



REVIEW ARTICLE

PREVENTION OF BLINDNESS CAUSED BY 'VITAMINA' DEFICIENCY- AN AYURVEDIC PERSPECTIVE

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ABSTRACT

Blindness comes with devastating physical condition and deep socio-economic implications. Approximately 45 million people in the world are blind and another 135 million people are deemed to be visually disabled by 2020. 'Vitamin A' deficiency alone accounts for 6% among the causes of blindness. It is the chief cause of Childhood Blindness in developing countries. As a step towards prevention of blindness, the 'National Programme for Control of Blindness' recommends a single massive dose of 2,00,000IU of 'vitamin A' orally every 6 months to preschool children and half the dose to children between 6 months to 1 year of age. But, these 'retinol form' prophylactic supplements in excess may lead to toxicity causing acute and chronic symptoms, birth defects and even death. Ayurveda as a science has an equal responsibility in protecting 'right to sight' of each individual. Though the classical references do not directly mention about the daily dose of the nutrients, all the drugs mentioned as *chakshushya*, such as *Garjara*, *Karavellaka*, *Draksha*, *Shigru*, *Paalankika* etc do contain a large amount of 'vitamin A' in them. Hence an attempt has been made in this article to quantify these classical *chakshushyadravya* for daily recommended need of 'vitamin A' to every individual.

Keywords: Blindness, 'Vitamin A', *Chakshushya*

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INTRODUCTION

Blindness incurs devastating physical and deep socio-economic implications on humanity. Approximately 45 million people in the world are blind and another 135 million are deemed to be visually disabled by 2020.^[5]

'Vitamin A' deficiency accounts for about 6% among the etiological factors causing blindness.¹It is one among the primary causes of 'childhood blindness' in developing countries. The aim of government in implementing 'National Programme for Control of Blindness' is to reduce blindness from 1.4% to 0.3% in India by 2020.

'Vitamin A' helps in the production of retinal pigments called 'rhodopsin' needed for vision in dim light. As a step towards prevention of blindness, a single massive dose of 2,00,000IU of 'vitamin A' orally is given every 6 months to preschool children and half the dose to children between 6 months to 1 year of age under 'National Programme for Control of Blindness'. But, these prophylactic retinol form supplements, when consumed in excess may lead to toxicity causing acute and chronic symptoms, birth defects and even death.^[6]

Ayurveda has an equal responsibility in protecting 'right to sight' of each individual. Though it doesn't proclaim about the daily dose of the nutrients, the maximum *chakshushyadravya* said in the classics such

asgarjara, karavellaka, draksha, shigru, paalankika^[12] etc contain a large amount of 'vitamin A' in them.

Hence, an attempt has been made here to provide *chakshushyadravya* in specific quantity to figure out the daily consumption; so that the recommended dose of 'vitamin A' is made available to an individual. Awareness and implementation of these formulations in National blindness control programme can prevent dreadful loss of vision in young age.

Childhood blindness

'Vitamin A' deficiency is the single most important cause of childhood blindness in developing countries. Young children are at greater risk because of their higher requirement and susceptibility for frequent infections.

An estimated 1.5 million children are blind worldwide, of whom one million live in Asia and 3 lakh in Africa. Each year, half a million children become blind. 'Vitamin A' deficiency affects approximately 1/3rd of children under the age of 5 around the world and 2 to 5 lakh children in developing countries go blind every year.^[1]

Objectives of this write-up

1. To prepare an alternative Ayurvedic 'vitamin A' supplement which fulfills the recommended daily dosage criteria.

2. To discuss the steps to be taken for incorporation of Ayurvedic dietary 'vitamin A'

substitutes in the 'National blindness Control programme'.

