Evaluation of Retinol Level Among Preschool Children, Pregnant and Lactating Women Attending Primary Health Care Centres in Baghdad

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Abstract: *Background*: Vitamin A deficiency (VAD) is a major public health nutrition problem in the developing world. There have been no studies on this topic in Iraq. This study was designed to evaluate the serum retinol levels of preschool children, pregnant and lactating women.

Objectives: The present study is an attempt to estimate the prevalence of vitamin A deficiency among preschool children, pregnant and lactating women attending primary health care centers in Baghdad, in addition to figure out the relation between vitamin A deficiency with some demographical, clinical, variables.

Subjects and Methods: The study was conducted during the period from October to December 2009.

The sample was comprised of 490 subjects, Lactating women pregnant women and under 6 year's old children attending ten primary health care centers in Baghdad.

The data were collected through direct interview; blood samples were taken and analyze for serum retinol (SR) by HPLC analysis and hemoglobin (Hb) level, anthropometric measurement were obtained for the study sample.

Results: The study showed that the prevalence of vitamin A deficiency in preschool aged children (below 6 years) was (38.3 %); and that for lactating women and pregnant women were (7.1 %) and (25 %) respectively.

Forty percent of pregnant women, (25.8 %) of lactating women and a total of (58.6 %) preschool children were anemic, A correlation coefficient between SR and Hb concentrations was significant (N=490, r=0.533, P<0.0001).

Conclusion: Vitamin A deficiency is a public health problem, this study shows that subjects in the 3 groups (preschool children, pregnant and lactating women) are at risk of VAD and anemia; nearly half of them had the co-occurrence of VAD and anemia. A close association between vitamin A deficiency and anemia with a correlation coefficient between SR and Hb concentrations was significant.

Keywords: Vitamin A, pregnant, lactating women, primary health care centers.

INTRODUCTION

Vitamin A (VA) intervenes in vision, growth, reproduction and the immune system. The most prominent clinical symptoms of vitamin A deficiency (VAD) are eye lesions and the extreme consequences of VAD are irreversible blindness and often death [1].

Vitamin A is one of most important nutrients which are essential to all, especially children and pregnant women [2, 3] and plays an important role in cellular differentiation, which is critical in growth, reproduction and immune response, Children with vitamin A deficiency (VAD) have a tendency to be more affected by infection [4-7].

The World Health Organization (WHO) estimated that 250 million children mainly in the developing countries are affected by VAD. VAD is now recognized to increase childhood and maternal mortality, When maternal VA status is low, breastfed infants are likely to become deficient [7]. In developing countries, blindness, measles and severe diarrhea are related to VAD Vitamin A deficiency increase vulnerability to other disorders, such as iron-deficiency anemia, for both women and children [8].

Many Nutritional surveys have shown a close relationship between vitamin A and iron metabolic indicators [9, 10], vitamin A is considered to influence anemia by modulating erythropoiesis and iron metabolism and enhancing immunity to infectious diseases [11, 12].

Vitamin A can be obtained from food, either as preformed vitamin A in animal products, such as eggs and dairy products, or as provitamin A carotenoids, mainly b-carotene in plant products, such as green leafy and yellow-colored vegetables and orange-colored fruit, Vitamin A deficiency is essentially attributed to inadequate dietary intake [13].

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Nowadays, severe VAD has been controlled efficiently with the efforts of the World Health Organization (WHO), the United Nations Children's Fund (UNICEF) and the International Vitamin A Consultative Group (IVACG), etc. It was estimated that more than 127 million preschool children are affected by VAD and 4.4 million with exophthalmia in the world. Most of them were from Africa and Southeast Asia because of an insufficiently varied diet, little food with abundant vitamin A, poor maternal education and inadequate hygiene. Epidemiological data on VAD can be useful in planning, designing, and targeting interventions [14-17].

