

Phytotherapeutics for management and prevention of cataract generation

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Abstract

Cataract is the main cause of blindness in the world, responsible for approximately 50% of the existing cases in both developed and developing countries. Yet it is a condition that can be treated by means of a rather safe and low-cost surgical procedure. In human the age of above 50 years, diabetes, ultraviolet radiation, smoking and chronic steroid therapy are among risk factors for accelerating cataract development. In rural Sub Saharan-Africa, Morocco, India, Nepal and China, blinding cataract is still frequently treated by traditional techniques of couching, a locally available treatment at a cost that members of a rural community can afford. This review explains the brief description of medicinal plants used in the management of cataract.

Keywords: phytotherapy; cataract; oxidative stress; diabetes

Introduction

Cataract is a major cause of blindness worldwide, especially in the tropical belt, where most of the densely populated developing countries are located as compared with other incidences in USA (Chatterjee et al., 1982; Kahn et al., 1977; Klein et al., 1982; Leske et al., 1991; Liu et al., 1977;). There are about 50 million blind people in the world, and cataract (opacities of the lens in the eye) is responsible for half of these cases (Johnson et al., 2004). In USA, over 1.2 million cataract operations are performed per year; costing over 3.4 billion \$ (West 2000). For age related cataracts, it is thought (based on twin studies) that the heritability for nuclear and cortical cataracts is around 50% (Hammond et al. 2000; Hammond et al., 2001). There are only few genetic studies for age-related cataracts reported till date (Graw et al., 2009; Jun et al., 2009; Okano et al., 2001). A cataract is the clouding of the lens of the eye that makes it hard to see. Cataracts can affect one or both eyes. Cataracts are common in older people. The first reports of radiation-induced cataracts appeared early in the 20th century, shortly after the first X-ray machine was developed (Rollins et al., 1903). The potential role of antioxidants in preventing various diseases is well documented. There

are reports suggesting the beneficial effects of vitamins C and E preventing cataract by virtue of their antioxidant property (Watkins et al., 2002).

Types of Cataract

Based on the causes of the cataract, there are five important types of cataracts seen among humans (Meena et al., 2010; Suryanarayana et al., 2004). Various types of cataracts are described in Table 1.

Etiology of Cataract

- Limited consumption of lactose-containing foods (milk products). In animal studies, galactose, a component of lactose, has been shown to promote cataracts formation.
- A riboflavin deficiency has been implicated in cataracts development. Therefore, a supplemental dosage of riboflavin, 10-50 mg/day, may help treat or at least slow the progression of cataracts formation.
- Early development of cataract of lens is due to the increased rate of sorbitol formation, caused by hyperglycemia. Glycosylation of retinal proteins and retinal micro vascular abnormalities lead to retinopathy and blindness (Meena et al., 2010).
- Glycosylation of lysine residues of lens proteins also causes cataract formation (Kelvin et al., 1992; Meena et al., 2010; Shukla et al., 2000).

Risk Factors of a Cataract

The risk of a cataract increases with age. Other risk factors include disease like *diabetes, smoking, alcohol use, nitric oxide* and *prolonged exposure to sunlight* (Ohio State University Medical Center, 2008). Total-body irradiation, especially when applied in a single session, plays a central role in cataract formation (Deeg et al., 1984; Lappi et al., 1990; Tichelli et al., 1987; Calissendorff et al., 1991). A significant excess risk for cataract formation was observed among survivors of the 1945 atomic bomb attacks on Hiroshima and Nagasaki, who received more than 3 Gy of irradiation (Choshi et al., 1983). Steroids are kno-

Table 1. List of various type of cataracts.

Type of Cataract	Causative factor	Vulnerable People
Senile Cataract	This cataract is caused due to the opacity of the eye lens by natural ageing process.	Elderly persons, mostly those over the age of 60 years.
Traumatic Cataract	This cataract is caused due to some physical damage to the eye lens capsule, such as that due to the entry of a difficult-to-remove foreign object	People working in hazardous conditions such as welders and those in glass furnaces.
Complicated Cataract	This cataract is the complication of some other chronic disease in the person.	Patients of diabetes, emphysema, asthma, etc.
Congenital Cataract	This cataract is caused in infants if the mother had contracted German measles during pregnancy	Newborn infants.
Toxic Cataracts	This cataract is caused due to long term use of medicines or chemicals that are toxic to the eyes	People using eye drops containing prednisone and cortisone for a long time. Also, smokers as they inhale toxic fumes which affect the eye lens

wn to cause cataracts in patients [Black et al., 1960; Havre, 1965; Kobayashi et al., 1974; Tichelli et al., 1993). Other risk factors include genetic factors, socioeconomic profile, malnutrition, myopia, renal failure, hypertension, obesity, chemical burn

Signs of a Cataract

Signs of a cataract develop slowly over time. Cloudy or blurry vision, a halo is seen around lights or lights are too bright, poor night vision, double vision, colors seem faded (Ohio State University Medical Center, 2008; Skalka et al., 1980).

Pharmacotherapy for prevention of Cataract

Aldose reductase inhibitors (ARI) are used in the treatment of cataract comprise a variety of structurally different compounds like plant extracts, animal tissues or specific small molecules. In diabetic rats, plant flavonoids, such as quercitrin or the isoflavone genistein, have delayed diabetic cataract formation (Huang et al., 2007; Leuenberger et al., 1978; Varma et al., 1977; Varma et al., 1979). Levels of polyol in the lenses of rats have been reduced by injection of intrinsic ARI containing extracts from human kidney and bovine lenses (Kador et al., 2001). Nonsteroidal anti-inflammatory drugs, such as sulindac (Jacobson et al., 1983; Sharma et al., 1989), aspirin (Cotlier et al., 1981; Gupta et al., 1991a) or naproxen (Gupta et al., 1991b) have been reported to delay cataract through a weak AR inhibitory activity. Fidarestat treatment completely prevented cataractous changes (Drel et al., 2008). In dogs the topically applied ARI Kinostat has been shown to reverse the development of cataracts (Kador et al., 2006). Other ARI with a beneficial effect on cataract prevention encompass Alrestatin (Chylack et al., 1979), Imrestat (Griffin et al., 1987), Ponalrestat (Stribling et al., 1985), Epalrestat (Kato et al., 1991), Zenarestat (Ao et al., 1991), Minalrestat (Robison et al., 1996), or Lidorestat (Zandt et al., 2005). A number of different antioxidants have been reported to delay cataract formation in diabetic animals. These include the antioxidant alpha lipoic acid, which has been shown to be effective in both delay and progression of cataract (Kojima et al., 2007).

Nepafenac, a topical NSAID indicated for the prevention and treatment of anterior segment pain and inflammation after cataract surgery, has been used recently in clinical trials to test its efficacy in reducing the incidence of macular edema after cataract surgery. The active ingredient is a prodrug that rapidly penetrates the cornea to form the active metabolite, amfenac, by intraocular hydrolases particularly in the retina, ciliary body epithelium and choroid (Ke et al., 2000; Pollreis et al., 2010).

Phytotherapy

So far extensive work is reported for efficacy of medicinal plants and nutraceuticals in effective management and prevention of cataractogenesis. Medicinal plant and related natural products control the process of cataract generation at very various level especially as an antioxidants and aldose reductase inhibitors (ARI). In table 2, a brief but comprehensive literature survey of medicinal plants as potential phytotherapeutic agent is discussed. This mini-review provides a path to researcher in developing new and effective phytotherapeutic agents for patients suffering from cataracts.

