Routine Administration of Vitamin A Mega Dose to Infants, is it Rational and Safe

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Abstract

Vitamin A is a fat soluble compound important for vision, immune functions and integrity of skin and mucus membranes. In susceptible communities with vitamin A deficiency, vitamin A supplementation with mega dose, improves child survival significantly. In Sri Lanka, Vitamin A mega dose is administered periodically from six months of age, irrespective of the vitamin A status in the child. In a descriptive cross sectional study, the dietary intake of vitamin A in 200 infants was assessed using an interviewer administered questionnaire. Intake of vitamin A rich food during the past week was obtained from the mother. Intake was found to be higher than the daily recommended amounts in the majority. Some children even had clinical evidence of carotinaemia indicating saturated vitamin A stores. In this context routine administration of vitamin A mega dose irrespective of children's vitamin A status is not scientific and dangerous, as infants are more likely to get vitamin A toxicity. Identifying the children with adequate stores of vitamin A by history and examination will make vitamin A mega dose administration both safe and cost effective.

ABBREVIATIONS

BIH: Benign Intracranial Hypertension; MOH: Medical Officer of Health

INTRODUCTION

Vitamin A is a fat soluble organic compound essential for vision in dim light, due its action in rods of retina. Vitamin A also play a major role in maintaining integrity of mucus membranes, where deficiency cause drying of mucous membranes and skin, making individuals susceptible to respiratory tract infections. In the eyes Vitamin A deficiency, causes range of clinical features from night blindness to keratomalacia, with resultant blindness [1]. In children, vitamin A deficiency cause significant morbidity and mortality, especially when associated with measles. In susceptible communities with vitamin A deficiency, supplementation improves child survival significantly [2,3].

Vitamin A is present in large number of food items commonly consumed by humans, either as preformed vitamin A (retinol) or in the form of carotenoids (pro-vitamin). Preformed vitamin A is efficiently absorbed and utilized by humans at rates of 70–90%. Preformed vitamin A constitute up to 75% of vitamin A, in the diet of industrialized countries. This is largely derived from fish liver oil and the fortification of foods such as milk, butter, margarine, breakfast cereals, and some snack foods [4]. In developing countries, 70–90% of vitamin A is consumed as carotenoids available in yellow fruits and vegetable and green leaves. Depending on vitamin A status and other dietary and non-dietary factors, only 20–50% of Carotenoids consumed are absorbed [5,6].

All preschool children in Sri Lanka receive Vitamin A mega doses, six monthly from the age of six months [7]. In addition pregnant mothers receive Vitamin A mega dose. As Vitamin A is fat soluble, body cannot excrete it when taken in excess, leading to toxicity. The conversion of carotenoids to retinol is well regulated so that, vitamin A toxicity from excess consumption of carotenoids is not reported. However with excessive consumption of preformed vitamin A, hepatic storage occurs very efficiently until the pathologic state of hypervitaminosis A develops [8]. Children are particularly sensitive to vitamin A, with daily intakes of 1500 IU per kilogram body weight leading to toxicity [9].

Clinical features of Vitamin A toxicity depend on whether exposure is acute or chronic. Acute toxicity is likely when a child with saturated vitamin A stores receive a vitamin A mega dose. Most worrying clinical effect of acute toxicity is benign intracranial hypertension (BIH), which is a vision threatening condition. Other features of acute toxicity include nausea, vomiting, interference with bone metabolism, loss of hair and bone pain [10]. In contrast only known effect of hypercarotenaemia is yellow pigmentation of skin, which is of no clinical significance.
Carrots, pumpkins, sweet potatoes and green leafy vegetables, which are rich in carotenoids, are common components of Sri Lankan weaning diets. In our clinical practice we often see children with carotenaemia due to overconsumption of vitamin A rich foods. There is a high risk of vitamin A toxicity among these children following vitamin A mega dose. Therefore, this study was conducted to verify the safety and necessity of routine Vitamin A mega dose administration to all Sri Lankan preschool children.

