NFI BULLETIN
Bulletin of the Nutrition Foundation of India
Volume 39 Number 2
April 2018

Massive Dose Vitamin A Supplementation (MDVAS) to Children in India: is there enough evidence to continue the programme?

Umesh Kapil

Vitamin A (VA) is an essential nutrient needed in small amounts for the normal functioning of the visual system, growth and development, maintenance of epithelial cellular integrity, immune function and reproduction. Severe VA deficiency is known to produce corneal xeropthalmia, keratomalacia and blindness in children. Vitamin A deficiency (VAD) is mainly seen amongst young children as their vitamin A dietary intake is low while requirements are greater due to their higher rate of physical growth. Episodes of illnesses such as acute respiratory tract infections and measles, which deplete VA reserves from the body, are common in the younger age groups. In the 1970s the National Programme for Prophylaxis Against Nutritional Blindness (NPPANB), also referred to as 'massive dose vitamin A supplementation' (MDVAS) programme, was initiated for the prevention of keratomalacia and nutritional blindness. Over the years there has been a decline in the prevalence of VAD and under-five mortality in the country. Globally there have been reports of the short- and long-term adverse side effects of MDVAS. In India there are resource constraints and competing priorities among child nutrition-related initiatives. This article describes the evolution of the MDVAS programme, reviews the prevalence and consequences of vitamin A deficiency in India, and assesses whether the time has come for adopting a targeted approach instead of universal administration of MDVAS in India.

Evolution of the massive dose vitamin A supplementation(MDVAS) programme in India

During the 1960s the prevalence of VAD in India was high (Tables 1 and 2). The prevalence rates of respiratory diseases, measles and severe under-nutrition in young children were also high. The primary health care infrastructure was poor in urban areas and non-existent in rural areas. Poverty and household food insecurity were widespread among large sections of the population. Dietary intake in general was low, and vitamin A and β carotene content were inadequate. The high prevalence of infectious diseases, especially measles, in the already severely under-nourished young children led to keratomalacia; those who survived were often left with nutritional blindness[1-3].

A five-year long community-based research study conducted by National Institute of Nutrition under Dr. C. Gopalan's leadership showed that if massive dose Vitamin A (200,000 units) is administered once in six months to children between one and three years of age, the incidence of corneal xerophthalmia is reduced by about 80%. In view of the serious nature of the problem of blindness due to Vitamin A deficiency, it was recommended that urgent remedial measures should be undertaken, in the form of specific nutrient supplementation covering the entire population of susceptible children. The National Programme for Prophylaxis Against Nutritional Blindness (NPPANB) was initiated in 1970[4]. All children 1 to 5 years of age were to be given a massive dose (2 lakh international units) of Vitamin A every six months. In addition, all children with clinical signs and symptoms of vitamin A deficiency were to be treated. The programme was initially started in 11 States. Subsequently, based on the reports of an evaluation study which showed that MDVAS led to reduction in vitamin A deficiency and keratomalacia, the MDVAS programme was extended to all the States in the country.

In 1975, the International Vitamin A Consultative Group (IVACG) was constituted with financial assistance from USAID; the IVACG had the mandate to promote activities for the prevention and control of VAD. The IVACG operated through a network of policy makers, programme administrators, and scientists interested in resolving the problem of VAD. It collaborated with international organizations working in developing countries and facilitated the establishment of policy guidelines for diagnosis, treatment, and prevention of VAD. It also collated and reported the outcome of research studies on the bio-availability of vitamin A and β carotene in foods, the association

CONTENTS

Table 1: Vitamin A deficiency and other deficiencies and diseases	
Vitamin A deficiency only	0.5%
Vitamin A Deficiency and protein energy malnutrition	79%
Vitamin A deficiency and marasmus	13%
Vitamin A deficiency and tuberculosis	2.4%
Vitamin A deficiency and other diseases	5.1%

between vitamin A and infection-related morbidity and mortality, methods for assessment of vitamin A deficiency both in the community and in the laboratory, the interaction of other micro-nutrients with vitamin A, and fortification of foods with vitamin A.

MDVAS and under-five (U5) mortality

Indonesian study

In 1985 a study was undertaken in Indonesia to assess the impact of MDVAS on childhood mortality. The study reported that MDVAS administered once in six months led to a reduction in U5 mortality rate by 34%. This reduction was mainly because of lower incidence of measles and diarrhoea. There was no significant reduction in mortality attributable to lower incidence of respiratory tract infections (RTIs) and malaria. Based on these results, it was concluded that vitamin A deficiency is an important determinant of child mortality in developing countries, and that MDVAS was the single most important measure that could reduce child mortality[5]. Commenting on the study results Dr. Gopalan wrote "It is quite likely that some part of the difference in the observed mortality between the supplemented and the un-supplemented groups in the study under discussion was in fact attributable to Vitamin A supplementation. However, the claim made in the study with regard to the extent of mortality reduction that vitamin supplementation alone can bring about appears highly exaggerated[6].

