Serum total proteins and vitamin A levels of adolescent girls (10-15 years) attending a government school in Jaipur city, India

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ABSTRACT

Vitamin A deficiency is widely prevalent amongst children in India. The present work was designed to be an intervention study with nutrient fortified biscuits to ameliorate the micronutrient status of adolescent girls coming from a low socio-economic background. Baseline data on serum total proteins and vitamin A levels of 111 adolescent girls (10-15 years) studying in a government school in Jaipur city, India, were collected. The mean serum total proteins of the subjects of the present study was 6.80 ±0.726 g%. A very high percentage of the adolescent girls (90.1%) had serum total proteins in the normal range (>=6.0g%) and only 9.9% of the adolescent girls had serum total proteins at low levels (<6.0g%). The mean serum vitamin A level of all subjects was 21.82 ± 6.579 mcg/dl. About 51% of the subjects were in the 'normal' category (serum vitamin A >=20 mcg/dl), 47.3% of the subjects were in the 'low' category (serum vitamin A between 10-19 mcg/dl) and only 1.8% subjects were in the 'deficient' category with serum vitamin A levels < 10 mcg/dl. The results, therefore, indicated that about 49.1% of the subjects had low levels of serum vitamin A. It is recommended that the school system can be used to distribute micronutrient fortified food products to mitigate the problem of nutrient deficiencies amongst school going children.

Keywords: Serum total proteins, vitamin A levels, adolescent girls, Jaipur city, India.

INTRODUCTION

Vitamin A deficiency has been recognized to be a major controllable public health and nutritional problem. Studies conducted by Indian Council of Medical Research (ICMR) have shown that the overall prevalence of conjunctival xerosis and bitot's spots were 4.2% and 2.9% respectively, for all regions studied- Calcutta, Hyderabad, Mumbai, New Delhi, Poone and Vellore.[1] The National Nutrition Monitoring Bureau (NNMB) surveys conducted between 1975–79 demonstrated that the prevalence of bitot's spots in pre-school children was on an average 1.8% in 9 states of Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttar Pradesh and West Bengal. Surveys repeated in the same areas (1988-90) indicated a decline in the prevalence rate from 1.8% to 0.7%.[2] The overall prevalence of bitot spots was found to be about 0.8% in <5 year old children (n=71,591) from eight states viz., Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Orissa, Tamil Nadu, Maharashtra and West Bengal in the years 2002-03,[3] which was comparable to the figures reported by NNMB in 2000-2001 (0.8%)[4] and the district level micronutrient survey by ICMR (0.7%).[5] In the age group of 1-5 years (n=3,934), 61.8% children had vitamin A levels <20 mcg/dl.[3] However, the overall prevalence of vitamin A deficiency using bitot's spot as a clinical indicator was found to be 1.2% amongst children in the age group of 6-11 years in the national capital territory of Delhi.[6] In Jodhpur, Barmer and Jaisalmer districts of Rajasthan, 7.4% children were detected to have xerophthalmia due to vitamin A deficiency.[7] About half (42.6%) of the urban children (6-35 months) living with their mothers had consumed vitamin A rich foods in the last 24 hours and 15.1% urban children aged 6-59 months had received vitamin A supplements in the last 6 months in Rajasthan.[8]

Adolescent girls are a marginalized group in any society more so when they belong to the low socio economic group and come from slums. This research paper is a part of an intervention study where biscuits fortified with nutrients as vitamin A, iron, folic acid, iodine and ascorbic acid were used to supplement the diets of adolescent girls attending a government school. The girls suffer from malnutrition and have multiple micronutrient deficiencies, hence, this study was an attempt to determine their micronutrient status. The current paper presents the baseline data on the serum total proteins and vitamin A levels of adolescent girls attending a government school located in a slum in Jaipur city, India.

MATERIALS AND METHODS

Ten government schools in Jaipur city were visited. The willingness of the Principal of the school to participate in the study, adequate number of girl students in a separate section in higher classes and the school being close to the University campus for logistic reasons were the points for consideration in the selection of the school. All adolescent girls (n=148, 10-16 years) studying in classes VI to VIII attending a government school fulfilling all criteria, and residing in a slum where the school was situated comprised the sample for the study. After collecting personal, anthropometry and nutrient intake data, baseline levels of serum total proteins and vitamin A could be determined for 111 adolescent girls (10-15 years) as few students were absent on the day of blood collection and in some cases blood/serum was not adequate for analysis. The blood collection was carried out in Jaipur and the blood samples were analysed for serum total proteins and vitamin A at All India Institute of Medical Sciences, New Delhi.

