View Point

Controversies Continue: Universal Supplementation of Megadose of Vitamin A to Young Children in India

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ABSTRACT

The universal megadose of vitamin A (MDVA) supplementation program was started in the year 1970. The program is presently in continuation for the prevention of nutritional blindness and possibly reduction in under-five mortality rate (U5MR). Presently, blindness due to vitamin A deficiency (VAD) has disappeared and the difference between U5MR and infant mortality rate (IMR) is less than 10 thus MDVA is unlikely to have any impact on mortality. The continuation of universal MDVA needs to be modified based on the current scientific evidence.

Keywords: India, nutritional blindness, under-five mortality rate (U5MR), vitamin A deficiency (VAD)

Introduction

In India, megadose of vitamin A (MDVA) is presently being administered to all children in the age group of 6-59 months under the National Programme for Prophylaxis against Nutritional Blindness (NPPNB). The possible benefits are i) prevention of nutritional blindness due to vitamin A deficiency (VAD) and ii) reduction in under-five mortality.

Vitamin A supplementation (VAS) was started in the year 1970 based on the evidence that during the 1960s the magnitude of VAD was high, leading to nutritional blindness. During that period, there was a high prevalence of respiratory diseases, measles, diarrhea, and undernutrition among young children. The health services infrastructure was poor and repeated home visits by health workers were not possible. The populations were consuming foods with low content of retinol/carotenes. All these factors contributed to the high prevalence of severe VAD, which led to nutritional blindness.[1]

The objective of the NPPNB was to prevent nutritional blindness due to VAD among children. Children between 1 year and 5 years were given MDVA at six monthly intervals to prevent nutritional blindness due to VAD. The village level health workers were responsible for the detection and treatment of cases of VAD based on clinical signs and symptoms.[2] Currently, is there a scientific rationale of universal

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administration of MDVA to young children in India for either prevention of nutritional blindness due to VAD or for reduction in under-five mortality rate (U5MR). The present manuscript examines both these issues based on scientific evidence.

Prevention of Nutritional Blindness Due to Vitamin A Deficiency

A decline in the prevalence of clinical signs of VAD has been reported by the National Nutrition Monitoring Bureau (NNMB) surveys conducted from 1975 to 2012. The overall prevalence of Bitot's spot (BS) has declined from 1.8% (1975) to 0.2% (2012) [Table 1].[3]

In the year 2000, a national survey conducted by the Indian Council of Medical Research (ICMR) covering 16 districts in all five regions of the country and it documented that only three out of 16 districts had a prevalence of BS of ≥0.5% (the cutoff to define a public health problem).The three districts, which had higher prevalence were either draught-prone (Bikaner, Rajasthan, India) or had poor socioeconomic development (Patna and Gaya, Bihar, India).[4] Thus, the existing evidence suggests that presently VAD is a public health problem only in isolated geographical pockets of the country. There are wide variations in the prevalence of VAD within the states.

Why reduction in vitamin A deficiency in India

During the last five decades, interventions in the field of child health have resulted in substantial improvements in the indicators of child health. The prevalence of undernutrition has reduced significantly. The prevalence of severe wasting has reduced from 8.3% (1975) to 3.7% (2012). Immunization coverage for measles and other vaccine preventable diseases has improved from 5% in the 70s to 80% at present.[5] Improvements in health infrastructure have led to better access to health care facilities and decreased burden of common childhood morbidities. Food availability has improved during the last 50 years. There has been a significant improvement in the overall diet of children including vitamin A.[6] The Government's Integrated Child Development Services (ICDS) program presently covers 80% of the population. Under this program, food and nutritional supplements are provided to all young children, along with nutrition education to mothers. All these factors working jointly have positively influenced the vitamin A status of children and have led to reduced prevalence of VAD in the country.[7] Thus, universal MDVA supplementation possibly does not have a role in the prevention of nutritional blindness due to VAD in the current health scenario of India.

Possible Benefits of Vitamin A Supplementation in Reduction of Under-Five Mortality

The research study conducted by the National Institute of Nutrition, Hyderabad, India in the early 90s did not substantiate mortality reduction in under-five children, as claimed earlier, after MDVA supplementation.[8] A meta-analysis of studies conducted in India on the impact of MDVA on reduction in under-five mortality conducted in India documented that there was a lack of scientific evidence in favor of or against the benefit of universal VAS to children.[9] A recent study, the deworming and Vitamin A (DEVTA) trial exploring the role of MDVA in reducing childhood mortality documented that there was no significant difference in the death rates between children who received the MDVA and those who did not.[10] These scientific evidences from India indicate that VAS possibly does not have a role in reduction of mortality in under-five children.