Table 2:- Medicinal plants used in treatment of Cataract

Sr. No.	Scientific name (Common name)	Family	Part used	References
1	<i>Abrus precatorius</i> L. (Crab's Eye)	Fabaceae	Leaf	(Okoli et al., 2007)
2	<i>Acorus calamus</i> L. (Sweet flag)	Araceae	Root	(Kumar et al., 2011)
3	<i>Adhatoda vasica</i> (L.) (Adusa)	Acanthaceae	Flower	(Gacche et al., 2011a)
4	<i>Aegle marmelos</i> (L.) Correa (Bael)	Rutaceae	Leaf	(Gacche et al., 2011a, Kirtikar et al., 1993; Sathiyaraj et al., 2010; Skalka et al., 1980)
5	<i>Ageratum conyzoides</i> L. (Goat weed)	Compositae	Leaf	(Klauss et al., 1994)
6	<i>Ajuga bracteosa</i> Wall. ex Benth. (Bugleweed)	Lamiaceae	Leaf	(Pande et al., 2007)
7	<i>Alangium lamarckii</i> Thwaites (Akol)	Alangiaceae	Root bark	(Kumar 2011)
8	<i>Allium cepa</i> L. (Onion)	Amaryllidaceae	Bulb	(Javadzadeh et al., 2009b)
9	<i>Allium sativum</i> L. (Garlic)	Liliaceae	Bulb	(Javadzadeh et al., 2009a; Raju et al., 2008)
10	<i>Angelica dahurica</i> (Fisch. ex Hoffm.) Benth. et Hook. (Dahurian angelica root)	Apiaceae	Root	(Liang et al., 2012; Shin et al., 1994)
11	<i>Aralia elata</i> (Miq) Seem. (Japanese Angelica-tree)	Araliaceae	Whole plant	(Chung et al., 2005)
12	<i>Artemisia annua</i> L. (Sweet Wormwood)	Asteraceae	Leaf, stem	(Lee et al., 2008)
13	<i>Aster koraiensis</i> Nakai (Korean starwort)	Asteraceae	Aerial parts	(Kim et al., 2009).
14	<i>Azadirachta indica</i> A. Juss. (Neem)	Meliaceae	Whole plant	(Halder et al., 2003; Rahmatullah et al., 2010)
15	<i>Barleria prionitis</i> Linn (Karunta)	Acanthaceae	Leaf	(Chavan et al., 2010; Etkin et al., 2001; Sankaranarayanan et al., 2010; Shukla et al., 2011)
16	<i>Bidens pilosa</i> L. (Spanish Needle)	Asteraceae	Leaf	(Klauss et al., 1994)
17	<i>Biophytum sensitivum</i> (L.) (Life Plant)	Oxalidaceae	Leaf	(Gacche et al., 2011a)
18	<i>Bobgunnia madagascariensis</i> (Desv.) J.H. Kirkbr (Snake bean)	Fabaceae	Seed	(Watson et al., 2008)
19	<i>Brassica oleracea</i> var. <i>italica</i> (Cabbage)	Brassicaceae	Flower	(Vibin et al., 2010)
20	<i>Brassica juncea</i> (L.) Czern. (Mustard greens)	Brassicaceae	Leaf	(Valavala et al., 2011)
21	<i>Brickellia arguta</i> B. L. Rob. (Pungent brickellbush)	Asteraceae	Leaf	(Guzman et al., 2005; Rosler et al., 1984)
22	<i>Brillantaisia patula</i> Ver texto (Nkon – kohomaneeh)	Acanthaceae	Whole plant	(Zapfack et al., 2001).

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23	<i>Buddleja officinalis</i> Maxim. (Pole butterflybush)	Scrophulariaceae	Flower	(Matsuda et al., 1995)
24	<i>Butea monosperma</i> (Lam.) Taub. (Dhak)	Leguminosae	Root	(Mengi et al., 1995).
27	<i>Caesalpinia volkensii</i> Harms (Msoro)	Leguminosae	Leaf	(Klauss et al., 1994)
28	<i>Caesalpinia bonduc</i> (L.) (Gray nicker bean)	Caesalpinaceae	Leaf	(Gacche et al., 2011a)
29	<i>Camellia sinensis</i> (L.) Kuntze (Green tea)	Commelinaceae	Inflorescences	(Gupta et al., 2002)
30	<i>Catharanthus roseus</i> L. (Rose Periwinkle)	Apocynaceae	Whole plant	(Gacche et al., 2011b)
31	<i>Capparis zeylanica</i> L. (Indian caper)	Capparidaceae	Leaf, root	(Sini et al., 2010)
32	<i>Capsicum frutescens</i> L. (African devil)	Solanaceae	Leaf or whole plant	(Chifundera et al., 1998; Klaus et al., 1994)
33	<i>Carissa edulis</i> (A. Rich.) Stapf. (Thungulu)	Apocynaceae	Leaf	(Samie et al., 2009)
34	<i>Cassia fistula</i> (L.) (Golden shower tree)	Fabeaceae	Leaf	(Gacche et al., 2011a)
35	<i>Caesalpinia digyna</i> Rottler (Teri pod)	Caesalpinaceae	Root	(Kumar et al., 2011)
36	<i>Centella asiatica</i> (L.) Urb. (Indian pennywort)	Umbelliferae	Leaf	(Bagchi et al., 2010; Rahmatullah et al., 2011)
37	<i>Cheilanthes glauca</i> (Cav.) Mett (Doradilla)	Adiantaceae	Leaf	(Pastene et al., 2007)
38	<i>Chloroxylon swietenia</i> DC (East Indian Satin Wood)	Rutaceae	Stem bark	(Palani et al., 2010)
39	<i>Cineraria maritime</i> L. (Silver ragwort)	Compositae	Whole plant	(Anitha et al., 2011)
40	<i>Cistanche deserticola</i> Ma (Desert-broomrape)	Orobanchaceae	Whole plant	(Stefanova et al., 2011)
41	<i>Cleistocalyx operculatus</i> (Roxb.) Merr. et Perry (Water fairy flower)	Myrtaceae	Flower bud	(Mai et al., 2010)
42	<i>Clerodendrum</i> genus L. (Glorybower)	Lamiaceae	Root	(Shrivastava et al., 2007)
43	<i>Coffea benghalensis</i> Roxb. ex Schult. (Cori ful)	Rubiaceae	Flower	(Rashid et al., 2010)
44	<i>Colebrooekea oppositifolia</i> Sm. (Dhurseli)	Lamiaceae	Leaf, root	(Joshi et al., 2011)
45	<i>Corydalis turtschaninovii</i> Besser (Corydalis tuber)	Fumariaceae	Tuber	Kubo et al., 1994)
46	<i>Crataegus pinnatifida</i> Bunge (Hawthorn tree)	Rosaceae	Leaf	(Wang et al., 2011)
47	<i>Crotalaria brevidens</i> Benth. (Ethiopian rattlebox)	Fabaceae	Leaf	(Klauss et al., 1994)
48	<i>Curcuma longa</i> Linn. (Turmeric)	Zingiberaceae	Rhizome	(Awasthi et al., 1996; Halder et al., 2003; Pandya et al., 2000; Pandey et al., 2010; Suryanarayana et al., 2005)

Sr. No.	Scientific name (Common name)	Family	Part used	References
49	<i>Dendrobium huoshanense</i> C.Z. Tang et S.J. Cheng (Orchids)	Orchidaceae	Leaf	(Luo et al., 2008)
50	<i>Dregea volubilis</i> (L.f.) Benth. ex Hook. f. (Sneeze Wort)	Asclepiadaceae	Leaf	(Biju et al., 2007)
51	<i>Duranta repens</i> L. (Golden Dewdrop)	Verbenaceae	Leaf, stem	(Lee et al., 2008)
52	<i>Emblica officinalis</i> Gaertn (Amla)	Euphorbiaceae	Fruit, seed	(Gupta et al., 2010a; Guzman et al., 2005; Nair et al., 2010; Suryanarayana et al., 2004)
53	<i>Emilia sonchifolia</i> (L.) DC (Sadamandi)	Asteraceae	Leaf	(Lija et al., 2006)
54	<i>Enicostemma hyssopifolium</i> (Willd.) Verd. (Indian gentian)	Gentianaceae	Arial parts	(Patel et al., 2009)
55	<i>Erigeron annuus</i> (L.) Pers (Annual fleabane)	Asteraceae	Leaf, stem	(Jang et al., 2010)
56	<i>Ervatamia divaricata</i> (L.) Burkill (Crape Jasmine)	Apocynaceae	Whole plant	(Unnikrishnan et al., 2004)
57	<i>Erythrina indica</i> Lam. (Indian Coral Tree)	Fabaceae	Root	(Bussa et al., 2010)
58	<i>Erythrina stricta</i> Roxb. (Tiger claw)	Fabaceae	Leaf	(Umamaheswari et al., 2010)
59	<i>Eucalyptus deglupta</i> Blume (Rainbow Eucalyptus)	Myrtaceae	Leaf	(Guzman et al., 2005)
60	<i>Eugenia borinquensis</i> Britton (Guayabota De Sierra)	Myrtaceae	Leaf	(Guzman et al., 2005)
61	<i>Eugenia jambolana</i> Lamark (Jambu)	Myrtaceae	Leaf	(Jadhav et al., 2009; Guzman et al., 2005; Rathi et al., 2002; Shahnawaz et al., 2010)
62	<i>Excoecaria cochinchinensis</i> Lour. (Chinese-Croton)	Euphorbiaceae	Aerial part	(Lee et al., 2008)
63	<i>Ficus golmerata</i> L. (Cluster Fig Tree)	Moraceae	Whole palnt	(Gacche et al., 2011b)
64	<i>Flueggea virosa</i> (Roxb.ex Willd.) Voigt (White berry-bush)	Euphorbiaceae	Leaf, stem	(Lee et al., 2008)
65	<i>Ginkgo biloba</i> L. (Maidenhair Tree)	Ginkgoaceae	Leaf	(Ertekin et al., 2004; Thiagarajan et al., 2002)
66	<i>Gymnema sylvestre</i> (Retz.) Schult (Gymnema)	Asclepiadaceae	Whole plant	(Li et al., 2004; Miyatake et al., 1994)
67	<i>Hydrocotyl bonariensis</i> Lam (Pennywort)	Apiaceae	Leaf	(Ajani et al., 2009)
68	<i>Khaya senegalensis</i> (Desr.) A. Juss. (African mahogany)	Meliaceae	Leaf	(Lee et al., 2008)
69	<i>Lantana camara</i> L. (Spanish Flag)	Verbenaceae	Leaf	(Kamatenesi et al., 2011)
70	<i>Mangifera indica</i> L. (Mango)	Anacardiaceae	Bark, Leaf	(Nikhil et al., 2010; Guzman et al., 2005)
71	<i>Magnolia fargesii</i> (Finet & Gagnep.) W. C. Cheng (Beaver Tree)	Magnoliaceae	Flower buds	(Lee et al., 2010)

