Is vitamin A deficiency a problem among pregnant Emirati women in Al-Ain City?

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هل يمثّل عَوَز الفيتامين A مشكلة بين الحوامل في مدينة العين الإماراتية؟

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الخلاصة: على الرغم من أن عَوَز الفيتامين A قد يؤدّي إلى تأثير سلبي على الحوامل، إلا أنه لم تجر دراسات في مدينة العين حول وضع هذا الفيتامين لدى الحوامل. وقد درس الباحثون 198 امرأة إماراتية من الحوامل اللواتي تـتراوح أعمارهن بين 15 — 49 عاماً، ممن يتردَّدن على عيادات رعاية الحوامل في منطقة العين الطبية (خلال المدة 1999 — 2000)، وذلك لتقدير مدى انتشار عَوَز الفيتامين A. وتم جمع معلومات اجتماعية ديمغرافية وصحية عن النساء من خلال استبيان، كما أجري لهن جميعاً تحليل للدم والمصل. ومن بين هؤلاء النساء المدروسات والبالغ عددهن 198 امرأة، تبيَّن أن 6 منهن فقط (أي بنسبة 3٪) يعانَيْن من عَوَز الفيتامين A (مقدار الفيتامين A في البلازما يقل عن 20 مكغ/دل) مما يدل على أن المشكلة خفيفة وفقاً لمعايير منظمة الصحة العالمية. و لم يُلاحظ أي ترابط يُعتَدّ به بين عَوَز الفيتامين A لدى النساء وبين أيٍّ من الخصائص الأخرى المدروسة. ومع أن القِيَم المتوسطة لجميع مَناسب الدم كانت أقل بشكل طفيف في المجموعة التي تعاني من عَوَز الفيتامين A، إلا أن ذلك لم يكن مما يُعتَدُّ به إحصائياً. وكان تناول الفيتامين A من المصادر الحيوانية منخفضاً، ولكن تناوله من المصادر النباتية كان كافياً.

ABSTRACT Vitamin A deficiency (VAD) can have a negative impact on pregnancy but there have been no studies in Al-Ain on the vitamin A status of pregnant women. We studied 198 pregnant Emirati women aged 15–49 years attending antenatal clinics in Al-Ain Medical District (1999–2000) to assess the prevalence of VAD. Sociodemographic and health information about the women was collected by questionnaire and they all underwent blood and serum analysis. Of the 198 women, only 6 (3%) had vitamin A deficiency (plasma vitamin A < 20 µg/dL), indicating only a mild problem according to WHO criteria. There was no significant association between the occurrence of VAD and any of the characteristics studied. While the mean values of all the haematological indices were slightly lower in the vitamin A deficient group, this was not significant.

La carence en vitamine A : un problème chez les femmes enceintes émiraties dans la ville d'Al Ain ?
RÉSUMÉ La carence en vitamine A peut avoir un impact négatif sur la grossesse mais aucune étude n'a été réalisée à Al Ain sur le statut en vitamine A des femmes enceintes. Nous avons examiné 198 femmes enceintes émiraties âgées de 15 à 49 ans qui fréquentaient les consultations prénatales dans le district médical d'Al Ain (1999-2000) afin d'évaluer la prévalence de la carence en vitamine A. Des données socio-démographiques et sanitaires sur ces femmes ont été recueillies par questionnaire et toutes les femmes ont subi une analyse de sang et de sérum. Sur les 198 femmes, 6 seulement (3 %) avaient une carence en vitamine A (vitamine A plasmatique < 20 µg/dL), indiquant uniquement un problème modéré selon les critères de l'OMS. Il n'y avait aucune association significative entre la survenue de la carence en vitamine A chez les femmes et l'une quelconque des caractéristiques étudiées. Les valeurs moyennes pour tous les indices hématologiques étaient légèrement inférieures dans le groupe de la carence en vitamine A mais cela n'était pas significatif.

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Introduction

Despite great collaborative efforts of many governmental and nongovernmental agencies, vitamin A deficiency (VAD) is still one of the most prevalent nutritional micronutrient deficiencies in the world. According to the estimates of the United Nations Children's Fund (UNICEF), more 100 million children worldwide have some degree of vitamin A deficiency [*1*]. The World Health Organization (WHO) database reports that between 100 and 140 million children in the world are vitamin A deficient; about 250 000–500 000 of them become night blinded as a result of VAD [*2*]. Furthermore, about 600 000 women die from childbirth-related causes every year, most of them due to complications that can be easily prevented by sound nutrition, including provision of vitamin A [*3*].

