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Prevention and Promotion of Vision: An Ayurveda Approach through Vegetables

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ABSTRACT

In today's era of resistance to antimicrobials, an enormous focus is put on preventive aspects of health and healthy lifestyles that includes healthy diet, exercise or sustained daily regimen. A healthy diet is not only good for heart, liver, bones but it also take good care of eyes. A lot of literature regarding food and food substances are available in ayurveda through which vision prevention and protection can be done but no such items are widely used in day to day practice or therapeutics for preventive aspects. So, this concept is analyzed and explored from sushrut for the potential benefits of vegetables that can keep eyes healthy. To find out the dietary sources for sustaining good ocular health through Ayurveda. In this context, *Suśruta saṁhitā, Uttara Tantra* has been analysed and a verse is taken in which vegetables beneficial for eyes are described. Further to make its concordance with modern science, literature search from *Ayurveda* and online resources has been done for their nutritional and medicinal properties for eyes. Review revealed that plants like *Paṭola (Trichoxanthes dioica)*, *Karkoṭaka (Momordica dioica Roxb.)*, *Kāravellaka (Momordica charantia L.)*, *Vārtāku (Solanum melongena L.)*, *Tarkāri (Clerodendrum phlomidis L.)*, *Karīra (Capparis decidua Edgew.)*, *Śigru (Moringa oleifera Lam.)* contains antioxidant properties and many specific nutrients like lutein, zeaxanthin, Vitamins A, C, E, beta-carotene, omega-3 fatty acids, zinc which are beneficial for eyes and various research trials also prove their efficacy. Study suggests that these vegetables when cooked in ghee are more beneficial for eyes and further research studies can be done in order to maintain good healthy eyes.

KEYWORDS: Conventional medicine, *Ayurveda*, *Suśrutasaṁhitā*, *ocular health*, *cakṣu*, *vegetables*

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INTRODUCTION

Health and healthy lifestyles have emerged as fundamental needs of the late twentieth century and for maintaining this, a well-balanced, healthy diet is being stressed on. It basically stress on keeping muscles, hearts, bones etc. healthy but taking good care of eyes for protection and maintenance of eye sight is also very vital for leading healthy lifestyle. It is an undeniable fact that vision is closely dependent on food preferences. Maintaining a well-balanced diet is a key for keeping eyes healthy and may help to reduce risk for developing diseased eye conditions. Serious eye conditions may be avoided if diet includes foods that contain a range of vitamins, nutrients and minerals, also known as antioxidants. Different types of nutrients like lutein, zeaxanthin, Vitamins A, C, E, beta-carotene, omega-3 fatty acids, zinc¹ in food help to prevent a wide range of eye diseases like cataract, glaucoma, dry eyes, poor night vision and also protect eyes from age-related muscular degeneration which can also limit eyesight.²

In Ayurveda, the term *caḡṣuṣya* is used which is beneficial for eyes, *Ācārya Suśruta* has given vast description regarding eye diseases and there treatment in *Suśruta Saṁhitā, uttatantra*. There are enormous vegetables described by *ācārya* for keeping eyes healthy or which may be helpful for reducing risk for eye diseases but substantial amount of review work is done on it. So, keeping this in observance, a verse from *Suśruta saṁhitā, uttatantra* has been taken which is given as *caḡṣuṣya*³ and it is reviewed for its wide range of nutrients which are beneficial for eyes.

MATERIAL AND METHODS:

To explore *Suśruta saṁhitā, uttatantra* for some vegetables which are beneficial for eyes and in this regard a verse has been taken for its review from contemporary and modern science.

