

ORIGINAL ARTICLE

Effect of Vitamin A supplementation on the Serum levels of some Immunoglobulins in Vitamin A deficient children

by

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Abstract

Effect of vitamin A deficiency and of subsequent vitamin A supplementation on the serum levels of immunoglobulins, IgG, IgA and IgM were studied in children with severe to moderate vitamin A deficiency. Decreased levels of IgG ($P < 0.001$), IgA ($P < 0.01$) and increased levels of serum IgM ($P < 0.01$) were found in vitamin A deficient children, compared to normal. On supplementation of 100,000 – 200,000 i.u. of vitamin A, during a period of 2 weeks, serum IgG, IgA and IgM levels in the vitamin A deficient children increased by $49.4 \pm 7.2\%$, $14.2 \pm 7.7\%$, and $8.0 \pm 2.3\%$ respectively with an increase in the serum vitamin A levels by 47.6 ± 10.6 per cent.

The results have been discussed on the possible interactions of vitamin A deficiency and immunity.

Introduction,

Vitamin A deficiency is a common health problem, especially in children of developing countries and clinical studies (Sorimshaw et al., 1968; Bang et al., 1972) have demonstrated that this deficiency is consistently synergistic with infectious diseases. The frequency and severity of infections in vitamin A deficient subject is assumed to be due to impairment of their immune status (Guggenheim and Buechler, 1947; Chandra and Au, 1981) and our previous study (Faruque and Bashar, 1983) has demonstrated reduced plaque forming response of antibody producing spleen cells against *Salmonella typhimurium* in vitamin A deficient rats. Several other studies in laboratory animals, have shown impaired phagocytosis (Krish-

nan et al., 1974), reduced antibody response and increased rejection time of skin grafts (Jurin and Tannook, 1972) in vitamin A deficiency. but very little specific information is available from human studies in this field.

In this study, we have investigated the serum levels of immunoglobulins, IgG, IgA, and IgM in vitamin A deficient children and the consequent change in these levels, on supplementation of vitamin A. Our investigation attempts to an understanding of the nature of impairment in immune status suffered by vitamin A deficient children and the effectiveness of vitamin A supplementation in overcoming this impairment.

Materials and Methods.

After a preliminary biochemical determination of serum vitamin A and total protein levels, eleven male children between 2 – 5 years, with severe to moderate vitamin A deficiency, and six normal male children of similar age group were selected for the investigation. The children classified as vitamin A deficient has serum vitamin A levels of 10.8 ± 2.5 ug% whereas the normal children had serum vitamin A levels of 23.4 ± 4.1 ug% and both groups of children had moderate to normal levels of serum total protein. Blood samples were collected from each of them by vein puncture with sterile syringe. It was allowed to clot and the serum was collected by centrifugation at low temperature.

The vitamin A deficient children came for treatment in the pediatric wards of Dhaka Medical College Hospital, Dhaka and after obtaining the initial blood samples,

these children were placed under vitamin A supplementation (100,000 – 200,000 i.u.) according to requirements. Vitamin A was administered either orally or as injections of water miscible vitamin A palmitate. After two weeks of vitamin A supplementation, blood samples of these children were collected again.

All samples were analyzed for the serum levels of vitamin A, total protein and immunoglobulins, IgG, IgA, and IgM. Serum vitamin A levels were determined by the trifluoroacetic acid method of Neeld and Pearson (1963), serum total protein was determined by a modification of the Lowry technique (Lowry et al., 1951) and serum immunoglobulin levels were determined by radial immunodiffusion (Mancini et al., 1965) using standard immunodiffusion plates and standard human serum, supplied by Behringwerke Ag, Marburg, West Germany.

Results.

The serum levels of IgG and IgA of the vitamin A deficient children were found to be significantly less than normal (Table I), whereas serum IgM levels were found to be higher than normal. After supplementation of vitamin A for two weeks the serum levels of IgG, IgA, and IgM in the vitamin A deficient children were found to have increased, on the average $49.4 \pm 7.2\%$, $14.2 \pm 7.7\%$

and $8.0 \pm 2.3\%$ respectively with an increase in the serum vitamin A levels by $47.6 \pm 10.6\%$ (Figure I) and serum total protein by $5.3 \pm 2.5\%$. Consequently, on vitamin A supplementation for two weeks, the serum levels of IgG and IgA, in the vitamin A deficient children attained the normal levels but serum IgM levels remained significantly higher than normal.

TABLE I : Serum levels of Vitamin A, total protein, IgG, IgA, and IgM of vitamin A deficient children upon admission and after two weeks of vitamin A supplementation.