The present study is an attempt to estimate the prevalence of vitamin A deficiency among preschool children, pregnant and lactating women attending primary health care centers in Baghdad, in addition to figure out the relation between vitamin A deficiency with some demographical, clinical, biological, and environmental variables

MATERIALS AND METHODS

Cross – sectional study was carried out in ten primary health care centers (PHCC), selected conveniently; five were located in Al-Rasafa region and the other five AL-Karkh sector in Baghdad. The study was approved by the Ethical Committee; ministry of health-Iraq No 657atno21/10/2008, The study was conducted during the period from October to December 2009, Each center was visited for 2-3 hours /day, four days / week for two month during the study period in order to obtain the required sample size, which was 490 subjects, (198) Lactating, (164) pregnant and a total of (128) under 6 years old children.

Direct interview was carried out with each voluntarily participant. The collected data included information about the age, menstruation, any concurrent illness history, medication, vitamin and mineral supplementations. Anthropometric assessments included measurement of weight and height was determined, and subsequently body mass index was calculated by dividing weight (kg) by squared height (m²).

Blood samples were taken and analyze for serum retinol (SR) and hemoglobin (Hb) level, analyze was done by the nutrition research Institute /Iraq, which controlled by CDC/ VITAL-EQA Program */Vitamin A Laboratory External Quality Assurance Program/ RETINOL*.

Anthropometric measurement (height and weight) were obtained for all participants. Weight was measured to the nearest 0.1 kg with a battery-powered digital scale (Uniscale). Height was measured to the nearest 0.1 cm with a height board. Height was measured in a standing position (and length is taken for children less than 2 years old). Calculate Z-scores for height-for-age, weight-for-height, and weight-for-age. A cut-off of less than minus two standard deviations (-2SD) was used to define stunt (height/length-for-age Z-score), wasting (weight-for-height/length Z-score), and underweight (weight-for-age Z-score).

Blood Sampling and Biochemical Measurements

A blood sample (5 ml) was collected by vein-puncture, and the volume of sample was about 1 ml for children whose ages were less than 1 year old. The specimens were collected in EDTA tubes, measure hemoglobin by hemiglobincyanide, continuously shielded from light, centrifugation. Aliquots of plasma were made and immediately frozen at -20°C; the plasma retinol concentration was determined by reversed-phase high-performance liquid chromatography (HPLC). A total of 0.2 ml plasma was added to 0.2 ml retinal acetate standard, and was deprotinised by ethanol. Plasma vitamin A was extracted with hexane (1 ml) and a portion of the sample (0.5 ml) evaporated to dryness under nitrogen and re-dissolved in 0.5 ml mobile phase(methanol: water, 95:5 by vol.), and injected into a C_{18}, reversed phase HPLC column (5 mm particle size; knauer Instruments, Inc.). The flow rate of mobile phase was 2.5 ml/min. Retinol was detected by monitoring the absorption at 287 nm in a knauer ultraviolet detector. The vitamin A concentration was quantified to the peak high of the internal retinal acetate standard. High sensitivity, accuracy and calibration curves linearities could be reached. Our results showed an overall coefficient of variation of less than 5%, 7% for the intra- and interday respectively, The limit of detection was 5 ug mL^{-1}. The accuracy was proven by good results from external quality assurance.

Definition of Outcome

The prevalence of anemia was determined according to the WHO criteria, i.e., hemoglobin <11 g/dl for to under 6 years old children and pregnant women, hemoglobin <12 g/dl for lactating women. According to the WHO criteria, a serum (plasma) retinol concentration <0.7 μmol/l (< 20 μg/dl) was classified as VAD, values 0.70-1.05 μmol/l (between 20 and 30 μg/dl) were taken as marginal VAD [18, 19].

Statistical Analyses

Data analysis for the inquired variables was done by using data analysis soft wares namely (SPSS version 13) and was represented by using tables and charts describing the distributions of variables under study.

RESULTS AND DISCUSSIONS

The study sample comprised 490 subjects, 198 (40.4%) Lactating women, 164 (33.5 %) pregnant women and a total of 128 (26.1 %) of under 6 years old children (been classified into 3 groups (below 6 months (4.7 %), 6 months to below 2years (22.6 %) and 2 year to 6 years (72.7%)) as shown in Table **1**.