Sr. No.	Scientific name (Common name)	Family	Part used	References
72	<i>Momordica charantia</i> Linn. (Bitter Gourd)	Cucurbitaceae	Fruit	(Grover et al., 2002; Grover et al., 2004; Rathi et al., 2002; Srivastava et al., 1988; Srivastava et al., 1993)
73	<i>Morinda citrifolia</i> L. (Canary wood)	Rubiaceae	Whole plant	(Gacche et al., 2011b)
74	<i>Moringa oleifera</i> Lam (Drumstick Tree)	Moringaceae	Leaf	(Sasikala et al., 2010)
75	<i>Mucuna pruriens</i> (L.) DL (Velvetbean)	Fabaceae	Seed	(Rathi et al., 2002)
76	<i>Ocimum basilicum</i> L. (Sweet basil)	Lamiaceae	Leaf	(Kamatenesi et al., 2011)
77	<i>Ocimum sanctum</i> Linn (Tulsi)	Labiatae	Leaf	(Dahanukar et al., 2000; Gupta et al., 2005; Halder et al., 2003; Pandey et al., 2010; Sharma et al., 1998; Vats et al., 2004)
78	<i>Oxalis corniculata</i> L. (Chari amilo)	Oxalidaceae	Leaf	(Joshi 2011; Pande et al., 2007)
79	<i>Plantago ovata</i> Forssk. (Desert Indian wheat)	Plantaginaceae	Seed	(Leonard et al., 2006)
80	<i>Platycodon grandiflorum</i> (Jacq.) A.DC. (Balloon flower)	Campanulaceae	Flower	(Jang et al., 2010)
81	<i>Pleurotus florida</i> (Mont.) Singer (Oyster mushroom)	Tricholomataceae	Whole plant	(Ganeshpurkar et al., 2011)
82	<i>Pleurotus ostreatus</i> (Jacq. Ex Fr.) P. Kumm (Oyster mushroom)	Tricholomataceae	Whole plant	(Isai et al., 2009)
83	<i>Polygonum orientale</i> L. (Ladyfingers)	Polygonaceae	Aerial part	(Lee et al., 2008)
84	<i>Potentilla fulgens</i> L. (Barren strawberries)	Rosaceae	Root	(Syiem et al., 2010)
85	<i>Psoralea corylifolia</i> L. (Babchi)	Fabaceae	Seed	(Gacche et al., 2011b)
86	<i>Pterocarpus marsupium</i> Roxb. (Indian kino)	Fabaceae	Bark	(Devgun et al., 2009; Gairola et al., 2010; Vats et al., 2004)
87	<i>Pueraria lobata</i> (Willd.) Ohwi (Kudzu vine)	Leguminosae	Root	(Hirakura et al., 1989; Kim et al., 2010; Li et al., 2004)
88	<i>Pyrus pashia</i> Buch.-Ham. Ex D. Don (Melu)	Rosaceae	Fruit	(Pande et al., 2007; Tiwari et al., 2010)
89	<i>Salvia miltiorrhiza</i> Bunge (Spanish Flag)	Lamiaceae	Root	(Tezuka et al., 1997)
90	<i>Santalum album</i> L. (Sandal)	Santalaceae	Wood	(Sindhu et al., 2010)

Sr. No.	Scientific name (Common name)	Family	Part used	References
91	<i>Scrophularia ningpoensis</i> Hemsl. (Ningpo figwort)	Scrophulariaceae	Root	(Huang et al., 2006)
92	<i>Scutellaria baicalensis</i> Georgi (Radix Scutellariae)	Labiataeae	Root	(Liang et al., 2012; Shin et al., 1994)
93	<i>Silybum marianum</i> (L.) Gaertn. (Silymarin)	Asteraceae	Seed	(Fallah et al., 2009; Huseini et al., 2004; Ranjbar et al., 2009)
94	<i>Solanum virginianum</i> Linn. (Berkateli)	Solanaceae	Root	(Tomar et al., 2009)
95	<i>Stellera chamaejasme</i> L. (Stellera)	Thymelaeaceae	Root	(Feng et al., 2005)
96	<i>Syzygium aromaticum</i> (L.) Merrill & Perry (Clove)	Myrtaceae	Dried flower Buds	(Sumalatha et al., 2010)
97	<i>Syzygium malaccense</i> (L.) Merr. (Malay Apple)	Myrtaceae	Leaf	(Guzman et al., 2005)
98	<i>Tagetes erecta</i> L. (Marigold flower)	Asteraceae	Flower	(Harikumar et al., 2008)
99	<i>Tamarindus indica</i> L. (Indian Date)	Fabaceae	Leaf, flower, fruit	(Muthu et al., 2006; Rahmatullah et al., 2010)
100	<i>Terminalia arjuna</i> L. Wight & Arn. (Arjun tree)	Combretaceae	Bark	(Dey et al., 2010)
101	<i>Terminalia bellerica</i> (Gaertn.) Roxb. (Vibhethaki)	Combretaceae	Seed, fruit	(Gupta et al., 2010)
102	<i>Terminalia chebula</i> Retz. (Harethaki)	Combretaceae	Fruit	(Gupta et al., 2010)
103	<i>Terminaria triptera</i> Stapf (Ham krai)	Combretaceae	Stem bark	(Chuakul et al., 2006)
104	<i>Tinospora cordifolia</i> Willd. (Guduchi)	Menispermaceae	Stem, root, Flower	(Gacche et al., 2011b; Rathi et al., 2002)
105	<i>Toxicodendron Succi-daneum</i> Mill. (Rhus tree)	Anacardiaceae	Leaf, stem	(Lee et al., 2008)
106	<i>Tribulus terrestris</i> L. (Devil's eyelashes)	Zygophyllaceae	Leaf, flower	(Gacche et al., 2011b)
107	<i>Tridax procumbens</i> L. (Vettukayapundu)	Compositae	Whole plant	(Pande et al., 2007)
108	<i>Trigonella foenum-graecum</i> L. (Methi)	Fabaceae	Seed	(Gupta et al., 2010b; Subhashini et al., 2011; Vats et al., 2004)
109	<i>Tylophora indica</i> R.Br. (Indian Ipecac)	Asclepiadaceae	Whole plant	(Bakmohammadi et al., 2008)
110	<i>Vaccinium myrtillus</i> L. (Bilberry)	Ericaceae	Leaf	(Bravetti et al., 1989; Kemper et al., 1999; Monograph et al., 2001)
111	<i>Vitex nugundo</i> L. (Nirgundi)	Verbenaceae	Leaf	(Rooban et al., 2009; Rooban et al., 2010)
112	<i>Vitis vinifera</i> L. (Grapes)	Vitaceae	Seed	(Yamakoshi et al., 2002)
114	<i>Warburgia ugandensis</i> Spargue (Uganda greenheart)	Canellaceae	Leaf	(Klauss et al., 1994)
115	<i>Withania Somnifera</i> Linn. (Ashwagandha)	Solanaceae	Leaf	(Halder et al., 2003; Thiagarajan et al., 2003)
116	<i>Zingiber officinalis</i> Roscoe. (Ginger)	Zigiberaceae	Rhizome	(Saraswat et al., 2010)