It has been viewed for its *rasapancaka* from *ayurveda* point of view (**Table 1**) and its nutrient properties has been analyzed from modern literatures, published article and online resources. Below verse is taken for review which explains that vegetables like *paṭola, karkoṭaka, kāravellaka, vārtāku, tarkāri, karīra, śigru* when cooked with ghee maintains the health of eyes and protect it from various eye diseases.

paṭolakarkoṭakakāravellavārtākutarkārikarīrajāni |
śākāniśigravārttagalānicaivahitānidṛṣṭeḡhṛtasādhitāni||

(*Suśruta saṁhitā, uttatantra*, chapter 17, verse 51)

ANALYSIS OF INDIVIDUAL PLANT

Table 1: Showing classification, pharmacological properties of above discussed plants

Name	Hindi/ Local name	Botanical name	Family	Rasa	Guṇa	Virya	Vipāka	Doṣaśāmakata
<i>Paṭola</i> (Gramya a)	<i>Paravala</i>	<i>Trichosanthes dioica</i> Roxb.	Cucurbitac eae	Tikta	<i>Laghu,</i> <i>snigdha</i>	<i>Uṣṇa</i>	<i>Madhura</i>	<i>Tridoṣaghna</i>
<i>Karkoṭ</i> <i>aka</i>	<i>kakoḍā</i>	<i>Momordia dioica</i> Roxb.	Cucurbitac eae	<i>Tikta, kaṭu</i>	<i>Laghu,</i> <i>rukṣa</i>	<i>Uṣṇa</i>	<i>Kaṭu</i>	<i>Kaphapittaghna</i>
<i>Kāaravel</i> <i>laka</i>	<i>Karela</i>	<i>Momordia charantia</i> Linn.	Cucurbitac eae	<i>Tikta, kaṭu</i>	<i>Laghu,</i> <i>rukṣa</i>	<i>Uṣṇa</i>	<i>Kaṭu</i>	<i>Kapha-</i> <i>pittaghna</i>
<i>Vārtāku</i>	<i>Baiṃgana</i>	<i>Solanum melongena</i> Linn.	Solanaceae	<i>Madhura</i>	<i>Laghu</i>	<i>Uṣṇa</i>	<i>Madhura</i>	<i>Tridoṣahara</i> <i>viśeṣataḥ</i> <i>Kaphapittaghna</i>
<i>Tarkāri</i> ,	<i>Araṇi</i> / <i>laghuagni</i> <i>mantha</i>	<i>Clerodendrum phlomidis</i> Linn.	Verbenacea e	<i>Kaṭu,</i> <i>tikta,</i> <i>kashaya,</i> <i>madhura</i>	<i>Laghu,</i> <i>rukṣa</i>	<i>Uṣṇa</i>	<i>Kaṭu</i>	<i>Kaphavātaghna</i>
<i>karīra</i>	<i>Kaira</i> / <i>ṭaimṭi</i>	<i>Capparis decidua</i> Edgew.	Capparidac eae	<i>Kaṭu, tikta</i>	<i>Laghu,</i> <i>rukṣa</i>	<i>Uṣṇa</i>	<i>Kaṭu</i>	<i>Kaphavātaghna</i>
<i>Śigru</i>	<i>saijana</i>	<i>Moringa oleifera</i> Lam.	Moringacea e	<i>Madhurak</i> <i>imcitakaṭu</i> , <i>tikta</i>	<i>Laghu,</i> <i>rukṣa,</i> <i>tikshna</i>	<i>Uṣṇa</i>	<i>Kaṭu</i>	<i>Kaphavātaghna</i>

Paṭola

It is a perennial climber which is usually cultivated as vegetable mainly in the ganges region. The fruits of *paṭola* which is short, tapered, green with white stripes are best for food. It has been described as *pathyatamaśāka* (beneficial vegetables). Its fruit resembles to the shape of eye, so according to the principle of doctrine of signature, it can be beneficial for eyes which can be seen by its nutrient value.