'Vitamin A'

'Vitamin A' is a group of unsaturated fat soluble nutritional organic compounds which contributes to the production of retinal pigments necessary for 'scotopic vision' (night vision) and 'colour vision'. It even plays a pivotal role in haematopoiesis, skin and cellular health, growth, gene transcription, embryonic development, reproduction, immune system and antioxidant activity. The term 'vitamin A' is used in the context of dietary requirements to include 'pro-vitamin A' carotenoids that are dietary precursors of retinol. Of the many carotenoids in nature, several have 'pro-vitamin A' activity but food composition data are only readily available for carotene, beta-carotene and crypto-xanthene. Preformed 'vitamin A' is found only in animal-derived foods, whereas dietary carotenoids are found primarily in oils, fruits and vegetables. Retinol is required for the integrity of epithelial cells throughout the body.

Retinoic acid regulates the expression of various genes that encode structural proteins, enzymes, extracellular matrix proteins and retinol binding proteins and receptors. Retinoic acid plays an important role in embryonic development, particularly in the development of the spinal cord and vertebrae, limbs, heart, eye and ears. It is also required to

maintain differentiation of the cornea and conjunctiva, preventing xerophthalmia, as well as for photoreceptor rod and cone cells in the retina. The retinal form of 'vitamin A' is also required by the eye to change light to neural signals for vision. Retinol and its metabolites are necessary for maintenance of immune function.^[6]

An adequate supply of 'vitamin A' also plays a role in preventing morbidity and mortality from infectious disease, particularly in children. Infection and infestation can cause defective absorption of 'vitamin A'. The matrix of foods eaten can affect the release of carotenoids from foods, however, processing of food (cutting up, cooking etc) greatly improves availability and thus absorption of carotenoids from foods. Some studies show improved absorption of carotenoids with increased fat intake but the data is not consistent.

Positive interactions between iron or zinc status and 'vitamin A' status have been reported in animal studies or within human population groups in developing countries.

'Vitamin A' status has been assessed using a variety of indicators including a dark adaptation test, a pupillary response test, plasma retinol concentration, total liver reserves by isotope dilution, relative dose response methods and/or immune function assessment.^[8]

Vitamin A sources

1. *Animal:* Liver, eggs, butter, cheese, whole milk, fish, meat are rich in retinol.
2. *Plant:* Spinach, Amaranth, Papaya, Mango, Pumpkin, Orange, Tomato, Carrots, Braccoli, Pea, Apricotand Sweet potatoes.

Table No. 1: Daily recommendation of ‘Vitamin A’:(WHO)^[8]

Age	Dose
0-6months	250mcg/day
6 -12months	300mcg/day
1-3yrs	300mcg/day
4-8yrs	400mcg/day
9-13yrs	600mcg
14-18yrs	900mcg/day
19-70yrs(male)	900mcg/day
19-70yrs(female)	700mcg/day
Lactation	1100mcg/day
Pregnancy	800mcg/day

Vitamin A Deficiency

Causes xerophthalmia, keratomalacia, night blindness, skin lesions, demyelination, follicular hyperkeratopathy, decreased resistance to infections and child mortality. Deficiency may be of two types primary and secondary.

- Primary deficiency: Due to decreased intake of dietary ‘vitamin A’
- Secondary deficiency:Mal-absorption of lipids, impaired bile production and release, chronic exposure to oxidants like cigarette

smoke, chronic alcoholism and low fat diet. Zincand iron deficiency can also impair its absorption,transportand metabolism.

The pregnant and lactating women are often affected as well, in some cases at alarmingly high levels. Yet global dietary changes, which receive little attention as part of large-scale programs focused on micronutrient malnutrition, are progressing such that nutrient dense traditional foods are declining and energy dense processed foods are increasing, a pattern which bodes ill for population status of vitamin^{[5],[6],[7]}

Nutritional deficiencies not only lead to severe illness entailing long and costly treatment, but also influence physical development, psychic behavior,and susceptibility to infections.