Table 1: The Distribution of Study Sample by Age Category

Age Category		Frequency	Percent
Under 6 years	Below 6 months	6	4.7%
	6m - <2Y	29	22.6%
	2y - 6y	93	72.7%
	Total	128	26.1 %
Lactating		198	40.4 %
pregnant		164	33.5 %
Grand Total		490	100.0 %

Eighty –three percent (407 subjects) of the overall study subjects are from urban areas which also represents the highest proportions in pregnant and lactating women (78.7%, 83.3 %) respectively and preschool children (88.3%).

The present study showed a percentage of vitamin A deficiency (38.3 %) among preschool aged children (below 6 years) which is increasing with age with a strong significant relationship ($p<0.0001$), (7.1 %) among lactating women and (25%) among pregnant women; which can be defined as a corroborative evidence of a public health problem in preschool aged children and pregnant women (more than 15 % of under-5-years-olds with serum retinol below 20 μg/dl). The overall mean (±SD) serum retinol level in this study is (30.4±12.6) ug/dl, in preschool children this mean (±SD) is (24.9±10.6) ug/dl and (54 %) of them were female, whereas in pregnant and lactating women the mean serum retinol level (±SD) is (27.1±9); (36.8±12) ug/dl respectively

Anemia status was estimated in this study by determining Hb level, the mean Hb level (±SD) in preschool children is (11 ±1) g/dl, while the mean Hb level in pregnant women is (11.4±1) g/dl, as for lactating women, Hb level is (12.1±1) g/dl, while (40.8 %) of pregnant women are anemic, (25.8 %) of lactating women are anemic and a total of (58.6 %) of included preschool children were anemic with a strong statistical significant differences between the age category and anemia ($P<0.0001$) as shown in Table **2**.

Table 2: The Prevalence of Anemia Among Study Groups

			Anemia Status		Total
			Anemic	Not Anemic	
Below 6 years	Below 6 months	Count	2	4	6
		% of Total	33.3 %	66.7 %	4.7 %
	6m - <2Y	Count	23	6	29
		% of Total	79.3 %	20.7 %	22.6 %
	2y - 6y	Count	50	43	93
		% of Total	53.8 %	46.2 %	72.7 %
	TOTAL	Count	75	53	128
		% of Total	58.6 %	41.4 %	26.1 %
Lactating		Count	51	147	198
		% of Total	25.8 %	74.2%	40.4 %
pregnant		Count	67	97	164
		% of Total	40.8 %	59.2 %	33.5 %
Total		Count	193	297	490
		% of Total	39.4 %	60.6 %	100 %

The overall proportion of subjects who had co-occurrence of VAD and anemia was (42 %) ((81out of 193) anemic cases included in the study). A close association between vitamin A deficiency and anemia has been shown in many nutritional surveys from around the world, and perhaps this is not surprising, given the widespread prevalence of nutritional anemia and vitamin A deficiency in developing countries[16]. Most of these epidemiological surveys did not identify the underlying causes of anemia, and often the proportion of subjects with concurrent vitamin A deficiency and anemia are not stated. The surveys generally demonstrate that there is often a high prevalence of vitamin A deficiency and anemia in the same population. In the nutrition survey from Paraguay, hemoglobin and plasma retinol concentrations were highly correlated, with a correlation coefficient of 0.90 (Interdepartmental Committee on Nutrition for National Defense 1998). Pooled data from surveys conducted in Vietnam, Chile, Brazil, Uruguay, Ecuador, Venezuela, Guatemala and Ethiopia showed a high correlation (r=0.77, P<0.0001) between hemoglobin and plasma retinol concentrations.

A correlation between hemoglobin (Hb) and serum retinol (SR) concentrations has been described in many studies, including studies of preschool children from Pakistan r=0.367, P<0.0001); school-aged children in Central America (r=0.209, P<0.05) [20,21], school-aged children from Bangladesh (r=0.31, P<0.001;), adolescent girls in Malawi (r=0.161, P<0.08); [22,23].

In this study, A correlation between hemoglobin (Hb) and serum retinol (SR) concentrations has been described in 3 scatter diagrams, Figures **1**, **2**, and **3** among the three study groups.