Indian study 1

A similar study was undertaken in India. The Indian study was a well-designed prospective randomised placebo-controlled double-blind study with adequate sample size to assess the impact of MDVAS on child mortality; data from this study showed that MDVAS did not have any effect either on morbidity or on the mortality rate[7]. The mortality rate among the children in the study areas was lower than the national average. However, there was no significant difference between the control and experimental groups. Commenting on the study results Dr. Gopalan wrote "The important conclusion of operational significance that emerges is that striking reductions in child mortality can be achieved in the rural areas of developing countries even among poverty-stricken communities, through regular systematic contacts between the communities and middle level health workers, which could help in the timely detection, prevention and cure of usual ailments of children. This is understandable; after all, the overwhelming majority of illnesses of children are preventable and curable by middle level health workers if detected in time, and do not call for expensive technology"[8].

Table 2: Prevalence of vitamin A deficiency							
	AGE (yr)					SEX	
	<1 yr	1-3 yrs	3-5	6-10	[illegible]	Males	Females
Hyderabad	3.8%	26.8%	48.7%	18.2%	2.5%	60%	40%
Coonoor	0.2%	17.9%	39.0%	31.4%	11.5%	58%	42%

Indian study 2

One of the largest trials exploring the role of MDVAS in reducing childhood mortality under programme conditions was undertaken in India. This study was conducted in 72 blocks in Uttar Pradesh between 1999 and 2004 (DEVTA trial). Approximately 1 million children were followed up and the MDVAS status and mortality rates in children were recorded. There were no significant differences in mortality rates between children who received the massive dose of vitamin A and those who did not[9]. In1986 Dr. C. Gopalan had commented "Policy makers and planners of developing countries, who because of their resource constraints, are desperately looking for easy remedies, simple solutions and soft options, should not be misled to believe that better child survival and child health and nutrition can be largely achieved by such instant devices and shortcuts as distribution of a pill or capsule once in six months. The eradication of ill health and under-nutrition and the reduction of morbidity and mortality among the poor in the developing countries of the world cannot be brought about by such simplistic solutions; it will call for action on a broad front, directed to the removal of the several socio-economic, environmental, and dietary constraints which afflict the poor everywhere"[6].

MDVAS in CSSM Programme

In 1994, the National Child Survival and Safe Motherhood (CSSM) Programme was launched in the country. The Government of India, on the advice of Indian scientists, lowered the age of children receiving initial dose of MDVAS to 9 months because of the evidence that severe VAD can occur even in younger children[10]; at nine months of age, the infants were to receive one lakh units of vitamin A supplement along with measles immunisation. Thereafter the children were to receive 2 lakh units of vitamin A at 18, 24, 30 and 36 months of age[10]. Despite clear instructions to the health workers, the coverage under MDVAS remained quite low in all the states.

Linking of MDVAS with immunization program

During the Eighth Five Year Plan an attempt was made to improve the coverage, especially of the first two doses, by linking Vitamin A administration to the ongoing immunisation programmes. Under the revised regimen a dose of 100,000 IU of Vitamin A was administered to all infants at nine months along with measles vaccine and a second dose of 200,000 IU was administered at 18 months of age along with booster dose of DPT and OPV. Subsequently, the children were to receive three further doses of 200,000 IU of Vitamin A once every six months until 36 months of age. The reported coverage figures under the modified regimen

indicate that there had been some improvement in coverage with the first dose (50 - 75%) but the coverage for subsequent doses remained low. Dr. Gopalan was not in favour of this, and wrote "These recommendations will no doubt vastly increase the market for the commercial product in question; but the safety and benefits of these procedures have never been assessed"[8].

National consultation under the aegis of Ministry of Health and Family Welfare

In the year 2000, a National consultation was held under the aegis of the Ministry of Health and Family Welfare, to discuss the scientific and epidemiological evidence on the benefits and safety of administration of vitamin A to pre-school children and pregnant and lactating women[11]. The following recommendations were made:

I) available data are not robust enough to recommend a policy of vitamin A supplementation for the purpose of mortality reduction in children;

ii) the current programme recommendations of periodic administration of vitamin A, starting alongside measles vaccination at 9 months and continuing till 3 years of age should be persisted with;

iii) the screening of children for clinical symptoms and signs of VAD should become part of primary health care, and all children with clinical VAD should be promptly treated. These recommendations were accepted by the Government of India.

These recommendations were accepted by the Government of India.

Linking MDVAS with pulse polio immunization

In order to improve coverage under MDVAS programmes, UNICEF and WHO along with other international agencies strongly recommended that MDVAS should be linked with the National Pulse Polio Immunization (PPI) programme and administered on the same designated days. Under PPI, all U5 children in the country were covered. UNICEF and other international agencies provided vitamin A doses free of cost; support was also provided to the ICDS and front line health functionaries in the form of honoraria and reimbursement of contingency expenses. Dr. C. Gopalan did not support this approach. He was of the opinion that the policy would benefit commercial interests while putting infants at risk of toxicity. The Indian Academy of Pediatrics (IAP) deliberated the merits and demerits of this strategy and recommended that the strategy of linking Vitamin A administration to PPI should be discontinued[12]. The Government of India accepted the IAP recommendations and delinked MDVA from PPI.

The Assam tragedy

In 2001, a MDVAS campaign was undertaken by the Assam government with support from UNICEF; on a single day, health workers administered MDVAS to 3.2 million children in Assam. The vitamin A doses were administered to children from a 5-ml cup instead of the usual 2 ml spoon (Fig 1). On the same day, about 1,000 children who had received the MDVA fell ill with symptoms of vitamin A toxicity, including vomiting, nausea and headache.Families of children in the more remote villages were unable to access medical care in time, and there were fatalities[13].