National blindness control programme: ^[1]

The National programme for control of blindness was launched in 1976 as a 100% central sponsored scheme and incorporates the earlier ‘Trachoma control programme’ started in 1968.Various activities of this programme includes establishment of regional institute of ophthalmology, up gradation of medical colleges and district hospitals, development of mobile eye units, recruitment of required ophthalmic manpower and provision of various ophthalmic services.The aims were;

1. To reduce blindness in our country from 1.4% to 0.3% by 2020;

2. To provide comprehensive eye care through primary health care;

Under “Maternal and child health “Government of India has acknowledged many programmes at primary, secondary and tertiary levels of child birth. Fresh milk and capsules of Vit A and D are given free of cost. “Antenatal Care” includes specific health protection that checks the nutritional deficiencies especially ‘vitamin A’ along with Iron, Folic acid, Proteins and Iodine.” “School health services” was started in 1909 in India. In 1961, according to the recommendation of ‘School Health Committee’, Medical examination and remedial measures in schools were started. The steps taken towards preventing nutrition related blindness are

- Diet improvement advice
- Five doses of ‘vitamin A’ are given to all children under 3yrs of age.

First dose(1 lakh units) is given at 9 months of age along with measles vaccination. Second dose(2 lakh units) is given along with DPT/OPV booster doses. Subsequent 3doses (2 lakh units each) are given at 6 months interval.

➤ Capsules provided to malnourished mothers in endemic areas at delivery and encouragement for breast-feeding.

➤ 50,000IU orally as a single dose is given to non-breast feeding infants.

➤ For a child suffering from measles, severe protein energy malnutrition, persistent diarrhea or other prolonged febrile illness should be given ‘vitamin A’ according to age, but only a single dose and not 3, mentioned in keratomalacia^[1]

Toxicity

Since the determination of accurate dose individually is difficult, when massive dose of concentrated ‘vitamin A’ is given, especially in the form of ‘retinol’ leads to many adverse effects. Although proponents of the supplementation approach state that it is “entirely safe,” the fact is, we neither think about the physiological effects of mega dosing children with ‘vitamin A’, nor the mechanism by which it may in many cases protect against mortality. Inflammation or infection rapidly reduces serum retinol. This promotes the immune system’s pro-inflammatory Th-1 responses. ‘Vitamin A’ supplements may interfere with and block this response. Especially in children with normal ‘vitamin A’ status, high dose supplements may lead to increasing respiratory tract infections or diarrhea and in HIV-positive women they may increase subclinical mastitis. Low-dose ‘vitamin A’ appears to have fewer side effects and at least equal benefit to a high dose of ‘vitamin A’.^[8]

• Acute toxicity: Causes jaundice, nausea, vomiting, blurred vision, headache,

hair loss, abdominal pain, weakness, drowsiness and altered mental status.

- Chronic toxicity: Osteoporosis, hip fractures and birth defects.
- Therapeutic doses used to treat acne have been shown to disrupt cephalic neural activity and affects organogenesis in fetus. In some studies, the use of 'vitamin A' supplements has been linked to increased rate of mortality.^[6]

Importance of food based supplements

Food-based approaches to combat 'vitamin A' deficiency continue to be largely ignored by governments and donors. This may be partly because the way of viewing them has largely been informed by the community, which supports supplementation. Food-based approaches may be perceived as competitive or distracting and are thus slandered, for example claiming they are unproven or even ineffective. To the contrary, the supplementation approach fails to improve 'vitamin A' status and is even lacking in proof of impact on young child mortality in real life settings. A wide variety of common and indigenous foods are proven effective in improving 'vitamin A' status even in short-term trials.^[9]

Food based approaches are complex to implement and to evaluate and take time to mature and exert impact. However, unlike supplementation, they reach all members of

the community, are safe for pregnant women, have no side effects, are sustainable, and confer a wide range of benefits in addition to improving 'vitamin A' status.

Food-based approaches are also often portrayed as being expensive, but this is only true from a 'donor-centric' way of viewing costs. From the point of view of host countries, communities and families who grow 'vitamin A' rich foods, the economic benefits are likely to outweigh the costs.^[10]

Ayurvedic perspective

Ayurveda, the ancient and authentic science has an eminent role towards achieving the 'right to sight' of every individual. Our classics provide good knowledge about nutrition - dietetics and conduct which are good for our eyes.

