The prevalence of anemia among under five years old children attending primary health care centers in 3 Iraqi governorates (Babil, Basrah and Nineveh)

By

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List of Abbreviations

CI……Confidence Interval

CFSVA ……..Comprehensive Food Security and Vulnerability Analysis

Hb……Hemoglobin

HIV……..…Human Immunodeficiency Virus

IDA……..…Iron Deficiency Anemia

M ……Mean

NRI ……Nutrition Research Institute

SD ……..Standard Deviation

WHO ……..World Health Organization

Summary

This study was aimed to estimate the extent of general anemia among children below 5 years of age visiting primary health care centers in 3 districts conveniently chosen from 3 governorates (Basrah, Babil and Nineveh) during the period 27- 30/9/2010.

The sample comprised of 450child enrolled; (53.3%) were males and (66.1%) were from urban areas; during this study blood samples drawn and anthropometrical measurements were taken along with a questionnaire form including many indicators related to the study subject is filled by trained teams ; hemoglobin was used as an indicator for assessing anemia status depending on WHO cutoff points for hemoglobin levels.

The study showed (26.2%) of enrolled children were anemic (with a mean hemoglobin level 11.6 g/dl) which signifies that Iraq have a moderate public health problem in anemia and specially in children between (6-11.9) months ; mostly in Urban (35.7%) than rural areas ; Basrah has a higher percentage of anemia (47.3%) ;nutritional status was also assessed and (11.5%) of children were wasted ; (17.8%) were stunted and (11.5%) have underweight ; distributing malnutrition rates with anemia status suggested that more than (20%) of children suffering from under nutrition indicators have concurrent anemia ; dietary fortification and iron supplementation are the most effective way for tackling anemia high rates along with dietary diversification and discouraging wrong dietary habits through rising public awareness on healthy dietary practices.

Introduction

Anemia: a public health problem

Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development. It occurs at all stages of the life cycle, but it is more prevalent in pregnant women and young children *(23)*. In 2002, iron deficiency anemia (IDA) was considered to be among the most important contributing factors to the global burden of disease (*1*).

Etiology

Anemia is the result of a wide variety of causes that can be isolated, but more often coexist. Globally, the most significant contributor to the onset of anemia is iron deficiency so that IDA and anemia are often used synonymously, and the prevalence of anemia has often been used as a proxyfor IDA. It is generally assumed that 50% of the cases of anemia are due to iron deficiency (*2*), but the proportion may vary among population groups and in different areas according to the local conditions. The main risk factors for IDA include a low intake of iron, poor absorption of iron from diets high in phytate or phenol compounds, and period of life when iron requirements are especially high (i.e. growth and pregnancy) *(20)*. Among the other causes of anemia, heavy blood loss as a result of menstruation, or parasite infections such as hookworms, ascaris, and schistosomiasis can lower blood hemoglobin (Hb) concentrations. Acute and chronic infections, including malaria, cancer, tuberculosis, and HIV can also lower blood Hb concentrations *(19)*. The presence of other micronutrient deficiencies, including vitamins A and B12, folate, riboflavin, and copper can increase the risk of anemia. Further more, the impact of haemoglobinopathies on anemia prevalence needs to be considered within some populations *(8, 12)*.

Health consequences

Anemia is an indicator of both poor nutrition and poor health. The most dramatic health effects of anemia, i.e., increased risk of maternal and child mortality due to severe anemia, have been well documented (*3–5*). In addition, the negative consequences of IDA on cognitive and physical development of children and on physical performance– particularly work productivity in adults – are of major concern (*2*).

Assessing anemia

Hemoglbin concentration is the most reliable indicator of anemia at the population level, as opposed to clinical measures which are subjective and therefore have more room for error. Measuring Hb concentration is relatively easy and inexpensive, and this measurement is frequently used as a proxy indicator of iron deficiency. However, anemia can be caused by factors other than iron deficiency. In addition, in populations where the prevalence of inherited haemoglobinopathiesis high, the mean level of Hb concentration may be lowered *(22)*. This underlines that the etiology of anemia should be interpreted with caution if the only indicator used is Hb concentration. The main objective for assessing anemia is to inform decision-makers on the type of measures to be taken to prevent and control anemia. This implies that in addition to the measurement of Hb concentration, the causes of anemia need to be identified considering that they may vary according to the population*(2,3)*.