A correlation between hemoglobin (Hb) and serum retinol (SR) concentrations among preschool children has been described, A close association between vitamin A deficiency and anemia with A correlation coefficient between SR and Hb concentrations was significant (P<0.0001).

A correlation between hemoglobin (Hb) and serum retinol (SR) concentrations among Lactating women. has been described, A close association between

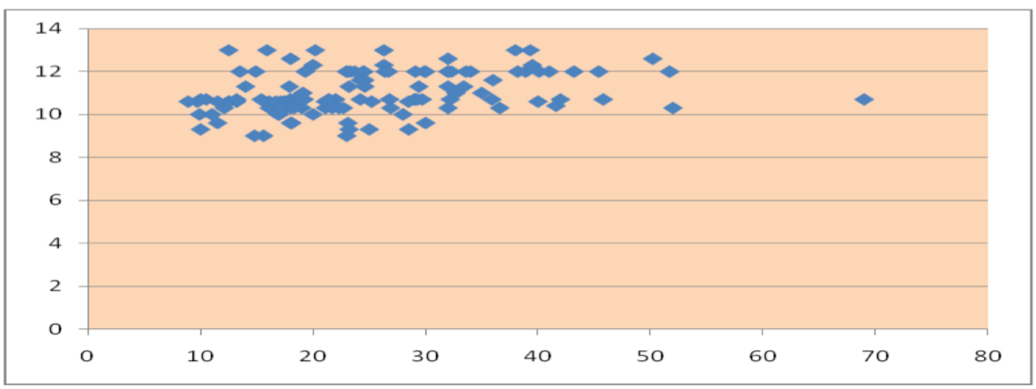

Figure 1: A scatter diagram of serum retinol levels (ug/dl) (X-axis) and Hb levels (gm/dl) (Y-Axes) among preschool children.

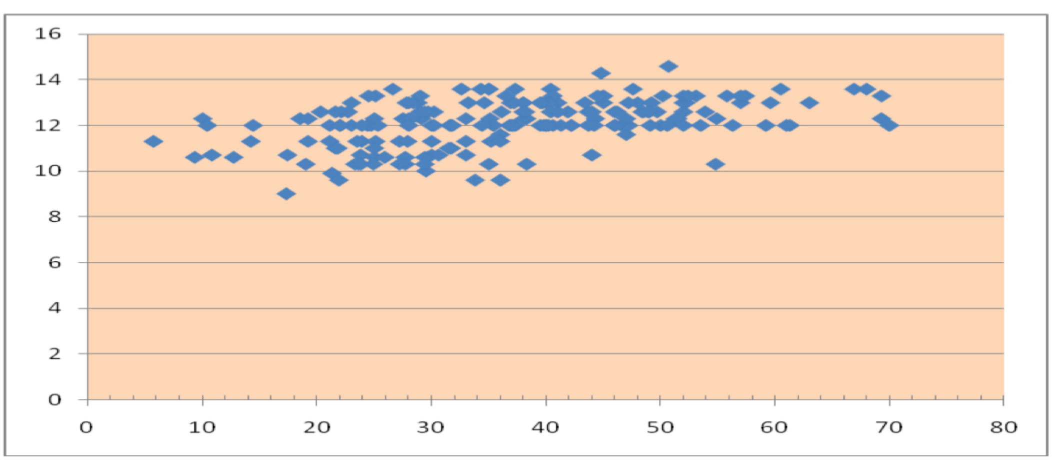

Figure 2: A scatter diagram of serum retinol levels (ug/dl) (X-axis) and Hb levels (gm/dl) (Y-Axes) among Lactating women.