The physiological role of vitamin A in health and disease is well recognized and has been frequently discussed [*4–7*]. During pregnancy and lactation, vitamin A plays a vital role in placental and fetal development [*8*]. Davila and colleagues looked at the relationship between maternal diet and vitamin A status of lactating rats and their offspring [*9*].

From a public health point of view, the global interest in preventing and eradicating VAD arises from the seriousness of its consequences and multiple effects on human health, in particular the health of infants, children and women of reproductive age in developing countries. For instance, growth failure, dysfunction of the immune system, recurrent infections, conjunctivitis, keratomalacia, xerophthalmia and night blindness are the most common outcomes of VAD [*10*]. During pregnancy, VAD increases the incidence of abortions and stillbirths [*11*], in addition to increasing infant mortality rates during the first year of life as reported by Semba et al. who found that serum vitamin A was lower among mothers whose infants had died during the first year of life as compared with mothers whose infants had survived [*12*]. The impact of VAD on pregnant women themselves has also been studied. In 1998, in Nepal, Christian and his co-workers studied two groups of pregnant women: healthy versus night-blinded ones [*13*]. The results revealed that serum vitamin A and haemoglobin were significantly lower among mothers of the latter group as compared with the former one. In addition, night blinded ones were at higher risk of being severely anaemic. Dietary assessment showed that mothers with night blindness were consuming only small amounts of foods rich in vitamin A [*13*]. The same authors reported that the maternal mortality rate among night-blinded pregnant women was 5 times higher than that of healthy women [*14*]. Furthermore, supplementation of vitamin A and its precursors contributed effectively to reducing mortality rates among pregnant women [*14*].

To assess vitamin A status, WHO identified two main categories of indicator: direct (biological) indicators, which include biochemical indices; and indirect (ecological) indicators that include social, economic, nutritional and health factors [*15*]. WHO recommends that biological indicators be used in conjunction with other indicators, but only biological indicators can be used to verify vitamin A status [*15*].

Data about the vitamin A status in Arab countries are scarce. WHO encouraged Arab countries like Egypt, Jordan and Syrian Arab Republic to conduct national surveys to determine the magnitude of VAD among vulnerable groups in their communities. The results of these surveys revealed that about 9% of a sample of 1118 Syrian

children aged 6–71 months were vitamin A deficient while about 0.4% of pregnant and nursing women (n = 252 women) were deficient [*16*]; serum retinol less than 20 mg/dL was the cut-off point used for diagnosis of VAD [*15*]. In Jordan, a mild problem of VAD was detected among children aged 6–71 months (n = 400 children) with a prevalence of 4% [*17*]. However, no data are available in other Arab countries. Therefore we conducted this study as the first such study in the United Arab Emirates (UAE) to determine the prevalence and determinants of vitamin A deficiency among a sample of pregnant Emirati women in Al-Ain City, UAE.

Methods

Sample size and sampling method

This descriptive cross-sectional study was conducted during the period 1999–2000 in clinics belonging to three health directorates in Al-Ain Medical District, namely: Preventive Medicine (1 clinic), Primary Health Care (10 clinics) and Obstetric/gynaecology in Al-Ain Governmental Hospital (1 clinic). This study was part of another study which was measuring the prevalence of iron deficiency anaemia. We selected a convenience sample: when a pregnant woman came for routine blood check-up according to UAE Ministry of Health schedule, she was asked to give an additional blood sample (5 mL) for research purposes after explaining to her the main objectives of the research; if she agreed to participate, she was asked to sign the study consent form. No women were excluded for health reasons (only haemolytic or genetic diseases were criteria for exclusion) and only 10 declined to participate. Thus 723 pregnant women aged 15–49 years were recruited into the study. Of these, only 198 were UAE nationals and their data were eligible for analysis for this current study.

Data collection

Data were collected on a questionnaire completed by a nutrition specialist during a face-to-face interview with the women. The questionnaire was designed by the researchers and discussed and corrected by a committee from the nutrition department, the preventive medicine directorate and the primary health care directorate. There was a pilot study but the reliability and validity were not statistically assessed. There were 4 interviewers (2 males and 2 females) who were trained to administer the questionnaire. Information was collected on demographic, socioeconomic, educational, health and nutritional factors. A food frequency table was used to collect data about the consumption of foods rich in vitamin A.