Blood was collected in labeled plain vials. Serum was separated from blood in plain vials and transferred to labeled vials for transport to New Delhi for analysis packed with dry ice in thermocole boxes. Serum total protein was estimated by the biuret method as per the kit of Randox Laboratories Ltd., UK. Serum vitamin A was analysed by an improved trifluoroacetic acid method as proposed by Bradley and Hornbeck.[9] The data were collected from July 2004 to December 2004. The study was approved by the Departmental Ethics Committee, and written consent for participation in the study was obtained from the parents of the adolescent girls.

Table-1: Serum total proteins and vitamin A levels of adolescent girls

	Serum total protein			Serum vitamin A			
	Total	Normal	Low	Vitamin A	Normal	Low	Deficient
	Protein	(>=6.0g%)	(<6.0g%)	(mcg/dl)	(>=20mcg/dl)	(10-19mcg/dl)	(<10mcg/dl)
	(g%)						
Total sample	(n=111)			(n=110)			
	6.80	100 (90.1)	11 (9.9)	21.82	56 (50.9)	52 (47.3)	2 (1.8)
	±0.726			±6.579			
10+ years	(n=15)			(n=14)			
	6.41	13 (86.7)	2 (13.3)	23.94	9 (64.3)	5 (35.7)	0
	±0.459			±6.810			
11+ years	(n=18)			(n=18)			
	6.77	16 (88.9)	2 (11.1)	23.48	12 (66.7)	5 (27.8)	1 (5.6)
	±0.666			±6.546			
12+ years	(n=29)			(n=29)			
	6.71	25 (86.2)	4 (13.8)	23.57	18 (62.1)	11 (37.9)	0
	±0.883			±6.772			
13+ years	(n=30)			(n=30)			
	6.91	27 (90.0)	3 (10.0)	19.49	11 (36.7)	19 (63.3)	0
	±0.706			±4.958			
14+ years	(n=8)			(n=8)			
	7.14	8 (100.0)	0	20.21	2 (25.0)	5 (62.5)	1 (12.5)
	±0.573			±9.468			
15+ years	(n=11)			(n=11)			
	7.09	11 (100.0)	0	19.26	4 (36.4)	7 (63.6)	0
	±0.644			±5.518			

Mean ± SD.: Figures in parentheses denote percentages.

Acceptable levels of serum proteins for 6-17 year old children were considered to be ≥ 6.0 g/100 ml, and low levels when these were below 6.0g/100 ml.[10] The cut off points for serum retinol were taken as < 10 mcg/dl as deficient and between 10-19 mcg/dl as low. The acceptable values were taken to be between 20-49 mcg/dl.[11] Low serum vitamin A values are suggestive of a depleted state, with or without the presence of clinical signs of deficiency.

RESULTS

Serum total protein levels: Serum total proteins can be used as an indicator of protein nutrition status. The mean serum total proteins in the subjects of the present study was 6.80 ±0.726 g% (Table-1) ie., above the acceptable level of serum total protein level of 6.0 g%. The mean serum total protein levels of the subjects (n=111) in all the ages were in the acceptable range, the means being higher than 6.0 g%. A very high percentage of the subjects (90.1%) had serum total proteins in the normal range and only 9.9% of the subjects had serum proteins at low levels. On the whole, the subjects had adequate

protein status. Looking at the data age wise, high percentage of girls in the younger ages of 10^+ to 13^+ years had low levels of serum total protein levels as compared to the older girls in the ages of 14^+ and 15^+ years where none of the girls had low serum total protein levels. Conclusively, girls of the younger age groups had low mean serum total protein levels relative to girls in the older age groups (Table-1).

Serum vitamin A levels: The mean serum vitamin A level of all subjects was 21.82 ± 6.579 mcg/dl (Table-1). About half of the subjects (50.9%) were in the 'normal' category (serum vitamin A >=20 mcg/dl), 47.3% of the subjects were in the 'low' category (serum vitamin A between 10-19 mcg/dl) and only 1.8 % subjects were in the 'deficient' category with serum vitamin A levels < 10 mcg/dl. The results, therefore, indicated that 49.1% of the subjects had low levels of serum vitamin A. An age wise analysis of the data revealed that high percentages of girls (62.5% to 63.6%) with low levels of serum vitamin A were in the older ages of 13^+ to 15^+ years as compared to those of girls (27.8% to 37.9%) in the younger age groups. Hence, the mean serum vitamin A levels were higher for the younger ages in relation to those of the older ages (Table-1).

