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VITAMIN A STATUS OF HEALTHY INFANTS IN ANKARA, TURKEY*

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SUMMARY: Hatun Ş, Teziç T. (Department of Endocrinology, Dr. Sami Ulus Children's Hospital, Ankara, Turkey). Vitamin A status of healthy infants in Ankara, Turkey. Turk J Pediatr 1995; 37: 187-192.

Vitamin A deficiency is considered widespread health problem among children in developing countries. There are a limited number of studies related to the vitamin A status of children in Turkey. We studied serum vitamin A levels in 80 healthy children less than 2 years of age admitted to Dr. Sami Ulus Children's Hospital for measles immunization. Vitamin A levels were determined by high performance liquid chromatography, and ranged from 8.5 to 34 µg/dl (mean 23.54 ± 6.86 µg/dl). We have shown that subclinical vitamin A deficiency is an important public health problem in Ankara, as approximately 30 percent of the children examined were found to have low levels of serum vitamin A (< 20 µg/dl).
Key words: vitamin A deficiency, child health, infant, Turkey.

Vitamin A, discovered in 1913, has such metabolic functions in the human organism as ensuring the integration of epithelial cells, growth, reproduction, vision and adjuvant actions of the immune system[1]. Vitamin A deficiency is one of the important nutritional deficiencies in developing countries and plays an important role in the vicious infection-malnutrition cycle (Fig. 1)[2].

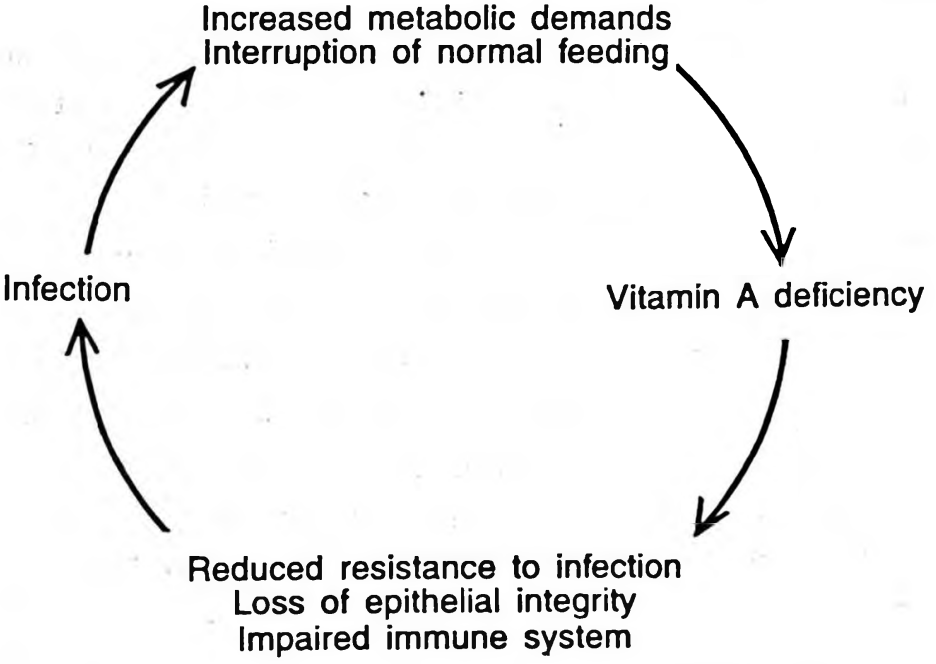

Fig. 1: Cycle of disease and vitamin A deficiency (2).

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Following the attention drawn to its anti-infective effects as early as 1928[3], vitamin A has once more become the focal point with the work in the early 1980s of Alfred Sommer et al[4,5]. Subsequent studies have revealed that deficiency of vitamin A resulted in respiratory and gastrointestinal infections[4], and that administration of this vitamin in cases of deficiency reduced the one-to five-year-old child mortality by as much as 35 percent[5]. These studies have contributed to the development of a significant nutritional initiative program with vitamin A during the childhood period.

According to World Health Organization (WHO) criteria, when the serum vitamin A level is less than 10 µg/dl in more than five percent of the population, there is a serious public health problem[6]. As for Pan-American Health Organization (PAHO) criteria, a public health problem arises when 15 percent or more of the population display serum vitamin A levels of 20 µg/dl or less[6]. These criteria suggest that many parts of the world, particularly African and Southeast Asian countries, suffer serious problems arising from vitamin A deficiency[4,5].

In Turkey, there have been a few studies related to vitamin A deficiency, most of which have been done on children with malnutrition[7-10]. Our hospital plans to provide vitamin A to healthy children also residing in the slum area in the immediate vicinity. This study aims to examine the vitamin A levels of children under two years of age to determine whether vitamin A deficiency constitutes a problem in our area.

Material and Methods

Eighty infants who were brought to Dr. Sami Ulus Children's Hospital for measles immunization were considered for enrollment in this study. Date of birth, sex, home area, education of the mother, number of children in the family, whether they were breast-fed at the time of reporting to the hospital and whether they received vitamin support and had an infection during the last three months were recorded.

