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Herbal Medicines and Nutritional supplements used in the treatment of Glaucoma: A Review

Yogayata S Pathare^{*1}, Vijay D Wagh²

¹ Dept of Pharmaceutics. K.B.H.S.S.T's Institute of Pharmacy, Bhaygaon road, Malegaon-423203 Dist Nasik, Maharashtra, India.

² Dept of Pharmaceutics, Y. B. Chavan College of Pharmacy, Dr. Rafiq Zakaria Campus, P. B. No 33, Rouza Bagh, Aurangabad-431001, Maharashtra, India.

ABSTRACT

Glaucoma is a group of eye diseases that damage the optic nerve. Glaucoma remains a leading cause of blindness in adults over age 60, according to the National Eye Institute (NEI), a division of the National Institutes of Health. Herbal medicine is the oldest form of healthcare known to mankind. Herbal medicine is still the mainstay of about 75–80% of the world population, mainly in the developing countries, for primary health care because of better cultural acceptability, better compatibility with the human body and lesser side effects. Population rise, inadequate supply of drugs, prohibitive cost of treatments, side effects of several allopathic drugs and development of resistance to currently used drugs for infectious diseases have led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments. In this review the different medicinal plants which are used in the treatment of glaucoma are discussed.

Keywords: Glaucoma, medicinal plants, herbal medicine, nutritional supplements.

**Corresponding author*

Email: yogyata18@gmail.com

INTRODUCTION

GLAUCOMA

Glaucoma is a group of eye diseases that damage the optic nerve. The optic nerve is the main nerve to the eye (located in the back of the eye) that is responsible for transmitting electrical impulses to the brain[1]. Damage usually occurs as a result of elevated pressure of the fluid (aqueous humor) in the eye. This damage results in gradual visual changes and then loss of vision. There are several recognized risk factors for glaucoma, such as an increased intraocular pressure (IOP), aging, family history, high myopia, systemic hypertension, cardiovascular disease, migraine headaches, peripheral vasospasm and prior nerve damage[2]. Possible factors leading to glaucoma include glutamate-induced neurotoxicity, nitric oxide based damage, disruption of neurotrophic factor transport and immune-induced neurodestruction. Glaucoma is sometimes called the silent thief because it can slowly steal your sight before you realize anything's wrong.

It is a second biggest cause of blindness. The condition affects 60 million people of whom about 10 become blind. At present, there are approximately 7.5 million diagnosed cases of blindness, of which glaucoma accounts for 10-20%. Glaucoma is estimated to affect 12 million Indians and causes 12.8% of the blindness in the country. Global cases of the eye disease glaucoma are expected to reach 60 million by 2010 and 80 million by 2020 about 15% of blindness in adults is due to glaucoma[3]. Glaucoma remains a leading cause of blindness in adults over age 60, according to the National Eye Institute (NEI), a division of the National Institutes of Health [4].

Treatment of Glaucoma [5]

Table 1: Adverse effects of current treatments used in Glaucoma

Group	Agent	Side effects
Cholinergic	Pilocarpine	Ocular : miosis, follicular conjunctivitis, ciliary spasm, lacrimation Systemic :salivation, urination
Cholinesterase inhibitors	Physostigmine Echothiophate	Pain, irritation, iris cysts Ocular: corneal anesthesia, eyedrops, uveitis, retinal detachment, ptosis, cataract Systemic : headache, palpitation, bradycardia, memory disturbances
Adrenergic agonists	Epinephrine	Ocular : irritation, conjunctival hyperemia Systemic : Headache, palpitation, sweating
	Apraclonidine	Ocular: hyperemia, mydriasis dryness Systemic :diarrhoea, bradycardia, insomnia
	Dipivefrin	Fewer side effects, minimum, systemic absorption, less allergic reactions
Adrenergic antagonists	Timolol	Ocular : irritation, diplopia, ptosis Systemic: headache, dizziness, bronchospasm, bradycardia,
	Betaxolol	hypotension Reduced side effects

