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# Prevalence of Iron Deficiency Anemia among children under one year of age



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## ABSTRACT

Iron deficiency anemia is an important health problem in Jordan. This study was conducted to estimate the prevalence of anemia among children less than one year in Wadi seer. The sample represents children of all levels and age ranged between 6-12 months. The level of hemoglobin and mean corpuscular volume concentration was measured in a group of 119 children. The serum iron was assessed and anemia was defined when hemoglobin below 11 g/dl. A questionnaire was developed to obtain information about the daily food consumption and socio-economic conditions. The prevalence of anemia was 42.85%. The prevalence rates of mild and moderate anemia were 11% and 27.7% respectively, no case of severe anemia. The results suggest that iron deficiency is an important determinant of anemia in this population. There was no significant relationship between family income and anemia in children. It is concluded that improving women education and health education about balanced animal and plant food consumption are recommended strategies to reduce the burden of anemia.

**Key words:** Anemia, hemoglobin, Iron deficiency, children.

## * INTRODUCTION

Iron Deficiency (ID) and Iron Deficiency Anemia (IDA) are considered the major public health problems and the most common nutritional deficiency around the world (DeMaeyer et al., 1989). The latest World Health Organization and United Nations Children's Fund estimates suggest that the number of children with ID and anemia is approximately 750 million. Young children between six and 24 months of age are at greatest risk for iron

deficiency anemia (IDA) due to their high dietary iron requirements during this period of rapid growth and limited access to iron-containing foods. In children, IDA has a significant impact on motor, cognitive and socioemotional development that may not be reversible (Pollitt E. et al., 1993, Lozoff et al., 2012). Although the cause of IDA among young children can be multifactorial, the consumption of foods with low bioavailable iron is likely the primary contributing factor. In industrialized countries, the prevalence of ID among children has been greatly reduced with the advent of fortified foods, such as iron-fortified infant cereals, specifically targeted toward children. However, IDA continues to be a significant public health problem among vulnerable groups within Jordan. These include remote Jordanian communities, where access to fortified foods is often limited and programs to control IDA have been unsuccessful. Adherence to treatment strategies using ferrous sulphate drops has also been unsuccessful in these communities due to the poor acceptability of the drops. (Zlotkin SH, et al., 2005).

The prevalence of anemia in the world is 24.8% (WHO., 2008). Furthermore, it is estimated that iron deficiency contributes towards 50% of the approximated 600 million global anemia cases in preschool and school-aged children (WHO., 2011). The population groups which are most affected are pregnant women, infants and young children (Dillon et al., 2000; Chhabra et al., 2012). This high prevalence of IDA in developing countries is associated with poor sanitation conditions, low socio-economic conditions, restricted access to food and lack of knowledge for good dietary practices (Finch, 1977). The overall prevalence of anemia in Jordan has not changed much in the last decade, decreasing very slightly from 34 % in 2002 to 32 % in 2012. Our data were consistent with data of Jordan population family the survey carried out in 2012. (Department of Statistics [Jordan] and ICF International. 2013).

Anemia has multiple consequences which can be extremely severe (Goudarzi et al., 2008; Ahmadi et al., 2010). It affects the physical and mental development of an individual leading to decreased working capacity, which in turn affects the development of the country (WHO., 2001).

Determining the prevalence of iron deficiency anemia in children in Wadi Seer, west of Amman, Jordan, was the aim of the current study.

*** MATERIALS AND METHODS**

*** Place and the sample study**

1- This study was conducted among children aged 6-12 months old in Wadi seer, located in the west of Amman-Jordan.

2- Study sample: 119 children aged between 6 and 12 months.

*** Type of study**

A cross-sectional descriptive survey was conducted using a structured questionnaire covering the following parameters:

1- Demographic and anthropometric indicators including age, sex, weight, height and BMI.

2- Socioeconomic indicators including family income and food consumption.

*** Anthropometric measurements**

The children's height and weight were measured according to the WHO's guideline (WHO., 2007). Weight, height and age data were used to calculate z-scores of the three different nutritional indicators in comparison to the newly published WHO Statistics (WHO/NCHS) reference population (WHO. and UNICEF., 2009) using the WHO AnthroPlus Software (Version 10.4, 2010). Underweight, stunting and wasting were defined as WAZ<-2.0, HAZ<-2.0 and WHZ<-2.0 Standard Deviation (SD) below the 2006 WHO reference, respectively.

Body Mass Index (BMI) was used to diagnose the degree of underweight and overweight in children as prescribed by WHO (2007).