References

- Anitha TS, Annadurai T, Thomas PA, Geraldine P. (2011). Prevention of selenite-induced cataractogenesis by an ethanolic extract of *Cineraria maritima*: An experimental evaluation of the traditional eye medication. *Biological Trace Element Research* 143(1), 425-436.
- Ajani EO, Salako AA, Sharlie PD, Akinleye WA, Adeoye AO, Salau BA, Adebawo OO. (2009). Chemopreventive and remediation effect of *Hydrocotyl bonariensis* Comm. Ex Lam (Apiaceae) leave extract in galactose-induced cataract. *Journal of Ethnopharmacology* 123(1), 134-142.
- Ao S, Shingu Y, Kikuchi C, Takano Y, Nomura K, Fujiwara T, Ohkubo Y, Notsu Y, Yamaguchi I. (1991). Characterization of a novel aldose reductase inhibitor, FR74366, and its effects on diabetic cataract and neuropathy in the rat. *Metabolism* 40(1), 77-87.
- Awasthi S, Srivastava SK, Piper JT, Singhal SS, Chaubey M, Awasthi YC. (1996). Curcumin protects against 4-hydroxy-2-trans-nonenal-induced cataract formation in rat lenses. *American Journal of Clinical Nutrition* 64, 761-766.
- Bagchi P, Hopper W, Bullah SM. (2010). Neuro-informatics: Establishing an in-silico-ayurvedic treatment for Multiple sclerosis. *Journal of Bioscience and Technology* 1(2), 70-83.
- Bakmohammadi Z, Ghole VS, Kodam KM. (2008). AR Inhibitory Activity of Herb. *International Conference on the Interface of Chemistry-Biology in Biomedical Research, BITS Pilani* 400.
- Biju PG, Devi VG, Lija Y, Abraham A. (2007). Protection against selenite cataract in rat lens by drevogenin D, a triterpenoid aglycone from *Dregea volubilis*. *Journal of Medicinal Food* 10(2), 308-315.
- Black RL, Oglesby RB, von Sallam L, Bunim JJ. (1960). Posterior subcapsular cataracts induced by corticosteroids in patients with rheumatoid arthritis. *Journal of American Medicines Association* 174, 166-171.
- Bravetti GO. (1989). Preventive medical treatment of senile cataract with vitamin E and *Vaccinium myrtillus* anthocyanosides: clinical evaluation. *Ann Ottal Clin Ocul* 115, 109-116.
- Bussa SK, Prasad ND, Rao KNV, Banji D. (2010). Free radical scavenging activity of methanolic extract of *Erythrina indica* Lam. root. *International Journal of Pharmaceutical Sciences* 2(3), 827-833.
- Calissendorff B, Bolme P, el-Azazi M. (1991). The development of cataract in children as a late side-effect of bone marrow transplantation. *Bone Marrow Transplant* 7, 427-429.
- Chatterjee A, Milton RC, Thyle S. (1982). Prevalence and aetiology of cataract in Punjab. *British Journal of Ophthalmology* 66, 35-42.
- Chavan CB, Shinde UV, Hogade M, Bhinge S. (2010). Screening of *in-vitro* antibacterial assay of *Barleria prionitis* Linn. *Journal of Herbal Medicine and Toxicology* 4(2), 197-200.
- Chifundera K. (1998). Livestock diseases and the traditional medicine in the Bushi Area, Kivu Province. *Democratic Republic of Congo African Study Monographs* 19(1), 13-33.
- Choshi K, Takaku I, Mishima H, Takase T, Neriishi S, Finch SC, Otake M. (1983). Ophthalmologic changes related to radiation exposure and age in adult health study sample. *Hiroshima and Nagasaki. Radiation Research* 96, 560-579.
- Chuakul W, Soonthornchareonnon N, Sappakun S. (2006). Medicinal plants used in Kungkrabaen Royal Development Study Center, Chanthaburi province. *Thai Journal of Phytopharmacy* 13(1), 27-42.
- Chung YS, Choi YH, Lee SJ, Choi SA, Lee JH, Kim H, Hong EK. (2005). Water extract of *Aralia elata* prevents cataractogenesis in vitro and in vivo. *Journal of Ethnopharmacology* 101(1-3), 49-54.
- Chylack LT, Henriques HF, Cheng HM, Tung WH. (1979). Efficacy of alrestatin, an aldose reductase inhibitor, in human diabetic and nondiabetic lenses. *Ophthalmology* 86(9), 1579-1585.
- Cotlier E. (1981). Aspirin effect on cataract formation in patients with rheumatoid arthritis alone or combined to diabetes. *International Ophthalmology* 3(3), 173-177.

- Dahanukar SA, Kulkarni RA, Rege NN. (2000). Pharmacology of medicinal plants and natural products. *Indian Journal of Pharmacology* 32, S81-S118.
- Deeg HJ, Flournoy N, Sullivan KM, Sheehan K, Buckner CD, Sanders JE, Storb R, Witherspoon RP, Thomas ED. (1984). Cataracts after total body irradiation and marrow transplantation: A sparing effect of dose fractionation. *International Journal of Radiation Oncology Biology Physics* 10, 957-964.
- Devgun M, Nanda A, Ansari SH. (2009). *Pterocarpus marsupium* Roxb. - A Comprehensive Pharmacognosy Review 3(6), 359-363.
- Dey SK, Banerjee D, Chattapadhyay S, Karmakar KB. (2010). Antimicrobial activities of some Medicinal Plants of West Bengal. *International Journal of Pharma and Bio Sciences* 1(3), 1-10.
- Drel VR, Pacher P, Ali TK, Shin J, Julius U, El-Remessy AB, Obrosova IG. (2008). Aldose reductase inhibitor fidarestat counteracts diabetes-associated cataract formation, retinal oxidative-nitrosative stress, glial activation, and apoptosis. *International Journal of Molecular Medicine* 21(6), 667-676.
- Ertekin MV, Kocer I, Karlioglu I, Taysi S, Gepdiremen A, Sezen O, Balci E, Bakan N. (2004). Effects of oral *Ginkgo biloba* supplementation on cataract formation and oxidative stress occurring in lenses of rats exposed to total cranium radiotherapy. *Japanese Journal of Ophthalmology* 48(5), 499-502.
- Etkin NL. (2001). Perspectives in Ethnopharmacology: forging a closer link between bioscience and traditional empirical knowledge. *Journal of Ethnopharmacology* 76, 177-182.
- Fallah HH, Zaree MA, Heshmat R, Raza M. (2009). The Effect of *Silybum marianum* (L.) Gaertn. Seed Extract (Silymarin) on Galactose Induced Cataract Formation in Rats. *Journal of Medicinal Plants* 8(5), 7-12.
- Feng B, Wang T, Zhang Y, Hua H, Jia J, Zhang H, Pei Y, Shi L, Wang Y. (2005). Aldose reductase inhibitors from *Stellera chamaejasme*. *Pharmaceutical Biology* 43(1), 12-14.
- Gacche RN, Dhole NA. (2011a). Aldose reductase inhibitory, anti-cataract and antioxidant potential of selected medicinal plants from the Marathwada region. *India Natural Product Research* 25(7), 760-763.
- Gacche RN, Dhole NA. (2011b). Profile of aldose reductase inhibition, anti-cataract and free radical scavenging activity of selected medicinal plants: An attempt to standardize the botanicals for amelioration of diabetes complications. *Food and Chemical Toxicology* 49(8), 1806-1813.
- Ganeshpurkar A, Bhadoriya SS, Pardhi P, Jain AP, Rai G. (2011). In vitro prevention of cataract by Oyster Mushroom *Pleurotus florida* extract on isolated goat eye lens. *Indian Journal of Pharmacology* 43(6), 667-670.
- Gairola S, Gupta V, Singh B, Maithani M, Bansal P. (2010). Phytochemistry and Pharmacological activities of *Pterocarpus marsupium* A Review. *International Research Journal of Pharmacy* 1(1), 100-104.
- Graw J. (2009). Mouse models of cataract. *Journal of Genetics* 88(4), 469-486.
- Griffin BW, McNatt LG, Chandler ML, York BM. (1987). Effects of two new aldose reductase inhibitors, AL-1567 and AL-1576, in diabetic rats. *Metabolism* 36(5), 486-490.
- Grover JK, Yadav S, Vats V. (2002). Medicinal plants of India with anti-diabetic potential. *Journal of Ethnopharmacology* 81, 81-100.
- Grover JK, Yadav SP. (2004). Pharmacological actions and potential uses of *Momordica charantia*: A review. *Journal of Ethnopharmacology*, 93(1), 123-132.
- Gupta SK, Halder N, Srivastava S, Trivedi D, Joshi S, Varma SD. (2002). Green tea (*Camellia sinensis*) protects against selenite-induced oxidative stress in experimental cataractogenesis. *Ophthalmic Research* 34(4), 258-263.
- Gupta SK, Joshi S. (1991a). Relationship between aldose reductase inhibiting activity and anti-cataract action of various non-steroidal anti-inflammatory drugs. *Developments in Ophthalmology* 21, 151-156.

