CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES
http://doi.org/10.5281/zenodo.3339386

**Available online at: http://www.iajps.com** ***Research Article***

# ASSOCIATION OF VITAMIN A DEFICIENCY & ANEMIA AMONG SCHOOL GOING CHILDREN

**Shameem Bhatti[1], Bakhtiar Ahmed Bhanbhro[2], Shafi Muhammad Wassan[3], Khalil ur Rahman Kazi[4], Roshan Ara Kazi[5], Muhammad Asif Naveed[6], Asma Rajput[7]**

Dept. of Community Medicine, Pir Syed Abdul Qadir Shah Jeelani (PSAQSJ) Institute of Medical Sciences Gambat (IMSG), Khairpur Mirs, Pakistan[1, 3]
Dept. of Pediatrics, Pir Syed Abdul Qadir Shah Jeelani (PSAQSJ) Institute of Medical Sciences Gambat (IMSG), Khairpur Mirs, Pakistan[2]
Dept. of Community Medicine – Indus Medical College, T.M.K[4]
Dept. of Obstetrics & Gynecology, Indus Medical College, T.M.K[5]
Pathology, Services Institute of Medical Sciences, Lahore[6]
LUMHS Research Forum[7]

**Article Received:** May 2019 **Accepted:** June 2019 **Published:** July 2019

**Abstract:**

***BACKGROUND:*** *Deficiency of vitamin A has been shown to be one of the major nutritional problems among children, particularly in the developing countries. Recent studies and experiments on animals have shown that vitamin A deficiency may have an apparent association with anemia.*

***OBJECTIVE:*** *To study the association between vitamin A deficiency and anemia among school going children.*

***METHODOLOGY:*** *This cross-sectional analysis was conducted upon a sample of 380 school going children (aged 6 to 14 years) volunteering to participate in free anemia screening camps (with parental permission) held at different schools from June 2018 to May 2019. Blood samples were collected and the concentrations of hemoglobin (Hb), serum iron, serum ferritin (SF), erythrocyte proto-porphyrin (EP), serum retinol and b-carotene, total iron binding capacity (TIBC), transferrin saturation (TS) and other hematological indices were measured. Additional, sociodemographic lifestyle and dietary details were inquired and recorded onto an interview-based questionnaire. The data obtained was recorded onto a structured questionnaire and analyzed using SPSS v.21 & Microsoft Excel 2016.*

***RESULTS:*** *Among, the 380-patient enrolled into the study, 47.1% were males while the remaining 52.9% were females. The mean age of the sample stood at 11 (SD ± 2). Several biochemical and dietary parameters related to anemia were correlated with plasma levels of retinol. Children between the ages of 6 and 12 years showed a significant positive correlation between hemoglobin and plasma retinol. In children of all age groups there were positive correlations between plasma retinol and serum iron. Percent saturation of transferrin was also found to be lower when plasma retinol levels were low. Children with an adequate intake of iron, as classified by both dietary information and socioeconomic level, showed a significant positive correlation between plasma retinol levels and iron in their serum.*

***CONCLUSION:*** *After careful consideration, it can be concluded that in the light of the results of this study, a possible relationship between vitamin A deficiency and anemia is suggested.*

***KEYWORDS:*** *Vitamin A, Retinol, School Children, Anemia, Nutritional Deficiency and Serum Iron Level.*

**Corresponding author:**

**Dr. Shameem Bhatti, (M.B.B.S, PhD)**
*Department of Community Medicine,*
*Pir Syed Abdul Qadir Shah Jeelani (PSAQSJ) Institute of Medical Sciences Gambat (IMSG)*
***Corresponding Email**: shamim_bhtt@yahoo.com* ***Contact Number:*** *+92-303-0589819*

QR code

*Please cite this article in press Shameem Bhatti et al.,* ***Association Of Vitamin A Deficiency & Anemia Among School Going Children.,*** *Indo Am. J. P. Sci, 2019; 06[07].*

## INTRODUCTION:

Deficiency of vitamin A and nutritional anemia have been shown to be two of the major nutritional problems, especially in children, not only in developing countries **[1, 2]** but also in highly developed nations. **[3]** In most of these countries, an inadequate intake of vitamin A appears to be the underlying cause of low plasma levels of retinol.