According to the Government of India report, 15 of these were in the 1-3 year age group. Although an ICMR research survey conducted in the year 2000 documented that the prevalence of Bitot's spots in two districts in Assam, namely Nagaon and Dibrugarh, was less than 0.5%, (a cut-off recommended by WHO to define VAD as a Public Health problem) these districts were included in this campaign. All U5 children were given MDVAS, although the eligible beneficiaries as per GOI guidelines were only those 9-36 months of age[13,14]. It was found that UNICEF had replaced the traditional 2 ml spoons used by health workers for the past 30 years with 5 ml cups to pour out vitamin A during the campaign. This change made it possible for the delivery of up to 500,000 IU (275 mg retinyl palmitate) of vitamin A in a single dose, to a child.

The Guwahati High Court, noted that UNICEF, by replacing the traditional 2-ml dosing spoon with 5-ml medicine cups, had created a situation in which there was a possibility that a larger, toxic dose of MDVAS could have been administered to the children. It ruled that both UNICEF and the government of Assam were to blame for the death of more than 20 children who were given MDVAS in the State. The court ordered the state government to pay compensation to the families of the children who died, at the rate of Rs 20,000 (US$400) in addition to Rs 5000 (US$100) that each family had already received.

Tenth Plan recommendations for MDVAS

The Tenth Five Year Plan recommended that the practice of administering 100,000 IU dose of Vitamin A at nine months along with the measles vaccine and administering MDVAS with 200,000 IU at 18, 24, 30 and 36 months of age may be continued. In order to improve coverage without too many logistical problems, these four doses are to be administered during April and October each year (pre-summer/pre-winter period). In addition:

- all children with xerophthalmia should be given two doses of synthetic Vitamin A as per the present schedule of the Government under the RCH programme;
- all children suffering from measles should also be given one dose of Vitamin A, if they have not received it during the previous one month; and
- all cases of severe CED (based on weight-for-age criteria or clinical signs) should be given one additional dose of Vitamin A.

Expanding the age group of children getting MDVAS

In the year 2006, the Government of India expanded the age groupof

Fig 1 Change from spoon to cup for MDVAS

Table 3: Prevalence of Bitot's Spot among Pre-school Children (NNMB survey 2012)

States	Year			
	1975-79	1988-90	1996-97	2011-12
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
Orissa	1.5	1.1	0	0.3
Pooled (7 States)	1.8	0.7	0.7	0.2

eligible children for MDVAS to those between the ages of 6 and 59 months "after reconsidering the recommendations of WHO and UNICEF"[15]. This recommendation ignored the available scientific evidence that clinical VAD was limited to children 6-36 months and that too in only a few isolated geographical pockets in the country[16]. In the same year (2006), the IAP recommended "that there is no compelling epidemiological data to indicate an increase in clinical VAD specifically in children above three years of age. Scientific evidence does not support the need for mega-dose supplementation in children above three years of age". However, the recommendations of IAP scientists were ignored by the Ministry of Health.

MDVAS in the Mother Child Protection Card

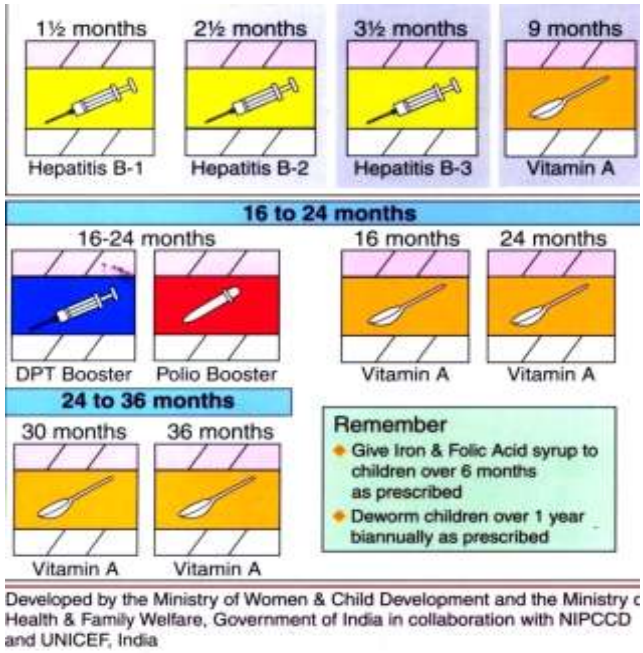
Presently, MDVAS is implemented through the existing network of health care facilities from tertiary care centres to primary health centres sub-centres. The ANMs, with help from ASHA and Anganwadi workers, are responsible for administering MDVAS at the community level, both in urban and rural areas. Intensive drives/campaigns are undertaken every six months to achieve universal coverage of those children who could not be covered during the routine home visits of health functionaries.

The Mother Child Protection Card (MCPC) is used by ICDS and health functionaries to record nutrition and health data including immunization for each mother/child; the card provides pictorial messages on appropriate infant and child feeding practices and age specific milestones for growth and development. The card has provided a space for recording Vitamin A supplementation (MDVAS) to children along with the space given for recording immunization details (Fig 2). Presently, health and ICDS functionaries are to achieve universal coverage both in immunizations and in MDVAS. The international agencies, including UNICEF, help by providing supplies to ensure smooth universal distribution of MDVAS to children.