	Levobunolol Metoprolol Carteolol	Stinging, bradycardia, hypotension Ocular : hyperemia of conjunctiva, Systemic : potential cardiac, respiratory side effects, allergic reaction, headache, nausea, nervousness, rashes Same as timolol
Carbonic anhydrase inhibitors	Acetazolamide	Systemic : GIT upset, nausea, diuresis, renal calculi, aplastic anaemia. Ocular : transient myopia
	Methazolamide	Minor side effects, fatigue, malaise nausea, vertigo, paresthesia
	Dorzolamide	Minimal side effects : burning, stinging in the eye
Prostaglandin	Latanoprost	Iris pigmentation, mild conjunctival Analogs hyperemia, local irritation, increased at bed time growth of eyelashes and cystoids macular edema

Prevention or modification of risk factors, particularly the raised intraocular pressure is the primary goal in the management of glaucoma. The antiglaucoma agents act on the aqueous humor dynamics to reduce the intraocular pressure mainly by three mechanisms.

- Decrease aqueous production in the ciliary body
- Increase aqueous humor outflow through the trabecular meshwork and
- Increase aqueous humor outflow via the uveoscleral pathway.

Various categories of drugs are used in the treatment of glaucoma. Many of them possesses the various side effects as described in Table No. 1

Herbal Medicine

This is the era of herbal. Herbal medicine is the oldest form of healthcare known to mankind Herbal Medicine, sometimes referred to as Herbalism or Botanical Medicine, is the use of herbs for their therapeutic or medicinal value. Herbalism is becoming more mainstream as improvements in analysis and quality control along with advances in clinical research show their value in the treatment and prevention of disease. An herb is a plant or plant part valued for its medicinal, aromatic or savory qualities. Herbal medicines are also in great demand in the developed world for primary health care because of their efficacy, safety and lesser side effects. Herbal medicine is still the mainstay of about 75–80% of the world population, mainly in the developing countries, for primary health care because of better cultural acceptability, better compatibility with the human body and lesser side effects. The World Health Organization (WHO) estimates that 4 billion people, 80 percent of the world population, presently use herbal medicine for some aspect of primary health care. Herbal medicine is a major component in all indigenous peoples traditional medicine and a common element in Ayurvedic, homeopathic, naturopathic, traditional oriental, and Native American Indian medicine. WHO notes that of 119 plant-derived pharmaceutical medicines, about 74 percent are used in modern medicine in ways that correlated directly with their traditional uses as plant medicines by native cultures. Major pharmaceutical companies are currently conducting extensive research on plant materials gathered from the rain forests and other places for their potential medicinal value. Over three- quarters of the world population relies mainly on plants and plant extracts for

health care. More than 30% of the entire plant species, at one time or other, were used for medicinal purposes. In India, drugs of herbal origin have been used in traditional systems of medicines such as Unani and Ayurveda since ancient times. Population rise, inadequate supply of drugs, prohibitive cost of treatments, side effects of several allopathic drugs and development of resistance to currently used drugs for infectious diseases have led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments[6,7] .

Classification of herbal medicine

Herbal medicine has such an extraordinary influence that numerous alternative medicine therapies treat their patients with herbal remedies, including naturopathy, orthomolecular medicine, and ayurveda. Approximately 25% of all prescription drugs are derived from trees, shrubs or herbs.

Herbal Medicine can be broadly classified into various basic systems :

1. Traditional Chinese Herbalism, which is part of Traditional Oriental Medicine.
2. Ayurvedic Herbalism, which is derived from Ayurveda.
3. Western Herbalism, which originally came from Greece and Rome to Europe and then spread to North and South America.