MATERIALS AND METHODS

Study setting

The study was conducted between October 2014 and September 2015 at child welfare clinics held in Ragama medical officer of health (MOH) area. Ragama MOH area is situated in the Gampaha district, Sri Lanka, and consists of a socio-economically mixed population [11]. Two child welfare clinics are held weekly in this area, where children are brought for growth assessment and vaccination.

Subject selection

Children aged between nine months and one year, brought to child welfare clinics accompanied by the mother was recruited for the study, on all-inclusive consecutive basis.

Data collection

Using a pretested and validated, interviewer administered questionnaire, history of consumption of Vitamin A rich foods (carrots, pumpkins, mango, green leaves, eggs, fish, sweet potatoes, chicken/ beef/liver, butter and margarine) during previous week by the child was obtained. Other feeding practices such as exclusive breast feeding, complementary feeds, and formula feeds were also recorded. Data on mother’s education and family income was also obtained. Child health development record (CHDR) was used to detect growth faltering and details of the food items mentioned in table 3, during the week prior to the study. Mostly consumed vitamin A rich food was carrots, where 93.5% children had carrots at least once during the week. Carrots were consumed by 47.8% children, every day and 27.4% children had carrots three times a day on all seven days. Similar pattern was observed for pumpkins and green leaves. 23.3% children had pumpkins once in a week. Carrots were consumed by 47.8% children, every day and 19.0% children had pumpkins three times a day on all seven days. 47.0% children had green leaves once in a week. Carrots were consumed by 47.8% children, every day and 22.0% children had green leaves three times a day on all seven days. 26.4% children had fish once in a week. Carrots were consumed by 47.8% children, every day and 16.1% children had fish three times a day on all seven days. 22.0% children had eggs once in a week. Carrots were consumed by 47.8% children, every day and 15.7% children had eggs three times a day on all seven days. 36.5% children had chicken or beef or liver once in a week. Carrots were consumed by 47.8% children, every day and 17.7% children had chicken or beef or liver three times a day on all seven days. 23.8% children had potatoes once in a week. Carrots were consumed by 47.8% children, every day and 14.1% children had potatoes three times a day on all seven days. 26.4% children had butter or margarine once in a week. Carrots were consumed by 47.8% children, every day and 16.1% children had butter or margarine three times a day on all seven days.

Data analysis

Data analysis was done using SPSS version 16.

Ethical issues

Ethical approval to conduct the study was obtained from the research ethics review committee of the Faculty of Medicine, University of Kelaniya. Permission to conduct the study was obtained from medical officer of health, in charge of the clinics. Informed written consent was obtained from mothers to include them and their babies in the study. None of the mothers refused consent.

RESULTS AND DISCUSSION

A total of 200 children were recruited for the study.

Socio demographic factors

Majority of the families included in the study were from low to low middle income families. Majority of others had a reasonably good education. The family income and mother’s highest education level are depicted in Table (1 & 2).

Nutritional status

Growth faltering according to the child health development record was noted in 46 (23%), but none had clinical evidence of severe protein energy malnutrition or vitamin A deficiency. Clinical evidence of carotenaemia was detected in 34.8%, but none of them had clinical evidence of hypothyroidism.

Feeding practices

Exclusive breast feeding for six months was received by 140 (70%) and 182 (91%) were still receiving breast milk at the time of the study. Eighty nine (44.5%) were on formula milk and 32 (16%) were receiving three or more formula feeds per day. All the children were on complementary feeds at the time of the study. Complementary feeds were started at six months in 134 (67%), before six months in 51 (25.5%) and after six months in 15 (7.5%). At the time of the study 25 (12.5%) children were on multivitamin syrups. A Vitamin A mega dose was received by 166 (83%) children at the six months clinic visit. All children with clinical evidence of carotenaemia have had the vitamin A mega dose.

Intake of vitamin A

Each child included in the study had consumed at least three of the food items mentioned in table 3, during the week prior to the study. Mostly consumed vitamin A rich food was carrots, where 93.5% children had carrots at least once during the week. Carrots were consumed by 47.8% children, every day and 27.4% children had carrots three times a day on all seven days. Similar pattern was observed for pumpkins and green leaves. Consumption of other vitamin A rich foods was also high.

