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Association of anemia with malnutrition among Iraqi children

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Abstract
Anemia is considered as a worldwide problem, affecting all age groups. Anemia in children is one of the social health problems because the children have reduced exercise capacity, slower growth and impaired cognitive development. The present study was conducted to quantify the magnitude of anemia and its association with malnutrition.
It can be concluded that Anemia in association with malnutrition is widely prevalent in our country. So there is a need for urgent community participation strategies in the form of counseling the parents for child feeding practices, immunization and sickness recognition from the first year of life.

Keywords: anemia, magnitude of anemia, malnutrition

Introduction
About half of the population in the developing countries has iron deficiency anemia. Preschool, school and adolescent children and women in childbearing age are at increased risk of developing anemia. Iron deficiency anemia affects 30% of the world population [1, 2]. The prevalence of anemia among children under 5 years of age is estimated to be about 20% in industrialized countries and 39% in non-industrialized countries [3]. Iron deficiency anemia is a leading cause of morbidity and mortality worldwide [1]. In India, the national program for prevention and control of anemia focuses on pregnant women and young children less than 5 years. However, the status of anemia in children is not well documented [1].

Materials and methods
This study was conducted during the period from November 2016 to May 2018 in Al-Falluja city/ Iraq. Patients having severe nutritional anemia with hemoglobin <7gm% were evaluated. Exclusion criteria included patients having mild to moderate anemia, severe anemia due to hemolysis, malaria, aplastic anemia and patients collapsed due to congestive cardiac failure within 12 hours of admission. Detailed history regarding symptoms and signs, diet and socioeconomic status of family and detailed anthropometry were recorded. Investigations for anemia and its causes i.e., peripheral smear, serum vitamin B12, serum folic acid, stool for worm infestation were done to all patients. The typing of anemia was done based on these reports. Hemoglobin was estimated by Sahli's method and expressed in gm%, and peripheral smear was stained by Leishman's stain, and PCV, MCV, MCH, MCHC and RDW were determined by automated cell counter. Normal values were taken as follows: PCV 35-45%, MCV 77-95fl, MCH 25-33pg, MCHC 31-37gm/dl and RDW 14.5-18.5. Reticulocyte count was done by Brilliant crystal stain method, serum iron determination was done by Ramany's dipyridyl method, total iron binding capacity was determined by Ramsay's method, serum vitamin B12 and folic acid were determined by Architect method.

Statistical analysis
Results were analyzed by SPSS v.21 software program. P value less than 0.05 was taken as statistically significant.

Results
A total of 3490 patients were admitted to Al-Falluja Teaching Hospital for Gynecology and Pediatrics from November 2016 to May 2018, of which 2792(80.0%) patients were having anemia, and 72 severe anemia, while prevalence of severe anemia being 2.57%.

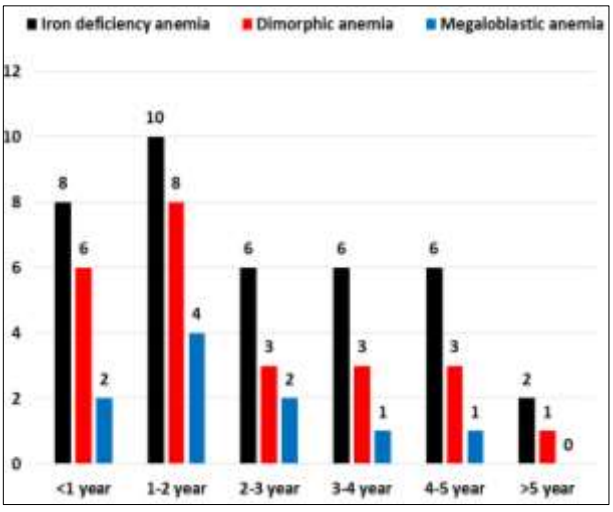

Fig 1: Distribution of patients with severe anemia according to age groups

It is observed from figure (1) that all the three types of anemia were more prevalent in the age group (1-2) years.

Table 1: Distribution of anemia according to gender

	Iron deficiency anemia	Dimorphic anemia	Megaloblastic anemia	Total
Male	18 (25.0%)	12 (16.6%)	4 (5.6%)	34 (47.2%)
Female	20 (27.8%)	12 (16.6%)	6 (8.3%)	38 (52.8%)

For iron deficiency anemia, incidence was more in females i.e., 27.8% against males 25.0%, while for dimorphic anemia incidence is equal i.e., 16.6% and 16.6% in males and females and for megaloblastic anemia incidence in females is more i.e. 8.3% against males 5.6% which is not statistically significant (P value >0.05).

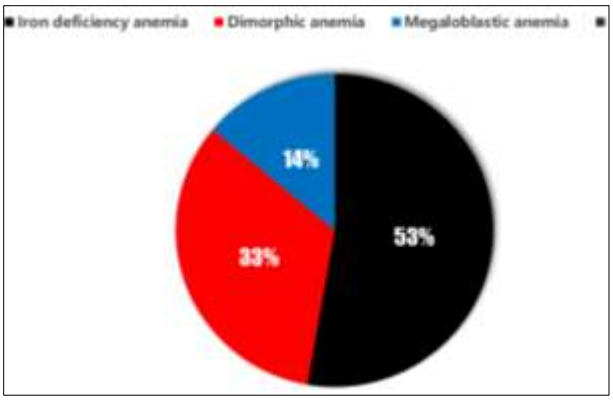

Fig 2: Prevalence of different types of anemia

In the current study, results showed that iron deficiency anemia was the most common type followed by dimorphic anemia then megaloblastic anemia.