Herbs that may be helpful for Glaucoma

Table 2: List of Herbs which are used in the treatment of glaucoma

Sr.No	Common name	Botanical name	Action in relation to Glaucoma
1	Forskolin (kaffir potato) ^{8,9}	Coleus forskohlii	Reduce fluid production by improving the level of cyclic AMP, Activates the adenylate cyclase
2	Ginkgo biloba ^{10,11,12}	Ginkgo biloba	Protect retinal photoreceptor against light induced damage
3	Dan shen/ asian red sage ¹²	Salvia miltiorrhiza	Inhibit TNF alpha induced activation of Nkkβ and protect against ganglion cell loss
4	Pycnogenol ¹²	French maritime pine bark(pinus pinaster)	Protect vascular endothelial cell by A β induced injury
5	Resveratrol ¹²	Skin of red grapes	Antioxidant
6	Grape seed extract ^{12,13}	Grape seeds	Scavenges free radicals and nitric acid
7	Quercetine ^{12,14,15}	Red wine, ginkgo biloba extract	Inhibit the release of NO and TNF α
8	Ginseng ¹⁶	Panax ginseng	Neuroprotection by inhibiting NMDDA also attenuate glutamate induced toxicity
9	Fennel ¹⁷	Foeniculum vulgare	Antioxidant and NO scavenging
10	Indian Gooseberry ¹⁸	Emblca officinalis	Antioxidants
11	Marijuana ^{19,20,21,22}	Cannabis sativa	Act on CB1 receptor to control the IOP
12	Oregano ²³	Organum vulgare	Antioxidants(neutralize naturally occurring highly reactive oxygen molecule(free radicals)

13	Pansy ²³	Viola species	Antioxidants
14	Shepherds purse ²³	Cap-sella bursa pastoris	Antioxidant
15	Jaborandi ²³	Pilocarpus, various species	Choline esterase inhibitors
16	Bilberry ^{23,24}	Vaccinium myrtillus	Retard the breakdown of Vit.c Protect against breakdown of rhodospin
17	Omega 3 fatty acid ²⁵	Algae, nut oil, flaxseed, canola, soyabean	Modify the activity of retinal enzymes
18	Arctigenin	Torreya nucifra Atrium lappa	Inhibit TNF α and NO production

Herbal medicine is also known as botanical medicine (in Europe it is known as phytotherapy or phytomedicine). An herb is a part of a plant that can be used for healing purposes (as a potion or remedy). An herb can be a leaf, a flower, a stem, a seed, a root, a fruit, bark, or any other plant part that can treat wounds, abrasions, cuts, and a number of other conditions. Interest in herbal drugs is growing due to their efficiency, low toxicity and absence of side effects. Various medicinal plants have antiglaucoma potential found in literature. Some of these along with their therapeutic activity related to glaucoma are shown in Table no.2

Chinese Herbs used in treatment of Glaucoma

Chinese herbal medicine is a component of traditional Chinese medicine which also includes the practice of acupuncture and tuina (massage). Herbal medicine has been used in China for centuries and is backed by a long and rich history of development, use and research. Chinese herbal medicine is unique in that the diagnosis and treatments are based on the theories of traditional Chinese medicine. Herbs administered within Chinese herbal medicines are usually raw and cooked into a tea, in a powder form and taken with hot water or in a pill form.

Some of the herbs commonly used to treat glaucoma in China are shown in Table no 3. Their principal actions are draining dampness/resolving phlegm, clearing heat (purging fire), and nourishing the kidney and liver [26].

Table 3: List of Chinese herbs which are used in the treatment of glaucoma [26]

Sr.No.	Common name	Botanical name	Action in relation to Glaucoma
1	Hoelen	Poria cocos	promote diuresis, eliminate dampness, invigorate spleen, alleviate phlegm retention
2	Atractylodes	Atractylodes macrocephala	invigorate the spleen, deprive dampness and promote diuresis
3	Polyporus	Polyporus umbellatus	promote diuresis, for dampness retention syndrome
4	Alisma	Alisma orientale	promote diuresis, eliminate dampness, expel heat
5	Plantago seed	Plantago asiatica	clear away heat, promote diuresis, improve visual acuity
6	Pinellia	Pinellia ternata	deprive dampness and eliminate phlegm, disperse stagnation
7	Arisaema	Arisaema erubescens	deprive dampness and eliminate phlegm