Consumption pattern of vitamin A rich food during the

| Table 1: Monthly Family Income (140 Sri Lankan rupees (SLR) = 1 US$). |
|-----------------|-----|-----|
| Income (SLR)   | number | percentage |
| <Rs.5000       | 14  | 7.0% |
| Rs.5000-15000  | 41  | 20.3%|
| Rs.15000-35000 | 95  | 47.8%|
| >Rs.35000      | 50  | 24.9%|
| Total          | 200 | 100.0%|

| Table 2: Mother’s education. |
|-----------------|-----|-----|
| Educational level | Number | Percentage |
| Up to Grades 5   | 8    | 4.0%  |
| Grade 6 – O/L*   | 122  | 61.0% |
| Up to A/L†       | 61   | 30.5% |
| University and above | 9   | 4.5%  |
| Total            | 200  | 100.0% |

*General certificate of Education Exam, Ordinary level (O/L) Barrier exam for A/L
†General certificate of Education Exam, Advanced level (A/L) university entrance exam

previous week by children included in the study is depicted in Table (3).

**DISCUSSION**

According to the National Institutes of Health, the recommended daily dietary allowances for vitamin A are, 400 micrograms (μg) of retinol activity equivalents (RAE) for children aged 0 to 6 months and 500 μg RAE for children aged 7 to 12 months [12]. Until recently, bioconversion factor for β-carotene to retinol was considered as 6:1. However recent studies have indicated that β-carotene absorption from a diet consisting mainly vegetables is about half of what was previously assumed, so that presently one μg RAE is considered equal to 12 μg of β-carotene [13].

Results of the study indicate that feeding practices and nutritional status amongst children between nine to twelve months of age were satisfactory. Though there was a variation in the pattern of consumption, majority of infants were receiving adequate amounts of vitamin A, either in the form of retinol or carotenoids. All children had vitamin A rich food items more than once during the week. Significant numbers had consumed vitamin A rich foods like carrot, daily at all three meals for all seven days. Just a half a cup of raw carrot will produce 450 μg RAE, fulfilling almost the requirement for a day [12]. It is evident that significant numbers of children were getting more than the recommended daily allowances of vitamin A through food. Clinical evidence of carotenaemia present in 38% of children is supportive of this.

Consumption in excess of the recommended daily allowance for several months leads to vitamin A toxicity. Toxicity is more likely in infants and children, because their body size is smaller. Symptoms of acute vitamin A toxicity include drowsiness, irritability, abdominal pain, nausea, vomiting and benign intra cranial hypertension. Though it is called benign, it causes visual loss in some individuals. There are reported cases of BIH among children, but screening children clinically before lead to toxicity in such children. As vitamin A supplementation for immunization. Even children with clear clinical evidence of carotenaemia are given vitamin A mega doses. Apart from BIH, vitamin A overdose has been implicated in osteoporosis which might not be immediately evident. So some healthy children are exposed to an unnecessary therapeutic intervention, which is potentially harmful. It is also an unnecessary expense on the health budget.

Excluding the children who does not need the mega dose by taking a dietary history, assessing growth parameters and looking for clinical evidence of carotenaemia, can easily reduce at least some cases of vitamin A toxicity amongst recipients of vitamin A mega dose. This can be easily done by the public health mid wife with the help of medical officer of health.

**Limitations**

One limitation of this study does not know the exact amount of vitamin A consumed by a child. There is no reliable method to know this; even if we got amount prepared child would not consume the entire amount and wastage during feeding is difficult to assess. Other limitations were not checking the Vitamin A levels. This was due to practical difficulty of doing this in the research setting and limited funds available for the study.

**CONCLUSION**

Majority of infants are getting a diet rich in vitamin A and some even in excess of daily requirement. Routine vitamin A mega dose administration to all infants without selection could lead to toxicity in such children. As vitamin A supplementation is an important public health intervention it should be continued among children , but screening children clinically before administration will reduce toxicity due to overdose.

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**REFERENCES**