	Normal (n=6) (X ± S.D.)	Vitamin A deficient (n=11)	
		On admission (X ± S.D.)	After supplementation (X ± S.D.)
Vitamin A (ug%)	23.4 ± 4.1	10.8 ± 2.5 ***	15.8 ± 3.2 ***
Protein (gm%)	6.4 ± 0.3	5.9 ± 0.4 *	6.2 ± 0.4
IgG. (mg%)	1527 ± 233	1182 ± 191 **	1756 ± 227
IgA (mg%)	149 ± 20	128 ± 19 *	145 ± 14
IgM (mg%)	118 ± 8	129 ± 10 *	140 ± 10 ***

The test results are significantly different from control at *P < 0.05.

P < 0.01, and *P < 0.001.

Discussion

Our previous report (Faruque and Bashar, 1983) and the present findings that the serum IgG and IgA levels are reduced in vitamin A deficient children suggest that vitamin A deficiency impairs the humoral immunity system of the body, but the finding of an average increased level of IgM,

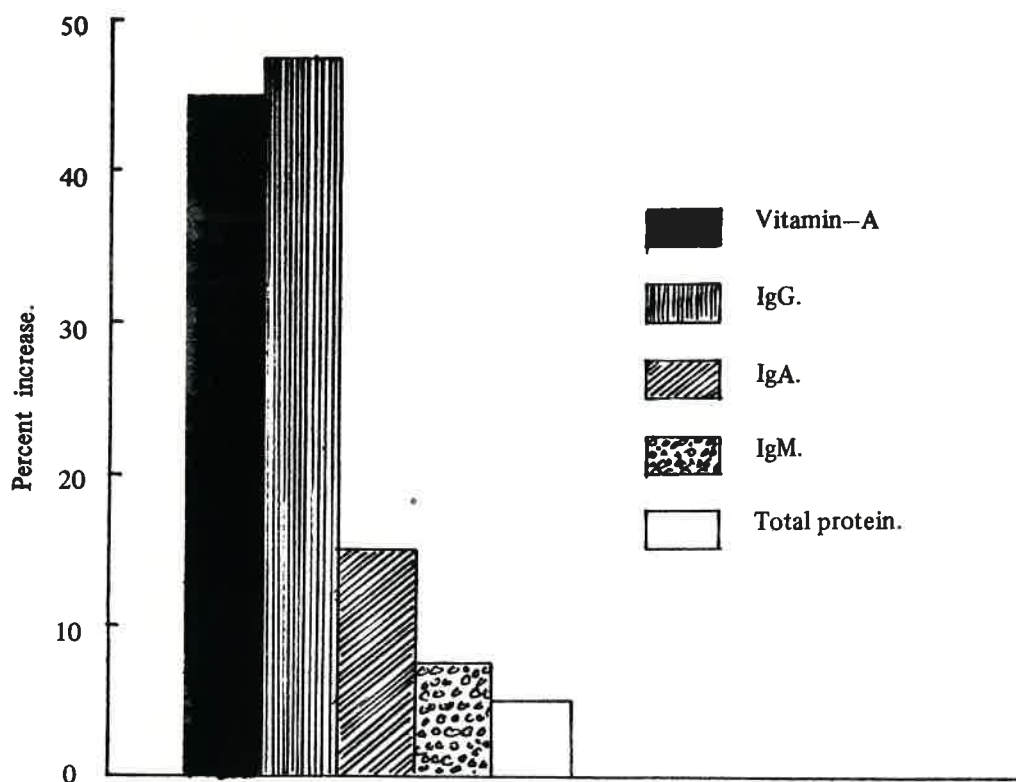
in vitamin A deficient children, compared to normal, requires satisfactory explanation. A possible explanation may be that, because IgM is the first antibody to appear in the circulation after an invasion, body stores of vitamin A is rapidly depleted in the process (Newberne and Hunt, 1972), and in case

of formation of other immunoglobulins is delayed due to severe vitamin A deficiency. This explanation is supported by the finding that serum levels of all the three immunoglobulins, under our study, increased significantly (Table I and Figure I) on vitamin A supplementation.

The increase in serum immunoglobulin levels on vitamin A supplementation is in agreement with the reports (Drenser, 1968; Cohen and Cohen, 1973) that vitamin A can act as adjuvant and enhance the bio-

synthesis of antibodies, but contradicts with the report (Brown et al., 1980) of failure to enhance antibody response against tetanus toxoid in children, in spite of administration of large doses of vitamin A. It is not unreasonable to suggest in the light of these studies that vitamin A administration to vitamin A deficient subjects only can enhance the biosynthesis of immunoglobulins so as to increase the serum levels of immunoglobulins and attain the normal levels.

FIGURE — I : Comparative relation in terms of percent increase of serum Vitamin-A, IgG, IgA, IgM and serum total protein upon supplementation of Vitamin-A in Vitamin-A deficient children.



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