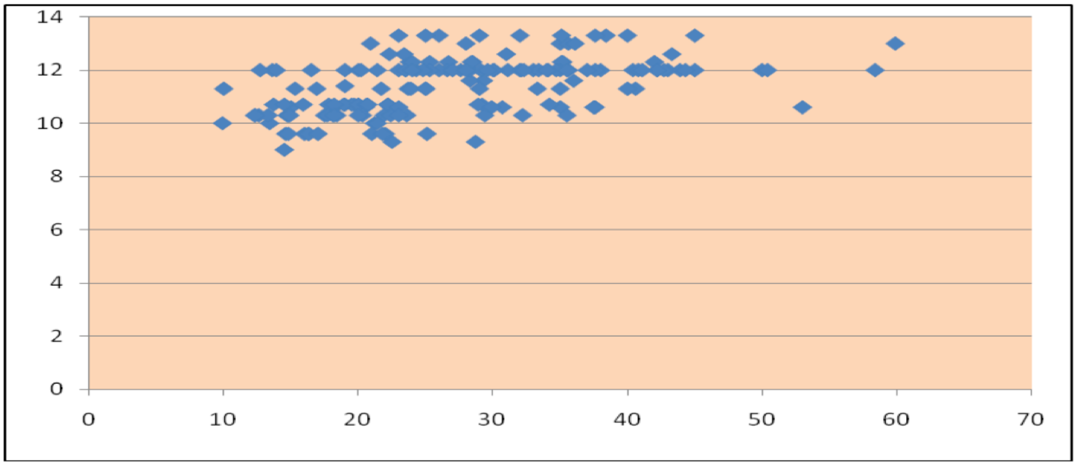

Figure 3: A scatter diagram of serum retinol levels (ug/dl) (X-axis) and Hb levels (gm/dl) (Y-Axes) among pregnant women.

vitamin A deficiency and anemia with A correlation coefficient between SR and Hb concentrations was significant (P<0.0001).

A correlation between hemoglobin (Hb) and serum retinol (SR) concentrations among pregnant women. has been described, A close association between vitamin A deficiency and anemia with A correlation coefficient between SR and Hb concentrations was significant (P<0.0001).

Vitamin A deficiency causes anemia through modulation of iron metabolism is strong and supported by observations from both experimental animal models and human studies. The hypothesis that vitamin A deficiency contributes to anemia through depressed immunity to infection and an increase in the anemia of chronic disease is reasonable.

Distributing VAD by frequencies of food group consumption shows that the least percentages of VAD were found in all food group frequency consumption patterns as shown in Figure **4** among all study groups with only a statistical significant association between frequencies of consuming meat and serum retinol concentration with a chi square (χ^2) value =9.92 for a df=2 and a P=0.007 (p<0.05) with differences between observed and expected values in pregnant and lactating women.

Proportions of VAD cases were distributed among growth indicators categories as shown in Figures **5**;

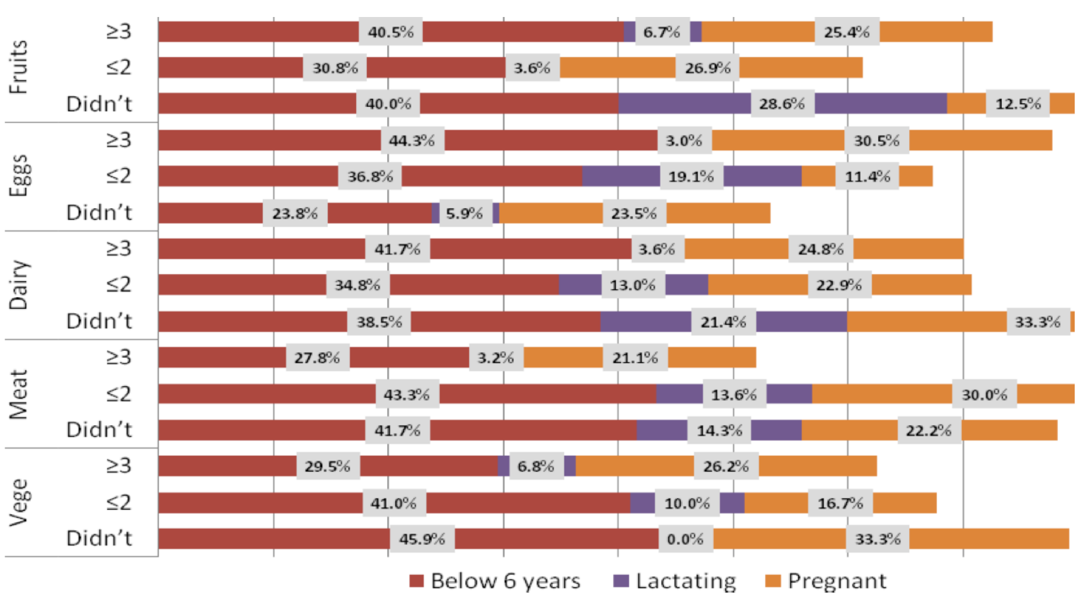

Figure 4: Proportion of VAD with frequency of food group consumed among study groups.