In India, a gradual reduction in U5MR has been observed from 191 (1970) to 48 (2015). Similarly, the infant mortality rate (IMR) has reduced from 80 (1991) to 38 (2015). If we calculate the difference between deaths in the two groups of children, the under-five deaths after the infant period average 10.[11,12] U5MR and IMR in selected states of India are depicted in Table 2. Presently, the main causes of

Table 1: Prevalence of Bitot spot among preschool children[3]

States	Year			
	1975-1979	1988-1990	1996-1997	2011-2012
Kerala	0.1	0.5	0.1	0
Tamil Nadu	2.9	0.6	0.7	0
Karnataka	2.3	1.1	0.5	0.6
Andhra Pradesh	3.1	1.0	0.8	0.1
Maharashtra	0.4	0.3	3.0	1.4
Gujarat	0.9	0.5	0	0.2
Odisha	1.5	1.1	0	0.3
Pooled (7 states)	1.8	0.7	0.7	0.2

Table 2: Under-five mortality rate and infant mortality rate in selected states of India[13]

States	Under-5 mortality rate (2010)	Infant mortality rate (2010)	Difference
India	59	47	12
Kerala	15	13	2
Tamil Nadu	27	24	3
Maharashtra	33	28	5
Delhi	34	30	4
West Bengal	37	31	6
Punjab	43	34	9
Karnataka	45	38	7
Andhra Pradesh	48	46	2
Jammu and Kashmir	48	43	5
Himachal Pradesh	49	40	9

under-five deaths are: injuries (4%), meningitis (2%), pneumonia (15%), diarrhea (11%), measles (3%), and other causes (13%).[13] Existing evidence suggests that MDVA is unlikely to have any impact on mortality due to injuries, measles, meningitis, and pneumonia. Thus, MDVA supplementation can only have a very limited role, if any, in the reduction of under-five mortality in the existing health scenario.

Public Health Concerns on Megadose of Vitamin A Supplementation in India

The available scientific evidence suggests that there are possible side effects of MDVA in under-five children as outlined below.

Risk of acute respiratory infection

A recent systematic review reported that there was insufficient evidence for protective or curative effect of vitamin A to prevent pneumonia.[14] A Cochrane database systematic review documented that there was no significant effect of VAS on cause-specific mortality due to measles, respiratory disease, and meningitis.[15] Another meta-analysis concluded that VAS has no consistent overall protective effect on the incidence of diarrhea; however, it slightly increased the incidence of respiratory tract infections. Vitamin A administration was associated with a significant increase in the rate of pneumonia in well-nourished children who received 10,000 IU of supplements weekly. The existing evidence suggests that VAS is not helpful for preventing pneumonia at least in normally nourished children and may rather worsen the situation. According to the authors, "these results might force the policy makers of the countries to think twice before continuing or starting a universal VAS program."[16]

Bulging fontanelle

It is documented that nearly 12% of young children when administered 50,000 IU of VA developed bulging fontanelle.[17] The development of the brain is not complete at birth, and the first 36 months are crucial from the point of view of brain development. During infancy, billions of brain cells multiply and establish several thousands of interneuronal synaptic connections. A significant proportion of brain development takes place before 3 years of age. As per the National Family Health Survey-3, nearly 48% of young children suffer from undernutrition in India.[18] Subjecting these undernourished children to repeated episodes of increased intracranial tension could possibly contribute to retarded brain development. There is a lack of scientific evidence on the long-term ill-effects of these repeated episodes of raised intracranial tension on brain development as this has not been systematically studied.[19,20]

Vitamin A and bone health

Animal studies have reported that vitamin A is an antagonist of vitamin D action. Increasing amounts of retinyl acetate produce progressive and significant decreases in total bone ash and increase in epiphyseal plate width. Increasing the levels of retinyl acetate abrogates the ability of vitamin D to elevate the level of serum calcium.[21-23] Excessive dietary intake of vitamin A has been associated with reduced bone mineral density and increased risk for hip fracture.[21] In multivariate analysis, retinol intake was negatively associated with bone mineral density.[21] For every 1 mg increase in daily intake of retinol, risk for hip fracture increased by 68%.[24] Thus, high dietary intake of retinol seems to be associated with osteoporosis.[24] Considering the current epidemic prevalence of vitamin D deficiency in the country, interventions potentially detrimental for bone health should be avoided.[25]

Way Forward

According to a recent evaluation, the annual cost per child dosed is US$1.14 (₹68). In India, we have 160 million under-five children (15% of 1200 million). A total amount of ₹8,000 million is being spent for universal distribution of MDVA, which has questionable health benefits. Apart from the cost of vitamin A, the distribution process consumes precious human and material resources meant for the delivery of primary health care.[26] Hence, we need to consider the need of judicious utilization of meager resources available in the field of child health. The present evidence strongly suggests a modification of the current program of universal MDVA supplementation to a targeted approach in which children with VAD should be identified and treated as part of routine health care services.

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Conflicts of interest

There are no conflicts of interest.

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