- Gupta SK, Joshi S. (1991b). Naproxen: an aldose reductase inhibitor and potential anti-cataract agent. *Developments in Ophthalmology* 21, 170–178.
- Gupta SK, Kalaiselvan V, Srivastava S, Agrawal SS, Saxena R. (2010a). Evaluation of anticataract potential of Triphala in selenite-induced cataract: In vitro and in vivo studies. *Journal of Ayurveda and Integrative Medicine* 1(4), 280-286.
- Gupta SK, Kalaiselvan V, Srivastava S, Saxena R, Agrawal SS. (2010b). *Trigonella foenum-graecum* (fenugreek) protects against selenite-induced oxidative stress in experimental cataractogenesis. *Biological Trace Element Research* 136(3), 258-268.
- Gupta SK, Srivastava S, Trivedi D, Joshi S, Halder N. (2005). *Ocimum sanctum* modulates selenite-induced cataractogenic changes and prevents rat lens opacification. *Current Eye Research* 30(7), 583-591.
- Guzman A, Guerrero RO. (2005). Inhibition of aldose reductase by herbs extracts and natural substances and their role in prevention of cataracts. *Revista Cubana de Plantas Medicinales* 10(3-4), 1-7.
- Halder N, Joshi S, Gupta SK. (2003). Lens aldose reductase inhibiting potential of some indigenous plants. *Journal of Ethnopharmacology* 86(1), 113-116.
- Hammond CJ, Snieder H, Spector TD, Gilbert CE. (2000). Genetic and environmental factors in age-related nuclear cataracts in monozygotic and dizygotic twins. *The New England Journal of Medicine* 342, 1786–1790.
- Hammond CJ, Duncan DD, Snieder H, de Lange M, West SK, Spector TD, Gilbert CE. (2001). The heritability of age related cortical cataract: the twin eye study. *Investigative Ophthalmology and Visual Science* 42, 601–605.
- Harikumar KB, Nimita CV, Preethi KC, Kuttan R, Shankaranarayana ML, Deshpande J. (2008). Toxicity profile of lutein and lutein ester isolated from marigold flowers (*Tagetes erecta*). *International Journal of Toxicology* 27(1), 1-9.
- Havre DC. (1965). Cataracts in children on long term corticosteroid therapy. *Archives of Ophthalmology* 73, 818-821.
- Hirakura K, Nakajima K, Sato S, Mihashi H. (1989). Isolation of 7-(6-O-malonyl)-d-glucopyranosyloxy)-3-(4-hydroxyphenyl)-4H-1-benzopyran-4-one from *Pueraria lobata* Ohwi as aldose reductase inhibitors and pharmaceutical formulations. *Japan Kokai Tokkyo Koho (Patent)*. Patent number: JP 01146894.
- Huang CG, Wei SJ. (2006). Prevention of D-galactose-induced cataract in rats epibueropyridinium A extracted from *Scrophularia ningpoensis*. *Academic Journal of Second Military Medical University* 27(11), 1204-1206.
- Huang R, Shi F, Lei T, Song Y, Hughes CL, Liu G. (2007). Effect of the isoflavone genistein against galactose-induced cataracts in rats. *Experimental Biology and Medicine* 232(1), 118–125.
- Huseini HF, Zaree AB, Zarch AB, Heshmat R. (2004). The effect of herbal medicine *Silybum marianum* (L.) Gaertn. seed extract on galactose induced cataract formation in rat. *Journal of Medicinal Plants* 3(12), 58-63.
- Isai M, Elanchezhian R, Sakthivel M, Chinnakkaruppan A, Rajamohan M, Jesudasan CN, Thomas PA, Geraldine P. (2009). Anticataractogenic Effect of an extract of the oyster mushroom, *pleurotus ostreatus*, in an experimental animal model. *Current Eye Research* 34(4), 264-273.
- Jacobson M, Sharma YR, Cotlier E, Hollander JD. (1983). Diabetic complications in lens and nerve and their prevention by sulindac or sorbinil: two novel aldose reductase inhibitors. *Investigative Ophthalmology and Visual Science* 24(10), 1426–1429.
- Jadhav VM, Kamble SS, Kadam VJ. (2009). Herbal medicine: *Syzygium cumini*: A Review. *Journal of Pharmacy Research* 2(8), 1212-1219.
- Jang DS, Lee YM, Jeong IH, Kim JS. (2010). Constituents of the flowers of *Platycodon grandiflorum* with inhibitory activity on advanced glycation end products and rat lens aldose reductase *in vitro*. *Archives of Pharmacal Research* 33(6), 875-880.

- Jang DS, Yoo NH, Kim NH, Lee YM, Kim CS, Kim J, Kim JH, Kim JS. (2010). 3,5-Di-O-caffeoyl-epi-quinic acid from the leaves and stems of *Erigeron annuus* inhibits protein glycation, aldose reductase, and cataractogenesis. *Biological and Pharmaceutical Bulletin* 33(2), 329-333.
- Javadzadeh A, Ghorbanihaghjo A, Arami S, Rashtchizadeh N, Mesgari M, Rafeey M, Omidi Y. (2009a). Prevention of selenite-induced cataractogenesis in wistar albino rats by aqueous extract of garlic. *Journal of Ocular Pharmacology and Therapeutics* 25(5), 395-399.
- Javadzadeh A, Ghorbanihaghjo A, Bonyadi S, Rashidi MR, Mesgari M, Rashtchizadeh N, Argani H. (2009b). Preventive effect of onion juice on selenite-induced experimental cataract. *Indian Journal of Ophthalmology* 57(3), 185-189.
- Johnson GJ, Foster A. (2004). Prevalence, incidence and distribution of visual impairment. In *The epidemiology of eye disease*. Arnold, London, UK, pp 3–28.
- Joshi B, Tyagi V. (2011). Traditional Knowledge and Utilization of Medicinal Plants of Himalayan Region. *Nature and Science* 9(5), 1-6.
- Jun G, Guo H, Klein BEK, Klein R, Wang JJ, Mitchell P, Miao H, Lee KE, Joshi T, Buck M, Chugha P, Iyengar SK, Wang B. (2009). EPHA2 is associated with age-related cortical cataract in mice and humans. *PLoS Genetics* 5(7) e1000584.
- Kador PF, Sun G, Rait VK, Rodriguez L, Ma Y, Sugiyama K. (2001). Intrinsic inhibition of aldose reductase. *Journal of Ocular Pharmacology and Therapeutics* 17(4), 373–381.
- Kador PF, Betts D, Wyman M, Blessing K, Randazzo J. (2006). Effects of topical administration of an aldose reductase inhibitor on cataract formation in dogs fed a diet high in galactose. *American Journal of Veterinary Research* 67(10), 1783–1787.
- Kahn HA, Leibowitz HM, Ganley JP, Kinni MM, Colton T, Nickerson RS, Dawber TR. (1977). The Framingham Eye study. I. outline and major prevalence findings. *American Journal of Epidemiology* 106(1), 33-41.
- Kamatnesi MM, Acipa A, Origa HO. (2011). Medicinal plants of Otwal and Ngai Sub Counties in Oyam District, Northern Uganda. *Journal of Ethnobiology and Ethnomedicine* 7(7), 1-14.
- Kato K, Nakayama K, Mizota M, Miwa I, Okuda J. (1991). Properties of novel aldose reductase inhibitors, M16209 and M16287, in comparison with known inhibitors, ONO-2235 and sorbinil. *Chemical and Pharmaceutical Bulletin* 39(6), 1540–1545.
- Ke TL, Graff G, Spellman JM, Yanni JM. (2000). Nepafenac, a unique nonsteroidal prodrug with potential utility in the treatment of trauma-induced ocular inflammation: II. In vitro bioactivation and permeation of external ocular barriers. *Inflammation* 24(4), 371–384.
- Kelvin R, Moss S. (1992). Visual impairment and diabetes, In Albert K. R. De Fronzo Keen, H P, Zimmet (Eds.), *International Textbook of Diabetes Mellitus*. Chi Chester, Wiley, pp 1373-1384.
- Kemper JK (1999) Bilberry (*Vaccinium myrtillus*), Longwood Herbal Task Force pp. 1-13.
- Kim CS, Kim J, Jeong IH, Kim YS, Lee J, Jang DS, Kim JS. (2009). Slow development of diabetic cataract in streptozotocin-induced diabetic rats via inhibition of aldose reductase activity and sorbitol accumulation by use of *Aster koraiensis* extract. *Korean Journal of Pharmacognosy* 40(4), 339-344.
- Kim NH, Kim YS, Lee YM, Jang DS, Kim JS. (2010). Inhibition of aldose reductase and Xylose-induced lens opacity by puerariafuran from the roots of *Pueraria lobata*. *Biological and Pharmaceutical Bulletin* 33(9), 1605-1609.
- Kirtikar KR, Basu BD. (1993). *Indian medicinal plants* 2nd Edn. Periodical Experts Books Agency, New Delhi, pp 499 – 505.
- Klauss V, Adala HS. (1994). Traditional Herbal eye medicine in Kenya. *World Health Forum* 15, 138-143.
- Klein, BE, Klein R. (1982). Cataracts and macular degeneration responder especially the patients of glaucoma, the in older Americans. *Archives of Ophthalmology* 100, 571-573.