Blood sampling and laboratory assessment

Under medical supervision, qualified personnel drew a 5-mL blood sample from the cubital vein of the pregnant women, using sterile syringes (Becton Dickinson, Vacutainer Systems, London, UK). Blood was collected in sterile vacuum tubes with EDTA and analysed for complete blood count. It was then centrifuged and the plasma collected and kept in Eppendorf Tubes® which were stored at –18 C° for further analysis. Plasma vitamin A was determined by qualified technicians using a high performance liquid chromatography (HPLC) method (Waters 2690 with 2586 UV/VIS detector) in the advanced laboratories of the Scientific Centre for Racing Camels.

Cut-off points for vitamin A deficiency

WHO criteria were used to diagnose VAD. Plasma vitamin A less than 20 µg/dL was used as the cut-off point for diagnosis [*11,15*]. According to this cut-off, WHO classifies the magnitude of the VAD problem into three categories: mild, when the prevalence ranges from 2% to < 10%; moderate, when the prevalence ranges from 10% to < 20%; and severe, when the prevalence is ≥ 20% [*15*]. For the diagnosis of anaemia, haemoglobin values less than 11 g/dL during the first trimester and less than 10.5 g/dL during the second and the third trimesters were used as cut-off points.

Statistical analysis

Data for the 198 eligible pregnant women (UAE nationals) were analysed using *Epi-Info*, version 6.04 and *SPSS*, version 11. The following statistical tests were used: *t*-test, chi-squared and correlation coefficient, in addition to some nonparametric tests. Missing values were not included in the statistical analysis. Statistical differences were considered significant at $P < 0.05$.

Results and discussion

Sociodemographic and health characteristics

The pregnant Emirati women in the sample constitute about 27.4% of the original sample. This percentage of local women is similar to the proportion of Emirati women among the UAE population (24.4%) reported in the national census of 1995 [*18*].

Table 1 shows the sociodemographic characteristics of the women in our sample. About 60% were aged 21–30 years, about 53% of them got married between 16 and 20 years of age. More interestingly, 26.5% of the women had married between

Table 1 **Sociodemographic characteristics of the pregnant Emirati women**

Sociodemographic characteristic	%
Health directorate (n = 198)	
Primary Health Care	24.2
Preventive Medicine	3.6
Al-Ain Hospital obstetric clinic	72.2
Woman's age (years) (n = 193)	
15–20	10.4
21–30	59.6
31–40	26.4
41–49	3.5
Woman's age at marriage (years) (n = 189)	
12–15	26.5
16–20	52.9
21–25	16.9
26–30	3.2
31–38	0.5
Woman's trimester of pregnancy (n = 194)	
First	13.9
Second	32.5
Third	53.6
Woman's educational level (n = 198)	
No schooling (illiterate)	21.7
Low (read and write/primary school)	19.7
Moderate (middle/secondary school)	40.4
High (graduate/postgraduate)	18.2
Woman's working status (n = 198)	
Working outside the home	13.1
Not working outside the home	86.9
Family type (n = 198)	
Extended	50.5
Nuclear	49.5
Family size (persons)(n = 198)	
≤ 8	48.5
> 8	51.5
Crowding index (n = 197)	
≤ 1	17.3
1–< 2	52.8
2–< 3	20.8
≥ 3	9.1

12 and 15 years of age which would increase their nutritional burden being both adolescent and pregnant at the same time. This would put them more at risk of being malnourished, especially as a result of micronutrient deficiencies.

Data in Table 1 also show that about 54% of the women were in the third trimester, 40% were moderately well educated, while only about 22% of them were illiterate. This is in line with the results of the UAE family health survey (UAE-FHS) [*19*]. Furthermore, most of the women (87%) were not working outside the home.

Just over half (50.5%) the women lived in extended households and 51.5% had over 8 persons in the family, a result similar to that reported in the UAE-FHS [*19*]. About 53% of the studied households had a crowding index (denoted by the number of co-residents per room) of 1 to 2 which included the mean value of crowding index for UAE (1.4) reported in UAE-FHS [*19*].

Regarding health status, about 45% of the women had been anaemic at least once in some point in their lives before the current pregnancy (Table 2), while 26.2% of them were anaemic at the time of this study. Table 2 also shows that only 55.1% of pregnant women were taking prenatal multivitamins on a regular basis (i.e. taking multivitamins tablets daily as prescribed by the physician). About 37% of the women had had at least one previous miscarriage. Data of anthropometry (Table 2) revealed that before the current pregnancy about 48% of the women had a normal body mass index, according to WHO classification [*20*], 11% of them were underweight while about 10% of them were obese. About 82% of the women visited the antenatal clinic regularly as per the UAE-MOH antenatal schedule. However, according to UAE-FHS only about 73% of pregnant women had a regular pattern of visiting antenatal clinics during pregnancy [*19*].