Nutritional anemia, on the other hand, has been traditionally associated with deficiencies of iron, folate, vitamin B12, and protein. It has also been thought that parasitic infestation plays an important role. **[4, 5]** The roles of vitamin E, vitamin B6, and some microelements such as zinc and copper have not been fully studied in these populations, thus there is not enough evidence to consider them of primary importance.

Recent studies in humans and in experimental animals have demonstrated an apparent association between vitamin A deficiency and anemia. **[6, 7]** Low values for hemoglobin, hematocrit, red blood cell count, and serum iron, accompanied by elevated levels of iron in the liver have been reported.

In vitamin A deficient humans, medicinal iron did not raise hemoglobin levels until after vitamin A was also given. Since 1922 numerous investigators have shown that anemia may be associated with vitamin A deficiency. **[8, 9]** These observations have been contradicted by other reports of apparent polycythemia that probably resulted from hemo-concentration that sometimes occurs in vitamin A deficiency. **[10]**

This disparity may have resulted from alterations in water metabolism as a result of impaired renal function. Polyuria in vitamin A deficient sheep that would lead to hemo-concentration, has been reported. **[11]** Alterations in glomerular filtration rate and renal plasma flow have also been found in ewes severely deficient in vitamin A. **[12]**

These physiological changes, as in the case of polyuria, would indeed mask any effect of vitamin A deficiency on hematopoiesis and could explain the elevated values of hemoglobin and hematocrit reported by several investigators. The results of other studies, however, show that there must be an interaction between vitamin A and iron. **[13]**

Despite the high prevalence of anemia (42% of preschool children, 53% of school age children, 44% of women of childbearing age, and 56% of pregnant women), and a highly probable role of vitamin A deficiency in the scenario, the epidemiology and pathogenesis of the anemia of vitamin A deficiency have not been well characterized. The hematological picture of vitamin A deficiency anemia is vaguely defined. Vitamin A appears to influence anemia via modulation of hematopoiesis, by enhancement of immunity to infectious diseases and, hence, the anemia of infection, and through the modulation of iron metabolism. **[14]**

This research thus hopes to shed much needed light on the association between vitamin A deficiency and anemia among school going children.

## METHODOLOGY:

This cross-sectional analysis was conducted upon a sample of 380 school going children (aged 6 to 14 years) volunteering to participate in free anemia screening camps (with parental permission) held at different schools from June 2018 to May 2019. Blood samples were collected and the concentrations of hemoglobin (Hb), serum iron, serum ferritin (SF), erythrocyte proto-porphyrin (EP), serum retinol and b-carotene, total iron binding capacity (TIBC), transferrin saturation (TS) and other hematological indices were measured. Additional, sociodemographic lifestyle and dietary details were inquired and recorded onto an interview based questionnaire. The data obtained was recorded onto a structured questionnaire and analyzed using SPSS v.21 & Microsoft Excel 2016.

## RESULTS:

Among, the 380 patient enrolled into the study, 47.1% were males while the remaining 52.9% were females. The mean age of the sample stood at 11 (SD ± 2).

| Age Group | Males | Females |
|---|---|---|
| 6 to 8 years | 31 | 17 |
| 9 to 10 years | 51 | 74 |
| 10 to 12 years | 63 | 89 |

| | | |
|---|---|---|
| 13 to 14 years | 34 | 21 |

Several biochemical and dietary parameters related to anemia were correlated with plasma levels of retinol. Children between the ages of 6 and 12 years showed a significant positive correlation between hemoglobin and plasma retinol. In children of all age groups there were positive correlations between plasma retinol and serum iron. Percent saturation of transferrin was also found to be lower when plasma retinol levels were low. Children with an adequate intake of iron, as classified by both dietary information and socioeconomic level, showed a significant positive correlation between plasma retinol levels and iron in their serum.

| **Vitamin A Level** | **Mean Hemoglobin Level** | **Mean Serum Iron Level** |
|---|---|---|
| **Low Vitamin A** | 9.4 gm/dL | 48 µg/dL |
| **Adequate Vitamin A** | 12.1 gm/dL | 117 µg/dL |

