iron supplement at 4 months (elemental iron 1 mg/kg daily, maximum 15 mg) and the supplement should be continued until the infant is taking sufficient quantities of iron-rich complementary foods [1].

Full-term and preterm babies should be taking complementary foods by 6 months of age. Iron-rich complementary foods include meat (lamb, chicken, beef, and pork), baby cereals (including fortified rice), and some vegetables (green beans, peas, and spinach) [23,24].

Conclusion

- Iron deficiency anemia (23%) in this population are consistent with other reports from region but higher than developed countries.

- The microcytosis in the study population apart from anemia could be attributed to alpha thalassemia trait and a normal variant microcytosis which is highly

Kumar et al. Int Arch Nurs Health Care 2019, 5:121

• Page 4 of 5 •

prevalent in the study population.

- Iron deficiency was found in 22% infants, warrant early interventions to reduce the risk of developing future anemia.

- Need to conduct studies with large sample size, which will help and signify the magnitude of the IDA.

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