Study showed that it is a rich source of vitamin A, vitamin C⁴ and these nutrients are beneficial for eyes as, for instance; Vitamin A is required by the retina of the eye in the form of retinal, which

combines with protein opsin to form rhodopsin⁵ and it is the light-absorbing molecule necessary for both low-light vision and color vision. Reports also shows significant results on the free radical scavenging properties of fruit of *Trichoxanthes dioica* as compared to standard (ascorbic acid) which may be helpful in degenerative conditions of the eyes. Aqueous extract of *T. dioica* analyzed for its Antioxidant activity on DPPH, nitric oxide, reducing power assay, hydrogen peroxide radical method and results were showing this plant fruit could serve as free radical inhibitors or scavengers, acting possibly as primary antioxidants.⁶

Karkoṭaka

It is commonly known as spine gourd, teasel gourd or small bitter gourd worldwide whereas in India as *kām̄karo*, *kaṁṭolī*, *kakoḍā*, *banakarelā*, or *jaṁgalīkarelā*. Two types of *karkoṭaka* are available in market now a day. One is short and the other one is long or cultivated. Small one is more beneficial for eyes which usually found after rainy season.

Study showed that nutritional value of per 100 g edible fruit is reported to contain vitamins like carotene 162mg/100 g of edible portion and also higher amount of ascorbic acid. *Momordica dioica* (peeled) contained 4.91mg/kg of zinc and *Momordica dioica* (unpeeled) contained 0.26mg/kg of chromium and 11.0mg/kg of zinc. The fruit also possess antioxidant properties due to the presence of flavonoids.⁷

Kāravellaka

Momordica charantia L. (Bitter gourd) has long been used as a food and medicine. It is commonly known as *karelā*, *karelī*. Different varieties are available in market. Long, thin, dark green hybrid variety is available in market nowadays which is not beneficial for eyes. The one which is not too short, not too long in shape, light green in color also known as *desikarela* considered as best for food as it is more nutritious. Bitter gourd causes *vāta*, reduces *kapha* and *pitta* and controls fever, blood impurities and jaundice. Moreover, this plant have role on liver and due to its *pittavirecaka* property, it works on different eye conditions.

Fresh raw fruit of *Momordica charantia* as per USDA national nutrient database contains vitamin A (471 IU) 16% and vitamin C 84 mg (140%) and zinc 0.80mg (7%) per 100gm. It also contains phytonutrients Carotene-β 190 μg, Carotene-α 185 μg, Lutein-zeaxanthin 170 μg however, carotein pigment changes with ripening of fruits.⁸

The nutrient analysis in USDA database of *M. charantia* raw leafy tips per 100gm revealed the presence of zinc (0.30mg) and selenium (0.9µg). Also it showed the presence of vitamin C, total ascorbic acid (88mg), vitamin A, RAE (87µg), Vitamin A (1734 IU). Other studies also revealed the presence of Vitamin A (β-carotene) (0.03 ppm), vitamin E (α-tocopherol) (800 ppm), ascorbic acid (66000 ppm). Trace amount of some other vitamins cholecalciferol (Vitamin D) were also found present in the methanolic and petroleum-ether leaf extract of *M. charantia*. Phytochemicals like alkaloids, tannins, flavonoids, saponins and glycosides were also found.⁹

A study demonstrated that the water extract fractions of bitter melon have different responses with different antioxidant methods. In this, total phenolics and total flavonoids were found to be in positive correlations with antioxygenic activities determined by the β-carotene-bleaching, ammonium thiocyanate and DPPH radical-scavenging methods. Study revealed that the green fruit extract showed the highest value of antioxidant activity, based on hydroxyl radical-scavenging activity, β-carotene-linoleate bleaching assay and total antioxidant capacity while the leaf extract showed the highest value of antioxidant activity, based on DPPH radical-scavenging activity and ferric reducing power.¹⁰

Vārtāku

It is a perennial plant also known as egg-plant or aubergines native to the Indian subcontinent and grown in many tropical and semitropical regions as a popular vegetable all around the year. Several varieties of aubergines are available in Indian market. They vary widely in size, shape and color like round or oval shaped, thin and elongated; white, purple or dark purple in color. Each fruit has smooth, glossy skin. Internally, it features of white color pulp with numerous centrally arranged small, soft seeds.