## DISCUSSION:

These results suggest that vitamin A may be essential for hematopoiesis and that the effect of vitamin A may not be directly on hemoglobin but on the availability of iron for synthesis of this heme protein. This concept is supported by the fact that, in all instances, serum iron levels increased proportionally with increased retinol. This was not always the case for hemoglobin, as observed in children. On the other hand, the possibility that this age group could have a greater susceptibility to changes in water metabolism and hemo-concentration in vitamin A deficiency cannot be ruled out. It has been recently reported that there is an increased concentration of liver iron in vitamin A deficient rats. **[15]**

Several investigators previously have found large amounts of storage iron in the liver and spleen of humans and animals deficient on vitamin A. **[16, 17]** Zinc has been found to be similarly deposited in vitamin A deficient chicks. **[18]** These findings have suggested to us that in vitamin A deficiency, iron may be sequestered in storage depots from which it is not efficiently released into the circulation for tissue use. In other words, iron mobilization may be impaired. This would explain the iron deficiency anemia found in humans and in experimental animals lacking adequate amounts of vitamin A.

It can also be inferred from this study, that there is a delay between the onset of vitamin A deficiency, low serum iron levels and the development of anemia. This is illustrated by the relatively high hemoglobin levels observed in the youngest group of children who also had low plasma values of retinol and low serum iron levels. This also suggests that serum iron could be a better index than hemoglobin, of the action of vitamin A on hematopoiesis. The absence of significant differences in total iron binding capacity at low or high plasma retinol levels, suggests that vitamin A deficiency may not affect the iron transport protein, transferrin. On the other hand, a high percentage of saturation of transferrin at high plasma retinol levels as compared with low retinol levels, indicates that vitamin A may indeed affect serum iron levels. **[19]**

These results, however, should be interpreted cautiously, because the correlations observed might be merely a reflection of dietary patterns or availability of iron in a given type of diet rather than an alteration of iron metabolism. Nevertheless, this possibility can be excluded in part by the finding of a positive correlation between serum iron and plasma retinol when dietary iron is high but not when dietary iron is low. **[20]**

It has been previously reported that there is an association between the socioeconomic level and the nutritional status. **[21, 22]** It can logically be assumed that at the low socioeconomic level, the iron intake is probably low be- cause the diet contains more plant foods but that at high socioeconomic levels the iron intake is likely to be high because of more animal foods in the diet.

At the same time, if the dietary iron status is adequate and there is a considerable storage of iron, then iron can be released into the circulation when retinol levels increase; thus a positive correlation is found. On the other hand if there is a lack of iron, the effect of vitamin A on this element cannot be seen and therefore, since there is nothing that can be released from storage into the circulation, there is no correlation between plasma retinol and blood hemoglobin.

Regardless, the deleterious effects of even mild anemia on physical work capacity are known. Periods of rapid growth as in childhood and during pregnancy, also create greater oxygen demands. Thus, if deficiency of vitamin A or any of its metabolites is involved in the etiology of anemia, this would be another important reason to strengthen our efforts to improve the supplies of vitamin A in those countries where dietary intakes of this vitamin are limited. **[23, 24]**

## CONCLUSION:

After careful consideration, it can be concluded that in the light of the results of this study, a possible relationship between vitamin A deficiency and anemia is suggested and vitamin A supplementation is recommended routinely.