Table 2 **Health characteristics of the pregnant Emirati women**

Health characteristic	% (*n* = 198)
Anaemia before pregnancy	
Yes	44.9
No	50.5
Don't know	4.6
Current anaemia	
Anaemic	26.3
Non-anaemic	73.7
Prenatal multivitamins	
Regular intake	55.1
Irregular intake	44.9
Number of miscarriages	
None	63.1
1–2	34.3
> 2	2.6
Clinic attendance	
Regular	81.8
Not regular	18.2
Body mass index before pregnancy[a] (n = 89)[b]	
< 18.5 kg.m^2 (underweight)	11.2
18.5–24.9 kg/m^2 (normal)	48.3
25.0–29.9 kg/m^2 (pre-obese)	30.3
30.0–34.9 kg/m^2 (obese I)	5.6
35.0–39.9 kg/m^2 (obese II)	4.5

[a] According to World Health Organization classification [20].
[b] This could not be calculated for the whole sample as only 89 women knew or remembered their pre-pregnancy weight.

Consumption pattern of vitamin A rich food sources

According to the WHO recommendation, more than one indicator in addition to plasma vitamin A should be used to assess the nutritional status of vitamin A among vul-

nerable groups in a community [*15*]. Consuming food sources rich in vitamin A at least 3 times a week by more than 75% of the population is considered a healthy indicator which minimizes the risk of being vitamin A deficient [*15*]. The results in Table 3 show the consumption pattern of the women in our study of selected food sources rich in vitamin A. Tomato, lettuce and orange were consumed at least 3 times weekly by 89.7%, 77.5% and 76.9% of the women respectively, followed by dates, carrots and eggs (about 70%). However, garden rocket and radish leaves which are very popular dark green leafy vegetables in UAE, were consumed by only about 50% of the women. Although the consumption of animal sources of vitamin A was low, the consumption of tomato, lettuce and orange, together with other plant sources rich in vitamin A, would, it is hoped, be enough to reduce VAD through the provision of beta carotene, a vitamin A precursor in the body.

Table 3 **Consumption of selected food sources rich in vitamin A by the pregnant Emirati women**

Food item	Percentage of the women consuming the food item:	
	< 3 times per week	≥ 3 times per week
Liver (***n*** = 182)	98.4	1.6
Tuna (***n*** = 181)	91.7	8.3
Sardines (***n*** = 181)	99.4	0.6
Eggs (***n*** = 180)	30.0	70.0
Garden rocket (***n*** = 182)	47.8	52.2
Radish leaves (***n*** = 183)	48.1	51.9
Spinach (n = 180)	97.2	2.8
Jew's mallow (***n*** = 180)	98.3	1.7
Grape leaves (***n*** = 181)	96.1	3.9
Mint (***n*** = 182)	62.6	37.4
Parsley (***n*** = 180)	40.6	59.4
Lettuce (***n*** = 182)	22.5	77.5
Cabbage (***n*** = 181)	53.6	46.4
Tomatoes (***n*** = 165)	10.3	89.7
Carrots (***n*** = 182)	30.2	69.8
Green peppers (***n*** = 180)	58.3	41.7
Oranges (***n*** = 182)	23.1	76.9
Dates (***n*** = 182)	29.7	70.3

n ***= number of women for whom data were available.***

Prevalence of vitamin A deficiency

According to WHO criterion (plasma vitamin A < 20 μg/dL), 3% of the women in our sample were suffering from VAD (Table 4). This result represents the first datum about the nutritional status of vitamin A among pregnant women in UAE in general, and in Al-Ain in particular.

Although this result indicates that VAD does exist among pregnant women in Al-Ain City, the problem is not serious in terms of severity. According to WHO, a VAD prevalence of 3% is considered a mild problem [*15*]. The actual mean value for plasma vitamin A among the deficient group was 17.2 mg/dL with a minimum value of 15.5 mg/dL (results not tabulated). These values are relatively high compared with

Table 4 **Prevalence of vitamin A deficiency among the pregnant Emirati women in Al-Ain city**

Vitamin A status	No.	%
Vitamin A deficient[a]	6	3
Vitamin A sufficient	192	97
Total	198	100

[a]Plasma vitamin A < 20 μg/dL according to the World Health Organization criterion [11,15***].***

the cut-off point (10 mg/dL) below which clinical symptoms of VAD start to appear [*21*]. In addition, the food consumption pattern shown in Table 3 supports the idea that a VAD problem in Al-Ain should only be mild.