*** Blood test**

Blood was collected by antecubital venipuncture and drawn into a container with EDTA for Red Blood Cell (RBC), Hemoglobin (Hb), Haematocrit (Hct), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH) and Mean Corpuscular Hemoglobin Concentration (MCHC) analyses. All these blood analyses were done by trained and experienced laboratory technicians in laboratory of medical analysis under suitable conditions.

Anemia was defined as hemoglobin level below 11 g/dl in children aged 6-12 months. The severity of anemia was classified as mild (Hb>10.5 g/dl), moderate (Hb≤10.5 g/dl) and severe (Hb≤7.5g/dl) (WHO., 2001).

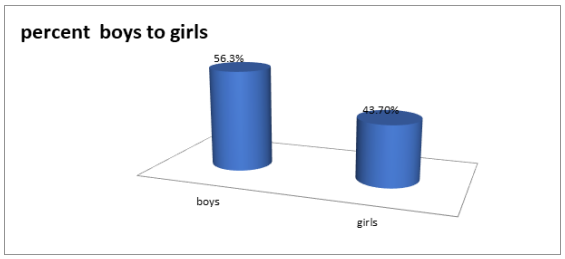
*** RESULTS**

Sociodemographic and anthropometric characteristics of the study participants: A total of 119 children were selected, among whom complete response of the anthropometric measurements and blood samples were obtained from 119 children. The Mean age was 10

±2 months ranged between 6 and 12 months.

From the total of 119 respondents, 67 (56.3%) children were male and 52 (43.7%) were female, fig.1.

**Fig.1: Percent of boys to girls**




From those children initially screened in the study described above, a total of 27.7% had moderate anemia (hemoglobin less than 10.5 g/dl). All of those children were treated with iron drops (3-6 mg/kg/day). After three months of treatment, hemoglobin data were collected from all children who had received drops. The overall hemoglobin increased significantly from 9.3g/dl to 11.4 g/dl. The cure rate for anemia was approximately 70%. Side effects, including diarrhea or constipation and vomiting, were reported more frequently in children who received iron drops.

According to the research, 70% of patients did not consume any food other than breastfeeding for the first six months of their lives. There was a significant relationship between education of the mother and anemia in children, in anemic children there was 80.6% of mothers has only secondary school or less.

Among anemic children 4 (3.36%) were underweight and 7 (5.88%) were short stature, Table 1.

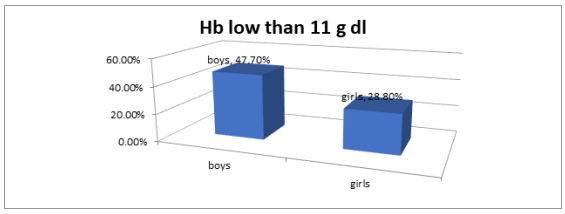
**Table 1: Socio-economic and anthropometric characteristic.**

| Parameters | | All children | | Children with anemia | |
|---|---|---|---|---|---|
| | | No. | % | No. | % |
| Sex | Male | 67 | 56.3 | 32 | 47.7 |
| | Female | 52 | 43.7 | 19 | 28.8 |
| Educational level (mother) | Secondary | 79 | 66.3 | 41 | 34.45 |
| | Tertiary | 40 | 33.7 | 10 | 8.4 |
| Breast feeding after age 6 months | Yes | 83 | 70 | 36 | 73 |
| | No | 36 | 30 | 15 | 27 |
| Family income | Temporary | 41 | 34.45 | 10 | 8.4 |
| | Permanent | 78 | 65.54 | 41 | 34.45 |
| BMI for age <-2 Z-score | Yes | 7 | 5.88 | 4 | 3.36 |
| | No | 112 | 94.11 | 47 | 39.5 |
| Height for age <-2 Z-score | Yes | 11 | 9.24 | 7 | 5.88 |
| | No | 108 | 90.75 | 44 | 36.94 |

*** BMI: body mass index**

In the study, the result of Hb level in all cases give us a conclusion of that low Hb in 47.7% boys and in 28.8% of girls fig.2.

**Fig.2: Hemoglobin concentration**




The result of this study also revealed that the prevalence rates of mild and moderate anemia were 11% and 27.7%, respectively, with no case of severe anemia, fig.3.

