SERUM VITAMIN A LEVELS IN CHILDREN DURING ACUTE GASTROENTERITIS AND LOWER RESPIRATORY TRACT INFECTION

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ABSTRACT

OBJECTIVES

To know the sub-clinical deficiency of vitamin A in children during Acute Gastroenteritis and Lower Respiratory Tract Infections and to compare serum Vitamin A levels of control group with WHO standard.

SUBJECTS

25 cases - 25 cases of gastroenteritis and lower respiratory tract infection and 25 controls aged between 6 months and 6 years.

STUDY DESIGN

Case control study.

METHODS

History with detailed diet history, clinical examination, evaluation of nutritional status and signs of vitamin A deficiency, blood samples for estimation of vitamin A levels and routine haematological indices (Hb, TC, DC, PS study) and serum electrolytes in some cases of GE cases, chest X-ray PA view taken in some of the lower respiratory tract infection, other relevant investigations done pertaining to individual case.

INCLUSION AND EXCLUSION CRITERIA

Children with gastroenteritis and lower respiratory tract infections as cases and children with minor ailments (not affecting vitamin A levels) coming to OPD as controls, age between 6 months to 6 years will be included in the study. Children admitted in the hospital for diseases other than lower respiratory tract infections and gastroenteritis and children who are given vitamin A before admission will be excluded.

RESULTS

In this study vitamin A levels in 13 cases of GE and 12 cases of LRTI compared 25 controls. Incidence of GE constituted 25.6±8.2 and LRTI constituted 25.5±8.3 of all paediatric admissions. In the study group, 8% cases had reduced serum vitamin A levels and none in the control group. Serum vitamin A levels in infants were relatively low when compared with the older. There was also notable correlation between serum vitamin levels and dietary practices, nutritional status and socioeconomic status. There was significantly low levels of serum vitamin A in both gastroenteritis cases and lower respiratory tract infection cases compared with controls. For every one case of frank clinical deficiency of vitamin A, there was 6 subclinical cases.

CONCLUSION

Significant reduction in serum vitamin A levels in gastroenteritis cases and lower respiratory tract infection cases compared to controls. There was no significant number of cases with frank clinical signs of vitamin A deficiency, in spite of reduced levels of serum vitamin A. Therefore, the need for vitamin A supplementation in all gastroenteritis cases and lower respiratory tract infections.

KEYWORDS

Vitamin A, WHO Standard, Xerophthalmia, Gastroenteritis, Respiratory Infection.

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INTRODUCTION

Vitamin A deficiency is a major public health problem in all developing countries reportedly affects five million Asian children.[1,2] and about 3,30,000 children in India.[3,4,5,6] and causing partial or total blindness among 60,000 to 1,84,500 Indian children as per National Nutritional Survey 1993.[7,8,9]

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The morbidity and mortality rates were four times higher in Respiratory infection, Diarrhea and Measles if they had associated vitamin A deficiency. The morbidity and mortality rates in under 5 years children can be decreased by providing required amount of vitamin A.[10,11]

Hence, this study was undertaken to estimate the vitamin A level in children from 6 months to 6 years with lower respiratory tract infection and gastroenteritis.

AIMS AND OBJECTIVES OF THE STUDY

To estimate serum vitamin A levels in children aged 6 months to 6 years during Acute Gastroenteritis and Lower Respiratory Tract Infection.

1. To know the sub-clinical vitamin A deficiency in children during Acute Gastroenteritis and Lower Respiratory Tract Infections.

2. To compare serum vitamin A levels of control group with WHO standard.
3. Hence, to know the necessity of vitamin A supplementation to children during Acute Gastroenteritis and Lower Respiratory Tract Infections.

MATERIAL AND METHODS

Source of DATA – Children in the age group from six months to 6 yrs. admitted to the paediatric medical wards of Sree Balaji Medical College and Hospital, Chennai.

A total of 25 cases and 25 controls were included in the study from October 2010 to October 2011.

The data was collected by direct questioning and examination of study group children. Funding for estimation of Vitamin A levels is borne by the researcher.

Sample Size – 25 Cases and 25 Controls

For each case one control is taken in the same age group of children attending Immunization clinic and Paediatric OPD with minor ailments (conditions not affecting vitamin A levels).

Sampling Procedure

Cases were taken in children between 6 months to 6 years of age presenting with Gastroenteritis and Lower respiratory tract infection and controls were taken in the same age group with minor ailments after fulfilling the inclusion and exclusion criteria were included in the study.

Inclusion Criteria

Cases

- Children with Gastroenteritis and Lower respiratory tract infections were included in the study.
- Age between 6 months to 6 yrs.

Controls

- Children with minor ailments attending to OPD and children who come for vaccination were included in the study.
- Age between 6 months to 6 yrs.

Exclusion Criteria

Cases

- Children admitted in the hospital for diseases other than Lower respiratory tract infections and Gastroenteritis are excluded.
- Children above 6 yrs. and below 6 months of age presenting with LRTI and GE are excluded in the study.
- Children with Gastroenteritis and Lower respiratory tract infection, who were given vitamin A before admission were excluded.