- Kobayashi Y, Akaishi K, Nishio T, Kobayashi Y, Kimura Y, Nagata M. (1974). Posterior subcapsular cataract in nephrotic children receiving steroid therapy. *American Journal of Diseases of Children* 128, 671-673.
- Kojima M, Sun L, Hata I, Sakamoto Y, Sasaki H, Sasaki K. (2007). Efficacy of α -lipoic acid against diabetic cataract in rat. *Japanese Journal of Ophthalmology* 51(1), 10-13.
- Kubo M, Matsuda H, Tokuoka K, Kobayashi Y, Ma S, Tanaka T. (1994). Studies of anti-cataract drugs from natural sources. I. Effects of a methanolic extract and the alkaloidal components from *Corydalis tuber* on in vitro aldose reductase activity. *Biological and Pharmaceutical Bulletin* 17(3), 458-459.
- Kumar D, Singh R. (2011). Anticataract activity of *Acorus calamus* Linn. against hydrogen peroxide induced cataractogenesis in Goat eyes. *International Journal of Pharmaceutical Sciences Review and Research* 11(2), 112-115.
- Kumar R, Patel DK, Laloo D, Sairam K, Hemalatha S. (2011). Inhibitory effect of two Indian medicinal plants on aldose reductase of rat lens in vitro. *Asian Pacific Journal of Tropical Medicine* 4(9), 694-697.
- Lappi M, Rajantie J, Uusitalo RJ. (1990). Irradiation cataract in children after bone marrow transplantation. *Graefes Archive for Clinical and Experimental Ophthalmology* 228, 218-221.
- Lee J, Kim NH, Nam JW, Lee YM, Jang DS, Kim YS, Nam SH, Seo EK, Yang MS, Kim JS. (2010). Scopoletin from the flower buds of *Magnolia fargesii* inhibits protein glycation, aldose reductase, and cataractogenesis Ex Vivo. *Archives of Pharmacal Research* 33(9), 1317-1323.
- Lee YM, Kim JM, Kim YS, Jang DS, Kim JH, Bae KH, Kim JS. (2008). Screening of inhibitory effect on aldose reductase of Vietnam herbal medicines (II). *Korean Journal of Pharmacognosy* 39(4), 324-329.
- Leonard BD. (2006). Medicine at your Feet: Healing Plants of the Hawaiian Kingdom *Plantago* spp. (Laukahi).
- Leske MC, Chylack LT, Suh YW. (1991). The lens opacities case-control study: Risk factors for cataract. *Archives of Ophthalmology* 109, 244-251.
- Leuenberger PM. (1978). Diabetic cataract and flavonoids (first results). *Klinische Monatsblätter für Augenheilkunde* 172(4), 460-462.
- Liang, XL, Liao ZG, Zhu JY, Zhao G W , Yang M , Yin RL, Cao YC, Zhang J, Zhao LJ. (2012). The absorption characterization effects and mechanism of Radix Angelicae dahuricae extracts on baicalin in Radix Scutellariae using *in vivo* and *in vitro* absorption models. *Journal of Ethnopharmacology* 139(1), 52-57.
- Li WL, Zheng HC, Bukuru J, Kimpe ND. (2004). Natural medicines used in the traditional Chinese medical system for therapy of diabetes mellitus. *Journal of Ethnopharmacology* 92, 1-21.
- Lija Y, Biju PG, Reeni A, Cibin TR, Sahasranamam V, Abraham A. (2006). Modulation of selenite cataract by the flavonoid fraction of *Emilia sonchifolia* in experimental animal models. *Phytotherapy Research* 20(12), 1091-1095.
- Liu HS, McGannon WJ, Tolentino FI, Schepens CL. (1977). Massive cataract relief in eye camps. *Annals of Ophthalmology* 9, 503-508.
- Luo, JP, Deng YY, Zha XQ. (2008). Mechanism of polysaccharides from *Dendrobium huoshanense* on streptozotocin-induced diabetic cataract. *Pharmaceutical Biology* 46(4), 243-249.
- Matsuda H, Cai H, Kuro M, Tosa H, Inuma M. (1995). Study on anti-cataract drugs from natural sources. II. Effects of *Buddlejae Flos* on *in vitro* aldose reductase activity. *Biological and Pharmaceutical Bulletin* 18(3), 463-466.
- Mai TT, Yamaguchi K, Yamanaka M, Lam NT, Otsuka Y, Chuyen NV. (2010). Protective and anticataract effects of the aqueous extract of *Cleistocalyx operculatus* flower buds on β -Cells of streptozotocin-diabetic rats. *Journal of Agricultural and Food Chemistry* 58(7), 4162-4168.
- Meena AK, Pal B, Singh B, Yadav AK, Singh U, Kaur R, Sachan A, Rao MM. (2010). A review on cataract and its herbal treatments. *Drug Invention Today* 2(2), 178-181.