Control of anemia

Given the multifactorial nature of this disease, correcting anemia often requires an integrated approach. In order to effectively combat it, the contributing factors must be identified and addressed. In settings where iron deficiency is the most frequent cause, additional iron intake is usually provided through iron supplements to vulnerable groups; in particular pregnant women and young children. Food based approaches to increase iron intake through food fortification and dietary diversification are important, sustainable strategies for preventing IDA in the general population. In settings where iron deficiency is not the only cause of anemia, approaches that combine iron interventions with other measures are needed *(23)*. Strategies should include addressing other causes of anemia(*6, 7*), and should be built into the primary health care system and existing programmes. These strategies should be tailored to local conditions, taking into account the specific etiology and prevalence of anemia in a given setting and population group *(23, 24)*.

Global anemia prevalence

Globally, anemia affects 1.62 billion people (95% CI: 1.50–1.74 billion), which corresponds to 24.8% of the population (95% CI: 22.9–26.7%). The highest prevalence is in preschool-age children (47.4%, 95% CI:45.7–49.1), and the lowest prevalence is in men (12.7%,95% CI: 8.6–16.9%). However, the population group with the greatest number of individuals affected is non-pregnant women (468.4 million, 95% CI: 446.2–490.6). WHO regional estimates generated for preschool-age children and pregnant and non-pregnant women indicate that the highest proportion of individuals affected are in Africa (47.5–67.6%), while the greatest number affected are in South-East Asia where 315 million (95% CI:291–340) individuals in these three population groups are affected (Table 1) *(13)*.

Table (1): Anemia prevalence and number of individuals affected in preschool-age children, pregnant women, and non-pregnant women in each WHO region*

WHO region	Preschool age children		Pregnant women		Non-pregnant women	
	Prevalence (%)	# affected (millions)	Prevalence (%)	# affected (millions)	(%)	# affected (millions)
Africa	67.6 (64.3-71.0)	83.5 (79.4-87.6)	57.1 (52.8-61.3)	17.2 (15.9-18.5)	47.5 (43.4-51.6)	69.9 (63.9-75.9)
Americas	29.3 (26.8-31.9)	23.1 (21.1-25.1)	24.1 (17.3-30.8)	3.9 (2.8-5.0)	17.8 (12.9-22.7)	39.0 (28.3-49.7)
South-East Asia	65.5 (61.0-70.0)	115.3 (107.3-123.2)	48.2 (43.9-52.5)	18.1 (16.4-19.7)	45.7 (41.9-49.4)	182.0 (166.9-197.1)
Europe	21.7 (15.4-28.0)	11.1 (7.9-14.4)	25.1 (18.6-31.6)	2.6 (2.0-3.3)	19.0 (14.7-23.3)	40.8 (31.5-50.1)

Eastern Mediterranean	46.7 (42.2-51.2)	0.8 (0.4-1.1)	44.2 (38.2-50.3)	7.1 (6.1-8.0)	32.4 (29.2-35.6)	39.8 (35.8-43.8)
Western Pacific	23.1 (21.9-24.4)	27.4 (25.9-28.9)	30.7 (28.8-32.7)	7.6 (7.1-8.1)	21.5 (20.8-22.2)	97.0 (94.0-100.0)
Global	47.4 (45.7-49.1)	293.1 (282.8-303.5)	41.8 (39.9-43.8)	56.4 (53.8-59.1)	30.2 (28.7-31.6)	468.4 (446.2-490.6)

Based on WHO global database of anemia prevalence in 2005 , Iraq actually suffers from high prevalence of anemia in different age groups as shown in table(2) where anemia is still a public health problem in Iraq.

Table (2): Iraqestimates of anemia prevalence in individuals affected*

Population group	Proportion of the population with anemia (%)	Public health problem
preschool-age children	**55.9**	**Severe**
pregnant women	**38.2**	**Moderate**
non-pregnant women of reproductive age(15-49 yrs)	**45.3**	**Severe**

****WHO Global database on anemia, 2005.***

Aims of the study

1) To estimate the extent of anemia among under five years old children attending primary health care centers in 3 Iraqi governorates (Babil, Basrah and Nineveh)
2) The distribution of anemia by some demographical, nutritional, biological and environmental variables have also been considered.