Current status of vitamin A deficiency

Clinical vitamin A deficiency has declined significantly during the last 50 years. There has been a virtual disappearance of keratomalacia, and a sharp decline in the prevalence of Bitot's spots. Repeat surveys by the National Nutrition Monitoring Bureau (NNMB) have revealed that the prevalence of Bitot's spots has shown a decline from 1.8% in 1975-79 to 0.2% in 2011-12 (Table 3). A national survey conducted

Fig 2 MVDAS in Mother Child Protection Card

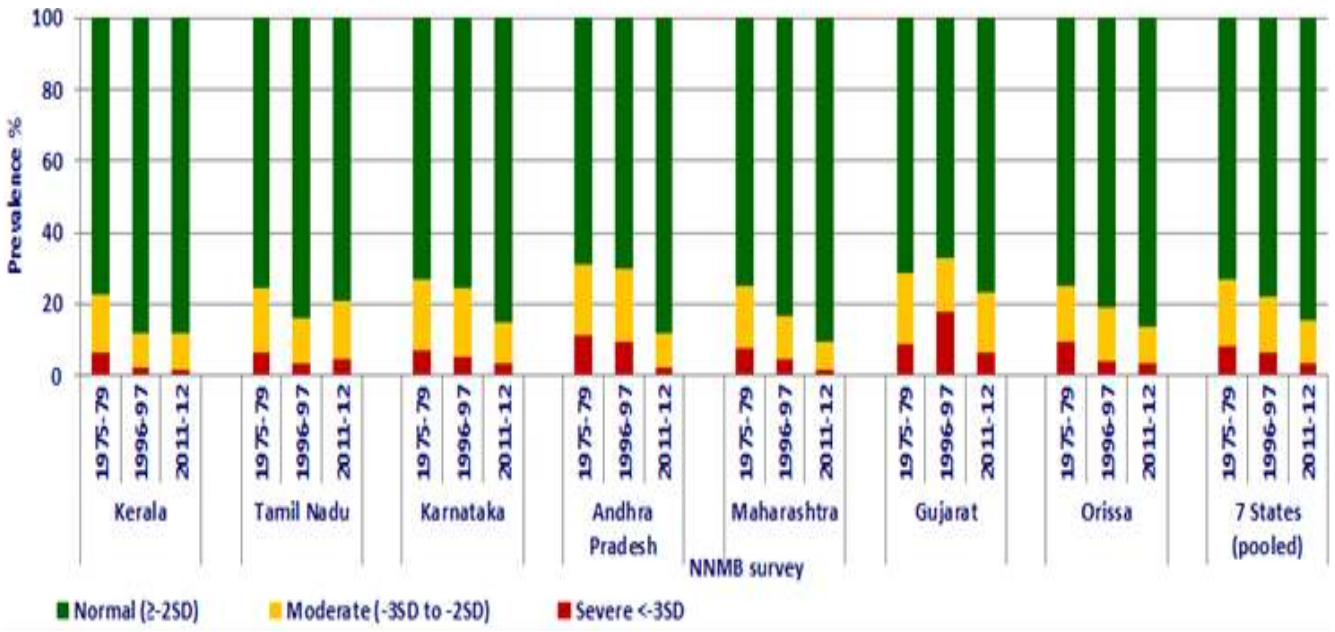


by ICMR also found that only three out of 16 districts had a ?0.5% prevalence of Bitot's spots in U5 children (Table 4). The clinical symptoms of vitamin A deficiency were found only in population groups which were socio-economically backward, poverty-stricken, and having poor access to health services, and only in certain seasons when green leafy vegetables are in short supply. However research studies have shown that over half of the U5 children have low plasma vitamin A levels and the international agencies continue

Table 4: Prevalence of Bitot's spot 6 yr (ICMR survey)

District	No. of children	Bitot's spot (%)
NORTH		
Mandi	10589	NIL
Dehradun	8912	NIL
Badaun	10782	NIL
Mainpuri	5562	0.02
Baramulla	10766	0.03
Srinagar	9713	0.04
Lakhimpur Kheri	11026	0.46
Bikaner	10730	1.10
EAST		
Bishnupur	11068	0.06
Kohima	11079	0.24
Dibrugarh	10754	0.30
Nagaon	10696	0.30
Patna	10739	3.1
Gaya	10711	4.71
SOUTH		
Mehboob Nagar	10343	0.37
WEST		
Raigarh	11042	0.03
ALL DISTRICTS	164512	0.70

Fig 3 Time trends in prevalence of wasting (NNMB surveys)



to highlight the fact that the biochemical evidence of vitamin A deficiency continues to be high.