A complete physical examination was done on all infants, and their weight percentiles by age were calculated according to Neyzi et al. Standards for Turkish Children[11].

Five milliliter venous blood samples were taken from all infants, and serum obtained by centrifugation was stored at -30 °C. The samples were kept away from sunlight during all procedures. Serum vitamin A levels (as retinol) were determined by the high-pressure liquid chromatography method (Beckmann Instruments, Inc., Altex Scientific Operations, California 94710, USA).

The determined serum vitamin A levels were classified according to sex, living environment (slum or residential area), maternal education (primary school, junior or senior high school and university), those who received vitamin support and had previous infections, and the results were compared. An inquiry was then made into the relations of the above parameters with groups in which the serum vitamin A levels were < 10 µg/dl and < 20 µg/dl.

All values are reported as meas ± SD. Chi square and Fisher exact chi square tests were used for the comparison of group ratios. Differences in the means of the two groups were compared using the Student's t test; the means of more than two groups were compared by one-way analysis of variance. The Pearson correlation analysis was used for determining the relation between the number of infants and vitamin A levels. Statistical analyses were performed with an SPSS for Windows V 5.01.

Results

The ages of the 80 infants included in the study ranged from 9 to 17 months, with a mean of 10.36 ± 1.40 months. The weight percentile mean was 24.2 ± 14.3, and none of the children had malnutrition according to weight percentile. The male/female ratio was 1.2. Thirty-six (45%) infants were from families living in slum areas, 32 (40%) received vitamin support and 30 (37.5%) had at least one respiratory tract infection during the previous three months. Ten percent of the mothers were illiterate, 46 percent had primary and 44 percent had senior high school or university educations. Eighty-five percent of the families had one or two children.

The mean serum vitamin A level was 23.54 ± 6.86 µg/dl (range 8.5-34.0 µg/dl). Thirty percent of the infants (24 infants) had serum vitamin A levels of less than 20 µgm/dl, while 1.3 percent (one infant) had a level < 10 µg/dl. The relations of serum vitamin A levels to various other parameters are given in Table I.

Table I: Vitamin A Status of Children According to Various Parameters

	Serum Retinol Level < 10 µg/dl	P*	No.with Retinol Level (µg/dl)	P*	No.with Retinol < 20 µg/dl	P*
Male (n: 44)	23.15±6.63	NS	15 (34.1%)	NS	0	NS
Female (n: 36)	23.98±7.11		9 (25%)		2 (2.8%)	
Slum areas (n: 36)	22.67±6.71	NS	12 (33.3%)	NS	1 (2.5%)	NS
Residential areas (n: 44)	24.22±6.94		12 (24.0%)		0	
Infections during the previous three months (n: 30)	22.57±7.56	NS	10 (33.3%)	NS	1 (28%)	NS
No. infections during the previous three months (n: 50)	24.10±6.35		14 (28.0%)		0	
Those receiving vitamin support (n: 92)	26.20±7.12	0.004	6 (15.8%)	0.07	0	NS
Those not receiving vitamin support (n: 48)	21.75±6.05		18 (37.5%)		1 (2.8%)	
Total (n: 80)	23.54±6.86		24 (30%)		1 (1.3%)	

$p < 0.05$ was considered significant; NS: not significant.

When the relationship of serum vitamin A levels with the above parameters were analyzed, only the group who received vitamin A support had significantly higher levels than those who did not. The other parameters did not display significant differences in serum vitamin A levels. There was no correlation between serum vitamin A level and the number of children in the family ($r = 0.2030$: $p = 0.07$).

Discussion

Vitamin A deficiency occurs as a result of low dietary intake, absorption disorders, problems related to the conversion of carotene into vitamin A and its transportation within the body, and rapid losses of vitamin A[1]. As a general rule, vitamin A deficiency occurs more frequently among preschool-age children; however, studies done in Asia and Africa suggest that the weaning period is a period of special risk[6]. WHO defines two main groups among those considered to be at high risk from the viewpoint of vitamin A deficiency[6]. The countries in the first group where xerophthalmia and nutritional blindness constitute serious public health problems are Tanzania, India and Indonesia, while the second group comprises countries where vitamin A deficiency does not constitute a significant health problem, though a continuous monitoring of its eventual consequences is recommended. According to WHO, Turkey is among the countries in the second group.

In our study, the vitamin A deficiency rate (< 20 µg/dl) in children under two years of age having no acute infections or malnutrition was found to be 30 percent. As for those having serum vitamin A levels of less than 10 µg/dl, the rate was 1.3 percent. Considering the criteria established by PAHO, vitamin A deficiency appears to be a problem in this country, although the WHO criteria do not corroborate this statement. A recent study, carried out in the semi-urban areas of Ankara on children with recurrent diarrhea and/or respiratory tract infections, revealed that 60.7 percent of the population have serum vitamin A levels of less than 20 µg/dl, while rates below 10 µg/dl were found in 3.7 percent of children[10]. Another study discovered 9.3 percent vitamin A deficiency (< 20 µg/dl) among healthy school-age (7 to 17 years of age) children[12]. Our study is the first of its kind on healthy infants and suggests that vitamin A deficency is a problem which should be considered.