Materials and Methods

Target areas, populations and team members

Figure (1) shows Districts (Makhmor, Hashmiyah and Basrah center) enrolled in the survey with their respective governorates (Ninevah, Babil and Basrah), During this survey, 3 central supervisors were dispatched from NRI (Nutrition Research Institute) to the 3 selected Districts and 3 teams with their local supervisors in each province start their field work in the 3 health centers for the period of 27-30/9/2010, each team consisted of two health workers and one lab technician. Each team planned to include 50 child from each health center (collectively 3 health centers to be included and a total of 150child for each governorate) so an overall convenient sample size of 450 child are to be included in the survey for the 3 governorates' Districts enrolled.

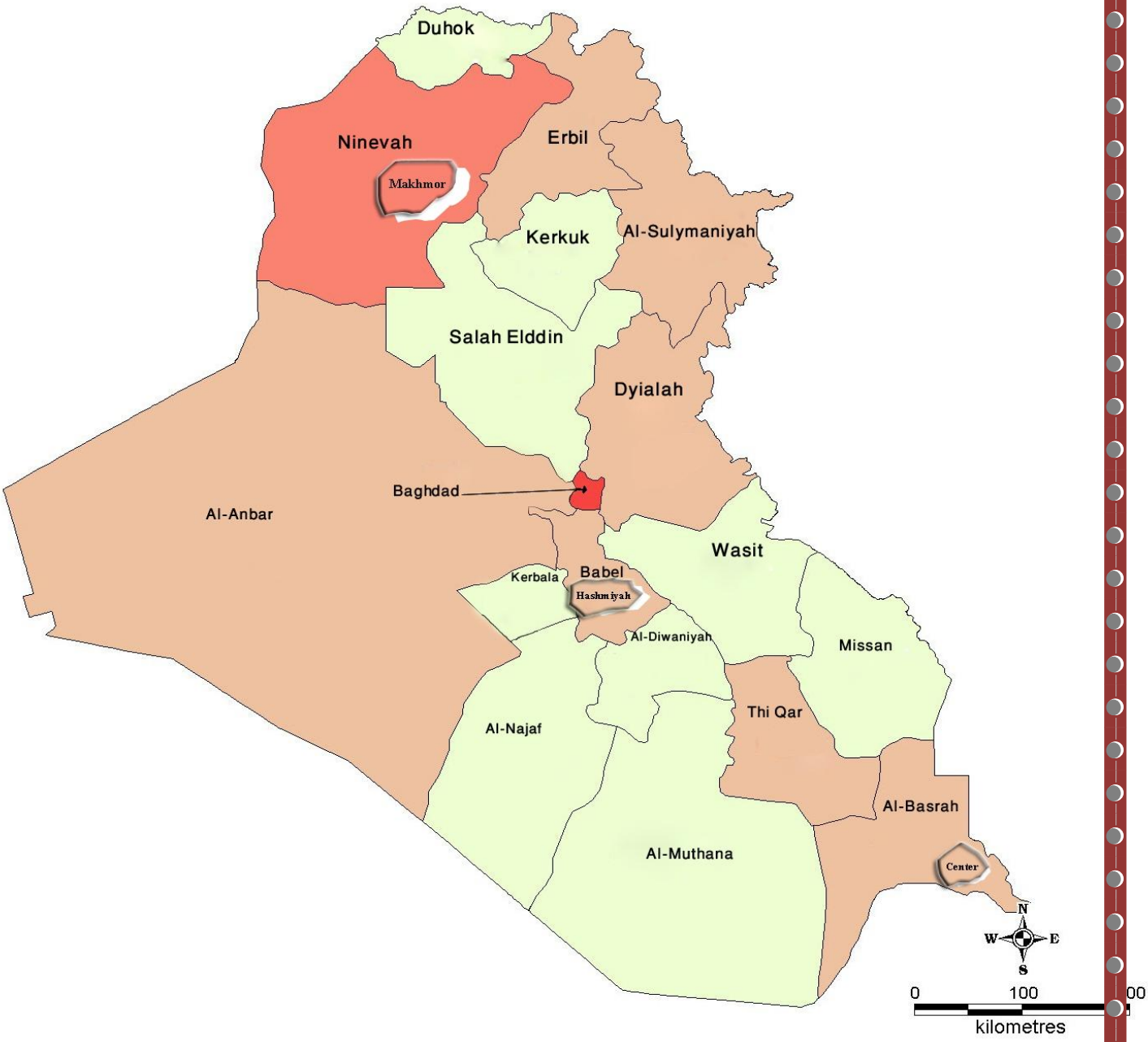


Figure (1): The distribution of Districts included in the survey

Training

The training of field staff started at 26th -September 2010 by each central supervisor for the 3 team members in the 3 Districts included in the study (3 members per team; a total of 9 trainees per province) (a total of 27 members to be trained with 3 local supervisors).