DISCUSSION

Vitamin A status of 1,956 children (0-12 years) of socio-economically backward families from slums of Bombay and its suburbs was assessed by Aspatwar *et al*.[12] Twenty percent children showed low (<20 mcg/dl) serum vitamin A levels, and 4.8% of the children were suffering from one or the other signs of vitamin A deficiency. Ramakrishnan *et al*[13] reported that the proportion of children (6-36 months, n=366) from Tamil Nadu with serum retinol concentrations <0.7 micromol/L was 16.9%. Varma *et al*[14] assessed the baseline retinol levels of preschool children (36-66 months, n=516) of a block in South 24 Parganas, West Bengal and noted that the mean serum retinol levels were 1.23±0.51 mcg/L for the non fortified and 1.10±0.44 mcg/L for the fortified group. Vitamin deficiency defined as serum retinol <0.7 mcg/L was found to be present in 13.0% and 17.5%; and low vitamin A status defined as 0.70> serum retinol <1.05 mcg/L as 40.8% and 47.9% in the non fortified group and fortified group, respectively. Mean serum vitamin A levels of school children (5-15 years of age) from Chennai were found to be 47.18±19.66 mcg/dl in the experimental group (n=82) and 43.62±13.83 mcg/dl in the control group (n=77).[15] However, in the present study, the mean serum vitamin A level of the adolescent girls from low socio-economic status from a slum in Jaipur city was found to be 21.82 ± 6.579 mcg/dl. The percentage of adolescent girls with low (<20mcg/dl) levels of serum vitamin A was 49.1%.

Malnourished preschool children (aged 0-72 months, n=358) from eastern Zaire also had low mean serum retinol concentrations. Deficient serum retinol (<0.35 micromol/L) was found in 19.1-25.6% of the children, low serum retinol (0.35-0.70 micromol/L) was found in 51.3 to 53.0% of the children and 21.4 to 29.1% of the children had retinol concentrations considered to be normal (>0.70 micromol/L).[16] In urban Bangladesh, of the 289 teenagers (14 - 19 years) who completed the study protocol, 70.5% were found to be vitamin A deficient (serum retinol <1.05 micromol/L); their mean serum retinol levels ranged between 0.88±0.28 to 0.96±0.29 micromol/L at baseline.[17] From two areas in rural Tanzania, Kidala et al[18] had reported mean serum retinol levels of children (aged 12-71 months, n=146) as 13.7 mcg/dl (n=75) and 19.3 mcg/dl (n=71). The mean serum retinol concentrations in rural Nepalese school children (n=145, 5-12 years) ranged from 51.63±21.93 mcg/dl to 70.00±22.43 mcg/dl.[19] A high prevalence of subclinical vitamin A deficiency was observed in Indonesian preschool children (6-48 months, n=1322); 15.4% of the children had very low serum retinol concentrations (<0.35 micromol/L), 52.0% had low serum retinol concentrations (0.35-0.70 micromol/L), and 32.6% had normal concentrations (>0.70 micromol/L).[20] In the present study, too, about 1.8% of the adolescent girls (10-15 years) had deficient, 47.3% low and 50.9% of the adolescent girls had normal levels of serum vitamin A concentrations.

Vitamin A deficiency signs have also been studied to determine the prevalence of vitamin A deficiency. Singh *et al*[21] had reported that 23.1% of the examined school children aged 8-13 years had an abnormal cytology reflecting a poor vitamin A status. This percentage was slightly higher, 35.7% of undersix children (n=308) from Nagpur exhibited subclinical vitamin A deficiency as determined by conjunctival impression cytology.[22] Khamgaonkar *et al*[23] stated that the prevalence of vitamin A deficiency signs ranged from 24.1 to 34.8% in 366 rural children (1-15 years) of Wardha district. Tandon *et al*[24] assessed the vitamin A nutritional status of 2,192 persons. Bitot's spots and night blindness were detected in 7.1% and 7.2% of the population, belonging to all age groups of a rural community in Haryana. Later in 2007, the prevalence of bitot's spots ranged from 4.3-5.1% in control children (1-5 years, n=252) from Chandigarh.[25]

In the present study on adolescent girls of poor socio economic group studying in a government school in Jaipur, it was observed that 90.1% of the adolescent girls had adequate protein status (serum proteins >= 6.0g%) and 49.1% of the subjects had low levels of serum vitamin A (serum vitamin A <= 20 mcg/dl).

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