USDA database reveals that it contains vitamin A 27IU, vitamin C 2.2mg, Vitamin E 0.30 mg and zinc 0.16 mg in amount. Some studies showed that one cup (99gm) cooked aubergine contains Vitamin A 36.63 IU, Vitamin A, Retinol Activity Equivalents (RAE) 1.83 mcg, Vitamin A, Retinol Equivalents (RE) 3.66 mcg, Carotenoid, Retinol Equivalents (RE) 3.66 mcg, Beta-Carotene 21.78 mcg, Beta-Carotene Equivalents 21.78 mcg, Vitamin C 1.29 mg, Vitamin E, Alpha-Tocopherol Equivalents (ATE) 0.41 mg, Vitamin E 0.60IU(0.41 mg), Selenium 0.10 mcg, Zinc 0.12 mg, Omega-3 Fatty Acids 0.01 g, Omega-6 Fatty Acids 0.08 g.¹¹

In addition to featuring a host of vitamins and minerals, it also contains important phytonutrients which act as antioxidants^{12,13}, include phenolic compounds, such caffeine and chlorogenic acid, and

flavonoids, such as *nasunin*. Research has focused on Nasunin, an anthocyanin phytonutrient found in eggplant skin is a potent antioxidant and free radical scavenger that has been shown to protect cell membranes from damage.

Recent clinical study was done on visually active male volunteers with bolus consumption of 10 g of *S.melongena* to determine its ocular complication and suggestive of its benefit to patients suffering from raised intraocular pressure (glaucoma) and convergence insufficiency.¹⁴ Results showed that the pupil size was reduced by 23%, NPC(Near point of convergence) was decreased (9%) and the AA was increased (22%) and the intraocular pressure dropped by 25% while there was no effect the habitual phoria. The miotic effect lowered the intraocular pressure appreciably and the reduced NPC which was still within normal range did not produce any vision discomfort. The increased AA and convergence excess positively correlated provide an efficient visual mechanism.

Tarkāri

It is a small tree, locally known as *araṇi* or *ṭekāra* and *laghuagnimantha* in Ayurveda. Its leaves and flowers are used as vegetable after frying it with ghee. In ancient times, it's wood have been used in *yajña* after rubbing its two sticks together for production of *agni* (heat). According to fundamental principle of ayurveda, *dṛṣṭi* is *tejomaya*, so it can be used for increasing eye sight. In eye disorder, it can be used both externally and internally. Externally parts of *araṇi* like leaves, flowers, and fruits can be bandaged on closed eyes after *svinna* (steaming) and internally in the form of vegetable.

A study was done to assess the free radical scavenging activity of root of *Clerodendrum phlomidis* extract obtained by sequential extraction with various polarities of solvents (Petroleum ether, chloroform, ethyl acetate and ethanol) was evaluated by three different *in vitro* methods: DPPH radical scavenging, superoxide anion radical scavenging and total antioxidant activity. The ethanolic extract showed best free radical scavenging activity than that of other three extracts. The super oxide radical scavenging activity of ethanolic extract (IC₅₀ = 60 µg/ml) was better than that of standard Quercetin (IC₅₀ = 130 µg/ml). The good total antioxidant activity was observed in ethanolic extract of *Clerodendrum phlomidis* than that of other extracts suggestive of that this plant could be used as an protection against oxidative damage¹⁵ However, study of leaves, fruits and flowers in relation to eyes were not found and their nutritive value were also not known.

Karīra

Karīra is an important medicinal plant of Rajasthan locally known as *kaira* or *ṭaimṭi*. Its immature fruit are recommended to be taken as vegetable. It is also used for preparing pickles and for that it has to be dipped in *takra* first and then used. In *veda*, it has been described as having *krimighna* (antimicrobial) activity.¹⁶ So, it can be used in infectious eye diseases. It can be used both externally and internally.