- ***Laboratory training***

The training of laboratory technicians included procedures for performing the blood sampling techniques and maintenance.

- ***Anthropometry training***

Trained to measure weight and height or length of children. This training includes practice on children and a standardization exercise.

- ***Interview techniques training***

Trained on how to conduct interviews and complete the questionnaires.

- ***local supervisor training***

Local supervisors trained to check completed data collection forms, correct survey procedures and survey best practices.

Blood sampling and biochemical measurements

Hemoglobin level was estimated using HemoCue diagnostic method through these 3 following simple steps:

1- Apply the microcuvette to a drop of blood. The correct volume is drawn into the cuvette by capillary action (capillary, venous or arterial blood can be used).
2- After wiping any excess blood from the sides of the cuvette, place it in the cuvette holder and insert it into the analyzer.
3- The lab quality result is displayed automatically.

Anthropometric measurements

Body physical measurements were taken for the preschoolers; Weight was recorded using a weighing scale. Height was measured in a standing position (and length is taken for children less than 2 years old). Z-scores for the four growth indicators {height (length)-for-age, weight-for-height (length), weight-for-age and BMI-for-age} have been calculated. A cut-off of less than minus two standard deviations (-2SD) was used to define under nutrition {stunt (height/length-for-age Z-score), wasting (weight-for-height/length Z-score), and underweight (weight-for-age Z-score) ;(BMI-for-Age Z-score)}.

Definition of outcome

Normal Hb distributions vary with age, sex, and physiological status, e.g., during pregnancy (8). WHO Hb thresholds were used to classify individuals living at sea level as anemic (Table 3) (2).

Table (3): Hemoglobin thresholds used to define anemia

Age or gender group	Hemoglobin threshold (g/dl)
Children (0.50–4.99 yrs)	11
Children (5.00–11.99 yrs)	11.5
Children (12.00–14.99 yrs)	12
Non-pregnant women (≥15.00 yrs)	12
Pregnant women	11
Men (≥15.00 yrs)	13

The prevalence of Hb values below the population-specific Hb threshold was used to classify countries by the level ofthe public health problem (Table 4) (*2*).

Table (4): Classification of anemia as a problem of public health significance

Prevalence of anemia (%)	Category of public health significance
≤4.9	No public health problem
5.0–19.9	Mild public health problem
20.0–39.9	Moderate public health problem
≥40.0	Severe public health problem

Hemoglobin value less than 11 g/dl was used as a cut-off point for the diagnosis of anemia is used in the current study. WHO growth references for children under 5 years used to estimate Z-scores for the four growth indicators and detect the nutritional status of children enrolled in the study (27).

Statistical Analyses

Data analysis for the inquired variables was done by using data analysis softwares namely SPSS , Excel and WHO Anthro and the results represented by using tables and charts describing the distributions of variables under study according to demographic, biologic and environmental factors reaching to determining the answer for our main research question in the study.

Results and Discussions

Out of 450 child enrolled in the study ;(53.3%) were boys and (46.7%) were girls and most of them (66.1%) are living in urban environment as shown in figure (2).