The results of this study indicate that there is no correlation between vitamin A deficency and sex, inhabited area and infections suffered during the previous three months. Though a statistically significant difference was not noted, the vitamin A deficiency rate (< 20 µg/dl) was higher among those inhabiting slum areas and not receiving vitamin A support. These results suggest that a nutritional initiative program should be a priority in the slum areas.

Several previous studies revealed that subclinical vitamin A deficiency (< 20 µg/dl) constitutes a major risk to infant health[13-15]. Similarly, vitamin A support given

to children at risk significantly reduces infant mortality[16]. A recent study done in Sudan indicates that the rate of diarrhea is reduced among children to whom vitamin A support is provided[17].

In conclusion, our study and the previous studies done in this country show that vitamin A deficiency is an important child health problem. For this reason, initiation of vitamin A support programs must be considered without delay, preferably integrated into immunization programs similar to those introduced in countries where vitamin A deficiency is a public health problem. Otherwise, "One child will die needlessy from vitamin A deficiency every minute we will wait"[18].

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REFERENCES

1. Olson JA. Vitamin A, retinoids, and carotenoids. In: Shills M, Young V (eds). Modern Nutrition in Health and Disease. Philadelphia: Lea and Febiger; 1988: 292-312.
2. Karyadi D. Vitamin A problems in South East Asia with special reference to its impact on child health. In: Visser HKA, Bindels JG (eds). Child Nutrition in South East Asia. Boston: Kluwer Academic Publishers; 1990: 21-35.
3. Green HN, Mellanby E. Vitamin A as an anti-infective agent. Br Med J 1928; 111: 691-696.
4. Editorial. Vitamin A and malnutrition/infection complex in developing countries. Lancet 1990; 336: 1349-1351.
5. Sommer A. Vitamin A, infectious disease, and childhood mortality: a 2 cent solution? J Infect Dis 1993; 167: 1003-1007.
6. Eastman SJ. Vitaminn A: deficiency and exophthalmia. UNICEF Press, 1988.
7. Kurdoğlu Ç, Gürson CT. Serum vitamin A and carotene levels in marasmic type of PEM. XVth International Pediatric Congress, New Delhi, 1977.
8. Hasanoğlu A, Özalp I. Serum vitamin A and carotene levels in children with PEM. Çocuk Sağılığı ve Hastalıkları Dergisi 1979; 22: 159-164.
9. Tanzer F, Sağnak K, Çağlar Y. Eye findings and serum vitamin A levels in children with malnutrition from Sivas. Doğa 1986; 10: 65-71.
10. Büyükgebiz B, Özalp I, Oran O. Investigation of serum vitamin A levels of children who had a history of recurrent diarrhoea and acute respiratory infections in Ankara. J Trop Pediatr 1990; 36: 251-255.
11. Neyzi O, Binyıldız P, Alp H. Türk Çocuklarında Büyüme-Gelişme Normları I. Tartı ve Boy Değerleri. İstanbul Tıp Fakültesi Mecmuası 1978; 41: 74.
12. Açkurt F, Wetherilt H, Okan B, Brubacher G, Aktaş S, Türdü S. Türkiye'nin Üç Bölgesinde 7-17 Yaş Grubu Okul Çocuklarının Büyüme-Gelişme, Vitamin ve Mineraller Yönünden Beslenme durumlarının Saptanması. TÜBİTAK Press, Ankara, 1989.
13. Sommer A, Tarwotjo I, Djunaedi E, et al. Impact of vitamin A supplementation on childhood mortality: a randomized controlled community trial. Lancet 1986; 1: 1169-1173.
14. Sommer A, Katz J, Tarwotjo I. Increased risk of respiratory disease and diarrhea in children with preexisting mild vitamin A deficiency. Am J Clin Nutr 1984; 40: 1090-1095.

15. Bloem MW, Wedel M, Eger RJ, et al. Mild vitamin A deficiency and risk of respiratory tract diseases and diarrhea in preschool and school children in northeastern Thailand. Am J Epidemiol 1990; 131: 332-339.

16. Fawzi WW, Chalmers TC, Herrera MG, Mosteller F. Vitamin A supplementation and child mortality. A meta analysis. JAMA 1993; 269: 898-903.

17. El Bushra HE, Lawrence R, Coulson AH, Neumann LG. Interrelationship between diarrhoea and vitamin A deficiency: is vitamin A deficiency a risk factor for diarrhoea? Pediatr Infect Dis J 1992; 11: 380-384.

18. Humphrey JH, West KP JR, Sommer A. Vitamin A deficiency and attributable mortality among under 5-year-olds. Bull World Health Organ 1992; 70: 225-232.