- Mengi SA, Deshpande SG. (1995). Evaluation of Ocular anti-inflammatory activity of *Butea frondosa*. *Indian Journal of Pharmacology* 27, 116-119.
- Mesa MD. (2000). Pharmacological and nutritional effects of *Curcuma longa* L. extracts and curcuminoids. *Ars Pharmaceutica* 41(3), 307-321.
- Miyatake K, Kensho G, Fujimoto T, Noguchi E, Shinohara M, Takenaka S, Taira T, Upadhaya SP, Ichimoto I, Nakano Y. (1994). Effects of conduritol A, a polyol from *Gymnema sylvestris*, on the development of diabetic cataracts in streptozotocin-treated rats and on aldose reductase. *Bioscience, Biotechnology, and Biochemistry* 58, 756-757.
- Monograph. (2001). *Vaccinium myrtillus* (bilberry). *Alternative Medicine Review* 6(5), 500-504.
- Muthu C, Ayyanar M, Raja N, Ignacimuthu S. (2006). Medicinal plants used by traditional healers in Kancheepuram District of Tamil Nadu, India. *Journal of Ethnobiology and Ethnomedicine* 2, 43.
- Nair NK, Patel K, Gandhi T. (2010). Effect of aqueous extract of *embelica officinalis* on selenite induced cataract in rats. *Iranian Journal of Pharmaceutical Research*, 9(2), 147-152.
- Nikhil S, Mahajan SD. (2010). Evaluation of antibacterial and antioxidant activity of *Mangifera indica* (leaves). *Journal of Pharmaceutical Sciences and Research* 2(1), 45-47.
- Okano Y, Asada M, Fujimoto A, Ohtake A, Murayama K, Hsiao KJ, Choeh K, Yang Y, Cao Q, Reichardt JK, Niihira S, Imamura T, Yamano T. (2001). A genetic factor for age-related cataract: Identification and characterization of a novel galactokinase variant, 'Osaka,' in Asians. *American Journal of Human Genetics* 68(4), 1036-1042.
- Okoli RI, Aigbe O, Obodo OJO, Mensah JK. (2007). Medicinal Herbs Used for Managing Some Common Ailments among Esan People of Edo State, Nigeria. *Pakistan Journal of Nutrition* 6(5), 490-496.
- Palani S, Raja S, Kumar BS. (2010). Hepatoprotective and antioxidant potential of *Chloroxylon swietenia* (Rutaceae) On Acetaminophen Induced toxicity in Male Albino Rats. *International Journal of Pharm Tech Research* 2(1), 162-170.
- Pandya U, Chandra A, Awasthi S, Jin, GF, Godley BF, Awasthi, YC. (2000). Attenuation of galactose cataract by low levels of dietary curcumin. *Nutrition Research* 20, 515-526.
- Pande PC, Tiwari L, Pande HC. (2007). Ethanoveterinary plants of Uttaranchal-A Review. *Indian Journal of Traditional Knowledge* 6(3), 444-458.
- Pandey A, Jagtap JV, Patil AA, Joshi RN, Kuchekar BS. (2010). Formulation and evaluation of antibacterial and anti-fungal activity of a herbal ointment containing *Aloe vera*, *Azadirachta indica* and *Curcuma longa*. *Journal of Chemical and Pharmaceutical Research* 2(3), 182-186.
- Pandey G, Madhuri S. (2010). Pharmacological activities of *Ocimum sanctum* (Tulsi): A review. *International Journal of Pharmaceutical Sciences Review and Research* 5(1), 61-66.
- Pastene E, Avello M, Letelier ME, Sanzana E, Vega M, Gonzalez M. (2007). Preliminary studies on antioxidant and anti-cataract activities of *Cheilanthes glauca* (Cav.) Mett. through various *in vitro* models. *Electronic Journal of Food and Plants Chemistry* 2(1), 1-8.
- Patel MB, Mishra SM. (2009). Aldose reductase inhibitory activity of a c-glycosidic flavonoid derived from *Encostemma hyssopifolium*. *Journal of Complementary and Integrative Medicine* 6(1), 5.
- Pollreis A, Erfurth US. (2010). Diabetic Cataract—Pathogenesis, Epidemiology and Treatment. *Journal of Ophthalmology* 10, 1-8.
- Rahmatullah M, Jahan R, Khatun MA, Jahan FI, Azad AK, Bashar AABM, Miajee UEZUM, Ahsan S, Nahar N, Ahmad I, Chowdhury MH. (2010). A Pharmacological Evaluation of Medicinal Plants used by Folk Medicinal Practitioners of Station Purbo Para Village of Jamalpur Sadar Upazila in Jamalpur district, Bangladesh. *American-Eurasian Journal of Sustainable Agriculture* 4(2), 170-195.
- Rahmatullah M, Hasan MM, Ahmed M, Khan MW, Hossain MS, Rahman MM, Nasrin D, Miajee ZUMEU, Hossain MS, Rownak JR, Khatun MA. (2010). A Survey of Medicinal Plants used

- by Folk Medicinal Practitioners in Balidha village of Jessore District, Bangladesh. *American-Eurasian Journal of Sustainable Agriculture* 4(2), 111-116.
- Rahmatullah M, Mahmud AA, Rahman MA, Uddin MF, Hasan M, Khatun MA, Bashir ABMA, Ahsan S, Mou SM, Begum R, Jahan R. (2011). An Ethnomedicinal Survey Conducted Amongst Folk Medicinal Practitioners in the Two Southern Districts of Noakhali and Feni, Bangladesh. *American-Eurasian Journal of Sustainable Agriculture* 5(1), 115-131.
- Raju TN, Kanth VR, Lavanya K. (2008). Effect of methanolic extract of *Allium sativum* (AS) in delaying cataract in STZ-induced diabetic rats. *Journal of Ocular Biology, Diseases, and Informatics* 1, 46-54.
- Ranjbar SH, Larijani B, Abdollahi M. (2009). A Systematic Review of the Potential Herbal Sources of Future Drugs Effective in Oxidant-Related Diseases. *Inflammation & Allergy - Drug Targets* 8, 2-10.
- Rashid MH, Tanzin R, Ghosh KC, Jahan R, Khatun M A, Rahmatullah M. (2010). An ethnoveterinary survey of medicinal plants used to treat cattle diseases in Birishiri area, Netrakona district, Bangladesh. *Advances in Natural and Applied Sciences* 4(1), 10-13.
- Rathi SS, Grover JK, Vikrant V, Biswas NR. (2002). Prevention of experimental diabetic cataract by Indian Ayurvedic plant extracts. *Phytotherapy Research* 16(8), 774-777.
- Robison WG, Laver NM, Jacot JL, Glover JP, Michael D. (1996). Diabetic-like retinopathy ameliorated with the aldose reductase inhibitor WAY-121,509. *Investigative Ophthalmology and Visual Science* 37(6), 1149-1156.
- Rooban BN, Lija Y, Biju PG, Sasikala V, Sahasranamam V, Abraham A (2009) *Vitex negundo* attenuates calpain activation and cataractogenesis in selenite models. *Experimental Eye Research* 88(3), 575-582.
- Rooban BN, Sasikala V, Sahasranamam V, Abraham A. (2010). *Vitex negundo* Modulates Selenite-Induced Opacification and Cataractogenesis in Rat Pups. *Biological Trace Element Research* 138(1-3), 282-292.
- Rollins W. (1903). Notes on x-light: the effect of x-light on the crystalline lens. *Boston Medical Surgery Journal* 148, 364-365.
- Rosler K, Goodwin RS, Mabry T, Varma SD, Norri J. (1984). Flavonoids with anti-cataract activity from *Brickellia arguta*. *Journal of Natural Products* 47(2), 316-319.
- Samie A, Obi CL, Lall N, Meyer JJM. (2009). *In-vitro* cytotoxicity and antimicrobial activities, against clinical isolates of *Campylobacter* species and *Entamoeba histolytica*, of local medicinal plants from the Venda region, in South Africa. *Annals of Tropical Medicine & Parasitology* 103(2), 159-170.
- Sankaranarayanan S, Bama P, Ramachandran J, Kalaichelvan PT, Deccaraman M, Vijayalakshmi M, Dhamotharan R, Dananjeyan B, Bama SS. (2010). Ethnobotanical study of medicinal plants used by traditional users in Villupuram district of Tamil Nadu India. *Journal of Medicinal Plants Research* 4(12), 1089-1101.
- Saraswat M, Suryanarayana P, Reddy PY, Patil MA, Balakrishna N, Reddy GB. (2010). Antiglycating potential of *Zingiber officinalis* and delay of diabetic cataract in rats. *Molecular Vision* 16, 1525-1537.
- Sasikala V, Rooban BN, Priya SGS, Sahasranamam V, Abraham A. (2010). *Moringa oleifera* prevents selenite-induced cataractogenesis in rat pups. *Journal of Ocular Pharmacology and Therapeutics* 26(5), 441-447.
- Sathiyaraj K, Sivaraj A, Madhumitha G, Kumar PV, Saral AM, Devi K, Kumar BS. (2010). Antifertility effect of aqueous Leaf extract of *Aegle marmelos* on Male Albino Rats. *International Journal of Current Pharmaceutical Research* 2(1), 26-29.
- Shahnawaz M, Sheikh SA, Nizamani SM. (2010). Treatment with extracts of *Eugenia jambolana* seed and *Aegle marmelos* leaf extracts prevents hyperglycemia and hyperlipidemia in alloxan induced diabetic rats. *African Journal of Pharmacy and Pharmacology* 4(5), 270-275.