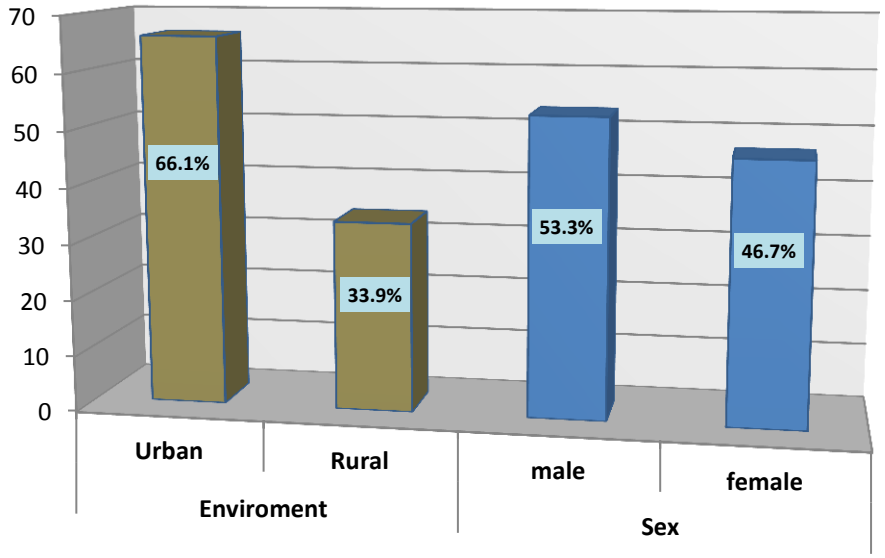


Figure (2): The distribution of children enrolled by sex and environment.

Most of the food groups included in the study questionnaire were consumed as shown in figure (3) which has to be linked to construction of Food Consumption Score cut-off for best match of proportion of food pattern, the highest proportion of food group consumed (around 80%) found in carbohydrates while milk, fruits and vegetables groups comes next (64.9% and 66.7%) respectively which represent a good percentage when combined with other food groups as a crucial part of the balanced diet.

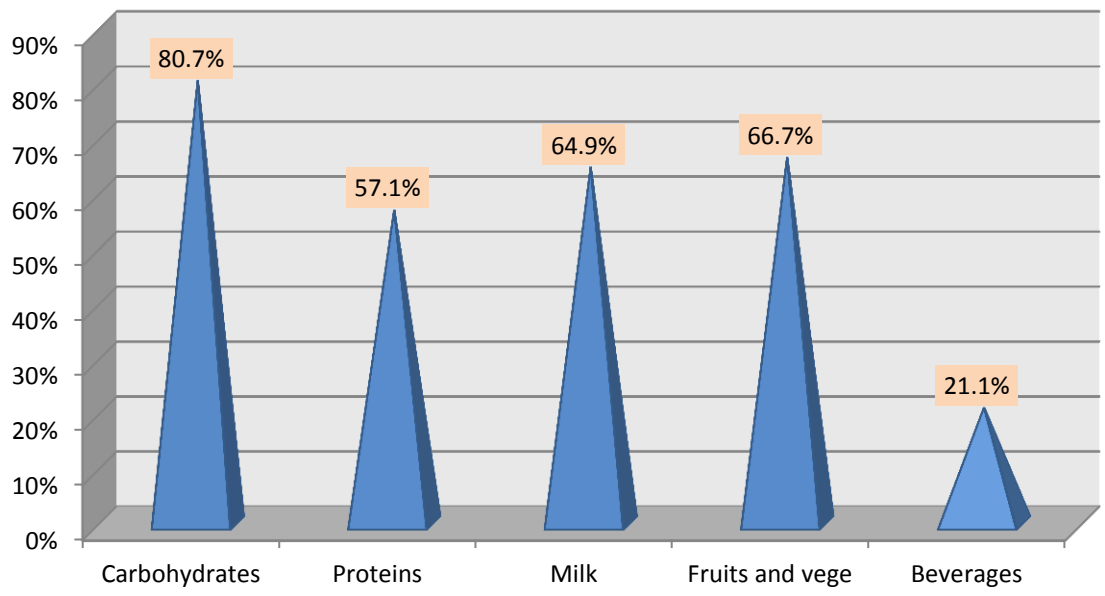


Figure (3): Distribution of food groups' consumption.

Data obtained from physical measurements of (434) study subjects revealed that the overall distribution of malnutrition indicators prevalence (wasting, stunting and underweight) shown in Figure (4) compared to the national average [26] were higher in wasting and underweight (11.5%) than the national average while stunting seems to be below national average (17.8%) which might either reflect the true rates or might be a result of a bios in data sampling or collecting procedures.