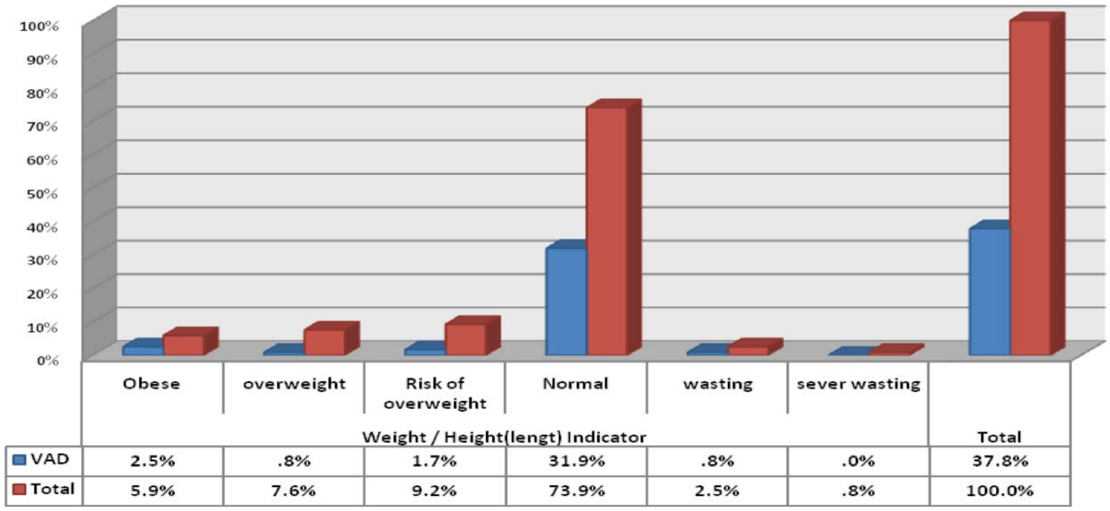

Figure 5: Distribution of VAD cases among Weight/Height (length) indicator categories.

which give an idea about the prevalence of VAD in relation to growth indicators.

CONCLUSIONS

This study shows that subjects in the 3 groups (preschool children, pregnant and lactating women) are at risk of VAD and anemia; nearly half of them had the co-occurrence of VAD and anemia. A close association between vitamin A deficiency and anemia with A correlation coefficient between SR and Hb concentrations was significant (N=490, r=0.533, P<0.0001) as proved in many studies.

RECOMMENDATIONS

The general recommendations are;

1) Food-based approach to prevent and control of VAD including dietary diversification , nutrition education and fortification of staple and value-added foods through increasing the variety and frequency of micronutrient rich food sources and improved food preparation and cooking methods.

2) Supplementation with vitamin A capsules with increasing interest in a multimicornutrient supplement to prevention and treatment vitamin A deficiency.

3) Effective nutrition education and information on health and nutrition to increase the demand for consumption of such foods using the available mass and multimedia like television and radio and supporting behavioral change to improve micronutrient intake.

4) Public health interventions such as immunization, adding vitamin A supplementation to national immunization days, promotion of breast-feeding and treatment of infectious diseases.

5) Iron supplementation is the most common strategy currently used to control iron deficiency in Iraq. It should also be considered as a preventive public health measure to control iron deficiency in populations at high risk of iron deficiency anemia.

6) Establish a nation-wide survey on VAD and anemia and create a national database on micronutrient deficiencies.

7) Further investigation is needed to identify risk factors and evaluate interventions to address nutrition programs towards preventing and controlling VAD and anemia nation-wide.

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