Controls

- Children attending OPD with GE and Lower respiratory infections are excluded.
- Children below 6 months and above 6 yrs. attending OPD and immunization clinic were excluded and children administered vitamin A within 6 months interval.

DATA COLLECTION

Procedure after Case Selection

1. A detailed history including diet history was taken and clinical examination performed, an evaluation of nutritional status and signs of vitamin A deficiency was done.
2. Blood samples were collected for estimation of vitamin A levels and routine haematological indices and serum electrolytes in some of the GE and Chest X-ray PA view taken in some of the lower respiratory tract infection cases. Urine samples were collected in sterile bottle for microscopic examination in some cases.
3. Other relevant investigations done pertaining to individual case.

Procedure for taking Blood Sample for Estimation of Serum Vitamin A

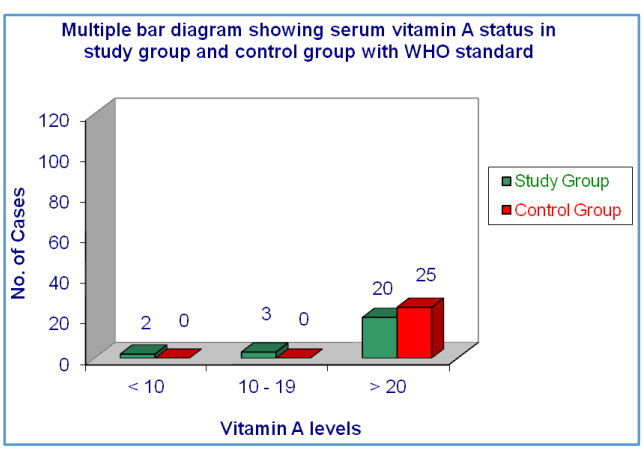
After the admission, 5 mL of blood was drawn into a plain test tube and immediately submitted to the laboratory and once the serum was separated samples were sent for processing by High Pressure Liquid Chromatography System.

RESULTS AND ANALYSIS

Serum Vitamin A Status in Study Group and Control Group with WHO Standard (Table 1)

S. Vitamin A µg/dL	Study	Control
<10	2 (8%)	0 (0%)
10-19	3 (12%)	0 (0%)
20 & Above	20 (80%)	25 (100%)
Total	**25 (100%)**	**25 (100%)**
Inference	Low levels of Serum Vitamin A is significantly more in cases compared to controls with P=0.050*	

Table 1: Shows the Vitamin A Status in Cases and Controls with Reference to WHO Standard



Serum Vitamin A Status in GE and LRTI Cases with WHO Standard (Table 2)

Diseased State	Serum Vitamin A (µg/dL)		
	<10	10-19	20 & Above
GE (n=13)	1 (8%)	2 (15%)	10 (77%)
LRTI (n=12)	1 (8%)	1 (8%)	10 (84%)

Table 2: Shows the Vitamin A Status in Gastroenteritis and Lower Respiratory Tract Infection Cases

Serum Vitamin A Levels in Relation to Age in Study Group and Control Group (Table 3)

Age distribution comparison of Serum Vitamin A levels according to age in cases and control.

Age in Years	S. Vitamin A µg/dL		P value
	Cases	Controls	
<1 years	33.25±6.17	54.02±28.12	0.108
1-2 years	21.88±7.62	65.95±27.21	<0.001**
2-4 years	27.64±6.06	49.46±20.35	0.031*
4-6 years	21.09±11.47	55.20±2.55	0.055+
P value	0.029*	0.594	-

Table 3: Shows the Serum Vitamin A Levels According to Age Group Indicating that, Vitamin A Levels in Infants are Low when Compared to Older Children

Serum Vitamin A Levels in Relation to Gender in Study and Control Group (Table 4)

Gender	S. Vitamin A (Mean + S.D. µg/dL)		P value
	Study Group (n=25)	Control Group (n=25)	
Male	25.62±9.78	52.82±28.98	<0.001**
Female	26.26±6.74	63.31±18.85	<0.001**
P value	0.855	0.298	-

Table 4: Shows the Decrease in Serum Vitamin A Levels in Males Compared to Females in Study Group and Control Group

Relation between Reduced Serum Vitamin A Levels and Xerophthalmic Changes in GE and LRTI Cases (Table 5)

Diseased State	Cases with Low Stores of Vitamin A (<20 µg/dL)	Xerophthalmic Changes
GE(n=13)	3(23.1%)	1(7.7%)
LRTI(n=12)	2(16.7%)	1(8.3%)

Table 5: Shows Low Stores Vitamin A and Xerophthalmic Changes

Relation between Reduced Serum Vitamin A Levels and Xerophthalmic Changes in Study Group and Control Group (Table 6)

Group	Cases with Low Stores of Vitamin A (<20 µg/dL)	Xerophthalmic Changes
Study (n=25)	5 (n=25)	2 (n=5)
Control (n=25)	0	0