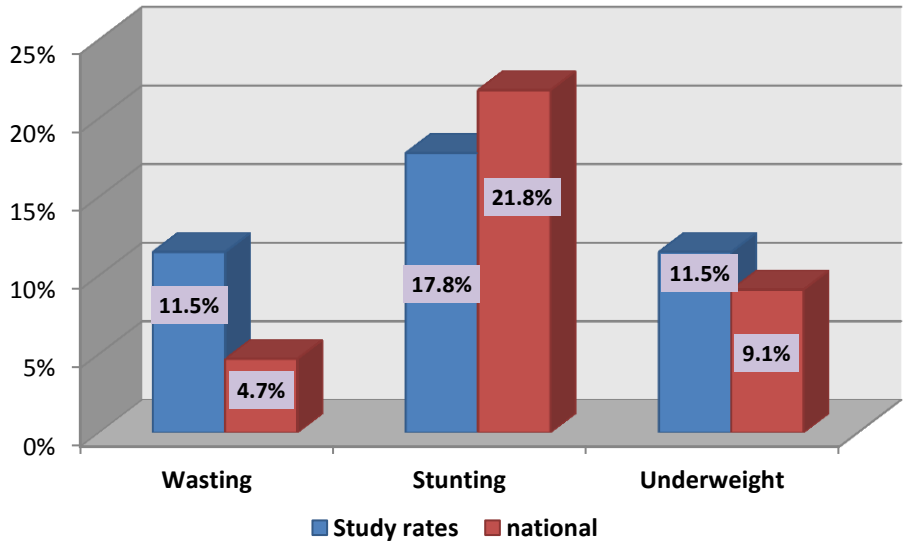
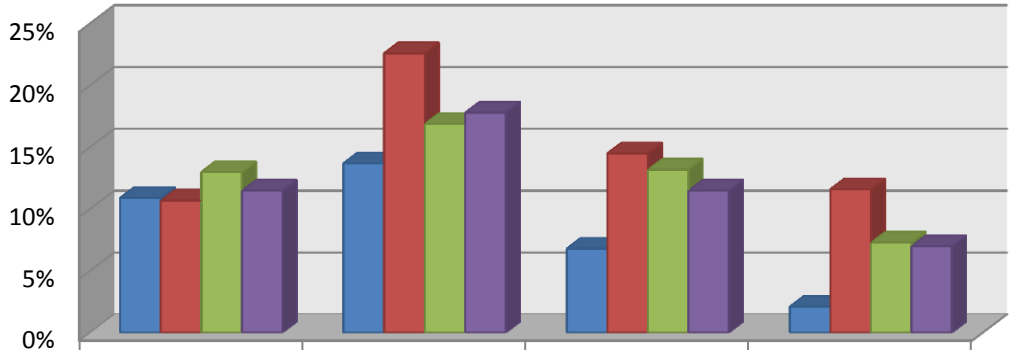


Figure (4): Distribution of study malnutrition rates compared to the national averages.

Distributing malnutrition rates by governorates included in the study shows that the highest prevalence of underweight found in Ninevah (13%) while Babil has the highest rate (22.6%) in stunting which indicate as WHO cutoff rates for stunting to be considered as a public health problem (stunting in more than 20% under 5 years old) has a public health problem; as for wasting there is a rather equal rates found in Babil and Ninevah (14.5% and 13.2%) and 6.8% in Basrah which represent a public health problem there , as for overweight ;Babil has the highest rates (11.6%) which also represent a public health problem depending on WHO cutoff points (underweight in more than 10% of under 5 years old children) as shown in figure (5).



	underweight	stunting	wasting	overweight
Basrah	10.9%	13.7%	6.8%	2.1%
Babil	10.7%	22.6%	14.5%	11.6%
Ninevah	13.0%	16.9%	13.2%	7.3%
Total	11.5%	17.8%	11.5%	7.0%

Figure (5): Distribution of study malnutrition rates by governorates.

The mean Hb level in this study is (11.6 g/dl ±1.31) and (26.2%) of children are anemic (having Hb level below 11 g/dl as defined by WHO) which denotes that Iraq still have a moderate public health problem in anemia ;Distributing anemia among different characteristics (demographical, environmental, educational and nutritional indicators) as shown in table (5) indicating that there is a high prevalence (46.9%) of anemia among children (6-11.9) months of age followed by nearly an equal percentages (around 33%) among (12-35.9) months of age , an almost equal percentages of anemia are found between male and female (26%), children living in urban areas have a higher percentage of anemia (35.7%) than those living in rural areas (9.7%) which might be due to the pattern and habits of their dietary intake ; Basrah governorate has the highest percentage (47.3%) of anemia among enrolled governorates ; Distributing anemia prevalence by father and mother's educational level shows that the highest anemia percentages were found in fathers completed secondary stage (33.3%) and mothers completed intermediate stage (31.8%) and this has to be statistically tested for their means differences ; (48.6%) of exclusively breast fed children were

anemic ; (29.4%) of those children who didn't complete their vaccination suffer from anemia ; (20.4%) of those drinking tea directly after meals suffer from anemia.

