Review Article

J Babol Univ Med Sci
Vol 19, Issu 4; Apr 2017. P:67-73

The Effective Medicinal plants in Cataract Treatment: An Inquiry in Persian Medicine Resources (4-13th century AH)

M.R. Sheikh Rezaee (MD)[1], A. Bonyadi (BSc)[2], A.S. Hosseini (MD)*[3]

1.Department of Ophthalmology, Faculty of Medicine, Mazandaran University of Medical Sciences, Sari, I.R.Iran
2.Student Research Committee, Faculty of Paramedicine, Mazandaran University of Medical Sciences, Sari, I.R.Iran
3.Traditional and Complementary Medicine Research Center, Mazandaran University of Medical Sciences, Sari, I.R.Iran

J Babol Univ Med Sci; 19(4); Apr 2017; PP: 67-73
Received: Jan 14th 2017, Revised: Feb 18th 2017, Accepted: Mar 14th 2017.

ABSTRACT

BACKGROUND AND OBJECTIVE: Cataract is a kind of eye disease that starts with blurriness of eye lens and the vision is disrupted as the opacity and cloudiness of the lens increases. Iranian people knew cataract as "Nozoul-al-ma" (water fall) and they believed that this disease was an effect of the moisture that accumulates between lens and cornea. Currently, surgery is the only way to restore vision in people with cataract. However, effective medical therapy can reduce the costs and risks of surgery. The purpose of this study is to find the effective medicinal plants in cataract treatment.

METHODS: This review article based on library research methods was conducted in three steps (keyword determination, analysis of resources, scoring and arrangement) by investigating Persian medicine references. In this study, seven books from 4-13th century AH were studied. The results were scored from 1 to 3 based on implicit or undecided statement, single citation, direct statement and emphatic effect statement.

FINDINGS: 36 medicinal plants were found and 11 plants (Ferula assafoetida, Ferula Persica, Foeniculum Vulgare, Cyclamen europaeum, Allium cepa, Euphorbia resinifera, Isatis tinctoria, Zataria multiflora , Olea europaea, Caesalpinia bonduc, Commiphora opobalsamum) obtained the highest scores.

CONCLUSION: The plants that obtained the highest scores were probably the most prominent drugs for the treatment of cataract in 4-13th century AH. Frequent use of these drugs in recent centuries may indicate their appropriate effect on cataract. However, more clinical researches are required to confirm that.

KEY WORDS: *Cataract, Treatment, Traditional Medicine.*

Please cite this article as follows:

Sheikh Rezaee MR, Bonyadi A, Hosseini AS. The Effective Medicinal plants in Cataract Treatment: An Inquiry in Persian Medicine Resources (4-13th century AH). J Babol Univ Med Sci. 2017; 19(4):67-73.

***Corresponding author: A.S. Hosseini (MD)**
Address: Traditional and Complementary Medicine Research Center, Mazandaran University of Medical Sciences, Sari, I.R.Iran
Tel: +98 11 33244893
E-mail: sadr128@yahoo.com

[DOR: 20.1001.1.15614107.1396.19.4.9.6]
[DOI: 10.22088/jbums.19.4.67]

Introduction

The progressive loss of optical quality of the eye lens, which is caused by the formation of crystals (crystalline lens) is called Cataract (1, 2). Several factors are associated with this disease including free radicals, ultraviolet radiation, infrared radiation, malnutrition, smoking, eye chemical damage, taking some medications such as corticosteroids, penetrating and non-penetrating injuries, intraocular inflammatory diseases, and some congenital diseases (3, 4). Usually the visual impairment will be greater when the cataract is more severe (4). Age-related cataract is the most common type of cataract, often observed in people above 50 years (2, 4).

According to the World Health Organization (WHO), cataract is the most common reversible cause of blindness in the world and its prevalence is increasing in societies because of inappropriate nutrition, low income, poor social status and low educational level (4). Cataract, which is the cause of 47.8% of all cases of blindness worldwide is a serious health concern in developing countries (5). Currently, surgery is the only way to cure blindness in patients with cataract (6). Although significant improvements can be observed in cataract surgery in recent years, it can still be followed by some complications such as endophthalmitis, posterior capsule rupture, intraocular pressure changes, and macular cystoid edema (3, 4, 7 – 10). According to Persian medicine references, cataract was known as "Nozoul-al-ma" (water fall) or watering eyes and its diagnosis and treatment have been discussed. Abu Rooh Jorjani, known as Zarrin dast (golden hands), who was an oculist in the 5th century AH, believed that this disease was an effect of the moisture that accumulates between iris and aqueous humor (11).

Avicenna, the famous physician in 4th century AH, also believed that the source of cataract is the moisture that accumulates between lens and cornea (12). Different types of water descended to the eye are different in terms of concentration and color. In terms of concentration, the water can be highly smooth, clear, diluted or concentrated. It terms of color, the water may be aerial, chalky while, pearl white, white color that tends to livid, turquoise and gold, yellow, black and gray. In response to the treatment, the color of water is highly significant (11–13).