## REFERENCES:


1. Grantham-McGregor S, Ani C. A review of studies on the effect of iron deficiency on cognitive development in children. Journal of Nutrition 2001; 131(Suppl. 2): 649S –68S.
2. National Institute of Nutrition (Kazakhstan) & Macro International Inc. Kazakhstan Demographic and Health Survey, 1995. Calverton, MD: National Institute of Nutrition and Macro International Inc., 1996.
3. World Health Organization (WHO). Complementary Feeding and the Control of Iron Deficiency Anaemia in the Newly Independent States. Copenhagen: WHO Regional Office for Europe, 2000.
4. Hashizume M, Kunii O, Sasaki S, Shimoda T, Wakai S, Mazhitova Z, et al. Anemia and iron deficiency among schoolchildren in the Aral Sea region, Kazakhstan. Journal of Tropical Pediatrics 2003; 49(3): 172 – 7.
5. Hashizume M, Shimoda T, Sasaki S, Kunii O, Caypil W, Dauletbaev D, et al. Anaemia in relation to low bioavailability of dietary iron among school-aged children in the Aral Sea region, Kazakhstan. International Journal of Food Sciences and Nutrition 2004; 55(1): 37– 43.
6. Majia LA, Hodges RE, Arroyave G, Viteri F, Torun B. Vitamin A deficiency and anemia in Central American children. American Journal of Clinical Nutrition 1977; 30(7): 1175 – 84.
7. Bloem MW, Wedel M, Egger RJ, Speek AJ, Schrijver J, Saowakontha S, et al. Iron metabolism and vitamin A deficiency in children in northeast Thailand. American Journal of Clinical Nutrition 1989; 50(2): 332 –8.
8. Mejia LA, Arroyave G. The effect of vitamin A fortification of sugar on iron metabolism in preschool children in Guatemala. American Journal of Clinical Nutrition 1982; 36(1): 87– 93.
9. Ahmed F, Khan MR, Karim R, Taj S, Hyderi T, Faruque MO, et al. Serum retinol and biochemical measures of iron status in adolescent schoolgirls in urban Bangladesh. European Journal of Clinical Nutrition 1996; 50(6): 346 – 51.
10. Ahmed F, Khan MR, Islam M, Kabir I, Fuchs GJ. Anaemia and iron deficiency among adolescent schoolgirls in peri-urban Bangladesh. European Journal of Clinical Nutrition 2000; 54(9): 678 – 83.
11. Semba RD, Bloem MW. The anemia of vitamin A deficiency: epidemiology and pathogenesis. European Journal of Clinical Nutrition 2002; 56(4): 271 – 81.
12. World Health Organization (WHO). Measuring Change in Nutritional Status. Guidelines for Assessing the Nutritional Impact of Supplementary Feeding Programmes for Vulnerable Groups. Geneva: WHO, 1983.
13. United Nations Children's Fund (UNICEF). How to Weigh and Measure Children: Assessing the Nutritional Status of Young Children in Household Surveys. New York: United Nations Department of Technical Co-operation for Development and Statistical Office, UNICEF, 1986.
14. Hamill PV, Drizd TA, Johnson CL, Reed RB, Roche AF, Moore WM. Physical growth: National Center for Health Statistics percentiles. American Journal of Clinical Nutrition 1979; 32(3): 607 –29.
15. World Health Organization (WHO). The Use and Interpretation of Anthropometry. Technical Report Series. Geneva: WHO, 1995.
16. Must A, Dallal GE, Dietz WH. Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht2 ) and triceps skinfold thickness. American Journal of Clinical Nutrition 1991; 53(4): 839 –46.
17. Must A, Dallal GE, Dietz WH. Reference data for obesity: 85th and 95th percentiles of body mass

index (wt/ht2 ) and triceps skinfold thickness – a correction. American Journal of Clinical Nutrition 1991; 54: 773.

**18.** Miller KW, Yang CS. An isocratic high-performance liquid chromatography method for the simultaneous analysis of plasma retinol, a-tocopherol, and various carotenoids. Analytical Biochemistry 1985; 145(1): 21– 6.

**19.** Sakai K, Takeuchi S, Araki T, Ushio K, Kondo M, Chiba M, et al. Determination of protoporphyrins in blood using HPLC – standardization of protoporphyrins and interlaboratory comparison of analyses. Japanese Journal of Industrial Health 1992; 34: 236 – 42.

**20.** Gibson R. Assessment of iron status. In: Gibson R, ed. Principles of Nutritional Assessment. New York: Oxford University Press, 1990; 349 –76.

**21.** De Maeyer EM. Preventing and Controlling Iron Deficiency Anemia through Primary Health Care. A Guide for Health Administrators and Programme Managers. Geneva: World Health Organization, 1989.

**22.** Thurnham DI, McCabe GP, Northrop-Clewes CA, Nestel P. Effects of subclinical infection on plasma retinol concentrations and assessment of prevalence of vitamin A deficiency: meta-analysis. Lancet 2003; 362(9401): 2052 – 8.

**23.** Hulthen L, Lindstedt G, Lundberg PA, Hallberg L. Effect of a mild infection on serum ferritin concentration – clinical and epidemiological implications. European Journal of Clinical Nutrition 1998; 52(5): 376 –9.

**24.** Cook JD, Finch CA, Smith NJ. Evaluation of the iron status of a population. Blood 1976; 48(3): 449 –55.