Reasons for decline in VAD in India

Surveys carried out by the NNMB and National Family Health Survey (NFHS) 2 and 3 have documented that less than 20% of U5 children had received MDVAS in the 6 months preceding the survey. Therefore MDVAS appears to have no role in the reported decline in the prevalence of vitamin A deficiency. During the last five decades, the indicators of child health have shown substantial improvement. This is attributable to improvements in:

I. Health infrastructure. There is now better access to health care for mothers and children. The doctor/population ratio and the ANM/population ratio have vastly improved. Health care delivery has improved. The availability of effective antibiotics has reduced the duration of acute respiratory infections and other infection-induced morbidities. Also, the improvement in literacy has led to better utilization of health care facilities. Immunization coverage for measles and other vaccine preventable diseases has improved from 5-7% in the early 1970s to 80-90% currently.

ii. Food availability. With policies in place to make subsidised food grains available and accessible to poor households, there has been a significant improvement in the overall dietary intake of young children. The ICDS covers more than 90% of rural India, providing nutritional supplements to children under the age of six years and nutrition education to mothers. The prevalence of severe under-nutrition has come down significantly[18] (Fig 3).

iii. Infrastructure. Roads, communication facilities, electricity supply, water supply and social security have improved significantly. All these factors have indirectly contributed to better health care and lower prevalence of vitamin A deficiency in children.

MDVAS and U5 mortality in India

The universal administration of MDVA is presently being undertaken in India for two stated purposes:

i) prevention of nutritional blindness due to VAD. This objective is no longer valid, as severe cases of VAD and nutritional blindness are not seen in the country.

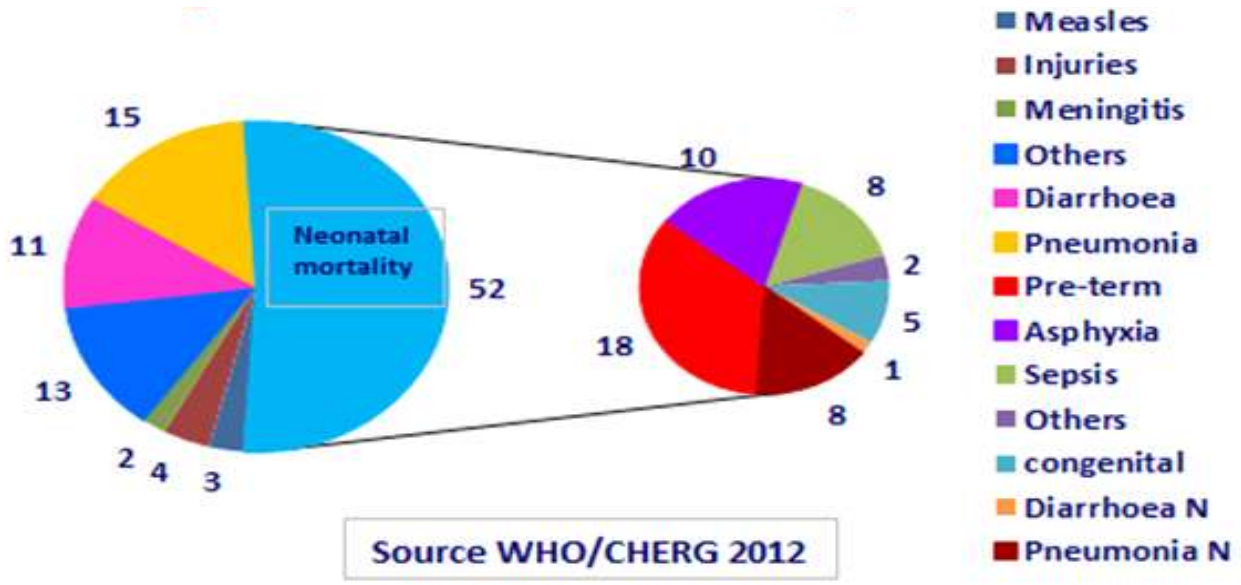
ii) reduction in U5 mortality.

In the following section the possible role of MDVA in the reduction of U5 mortality in India is reviewed.

In India, there has been a gradual reduction in U5MR from 191 (1970) to 48 (2015). The infant mortality rate (IMR) has also declined from 80 (1991) to 38 (2015). An analysis of the data from NFHS-4[16] suggests that, if the total number of infant (<1 year of age) deaths are subtracted from the U5 deaths, only a small proportion of deaths occur in the >1 year age group (0-14 points) (Table 5)[16]. Further, the causes of these deaths include accidents, genetic disorders, congenital anomalies, meningitis, and pneumonia (Fig 4)[16]; clearly MDVAS has no role to play in preventing deaths due to these causes. The above evidence suggests that, currently, universal MDVAS may not have any role in the reduction of U5 mortality. Indeed, if MDVAS were to be given in 2018 to children in the same villages of Indonesia where it was administered in 1985, it is highly unlikely that there would be a 34% reduction in mortality, because the U5 mortality rates of the community would have improved over time.

Unjustified claims of the benefits of MDVAS

Fig 4 Causes of under-5 mortality in India



The administration of massive doses of vitamin A in U5 children is advocated by some on the grounds that this could bring about a significant reduction in mortality in this age group. However, benefits on this scale have been found only in areas with poor health-care facilities, where clinical VAD deficiency is common. The original meta-analysis by Beaton in 1993 drew upon the 8 studies available at that time. It was estimated that MDVAS resulted in an average mortality reduction of 23% in children 12-59 months of age[17]. Another meta-analysis done in 2010 included seven of the earlier studies and added nine more studies; however, the Indian study in UP was not included in the analysis. This analysis concluded that the weighted average mortality finding remained unchanged from the previous meta-analysis. It is important to note that in this meta-analysis, 89% of the weightage was given to the seven pre-1993 trials; the newer 9 trials were given only 11% weightage. Further, out of the 16 study results, 8 showed no significant impact on U5MR and only two of the 9 studies conducted after 1993 showed an impact of MDVAS on U5 MR. These findings confirm that, despite early MDVAS trials showing an impact by MDVAS on U5 mortality rate, there is little evidence for this from subsequent studies undertaken in the past 20 years. The meta-analyses did not consider the effect of major changes in disease patterns over the period of time and health care delivery and improvements in health status[18]. The reduction in mortality rate as estimated in the earlier MDVAS trials were largely due to reduction in deaths from measles and diarrhoea; no other causes were significant. Since the 1990s the prevalence of measles has been greatly reduced by successful immunization programs, and deaths due to diarrhoea have declined due to improved living conditions, better utilization of health services, and use of oral rehydration therapy[20,21].