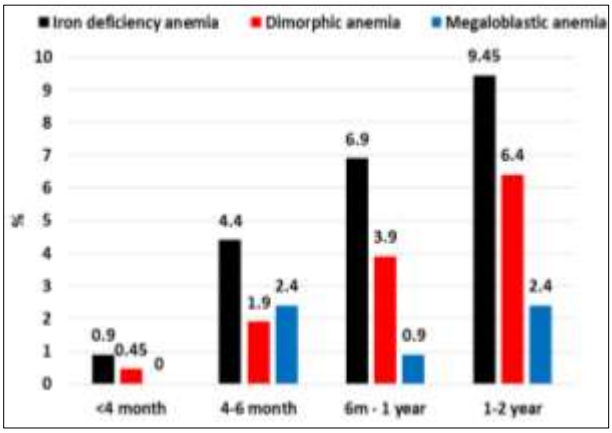

Fig 3: Relationship between exclusive breastfeeding and anemia

In the present study, maximum numbers of patients were in the age group (1–2) years. Exclusive breast feeding up to (4-6) months helps in controlling anemia of infancy through breast milk. Although breast milk has very low iron content, it has high bioavailability which is seen in present study.

Symptoms

Fever was seen in (61.3%) of patients followed by weakness (56.2%), cough (36.7%), diarrhea (19.3%), breathlessness (13.8%), pica (10.4%), worm infestation (9.1%), vomiting (8.1%), tremor (5.3%) and bloody stool (1.8%).

General examinations

Pallor was seen in 100% of patients, vitamin deficiency in 57.3%, knuckle pigmentation in 32.8%, edema in 22.9% and koilonychia in 11.9%.

Table 2: Relation of RBC indices toanemia

Parameter	Iron deficiency anemia	Megaloblastic anemia	Dimorphic anemia
PCV↓	39(54.2%)	9(12.5%)	24(33.3%)
MCV↓	40(55.6%)	-	11(15.3%)
MCV↑	-	9(12.5%)	12(16.6%)
MCH Normal	-	-	13(18.0%)
MCH↓	39(54.2%)	9(12.5%)	11(15.3%)
MCHC Normal	6(8.3%)	6(8.3%)	11(15.3%)
MCHC↓	34(47.2%)	3(4.2%)	12(16.7%)
RDW↑	39(54.2%)	3(4.2%)	20(27.8%)
RDW↓	-	6(8.3%)	4(5.5%)

PCV, packed cell volume; MCV, mean corpuscular volume; MCH, mean corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; RDW, red cell distribution width.

In Iron deficiency anemia, PCV, MCV, MCHC, MCH were decreased and RDW was increased. In megaloblastic anemia PCV and MCH were decreased, MCV and MCHC were increased. In dimorphic anemia PCV was decreased in all patients and variation wasseen in all other indices.

Peripheral smear examination

Microcytic hypochromic anemia was seen in 54.2% of patients, macrocytic hypochromic anemia was seen in 12.5% and dimorphic anemia was seen in 33.3% of patients.

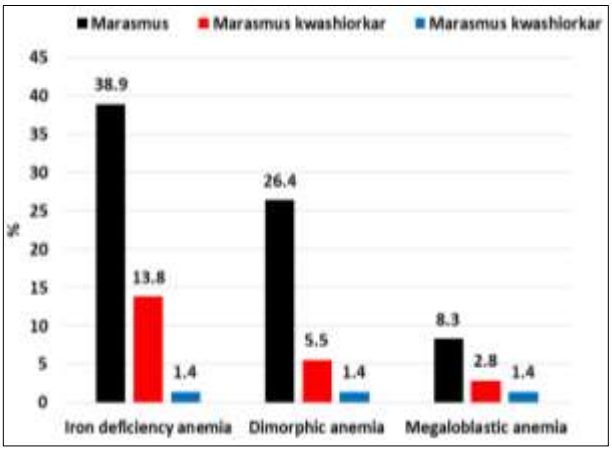

Fig 4: Relationship between anemia and PEM

In iron deficiency anemia, patients in marasmus group were 38.9% against 13.8% in marasmic kwashiorkor. In dimorphic anemia, patients in marasmus group were 26.4% against 5.5% in marasmic kwashiorkor group. In megloblastic anemia, 8.3% patients were in marasmus group as compared to 2.8% in marasmic kwashiorkor.

Relation of socio-economic class to anemic patients

Most of the patients were in class V socioeconomic group i.e. 55.1%, class IV - 25.2%, class III –15.8%, class II - 2.9% and class I - 1%. This is according to Kuppuswamy socioeconomic scale which was in contrast to a study conducted by Fadila A Assiri *et al* (16, 17).