Table 6: Shows 5 Cases in the Study Group to have Low Stores of Vitamin A Levels. Out of these 5 Study Group Cases, Only 2 Cases showed Xerophthalmic Changes

Serum Vitamin A Levels in Cases and Controls (Table 7)

S. Vitamin A	Cases	Controls	P Value
Min-Max	8.68-39.12	23.50-106.50	t = 6.236 p<0.001**
Mean ± SD	25.93±8.29	58.27±24.73	
95% CI	22.50-29.35	48.06-68.48	

Disease State	Cases (Mean±SD µg/dL)	Controls (Mean±SD µg/dL) (n=100)	Z Test	P Value
Gastroenteritis	25.6±8.2 (n=13)	58.27±24.73	Significant	0.001
Lower respiratory tract infection	25.5±8.3 (n=12)	58.27±24.73	Significant	0.001

Table 7: Shows the Mean Serum Vitamin A Levels in Cases and Controls

DISCUSSION

For the present study of 25 cases, 13 cases of Gastroenteritis and 12 cases of lower respiratory tract infection were chosen between the age group of 6 months to 6 years. Comparison of these 25 cases was made with 25 controls.

Correlation with WHO Standard

As per the WHO standard, in the study group 2 cases had less than 10 µg/dL of serum vitamin A indicating deficiency; 3 cases had 10-19 µg/dL indicating low stores and 20 cases had >20 µg/dL indicating normal levels of serum vitamin A. All the control group children had >20 µg/dL indicating normal serum vitamin A levels. In the present study, 8% of GE and LRTI cases had lower levels of vitamin A. This reduced serum vitamin A levels is probably related to infections, which causes reduced intake and absorption of Vitamin A as well as increased utilisation in tissues and increased renal loss as suggested by Semba R. D.[12]

Correlation with Age

In the present study, Vitamin A levels in the age group of 6 months to 2 years was lower than the other age groups in both study and control group. This can be explained by a pre-existing low serum vitamin A levels in normal infants compared to normal children as seen in our control group.[13]

Relation between Reduced Serum Vitamin A Levels and Xerophthalmic Changes

Though subclinical vitamin A deficiency was present in 23.1% of GE cases and 16.7% LRTI cases, xerophthalmic changes were observed only in 7.7% of GE cases and 8.3% of LRTI cases. This shows the existence of subclinical vitamin A deficiency without any clinical evidence of vitamin A deficiency. The prevalence of subclinical vitamin A deficiency in India is in the range of 25 to 86 percent as reported by Reddy V et al (1989).[14] Mehra S. Aneja et al (1994)[15] and Laxmaiah A (2011).[16]

Serum Vitamin A Levels in Both Cases GE and LRTI and Controls

In our study, the mean serum vitamin A level in gastroenteritis cases was 25.6±8.2 µg/dL and mean vitamin A level in lower respiratory tract infection cases was 25.5±8.3 µg/dL. In controls, the mean vitamin A levels was 58.27±24.73 µg/dL. Serum vitamin A levels in both GE cases and LRTI cases were significantly lower than the control group. A study done by Kucukbay H. et al[17] in Malatya children with recurrent acute respiratory infections and diarrhoea was shown serum vitamin A level of 51.66±8.1 µg/dL in respiratory infections, 47.21±8.27 µg/dL in diarrhea cases and 58.14±9.07 µg/dL in

controls. A study done by Velasquez-Melendez G. et al[18] in children of Brazil with acute respiratory infection and diarrheal diseases was showing plasma vitamin A level (15.2 μg/dL in both infection) lower than control group (18.8 μg/dL). A case control study done by Dudley L et al[19] on vitamin A status in respiratory infection was showing mean (SD) vitamin A levels were 22.09 (7.27) μg/dL for controls, 20.27 (11.11) μg/dL for the mild cases and 13.79 (7.60) μg/dL for severe cases. A study done by Hanekom WA et al[20] in South African children with pulmonary tuberculosis was showing low plasma vitamin A levels (Mean 18.1±10.3 μg/dL, 62% below normal).

A study done by Kassu A.[21] in Ethiopia showed serum vitamin A levels (serum retinol <20.05 μg/dL) in 52.7% of diarrhoea patients among the total number of cases, and a study done in China by Qian L and Lu JR.[22] showed that serum vitamin A levels in children with recurrent respiratory infections were significantly lower than controls (33.23 +/- 6.3 μg/dL versus 44.6 +/- 3.4 μg/dL; P <0.05). In comparison with other studies, our study also showed low levels of serum vitamin A in Gastroenteritis and Lower respiratory tract infection cases than in controls.

CONCLUSION

There is significant reduction in serum vitamin A levels in gastroenteritis cases and lower respiratory tract infection cases compared to controls. In spite of reduced levels of serum vitamin A, there is no significant number of cases with frank clinical signs of vitamin A deficiency. Hence, the need for vitamin A supplementation in all gastroenteritis cases and lower respiratory tract infections. All the controls in the study had normal serum vitamin A levels.

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