Table 5 shows the haematological indices of the 6 women found to have VAD compared with those without VAD. There were no statistical differences between the mean values of these indices for the two groups. However, the mean values of all the haematological indices were slightly lower in the vitamin A deficient group. Furthermore, non-parametric analysis (data not tabulated) showed that there was no association between vitamin A status (expressed as sufficient or deficient) of the women and their anaemia status (anaemic or non-anaemic) (Fisher exact test, $P = 0.1869$). This again suggests that the problem of VAD is mild and did not affect erythrpoiesis for these women. In contrast, Nepali pregnant women who developed night blindness due to severe VAD were at higher risk of developing severe anaemia as compared with healthy pregnant women [*13*]. Furthermore, the night-blinded women had significantly ($P = 0.004$) lower haemoglobin levels than those of healthy pregnant women, due to impaired erythrpoiesis [*13*].

Indicators other than plasma vitamin A that can be used to assess the vitamin A status and can be considered to be risk factors for VAD also suggest a low risk of there being a VAD problem in UAE. These indices include: infant mortality rate, which is considered as risk factor for VAD when exceeding 75 cases per 1000 live births, and the under-5 mortality rate that is a risk factor when exceeding 100 cases per 1000 live births. The corresponding values for these indicators in UAE were 15 and 18 cases per 1000 live birth respectively according to UNICEF estimates in 1998 [*1*], far lower than would suggest a VAD problem. Illiteracy among women aged 15–44 years is another risk factor of VAD when exceeding 50% [*15*]. According to the results of our study, illiterate women only

Table 5 **Haematological values of the vitamin A deficient[a] versus vitamin A sufficient pregnant Emirati women**

Haematological index	Vitamin A status			
	Deficient[b]		Sufficient[c]	
	Mean	SD	Mean	SD
Haemoglobin (g/dL)	10.6	1.39	11.1	1.21
Haematocrit (%)	31.7	3.42	33.7	3.23
Mean cell volume (fL)	77.3	11.02	79.7	8.18
Mean cell haemoglobin (pg/mL)	25.8	4.38	26.4	3.34
Mean cell haemoglobin concentration (%)	33.3	1.18	33.0	1.03
Ferritin (ng/mL)	12.0	10.91	15.3	19.30

No significant statistical differences were found between vitamin A deficient and sufficient women for all the indices, t-***test (***P ***e" 0.05).***
[a]***Plasma vitamin A < 20*** *μ*g***/dL [***11,15***].***
[b]***For all indices,*** n ***= 6 women, except for ferritin where data were only available for 5 women.***
[c]***For all indices,*** n ***= 192 women, except for ferritin where*** n ***= 134.***
SD = standard deviation.

constituted about 22% of the sample, which, in addition to the other two indicators mentioned, suggests no or very low risk of a VAD problem in UAE. All of these indicators can explain the low prevalence of VAD (3%) among the studied sample.

We were unable to define any determinants of VAD as our sample of VAD women (n = 6) was too small for any valid results to be derived.

Conclusion

This study provides the first data about VAD among pregnant women in Al-Ain City in the UAE. It suggests that VAD is no more than a mild problem among pregnant Emirati women in Al-Ain. Since the WHO goal is to eliminate VAD globally and since the problem in our country is clearly a mild one, efforts should be directed to achieve this objective and bring about a complete elimination of VAD in UAE. Establishment of a comprehensive national plan, including flour fortification with vitamin A, iron and folic acid, could effectively contribute to the complete elimination of VAD and a reduction of other micronutrients deficiencies in UAE.

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Partnerships for progress

In 1998 WHO and its major partners – UNICEF, the Canadian International Development Agency (CIDA), the US Agency for International Development (USAID) and the Micronutrient Initiative (MI) – launched the Vitamin A Global Initiative. In addition, over the past few years, WHO, UNICEF and other partners have provided support to countries to deliver vitamin A supplements through immunization programmes. For example, in 1998 alone, vitamin A supplements were delivered through national immunization days to children in 40 countries. Further information on vitamin A deficiency is available at: http://www.who.int/nut/vad.htm