8	Bamboo	Phyllostachys nigra	clear away heat to cool the blood, clear away lung heat to eliminate phlegm
9	Platycodon	Platycodon grandifolium	eliminate phlegm
10	Chih-shih	Citrus aurantium	activate vital energy circulation and eliminate phlegm, disperse stagnation
11	Citrus	Citrus reticulata	deprive dampness and eliminate phlegm
12	Antelope horn	Saiga tatarica (now substituted by Procarpa guttorosa, or other species)	clear away heat, calm the liver, clear away liver-fire to improve visual acuity
13	Gardenia	Gardenia jasminoides	purge fire, clear away heat and promote diuresis, cool blood, remove blood stasis
14	Moutan	Paeonia suffruticosa	clear away heat, cool the blood, promote blood circulation, remove blood stasis
15	Bupleurum	Bupleurum chinense	let off heat, disperse stagnated liver energy
16	Mentha	Mentha haplocalyx	clear away heat from head and eye
17	Prunella	Prunella vulgaris	clear away liver-fire and calm liver yang, eliminate phlegm and disperse stagnation
18	Peony	Paeonia lactiflora	calm liver yang, soothe the liver, astringe
19	Chrysanthemum	Chrysanthemum morifolium	clear away heat, clear away liver-fire to treat eye disease, calm the excess liver energy
20	Vitex	Vitex trifolia	expel the wind and heat, ease the eye and the head
21	Phragmites	Phragmites communis	clear away heat, promote diuresis
22	Scute	Scutellaria baicalensis	clear away heat and deprive dampness
23	Rehmannia	Rehmannia glutinosa	produce essence and enrich blood, nourish yin
24	Lycium fruit	Lycium barbarum	nourish yin, enrich blood, benefit essence, and improve visual acuity
25	Cornus	Cornus officinalis	supplement essence and improve visual acuity, astringe and preserve essence

Natural Remedies useful in treatment of Glaucoma.

The various natural remedies which are used in the treatment of glaucoma mainly include various vitamins, minerals etc. These natural remedies shows the therapeutic activity which may useful in the treatment of glaucoma [10, 13]. Some of these together with their action related to glaucoma are described below

Minerals: Magnesium, Selenium Improves visual field and peripheral circulation.

Amino acid: Acetyl L-carnitine: Prevent damage to optic nerve by inhibiting the glycosylation
 Glucosamine: Maintain the collagen structure of fluid drain.

Quinones: Co-enzyme Q 10: Counteract the toxicity of glutamic acid.

Peptides: Carnosine, Glutathione Help to maintain optimal fluid outflow.



Vitamins: Folic acid Counteract the toxicity of glutamic acid, Vitamin B1 Restore the level of B1 beneficial for glaucoma, Vitamin B12 Counteract the toxicity of glutamic acid and preserve the myeline, Vitamin C [27] Vitamin E [12] act as antioxidant.

Carotenoids: Lutein Protect the Optic Nerve from damage and sub-optimal levels of Lutein in the Optic nerve

Fish oil [12, 28]: Cod liver oil lowers the risk of macular degeneration

CONCLUSION

Herbal medicine is the most ancient form of health care known to man. Herbs have been used in all cultures since history records were recorded. Herbal medicine has such an extraordinary influence that numerous alternative medicine therapies treat their patients with herbal remedies, including naturopathy, orthomolecular medicine, and ayurveda. Approximately 25 percent of all prescription drugs are derived from trees, shrubs, or herbs. Herbal medicines are popular due to their efficiency, low toxicity and absence of side effects. About 90% herbal raw drugs used in the manufacture of vegetable drugs are obtained from the wild source which is limited. India is the largest producer of medicinal herbs and approximately called the botanical garden of the world [29] . Herbal medicine is also known as botanical medicine (in Europe it is known as phytotherapy or phytomedicine). An herb is a part of a plant that can be used for healing purposes (as a potion or remedy). Herbs are utilized in more than a quarter of the alternative therapies for treatment after diagnosis. Traditional Chinese medicine, ayurveda, and western medicine all have distinctly different the world population is dependent on conventional medicine for primary health care. Herbal medicine constitutes a large part of what is practiced as traditional medicine around the world. For the treatment of glaucoma different drugs are used most of them possesses various side effects. The various medicinal plants like Jaborandi (Pilocarpus), forskoline, ginkgo biloba are traditionally used in the treatment of glaucoma. The major hindrance in the amalgamation of herbal medicine into modern medical practices is the lack of scientific and clinical data and better understanding of efficacy and safety of herbal products. The research on traditional medicinal plants has to be focused on providing scientific evidence for the presence of active principles in assessment of toxicities. To ensure the quality and safety of herbal products, standardization is of vital importance. So that the herbal medicines can be safely used to treat the glaucoma.

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