We find several references in *Bruhatrayis*, *Laghutrayis*, *Chakradatta*, *Bhaishajyaratnavali*, *Sahasrayoga* and *Vangasena* about the *chakshushyayogas* (drugs good for vision) and *pathyaahara – vihara* (proper diet and conducts). The treasure of medicinal herbs explained in our classics have curative as well as nutritive value. Drugs explained as *chakshushya* either contain 'vitamin A', or help in its absorption and thereby improving vision.

Though the classical references doesn't directly reveal about the exact daily dose of the nutrients, the maximum *chakshushyadravya* told in the texts

contain a large amount of 'vitamin A'. The drugs, which contain zinc and iron, also contribute in the absorption of 'vitamin A'. Hence, an attempt should be made here to give *chakshushyadravya* in specific quantity so

that the recommended daily dose of 'vitamin A' is made available to an individual.

The symptoms presented by 'vitamin A' deficiency in the eye can be correlated to various classically explained eye diseases by Acharya Sushruta areas follows.^[4]

Table No - 2

Stages Of Deficiency	Presenting Features	Classical Condition
Primary	Xerophthalmia	<i>Shuktika</i> ¹¹
Secondary	Night blindness	<i>Kaphavidagdhadrushti</i> ¹¹
Tertiary	Complete blindness	<i>Linganasha/andhatwa</i> ¹¹

Classical references of *Nityasevaniyadravyas*³ (daily consumable substances)

While explaining the *nityasevaniyadravyas*, Acharya Charaka in *Sutra stana* tells some important drugs with high nutritive value which together serve as a complete diet. *Madhu* is an antioxidant rich in Vitamin B₆, riboflavin and folate. *Ksheera*, *ghruta*, and *jangalamamsa* like *mayura-mamsa* and *kukkuta-mamsa* contain 'vitamin A', where as *amalaki*, *yava* and *mudga* contain antioxidants and are immune boosters.^[3]

***Netraroga Pathya*² (dietics to be followed in eye disorders)**

Among the *pathya* drugs explained in *Yoga Ratnakara*, *draksha*, *karavellaka*, *kumari*, *vastuka* contain 'vitamin A'. *Naariksheera* (breast milk) is rich in 'vitamin A' (310mcg/litre), E, C and D. *Lohitashaali* contains zinc which helps in absorption of 'vitamin A'. Other drugs are antioxidants, help in absorption of 'vitamin A' and have anti-helmenthic property.

TABLE NO –3: Ayurvedic drugs which contain 'Vitamin A':^{[5],[6],[7]}

Ayurvedic drugs	Botanical name	Content of 'vitamin A'
1) <i>Draksha</i>	Vitisvinifera	1376mcg/100gm
2) <i>Shigru</i>	Moringooleifera	378mcg/100gm,
3) <i>Paalankika</i>	Spinaciaoleracea	469mcg/100gm
4) <i>Karavellaka</i>	Momordicacharantia	706mcg/100gm
5) <i>Navaneetha</i>	Butter	780mcg/100gm

6) <i>Kukkutanda</i>	Hen's Egg	630mcg/100gm
7) <i>Ksheera</i>	Cow's milk	28mcg/litre
8) <i>Garjara</i>	<i>Daucuscarota</i>	2502mcg/100gm
9) <i>Raktaluka</i>	<i>Ipomoea batatas</i>	961mcg/100gm
10) <i>Payaswini</i>	<i>Taraxacumofficinale</i>	5854mcg/100gm

Ayurvedic substitutes for 'Vitamin A'

Considering the *chakshushyadravya* (good for vision) told in our classics, an attempt has been made here to provide an alternative substitute for 'vitamin A'. A combination of drugs is tried by taking the age and palatability into the account. This

combination can be given as a food supplement in divided doses per day so that the requirement is fulfilled. Prior assessment of Prakruti, Vaya and Agni must be done. Agni deepana and Shodhana as purvakarmas before administration of these drugs would be of a better help in getting better results.