A study was done to find the β -carotene contents of some locally available fruits and vegetables of the arid zone of Rajasthan; *dāmsarā* (*Rhus myserensis*), *kācarī* (*Cucumis collosus*), *Kaira* (*Capparis decidua*) and *Sāmgarī* (*Prosopis cineraria*) were estimated in fresh and various processed states (blanched, dried and roasted). Among the samples, *kaira* was found to be the richest source of β -carotene.¹⁷ Another reference also showed that *Pinju* (*Capparis decidua*) contained appreciable amounts of beta-carotene and vitamin C¹⁸; phenolic content in extracts obtained from different aerial parts of *C. decidua*, as well as antioxidant activity.¹⁹ A review study also shows presence of Zn (4%), β -Carotene (14%) in ripened fruits.²⁰

Śigru

It is locally known as *saijana* or *mungā*. In Ayurveda, description of two bed of two types: *madhura* (pink slightly yellowish flowers) and *kaṭu* (white flowers). Its *madhura* variety is more beneficial for eyes as vegetable. Its leaves and fruits (drumsticks) when cooked in ghee are more beneficial for eyes. It can be used both externally and internally.

According to USDA nutrient Database its pod per 100 gm contains vitamin A 74IU(2.5%), 141mg(235%) of vitamin C, 8.2 μ g(15%) of selenium, 0.45mg(4%) of Zinc. While its leaves contains 7564IU(252%) of vitamin A, 51.7mg(86%) of vitamin C, 0.9 μ g(1.5%) of selenium, 0.60mg(5%) of zinc.

Among green leafy vegetables, drumstick leaves (*Moringa oleifera*) contains 23791.91mcg total carotene and β -carotene content 16165.33 mcg/100gm. Apart from β -carotene content they are also a good source of ascorbic acid, calcium, phosphorus, vitamin E and has low levels of oxalates.²¹ They are rich source of protective nutrients essential for healthy vision, bones, blood and skin.

Recent study was done on bioavailability of β -carotene from fresh and dehydrated drumstick leaves in a rat model. Result was suggestive of β -carotene from drumstick leaves was effective in overcoming

vitamin A deficiency although serum vitamin A levels remained somewhat lower compared to the group with vitamin A acetate.²²

Another study was also conducted to evaluate the retino-protective effects of *Moringa oleifera* (MO) in streptozotocin-induced diabetic rats via antioxidant, anti-inflammatory, and anti-angiogenic mechanisms. It showed potential hypoglycemic and retinal antioxidant effects of MO. Study shows a significant rise in the expression of retinal inflammatory (TNF-a and IL-1b) and angiogenic (VEGF and PKC-b) parameters was observed in diabetic retinae as compared to normal retinae. However, MO-treated retinae showed marked inhibition in the expression of inflammatory and angiogenic parameters. Further, in this study, diabetic retinae showed dilated retinal vessels as compared to normal. However, MO-treated retinae showed marked prevention in the dilatation of retinal vessels. Fluorescein angiograms obtained from diabetic retinae showed leaky and diffused retinal vasculature. On the other hand, MO-treated retinae showed intact retinal vasculature. Further, results of the transmission electron microscopy study showed thickened capillary BM in the diabetic retina as compared to normal retinae. However, treatment with MO prevented thickening of capillary BM.²³

Ārttagala

Ācārya Suśruta has described this plant beneficial for eyes. As *Ayurveda* texts are written dated back, so there are a lot of concepts which are unexplored. Botanical identity of *ārttagala* is not confirmed till today however a few suggestions has been postulated by various *ācārya* for identifying it. *Ācārya priyavrat sharma* took *karaunī* or *karathuā* (*Xanthium strumarium* Linn.) from *ārttagala*. Some *ācārya* took it as *vikamkata* locally known as *kaṭāī* or *kaṃketa* (*Flacourtiamontchi* L.) while some other take it as *kāhuśāka* (*Lactucaindica* Linn.).²⁴