Table 3: Stool for ova and cyst examination

Stool examination	Iron deficiency anemia	Dimorphic anemia	Megaloblastic anemia
Positive	11 (15.3%)	3 (4.2%)	3 (4.2%)
Negative	28 (38.8)	21 (29.2%)	6 (8.3%)

Stool examination for ova and cyst was positive in 15.3% of iron deficiency anemia, 4.2% of dimorphic anemia and 4.2% of megaloblastic anemia. Stool examination was negative in 38.8% of iron deficiency anemia, 29.2% of dimorphic anemia and 8.3% of megaloblastic anemia. In the present study, 79% of patients presented with infection and 11.8% with congestive cardiac failure due to severe anemia.

Table 4: Treatment given to anemic patients

Treatment	Iron deficiency anemia	Dimorphic anemia	Megaloblastic anemia
Transfusion	24(33.3%)	16(22.2%)	2(2.8%)
Oral iron	39(54.2%)	24(33.3%)	8(11.1%)
Folic acid	-	24(33.3%)	8(11.1%)
Methicobalamine	-	24(33.3%)	8(11.1%)

In the present study, 33.3% patients with iron deficiency anemia, 22.2% patients with dimorphic anemia and 2.8% patients with megaloblastic anemia were transfused packed cell volume. The remaining patients were managed by oral hematinic drugs.

Discussion

In our study, the prevalence of anemia was 80%, which is in accordance to a study conducted by Margaret F *et al*, while it was inconsistent with the studies of [11, 1], [3] and [4] who found a prevalence of 37-38%, 43.9% and 6% respectively. The prevalence of severe anemia in the current study was 2.57%, which was in accordance to the study conducted by [1], whereas the study conducted by [5] found a prevalence rate of 12-29%.

It was observed from our study that all three types of anemia were more prevalent in the age group (1-2) years, which almost agreed with previous studies performed by [1, 2, 3, 4, 5, 7, 9, 10, 13, 14], which may be attributed to poverty, maternal anemia, continued exclusive breast feeding beyond 6 months and improper complimentary diet. As the age advances there is decrease in the incidence of anemia probably due to introduction of proper feeding.

There was no statistical significant difference between the males and females in the current study, which was in accordance to previous studies of [1, 3, 5, 11, 16], whereas study conducted by [8] found higher incidence of anemia in girls and [12] who found higher incidence of anemia in boys.

Iron deficiency was the most common type of anemia in our study followed by dimorphic anemia and megaloblastic anemia, which was in agreement with previous studies by [1, 2, 3, 4, 8, 10, 12, 13, 14, 15]. There are several causes of iron deficiency anemia. The principal cause in children in developing countries is inadequate intake of usable iron, which is normally found in a well-balanced diet in the form of heme and non heme iron. Several well controlled trials have been effective in reducing the prevalence of anemia in school-age children. Fortification is an attractive option for controlling iron deficiency anemia in countries where a significant number of groups are vulnerable to an ever increasing consumption of centrally processed foods [10].

Exclusive breast feeding up to 4-6 months helps in controlling anemia of infancy through breast milk which was seen in the present study which was in agreement with the study conducted by [3].

In our study, fever was the most common symptom followed by weakness, cough etc. This result agreed with previous studies of [1, 2, 3, 5, 9, 10, 11]. Pallor and vitamin deficiency were found in our study, which was in accordance with previous studies done by [2, 5].

In Iron deficiency anemia, PCV, MCV, MCHC, MCH were decreased and RDW was increased. In megaloblastic anemia PCV and MCH were decreased, MCV and MCHC were increased. In dimorphic anemia PCV was decreased in all patients and variation was seen in all other indices. These results were consistent with previous studies of [3, 4]. In the present study, microcytic hypochromic anemia was the most common followed by dimorphic anemia and macrocytic hypochromic anemia, which agreed with a study conducted [8].

For iron deficiency anemia, patients in marasmus group were 38.9% against 13.8% in marasmic kwashiorkorm while for dimorphic anemia, 26.4% patients were in marasmus group against 5.5% in marasmic kwashiorkor group, whereas for megloblastic anemia, 8.3% patients were in marasmus as compared to 2.8% in marasmic kwashiorkor group. Studies to compare the results were not found in other articles. It is therefore concluded that association of protein energy malnutrition is widely prevalent in preschool children in Iraq. There was an association between anemia and malnutrition with lower hemoglobin levels in the underweight and stunted children.

In the current study, patients were in class V socioeconomic status, which was in accordance to previous studies of [1, 2, 3, 8, 13], but the study conducted by [11] found that most cases were in the average socioeconomic status group.

In the current study, stool examination for ova and cyst was positive in 15.3% of iron deficiency anemia, 4.2% of dimorphic anemia and 4.2% of megaloblastic anemia patients, which was in agreement with the previous studies of [5, 8]. The study conducted by [6] and [12] found higher parasitic infection in children.

Our results recorded that 33.3% patients with iron deficiency anemia, 22.2% patients with dimorphic anemia and 2.8% patients with megaloblastic anemia were transfused packed cell volume, while the remaining patients were managed by oral hematinic drugs.

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