TABLE NO - 3

AGE	WHO Recommended dose/day	Ayurvedic substitutes/day
1. 6-12months	430mcg	<i>Draksha</i> (200mcg) – 15gm <i>Garjara</i> (200mcg) – 8gm <i>Naariksheera</i> (30mcg) - 100ml
2. 1-3yrs	300mcg	<i>Draksha</i> (100mcg) – 7.2gm <i>Garjara</i> (100mcg) – 4gm <i>Kukkutanda</i> (yellow portion)(100mcg) – 18.5gm
3. 4-8yrs	400mcg	<i>Shigru</i> (150mcg) - 39.6gm <i>Garjara</i> (100mcg) – 3.9gm <i>Navaneetha</i> (50mcg) 12.8gm <i>Paalankika</i> (100mcg) – 21.3gm
4. 9-13yrs	600mcg	<i>Shigru</i> (100mcg) - 26.45 <i>Garjara</i> (100mcg) – 3.9 <i>Navaneetha</i> (50mcg) – 12.8 <i>Paalankika</i> (200mcg) – 42.6 <i>Raktaluka</i> (150mcg) – 15.6

5.	14-18yrs	900mcg	<i>Shigru</i> (200mcg) – 52.9 <i>Garjara</i> (250mcg) – 10gm <i>Paalankika</i> (200mcg) – 42.6gm <i>Navaneetha</i> (50mcg) – 12.8gm <i>Kushmanda</i> (200mcg) – 50gm
6.	19-70yrs	900mcg	<i>Karavellaka</i> (100mcg) – 142.8gm <i>Garjara</i> (400mcg) – 15.9gm <i>Paalankika</i> (200mcg) – 42.6gm <i>Raktaluka</i> (200mcg) – 20.8
7.	Pregnancy	800mcg	<i>Draksha</i> (200mcg) – 15gm <i>Garjara</i> (200mcg) – 8gm <i>Paalankika</i> (100mcg) – 21.3 <i>Raktaluka</i> (300mcg) – 31.2
8.	Lactation	1100mcg	<i>Garjara</i> (500mcg) – 20gms <i>Shigru</i> (300mcg) – 79.3gms <i>Raktaluka</i> (200mcg) – 20.8gm <i>Paalankika</i> (80mcg) – 17gm <i>Ksheera</i> (20mcg) – 715ml

DISCUSSION

By 2020, the visually disabled population is estimated to grow up to 135 million.^[5] Among the several etiological factors causing visual disability, 'Vitamin A' deficiency accounts for about 6% blindness. It is one among the primary causes of 'childhood blindness' in developing countries.^[1]

An estimated 1.5 million children are blind worldwide, of whom one million live in Asia and 3 lakh in Africa. Each year, half a million children become blind. 'Vitamin A' deficiency affects approximately 1/3rd of children under

the age of 5 around the world and 2 to 5 lakh children in developing countries go blind every year.^[1]

'Vitamin A' helps in the production of retinal pigments called 'rhodopsin' needed for vision in dim light. As a step towards prevention of blindness, a single massive dose of 2,00,000IU of 'vitamin A' orally is given every 6 months to preschool children and half the dose to children between 6 months to 1year of age under 'National Programme for Control of Blindness'. But, these prophylactic retinol form supplements, when consumed in

excess may lead to toxicity causing acute and chronic symptoms, birth defects and even death.^[6]

In this regard, Ayurveda as a health science has an equal responsibility in protecting 'right to sight' of each individual. Though it doesn't proclaim about the daily dose of the nutrients, the maximum *chakshushyadravya* said in the classics such as *garjara*, *karavellaka*, *draksha*, *shigru*, *paalankika*etc^[12] contain a large amount of 'vitamin A' in them.

Thus it is need of the hour to make an attempt to provide *chakshushyadravya* in specific quantity to figure out the daily consumption; so that the recommended dose of 'vitamin A' is made available to an individual. Awareness and implementation of these formulations in National blindness control programme can prevent dreadful loss of vision in young age.

Requirement of 'vitamin A' for a child of 0-6months is 242mcg/day; which can be obtained by-Average intake (0.78L/day) x Average concentration of retinol present in human milk (310mg/L). Hence, an infant's requirement is solely supplemented by Mother's milk.^[8]

As classics of Ayurveda do not directly reveal the concept of micronutrients and exact required dosage per day, we need to access the quoted classical drugs using the current

tools to recognize their relevance in current era.