Xanthium strumarium Linn. is available in different parts of Rajasthan and its fruit can be used as vegetable. *Lactusa indica* is also available in market and used as salad while its seeds are also used as eye tonic. One another opinion regarding this plant can be made as *Ḍalhaṇa* commented on it as 'bahikeśarekaṃṭakitaphaloviṭapaitianye'²⁵ (Su. Chi. 7/6) i.e. a small plant which is *keśaravarṇa* (colour) from outside and have spiked fruit. On the basis of above given *Ḍalhaṇa* commentary, it can be taken as *Cucumisprophetarum* Linn.; as it's a spiked fruit and after ripening of the fruit it becomes yellow. And it is a wild variety of *kācarī* (*Cucumi smomordica* Roxb.) which itself used in vegetable. On the basis of above description, *Cucumisprophetarum* can be taken as *Ārttagala*.

DISCUSSION

Ācārya Caraka has said that *cakṣu* (eyes) are *tejomaya* (consisting of light) and it has more prone to *kaphaja* (one of the body humor) diseases. So for *prasādana* (cleaning) of eyes *śleśmahara karma* should be done.²⁶ All the above plants discussed above contains mainly *laghu*, *rukṣa*, *guṇa*; *kaṭu*, *tikta rasa*; *uṣṇavīrya*, and *kaṭuvipāka* and thus all having *kapha-pitta śāmaka* properties. Few are *tridoṣahara* and some alleviates *vātadoṣa* also. Thus, keeping the concept of *kapha-pittaghn* properties for eyes, these all plants are beneficial for vision improvement.

A methodology has also been given that how to take these vegetables. *Ācārya* has mentioned that it should be consumed after processing it with *ghṛta*.³ *Ācāryacaraka* has described a general principle related to the *śāka*(vegetables) that these vegetables are more beneficial to health if steamed, then squeezed followed by cooking it in *ghṛta*.²⁷ *Ācāryavāgbhaṭṭa* has said that *Ghṛta* have *cakṣuṣya*²⁸ properties and by its *saṃskārasyaṅuvartana*²⁹ (transformative) *guṇa*, these *śāka* become more beneficial for eyes. This may be the reason, *Acarya Suśruta* has described these vegetables to be cooked in *ghṛta*, as it increases the properties of above vegetables.

Research suggests that [antioxidants](#) and other important nutrients may reduce the risk of cataracts and [macular degeneration](#). Specific antioxidants can have additional benefits as well; for example, vitamin A protects against blindness and dry eyes, and vitamin C may play a role in preventing or alleviating [glaucoma](#). Beta-carotene; Lutein and Zeaxanthin, vitamin A, C, D, E, Zinc, selenium may reduce the progression of macular degeneration. Omega-3 essential fatty acids appear to help the eye in a variety of ways, from alleviating symptoms of [dry eye syndrome](#) to guarding against macular damage.³⁰

Scientific data also support this verse as these plants contains antioxidants and many specific nutrients like lutein, zeaxanthin, vitamins A, C, E, beta-carotene, omega-3 fatty acids, zinc which are essential for keeping eyes healthy. They are a rich source of protective nutrients essential for healthy vision, bones, blood and skin.²¹ They are also rich in various polyphenols, which act as antioxidants and are recommended for protecting against (Cardio Vascular Diseases) CVDs, age-related macular degeneration.

CONCLUSION

Among all the eight plants given in verse, botanical identity of *Ārttagalais* not confirmed while all other plants can easily be grown and cultivated in suitable climates and are also easily available in markets. All these can be used externally for washing of eyes and internally in the form of vegetables

after cooking it with *ghṛta*. *Ghṛta* increases their potency by its *cakṣuṣya* property and *saṃskārānuvartana* (transformative) *guṇa*, that's why *Ācārya* *Suśruta* have said to cook these vegetables in *ghṛta*. This review also reveals that these plants contains antioxidant properties and specific nutrients which are beneficial for eyes. All these vegetables can provide prevention and protection of eye from various eye disease if consumed according to rules mentioned by *ācārya*. Further revalidation can be done by conducting experimental and clinical studies to prove its efficacy.

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