**Fig.3: Severity of IDA**

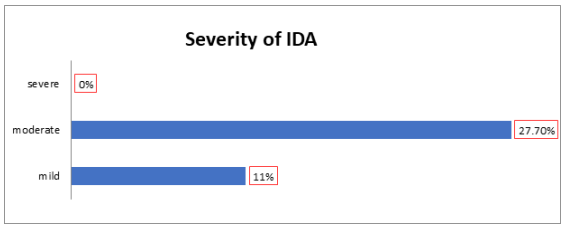



**Table 2: Global results hemoglobin of the studied population**

| Hemoglobin (g/dl) | values |
|---|---|
| mean | 12,5 |
| Minimum | 8.5 |
| Maximum | 13.3 |
| All cases | 119 |

*** Prevalence of anemia**

The distribution of hemoglobin concentration shown in Fig. 2 and global results of Hb in Table 2. The hemoglobin concentration was 11.1 g/dl in boys and 11.29 g/dl in girls. The prevalence of anemia among children was 42.85%.

*** DISCUSSION**

Iron deficiency is the most widespread and common nutritional disorder in the world. In spite of the efforts to decrease the frequency, the prevalence varies in different parts of the world with higher rates in the developing countries (Lerner and Sills, 2011; WHO., 1989).

We found that boys are more affected than girls. Similar findings have been documented in previous studies which revealed that the prevalence of anemia increased among male children (Nicklas et al., 1998; Ayoya et al., 2013; Leite et al., 2013). These differences can be attributed to genetics or an increased incidence of iron deficiency in boys (Siegel et al., 2006).

Gomber et al. (2003) found anemia in 24.8% of children, stated that the prevalence of anemia in children from urban slums, aged 6-12 months was 41.8%. Srivastava et al. (2012) found anemia in 37.5% of children (2012). Asendabo Town, Southwest of Ethiopia (Alemayehu, 2005) and 36.4% among Vietnamese children (Le et al., 2006).

In the current study, 42.85% of children were anemic. The prevalence of IDA, which is more in our study. This difference in the prevalence of IDA in these regions may be due to difference in the study area, sample size, the food consumption and other factors.

According to sociodemographic characteristics of children which showed statistically significant differences for some sort of variables. The distribution of anemic children by age group shows that 26% were age of 10 months whereas, 7% had age between 10 and 12 months and the difference was statistically not significant. In current study we found that 70 % of all cases have no other food except breastfeeding more than 6 months of life. There was a significant

relationship between education of the mother and anemia in children.

In line with this finding, El Hioui et al. (2008), Choi et al. (2011), Alemayehu (2005), Kaya et al. (2006), Al-Zain (2009) and Male et al. (2001), reported that mother's educational level is an important determinant of anemia. There was no significant relationship between the prevalence of anemia and family income.

Furthermore, this study showed that 50.3% children with anemia had lower intake of foods from animal sources, which is a source of heme iron. There are two forms of dietary iron: non-heme and heme iron. Non-heme iron takes the simplest form of free iron atoms such as ferric ($Fe^{3+}$) or ferrous ($Fe^{2+}$) iron. Non-heme iron is obtained from foods such as grains, legumes, fruits and vegetables (Neumann et al., 2003). Consumption of animal source foods was found to be associated with a decreased risk of stunting and underweight. A study that was conducted by Dror and Allen (2011), reported that consuming animal source foods not only decreased stunting but also improved other anthropometric indices toward the reduction of morbidity and mortality among undernourished children.

*** SUPPLEMENTATION**

When food-based strategies (fortification and diversification) are not feasible to protect children from IDA, supplementation may be an option. For example, the World Health Organization and the United Nations Children's Fund recommend routine iron supplementation to all children six to 24 months of age who are living in communities where the prevalence of anemia is 40% or greater (WHO., 2006).

For the past 150 years or more, oral ferrous sulphate syrups (iron drops) have been the primary strategy used to control IDA in infants and young children (Andreas et al., 2000).

However, adherence to iron drops is often limited owing to a combination of their unpleasant metallic aftertaste, the dark stain they may leave on the child's teeth and abdominal discomfort (Mora et al., 2002).

*** CONCLUSIONS**

Iron deficiency anemia, is a serious health problem affecting mostly infant, children and women of reproductive age and requires urgent attention.

The prevalence of IDA is still high in children below age of 12 months, with increased risk in males, lower mother education, lower meal intake and breastfeeding children.

Our findings suggest that current public-health strategies such as food fortification are necessary but not sufficient to reduce childhood anemia. Instead, combining iron fortification and iron supplementation programs with efforts to reduce maternal anemia, family poverty and food insecurity may yield optimal improvement of children's hemoglobin levels. In April 2002, Jordan began a wheat flour fortification program that included iron and folic acid, but despite this national fortification program there was no statistically significant change in the prevalence of anemia, indicating that other causes (in addition to iron deficiency) are responsible for anemia.

In addition, the high prevalence of anemia supports the need to develop strategies in prevention rather than treatment in this important public health issue.

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