Indiscriminate mega-dosing

Universal supplementation of vitamin A to Indian children is being undertaken irrespective of their family background and vitamin A nutritional status. Vitamin A deficiency is currently limited to isolated geographical pockets in the country; there is no substantive evidence of benefit of vitamin A supplementation to children in the absence of clinical signs of deficiency. Vitamin A is toxic in high doses. The mega-dose of vitamin A (200 000 IU) given to children is 500 times higher than the daily recommended dose (400 IU). Children hospitalized for acute infectious diseases with low vitamin A status on admission tend to benefit from high-dose supplements, but no benefits have been observed among those with adequate pre-admission vitamin A status. It is therefore inappropriate to administer a pharmacological dose of vitamin A to large numbers of children whose vitamin A status is adequate. At present, MDVAS aims at universal supplementation in all states without consideration of prevalence of deficiency, immunization status, U5 mortality rate, dietary intake of vitamin A and access to health care. For example, despite widely varying child health and nutrition

Table 5 .Death rates in 1-5 year of age (NFHS4)

State	U5MR	IMR	Deaths in 1-5 years
Goa	13	13	0
Puducherry	16	16	0
Andaman & Nicobar	13	10	3
Sikkim	32	29	3
Karnataka	32	28	4
Manipur	26	22	4
Telangana	32	28	4
Maharashtra	29	24	5
West Bengal	32	27	5
Andhra Pradesh	41	35	6
Tamil Nadu	27	21	6
Tripura	33	27	6
Uttrakhand	47	40	7
Haryana	41	33	8
Bihar	58	48	10
Meghalaya	40	30	10
Madhya Pradesh	65	51	14

indicators, the states of Kerala and Uttar Pradesh have the same policy of MDVAS. The potential adverse effects of administering a pharmacological dose of vitamin A to a child who is not suffering from deficiency, have not received due attention.

Adverse effects of MDVAS

Acute toxicity following MDVAS in infancy has been reported across the globe[19].

Bulging fontanelle

Nearly 12% of infants developed bulging fontanellae, when administered 100,000 IU of vitamin A. A significant proportion of brain development takes place in children below the age of three years. Data from NFHS 4[16] indicate that in India, 38.4 % of children have under-nutrition (HAZ below minus 2 SD). Subjecting these under-nourished children to repeated episodes of increased intra-cranial tension could contribute to retarded brain development. There is lack of scientific evidence on the long-term adverse consequences of these repeated episodes of raised intra-cranial tension on brain development in small, intrauterine-growth-retarded Indian children[22].

Vitamin A and vitamin D antagonism

Animal studies suggest that vitamin A is an antagonist of vitamin D. MDVAS intensifies the severity of bone demineralization and inhibits the ability of vitamin D to prevent such demineralization. Increasing the amounts of retinyl acetate produces 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[20-23]. Considering the current high prevalence of Vitamin D deficiency in the country, interventions potentially detrimental for bone health (such as MDVAS) are best avoided.

Potential for aggravation of zinc deficiency

There is a possibility that zinc deficiency, which is already present in under-nourished children, could be aggravated by massive doses of vitamin A. The administration of massive doses of vitamin A to children who may be deficient in multiple nutrients including vitamin D and zinc could aggravate growth retardation. The potential role of massive-dose vitamin A prophylaxis in the persistence of stunting in poor children has to be carefully investigated.

Risk of acute respiratory infection

Vitamin A administration has been associated with a significant increase in the prevalence rate of pneumonia in well-nourished children who received 10,000 IU of vitamin A supplements weekly. A meta-analysis concluded that MDVAS has no consistent overall protective effect on the incidence of diarrhoea, however it slightly increases the incidence of respiratory tract infections; hence, high dose vitamin A supplements are not recommended on a routine basis for all pre-school children and should be offered only to individuals or populations with vitamin A deficiency[18]. Another recent review of 9 randomized controlled trials enrolling 33,179 children with lower respiratory tract infections (31,379 in the community and 1800 in hospital) concluded that vitamin A supplementation is not helpful for preventing pneumonia, at least in normally nourished children, and may actually worsen the situation. According to these investigators, the results should make the policy makers think twice before continuing with the universal vitamin A supplementation program[24,25].