- Sharma P, Kulshreshtha DK, Sharma AL. (1998). Anti-cataract activity of *Ocimum sanctum* on experimental cataract. *Indian Journal of Pharmacology* 30, 16-20.
- Sharma YR, Vajpayee RB, Bhatnagar R, Mohan M, Azad RV, Kumar M, Nath R. (1989). Topical sulindac therapy in diabetic senile cataracts: cataract—IV. *Indian Journal of Ophthalmology* 37(3), 127–133.
- Shin KH, Chae YJ, Chung MS, Lee HJ. (1994). Effect of flavonoids from *scutellariae radix* on cataract formation and polyol accumulation in rat lens. *Korean Journal of Pharmacognosy* 25(1), 41-46.
- Shin KH, Chung MS, Cho TS. (1994). Effects of furanocoumarins from *Angelica dahurica* on aldose reductase and galactosemic cataract formation in rats. *Archives of Pharmacal Research* 17(5), 331-336.
- Shrivastava N, Patel T. (2007). *Clerodendrum* and Healthcare: An Overview. *Medicinal and Aromatic Plant Science and Biotechnology* 1(1), 142-150.
- Shukla R, Sharma SB, Puri D, Prabhu KM, Murthy PS. (2000). Medicinal Plants for treatment of diabetes mellitus. *Indian Journal of Clinical Biochemistry* 15(supp), 169-177.
- Shukla P, Singh A, Gawri S, Alexander A, Sonwane S. (2011). *In Vitro* propagation of *Barleria prionitis* Linn and its antibacterial activity. *International Journal of Pharma Professional's Research* 2(1), 198-200.
- Sindhu RK, Upma, Kumar A, Arora S. (2010). *Santalum album* Linn: A Review on Morphology, Phytochemistry and Pharmacological aspects. *International Journal of PharmTech Research* 2(1), 914-919.
- Sini KR, Sinha BN, Karpagavalli M. (2010). Determining the Antioxidant Activity of Certain Medicinal Plants of Attapady, (Palakkad), India Using DPPH Assay. *Current Botany* 1(1), 13-17.
- Singan V, Singan M, Begum H. (2007). The Hepatoprotective Effect of Bael Leaves (*Aegle Marmelos*) in Alcohol Induced Liver Injury in Albino Rats. *International Journal of Science & Technology* 2(2), 83-92.
- Skalka HW, Prechal JT. (1980). Presenile Cataract Formation and Decreased Activity of Galactosemic Enzymes. *Archives of Ophthalmology* 98, 269-273.
- Srivastava Y, Bhatt VH, Verma Y. (1988). Effect of *Momordica charantia* Linn. pomous aqueous extract on cataractogenesis in murrin alloxan diabetics. *Pharmacology Research and Communication* 20(3), 201-209.
- Srivastava Y, Bhatt VH, Verma Y, Venkaiah K, Raval BH. (1993). Antidiabetic and adaptogenic properties of *Momordica charantia* extract: An experimental and clinical evaluation. *Phytotherapy Research* 7(4), 285-289.
- Stefanova NA, Fursova AZ, Sarsenbaev KN, Kolosova NG. (2011). Effects of *Cistanche deserticola* on behavior and signs of cataract and retinopathy in senescence-accelerated OXYS rats. *Journal of Ethnopharmacology* 138(2), 624-632.
- Stribling D, Mirrlees DJ, Harrison HE, Earl DCN. (1985). Properties of ICI 128,436, a novel aldose reductase inhibitor, and its effects on diabetic complications in the rat. *Metabolism* 34(4), 336–344.
- Subhashini N, Thangathirupathi A, Lavanya N. (2011). Antioxidant activity of *Trigonella foenum graecum* using various in vitro and ex vivo models. *International Journal of Pharmacy and Pharmaceutical Sciences* 3(2), 96-102.
- Sumalatha K, Kumar SA, Lakshmi SM. (2010). Review on Natural Aphrodisiac potentials to treat Sexual dysfunction. *International Journal of Pharmacy & Therapeutics* 1, 10-18.
- Suryanarayana P, Kumar PA, Saraswat M, Petrash JM, Reddy GB. (2004). Inhibition of aldose reductase by tannoid principles of *Embllica officinalis*: implications for the prevention of sugar cataract. *Molecular Vision* 12(10), 148-154.
- Suryanarayana P, Saraswat M, Mrudula T, Krishna TP, Krishnaswamy K, Reddy GB. (2005). Curcumin and Turmeric Delay Streptozotocin-Induced Diabetic Cataract in Rats. *Investigative Ophthalmology and Visual Sciences* 46, 2092–2099.

- Syiem D, Majaw S. (2010). Effect of potentilla fulgens l. methanolic extract on sorbitol dehydrogenase in normal and alloxan-induced diabetic mice. *Pharmacologyonline* 2, 671-680.
- Tezuka Y, Kasimu R, Basnet P, Namba T, Kadota S. (1997). Aldose reductase inhibitory constituents of the root of *Salvia miltiorhiza* BUNGE. *Chemical and Pharmaceutical Bulletin*, 45(8), 1306-1311.
- The Ohio State University Medical Center. (2008). Mount Carmel Health and Ohio Health, Columbus, Ohio 2: www.healthinfotranslations.org.
- Thiagarajan G, Chandani S, Rao HS, Samuni AM, Chandrasekaran K, Balasubramanian D. (2002). Molecular and cellular assessment of *Ginkgo biloba* extract as a possible ophthalmic drug. *Experimental Eye Research* 75(4), 421-430.
- Thiagarajan G, Venu T, Balasubramanian D. (2003). Approaches to relieve the burden of cataract blindness through natural antioxidants: Use of Ashwagandha (*Withania somnifera*). *Current Science* 85(7), 1065-1071.
- Tichelli A, Gratwohl A, Wursch A, Wenger R, Nissen C, Speck B. (1987). Cataract formation after bone marrow transplantation with and without irradiation: therapeutic implications. *Bone Marrow Transplant* 2(1), 250.
- Tichelli A, Gratwohl A, Egger T, Roth J, Priinte A, Nissen C, Speck B. (1993). Cataract Formation after Bone Marrow Transplantation. *Annals of Internal Medicine* 119(12), 1175-1180.
- Tiwari KJ, Ballabha R, Tiwari P. (2010). Diversity and Present Status of Medicinal Plants in and around Srinagar Hydroelectric Power Project in Garhwal Himalaya, India: Needs for Conservation. *Researcher* 2(2), 50-60.
- Tomar A. (2009). Folk medicinal uses of plant roots from Meerut district, Uttar Pradesh. *Indian Journal of Traditional Knowledge* 8(2), 298-301.
- Umamaheswari M, Asokkumar K, Sivashanmuga, AT, Subhadradevi V, Neethu M. (2010). Anticataract activity of *Erythrina stricta* against naphthalene induced cataractogenesis in rats. *Bangladesh Journal of Pharmacology* 5(2), 77-81.
- Unnikrishnan E. (2004). Materia Medica of the Local Health Traditions of Payyannur, Discussion Paper No. 80, 1st ed. Kerala Research Programme on Local Level Development Centre for Development Studies Thiruvananthapuram.
- Valavala VK, Vangipurapu RK, Banam VR, Pulkurthi UMR, Turlapati NR. (2011). Effect of mustard (*brassica juncea*) leaf extract on streptozotocin-induced diabetic cataract in wistar rats. *Journal of Food Biochemistry* 35(1), 109-124.
- Varma SD, Mizuno A, Kinoshita JH. (1977). Diabetic cataracts and flavonoids. *Science* 195 (4274), 205-206.
- Varma SD, Shocket SS, Richards RD. (1979). Implications of aldose reductase in cataracts in human diabetes. *Investigative Ophthalmology and Visual Science* 18(3), 237-241.
- Vats V, Yadav SP, Biswas NR, Grover JK. (2004). Anticataract activity of *Pterocarpus marsupium* bark and *Trigonella foenum-graecum* seeds extract in alloxan diabetic rats. *Journal of Ethanopharmacology* 93(2-3), 289-294.
- Vibin M, SivaPriya SG, Rooban NB, Sasikala V, Sahasranamam V, Abraham A. (2010). Broccoli regulates protein alterations and cataractogenesis in selenite models. *Current Eye Research* 35(2), 99-107.
- Wang T, Zhang P, Zhao C, Zhang Y, Liu H, Hu L, Gao X, Zhang D. (2011). Prevention effect in selenite-induced cataract in vivo and antioxidative effects in vitro of *Crataegus pinnatifida* leaves. *Biological Trace Element Research* 142(1), 106-116.
- Watkins R. (2002). Foundation of a solution to cataract blindness. *Clinical and Experimental Optometry* 85, 59-60.
- Watson RR, Preedy VR (2008) Botanical medicine in Clinical Practice. CABI, Cromwell Press, Trowbridge, UK, pp 10.

- West SK. (2000). Looking forward to 20/20: a focus on the epidemiology of eye diseases. *Epidemiology Reviews* 22, 64–70.
- Yamakoshi J, Saito M, Kataoka S, Tokutake S. (2002). Procyanidin-rich extract from grape seeds prevents cataract formation in hereditary cataractous (ICR/f) rats. *Journal of Agricultural and Food Chemistry* 50(17), 4983-4988.
- Zandt VMC, Jones ML, Gunn DE, Geraci LS, Jones JH, Sawicki DR, Sredy J, Jacot JL, Dicioccio AT, Petrova T, Mitschler A, Podharny AD. (2005). Discovery of 3-[(4,5,7-trifluorobenzothiazol-2-yl)methyl]indole-N-acetic acid (lidoestat) and congeners as highly potent and selective inhibitors of aldose reductase for treatment of chronic diabetic complications. *Journal of Medicinal Chemistry* 48(9), 3141–3152.
- Zapfack L, Ayeni JSO, Besong S, Mdaihi M. (2001). Ethnobotanical survey of the Takamanda Forest Reserve.