Table (5): Prevalence of anemia percentage among under 5 years old by their characteristics.

Characteristics of under 5 years old children	Total number	Prevalence (%) of anemia (Hb<11 g/dl)	Mean Hb (g/dl)
Age group (months)			
0-5.9	51	39.2%	11.341
6-11.9	49	46.9%	11.022
12-23.9	67	32.8%	11.063
24-35.9	72	34.7%	11.572
36-47.9	69	18.8%	12.012
48-59.9	126	11.1%	12.044
SEX			
Male	240	26.7%	11.648
Female	210	25.7%	11.627
Residence			
Urban	283	35.7%	11.349
Rural	145	9.7%	12.147
Governorate			
Basrah	150	47.3%	10.917
Babil	150	20.7%	11.905
Ninevah	150	10.7%	12.092
Father education			
Ignorant	107	24.3%	11.684
Primary	167	26.3%	11.640
Intermediate	93	30.1%	11.696
Secondary	30	33.3%	11.160
Diploma and above	49	18.4%	11.692
Mother education			
Ignorant	142	21.8%	11.721
Primary	198	28.8%	11.608
Intermediate	66	31.8%	11.408
Secondary	14	7.1%	12.036
Diploma and above	27	29.6%	11.630
Feeding			
Exclusive BF	35	48.6%	11.194
Artificial	56	32.1%	11.345
Mixed	63	19.0%	11.789
Complementary with BF	54	35.2%	11.207
Complementary alone	191	17.8%	11.958
Vaccination status			
completed vaccination	319	25.1%	11.669
not completed	126	29.4%	11.578
Never vaccinated	1	0.0%	12.000
Worm infestation			
Yes	47	21.3%	11.940

No	397	26.2%	11.617
Infection during the last 3 months			
Yes	141	28.4%	11.538
No	297	24.2%	11.715
Drinking teadirectly after the meals			
Yes	289	20.4%	11.819
No	148	33.8%	11.406
Drinking natural juice with meals			
Yes	149	26.8%	11.563
No	237	26.6%	11.634
TOTAL	**450**	**26.2%**	**11.638**

Distributing children with anemia by malnutrition indicators shows that there is (27.3%) of wasted children have anemia; (29.8%) of stunted children have anemia; (35.3%) of underweight children suffer from anemia and (20.6%) of overweight children have anemia which gives a clue that anemia can coexist with malnutrition as shown in table (6).

Table (6): Prevalence of anemia among under 5 years old enrolled by malnutrition indicators.

Malnutrition indicators	Total number	Prevalence (%) of anemia (Hb<11 g/dl)
Wasting	55	27.3%
Stunting	84	29.8%
Underweight	51	35.3%
Overweight	34	20.6%

Conclusions

This study was aimed to estimate the extent of general anemia among children below 5 years of age in 3 districts conveniently chosen from 3 governorates (Basrah, Babil and Nineveh) and (450) child enrolled; (53.3%) were males and (66.1%) were from urban areas ; (26.2%) of enrolled children were anemic (with a mean hemoglobin level 11.6 g/dl) which signifies that Iraq have a moderate public health problem in anemia and specially in children between (6-11.9) months ; mostly in Urban (35.7%) than rural areas ;Basrah has a higher percentage of anemia (47.3%); nutritional status was also assessed and (11.5%) of children were wasted ; (17.8%) were stunted and (11.5%) have underweight ; distributing malnutrition rates with anemia status suggested that more than (20%) of children suffering from under nutrition indicators have concurrent anemia.

Recommendations

1) Increase micronutrient intake through the diet, include meat and organs from cattle, fish, and poultry; and non-animal foods such as green leafy vegetables.
2) Enhance the absorption or utilization of iron. Examples include those of animal origin, and non-animal foods - such as some fruits, vegetables, that are good sources of vitamins A and C, and folic acid.
3) Effective nutrition education and information on health and nutrition to increase the demand for consumption of such foods.
4) The primary goal of dietary modification to improve and maintain the iron status of a population involves changes in behavior, leading to an increase in the selection of iron-containing foods and a meal pattern favorable to increased bioavailability.
5) Food fortification is an effective long-term approach to improving the iron status of populations through supporting the national wheat flour fortification program.
6) Sustainability of Iron supplementation program which is considered as a preventive public health measure to control iron deficiency in populations at high risk of iron deficiency and anemia.

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