Cost of universal MDVAS coverage

It has been evaluated that the annual cost per child dosed is 1.14 USD (R 75). This includes: (I) programme-specific costs 0.42 USD (R 28), (ii) personnel cost 0.55 USD R 36) and (iii) capital costs 0.17 USD (R 11). The total number of U5 children in India is about 180 million (15% of 1200 million). A recurring cost of R 13,500 million (180 million x R 75) is being spent on MDVAS. Apart from the cost of the micro-nutrient, the programme also uses precious human and material resources meant for delivery of primary health care[26]. India has long ago emerged out of the era of rampant clinical vitamin A deficiency leading to blindness. Prevalence of night blindness and Bitot's spots is quite low except in marginalised populations in small pockets. In the current Indian scenario, where there are competing claims on the limited resources available, it is not appropriate to spend such large amounts of resources on MDVAS, which is an intervention with questionable health benefits to children who are not deficient in vitamin A.

The way forward

In 2011, the WHO issued guidelines which provide global, evidence-informed recommendations on the use of vitamin A supplements for the reduction of morbidity and mortality. According to these guidelines, Vitamin A supplementation in children 6-59 months of age is recommended in settings where vitamin A deficiency is a public health problem[27]. The mechanisms by which vitamin A reduces mortality are not fully understood, and it is not clear whether its action is mediated through the correction of underlying deficiencies or through adjuvant therapeutic effects. In the Indian context, it would therefore be prudent to restrict MDVAS to geographical pockets or areas where clinical vitamin A deficiency is a significant public health problem rather than continuing universal prophylaxis. Areas with high prevalence of vitamin A deficiency should be identified and the MVDAS should be undertaken in these regions only[27]. India is currently at a stage to move from universal MDVAS to a targeted supplementation program and treatment of identified persons with vitamin A deficiency. Dr. Gopalan had written "Public spirited citizens together with scientific community must now ensure scrapping of the massive dose vitamin A prophylaxis approach. This will not only avoid the considerable unnecessary expenditure, which Indian and other governments are incurring in the programme, but more importantly save our children from undesirable side effects"[28].

In India, for cost effective utilization of limited resources available to the health sector, the 'Triple A' (Assessment, Analysis and Action) of UNICEF should be adopted; first assess the problem of magnitude of vitamin A deficiency, then undertake the detailed analysis of causes of vitamin A deficiency, and then decide the combination of approaches to be adopted for prevention and control in the community[29]. Countries with limited financial resources and competing health priorities cannot afford the luxury of initiating interventions to raise serum biochemistry of vitamin A alone. Unambiguous demonstration of health benefits is imperative to consider vitamin A supplementation; extrapolations based on simple cross-sectional correlations have no meaning in this context. Dr. Gopalan always advocated that the country should look to our

farms not pharmacies, for combating vitamin A deficiency and other micro-nutrient deficiencies. The primary focus should be on adopting sustainable food based approaches to combat vitamin A deficiency. The micro-nutrient deficiencies are usually due to household food insecurity and poor quality of household diets. Ultimately, the solution to all nutrient deficiencies will have to be through improvement of diets[30]. When overall food intake becomes adequate enough to provide energy needs, other nutrient needs would be met to a considerable extent even with the current diets. The focus of efforts should be on sustainable food-based approaches to combat vitamin A deficiency. Efforts have to be made to increase local production and consumption of green leafy vegetables and other plant foods that are rich sources of carotenoids. Green leafy vegetables, many fruits and plant foods are also good sources of folate, vitamin C, Fe, Ca and many other micro-nutrients and bio-active compounds. They contribute to improvement of the overall nutritional status of children and improve satiety; the phyto-nutrients also help in prevention of non-communicable diseases. A food-based approach would be a sustainable and cost effective solution to combat even biochemical vitamin A deficiency in areas where there are no clinical signs of vitamin A deficiency[30].

The author is Professor Public Health Nutrition, Human Nutrition Unit, All India Institute of Medical Sciences, New Delhi