As the current rule of supplementation of 'vitamin A' in the form of capsules, is found to have toxic effects, food supplements rich in 'vitamin A' in 'beta kerotene' forms should gain the needed relevance.

Plant-based 'vitamin A' supplements are safe even for pregnant women.^[10] In the attempt to provide a comprehensive 'vitamin A' dietary supplement, *chakshushya*(good for vision) *dravya* are selected and their 'vitamin A' content is studied.

Commonly available drugs, which have daily dietary importance, are listed out. Later, based on age, the recommended daily requirement according to WHO is tabulated. Careful selection of drugs based on age and palatability is done. The amount of each drug needed in the combination to fulfill the recommended dose is calculated. This approximate quantity can be given to that particular age group in different suitable forms like 'powder', 'salad', 'curry' or 'soup' in divided doses per day.

CONCLUSION

As 'vitamin A' deficiency is the leading cause of childhood blindness in developing countries, urgent measures are to be in place to check the number of children going blind every year. Under WHO's Prevention of Blindness

programmes, Vision 2020– Right to sight is an important step.

National blindness control programme started in India aims at distributing ‘vitamin A’ capsules or injections in large doses along with dietary advice. The supplements are difficult to reach every person in a community.

Individual nutrient supplements do not contain as many nutrients, lack other health-promoting constituents and have had such disappointing results in several contexts. They have shown toxicity when given in a normal dosage, especially in children and pregnant women.

Hence, a safer and easier approach needs to be incorporated in ‘National blindness Control Programme’ to avoid the blindness caused by deficiency of ‘vitamin A’ and thus decreasing the general mortality rate in children. This can be achieved by providing herbal supplements explained in classics of Ayurveda that are in beta kerotene form and nontoxic.

REFERENCES

1. Park, K. Textbook of Preventive and Social Medicine. (23rd ed.). Jabalpur: M/S BanarasidasBhanot; 2011 ; 317 and 321.
2. Yogaratnakara, Vaidyashreelakshmipathy ,Shastry Brahma shankar , ShastryYogaratnakara. Varanasi: ChaukhambaKrishnadas Academy; 2005; 504.
3. Charaka, Vidyadharshukla, Ravidattatripati. CharakaSamhita. New Delhi: Chaukambha Sanskrit Prakashan; 2004; 86.
4. Sushruta, Ambikaduttashastri. SushrutaSamhita. Varanasi: Chaukambha Sanskrit sansthan; 2008. 2; 29.
5. Wikipediaorg. 1. Wikipediaorg. [Online]. Available from: <http://en.wikipedia.org/wiki/Vitamin-A/Blindness> [Accessed 10 August 2015].
6. Nihgov. 1. Nihgov. [Online]. Available from: <http://ods.od.nih.gov/factsheets/Vitamin> [Accessed 16 September 2015].
7. Healthaliciousnesscom. 1. Healthaliciousnesscom. [Online]. Available from: <http://www.healthaliciousness.com/articles/food-sources-of-vitamin-A.php> [Accessed 16 September 2015].
8. Nhmrcgovau. 1. Nhmrcgovau. [Online]. Available from: <http://www.nhmrc.gov.au> [Accessed 16 September 2015].
9. Wwwwbmjcom/content/343/bmj.d5094,. 1. Wwwwbmjcom/content/343/bmj.d5094. [Online]. Available from: www.bmj.com/content/343/bmj.d5094 [Accessed 16 September 2015].
10. Wwwwfaoorg/publications,. 1. Wwwwfaoorg/publications. [Online]. Available from: www.fao.org/publications [Accessed 16 September 2015].
11. Choudhury, R. .C. Shalakyavijnana. (20th ed.). Varanasi: ChaukhambaOrientalia; 2011.
12. Shastry, J. .L. .N. DravyaGunaVijnana, Vol 2. Varanasi: ChaukhambaOrientalia; 2004; 51.

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