References

1. Chandra H, Venkatachalam PS, Belavadi B, Reddy V, Gopalan C. Some observations on VAD in Indian Children: The India Journal of Child health, 1960, 589-595.
2. Venkatachalam PS, Belavadi B, Gopalan C. Studies on vitamin A nutritional status of mothers and infants in poor communities of India. J Pediatr. 1962 262-8.
3. Gopalan C, Venkatachalam PS, Belavadi B. Studies of Vitamin A Deficiency in Children. The American Journal of Clinical Nutrition, 1960, 833–840.
4. Maternal and Child Health scheme for Prophylaxis against Nutritional Blindness in children caused by Vitamin A Deficiency.
Family Planning Programme, Fourth Five-Year Plan Technical Information: MCH No. 2, Government of India Press, New Delhi, 1970; 1–22.
5. Sommer A, Djunaedi E, Loeden AA, Tarwotjo I. Impact of vitamin A supplementation on childhood mortality: a randomised controlled community trial. The Lancet. 1986. Pages 1169-1173.
6. Gopalan C. Vitamin A deficiency and child mortality. NFI Bull 1986; 7: 3-68.
7. Vijayaraghavan K, Radhaiah G, Prakasam BS, Sarma KV, Reddy V. Effect of massive dose vitamin A on morbidity and mortality in Indian children Lancet. 1990:1342-5.
8. Gopalan C Vitamin A and mortality: Now the Nepal study NFI bulletin 1992 13 (1) 6-7
9. Awasthi S, Peto R, Read S, Clark S, Pande V, Bundy D, and the DEVTA (Deworming and Enhanced Vitamin A) team. Vitamin A supplementation every 6 months with retinol in 1 million pre-school children in north India: DEVTA, a cluster-randomised trial. Lancet. 2013; 1469–147.
10. Vitamin A prophylaxis. In: National Child Survival and Safe Motherhood Programme- MCH Division, Department of Family welfare, Ministry of Health and Family Welfare, Government of India, Government press, New Delhi 1994, pp 88-93.
11. National Consultation on benefits and safety of administration of vitamin A to pre-school children and pregnant and lactating women. Indian Pediatr. 2001; 38:37–42.
12. Indian Academy of Pediatrics. Policy on linking vitamin A to the pulse polio program. Indian Pediatr. 2000; 37:727.
13. Kapil U. Deaths in Assam during vitamin A pulse distribution: the needle of suspicion is on the new measuring cup. Indian Pediatr. 2002 Jan;39(1):114-5
14. Kapil U. Update on vitamin A-related deaths in Assam, India. Am J Clin Nutr. 2004; 80:1083-84.
15. Government of India, Ministry of Health and Family Welfare, Department of Family Welfare, Child Health Division, Order no. Z.28020/30/2003-CH dated 2 November 2006.
16. IIPS National Family Health Survey -4 http://rchiips.org/NFHS/factsheet_NFHS-4.shtml accessed on 23.03.2018
17. Beaton, GH, Martorell, R., Aronson, KJ, Edmonston, B., McCabe, G., Ross, AC, Harvey, B. Effectiveness of Vitamin A Supplementation in the Control of Young Child Morbidity and Mortality in Developing Countries. 1993. ACC/SCN State-of-the-Art Series, Nutrition Policy Discussion Paper No. 13. ACC/SCN, Geneva.http://www.unscn.org/layout/modules/resources/files/Policy_paper_No_13.pdf
18. Imdad A,Herzer K, Mayo-Wilson E, Yakoob MY, Bhutta ZA Vitamin A supplementation for preventing morbidity and mortality in children from 6 months to 5 years of age. Cochrane Database of Systematic Reviews, 2010, (12): CD008524 (httpf/onlinelibrary.wiley.com/o/cochrane/clsysrev/articles/CD008524/pdf accessed 24 March 2018
19. De Francisco A, Chakraborty J, Chowdhury HR, Yunus M, Baqui AH, Siddique AK, Sack RB. Acute toxicity of vitamin A given with vaccines in infancy. Lancet 1993; 526–7.
20. Rohde CM, Manatt M, Clagett-Darne M and DeLuca HF. Vitamin A antagonizes the action of vitamin D in rats. J Nutr. 1999; 246–50.
21. Raghavan VV, Smith JE, Bilezikian JP. Vitamin A toxicity and hypercalcemia. Am J Med Sci. 1982; 283: 161–4.
22. Freudenheim JL, Johnson NE, Smith EL. Relationships between usual nutrient intake and bone-mineral content of women 35-65 years of age: Longitudinal and cross-sectional analysis. Am J Clin Nutr. 2005; 863–76.
23. Melhus H, Michaëlsson K, Kindmark A, Bergström R, Holmberg L, Mallmin H et al. Excessive dietary intake of vitamin A is associated with reduced bone mineral density and increased risk for hip fracture. Ann Intern Med. 1998; 129:770-8.
24. Shah. D. Does Vitamin A Supplementation Help in Preventing Pneumonia? Indian Pediatrics. 2009:403-4.
25. Mathew JL, Patwari AK, Gupta P, Shah D, Gera T, Gogia S, Mohan P, Panda R, Menon S. Acute respiratory infection and pneumonia in India: a systematic review of literature for advocacy and action: UNICEF-PHFI series on newborn and child health, India. Indian Pediatrics, 2011; 191-218.
26. USAID. Cost analysis of the national vitamin A supplementation programs in Ghana, Nepal, and Zambia: a synthesis of three studies. Arlington, VA, USAID, 2004 (httpf/www.mostproject.org/IVACG/GhanaNepalZambiaSythesis.pdf, accessed 20 May 2011).
27. World Health Organization (WHO). Guidelines for Vitamin A supplementation in Infants and Children 6-59 months of age Geneva: WHO;2011.www.who.int/entity/nutrition/ accessed 20 January 2011.
28. Gopalan C. Massive dose vitamin A prophylaxis should now be scrapped. World Nutr. 2010; 1: 79–85. Available at www.wphna.org (accessed on 15 July 2010).
29. Kapil U, Gupta A. Low-quality scientific evidence for the continuation of universal Vitamin A supplementation among under-5 children in India. Indian J Public Health. 2016; 60 (3):176-80.
30. Gopalan C & Tamber B. Food-based approaches to prevent and control micronutrient malnutrition: scientific evidence and policy implications. World Rev Nutr Diet. 2003: 91;76-131

FOUNDATION NEWS

- Dr Prema Ramachandran participated as expert panel reviewer in DBT-DFID-ESRC-MRC Global Research Programme Health Panel meeting in New Delhi on 15-16 March 2018
- Dr Prema Ramachandran participated and made presentations on Assessment of nutritional status in the FAO-SEWA workshop at Ahmadabad on 28th and 29th March 2018.

Edited by Dr. Anshu Sharma for the Nutrition Foundation of India, C-13, Qutab Institutional Area, New Delhi - 110016, website : www.nutritionfoundationofindia.res.in
Designed & Printed by Himanshi Enterprises