Modifying nutrition and behavioral habits, use of medications and surgery are constitute the treatments of this disease (13). It is generally believed that if the disease is in its early stages and water is not consolidated in the eyes, the treatment will have better results. If the disease becomes severe, the water needs to be extracted by a device and treatment without water extraction will not be possible (12). Traditional and complementary medicine methods such as Persian medicine have a very long history, achieved from perceptions, beliefs and experiences of nations and cultures during thousands of years (14).

Therefore, it is a very important and inspiring asset in treatment of diseases. Understanding cataracts and the medicinal plants that affect this disease has provided the topic for several review articles and original studies. A study by Nejabat et al. investigated the diagnosis and treatment of cataract from the perspective of Avicenna (15). Another study by Etezad Razavi et al. investigated the diagnosis and treatment of eye diseases in Persian and Islamic medicine (16). Despite discussion about cataract, these two studies did not mention the plants that can affect this disease. In a study by Shabaninejad et al., three references of Qanun, al-Mansouri fi al-Tibb and Ferdous al Hakmeh (3 – 5th century AH) were reviewed for explaining cataract, meanwhile indicating the effect of some medicinal plants (13).

The role of medicinal plants in prevention and treatment of cataract have been considered in recent researches and a part of this effect is attributed to the antioxidant properties of medicinal plants (17, 18). A study by Sreelakshmi et al. demonstrated that Cassia tora can delay cataract pathology attack in mice. Considering the edibility of this plant, adding this plant to daily diet has been presented as an effective effort in preventing and delaying cataract (19).

The study of Noroozpour Dailami et al. reported the effective role of Borage Leaf extract in preventing induced cataract in mice (20). Studies have shown that the chance of finding a new effective medication based on traditional experiences increases by 40%, while this rate in random researches is only 1% (21). Therefore, this review article aims to present medicinal plants with positive effects in cataract treatment using Persian medicine references in order to provide the chance to discover the effective medications and improve the treatment of this disease based on clinical researches.

Methods

In this non-systematic overview based on library methodology and literature review, seven authentic books from 4 – 13th century AH were selected as references, including The Canon of Medicine (al-

[DOR: 20.1001.1.15614107.1396.19.4.9.6]
[DOI: 10.22088/jbums.19.4.67]

Qanun fi'l-tibb) by Avicenna from 4th and 5th century AH (12), Al-Abnieh a Haghayegh al-Advieh by Bin Ali Heravi from 4th and 5th century AH (22), Noor El Ayoun by Abu Rooh Jorjani from 5th century AH (11), Ikhtiyarat-e-Badiyee by Ali ibn Hosein Ansari Shirazi from 8th and 9th century AH (23), Tohfe- al- Momenin by Momen Tonekaboni from 11th century AH (24), Makhzan-ol-Advieh by Mohammad Hossein Aghili Alavi Khorasani from 12th century AH (25), Al-Mohit al-azam by Mohammad Azam Khan Chishti from 13th century AH (26). The selected texts were analyzed according to the following steps (27, 28):

Determining the keywords: After primary analysis of treatment methods and medicinal plants, the words such as Nozoul-al-ma (water fall) and watering eyes were chosen as keywords.

Reference review: A. The introduced references were searched using the abovementioned keywords. B. The medicinal plants in singular form and not combined with other plants, for which the property of cataract treatment was mentioned, were recorded in separate sheets of paper along with the sentences that mentioned their effects. C. The findings were alphabetically arranged in a table.

Scoring and arrangement: A. Each medicinal plant was separately score from +1 to +3 by two researches Table 1). B. In cases of disagreement, an agreement was reached by discussion and if necessary, by referring to a third researcher. C. After summing up the scores, the medicinal plants were prioritized based on their score. The maximum score from each book was +3 for each plant. Table 2 is an example of scoring method.

Results

All references of this research mentioned cataract and the medicinal plants that had positive effects on this disease. In the order of century, the effective plants were 7 plants in Al-Abnieh a Haghayegh al-Advieh, 10 plants in al-Qanun fi'l-tibb, 11 plants in Noor El Ayoun, 16 plants in Ikhtiyarat-e-Badiyee, 24 plants in Tohfe- al- Momenin, 29 plants in Makhzan-ol-Advieh and 33 plants in Al-Mohit al-azam. Based on the references of this research, the effect of some plants was indicated using phrases such as: the best medicine, superior medicine, best surgery, effective, extremely beneficial, extremely helpful and experienced. The sentence "it is beneficial among plants used to cure water fall" had an implied aspect about Foeniculum Vulgare. Moreover, considering that "moisture overflow" is not confined to cataract, the indication of this sentence in describing the effect of plants was considered implicative, and the sentence "maybe if water is in the first stage of formation or is diluted, the cataract can be treated" was the only sentence with hesitation. At the end of the search, 36 medicinal plants were found. Of these plants, 11 plants achieved a score of 10 or more than 10. 31 plants (86%) were warm and dry, 3 plants (8%) were warm and wet, 1 plant (3%) was cold and wet and 1 plant (3%) was cold and dry. Ferula assa-foetida and Ferula Persica with a score of 15 and Veratrum album and Lilium candidum with a score of 2 got the highest and lowest score, respectively. Overall, 22 families were present in these plants. 4 plants belonged to Apiaceae and Lamiaceae families each, 3 plants belonged to Burseraceae family, 2 plants belonged to Brassicaceae, Euphorbiaceae, Aspargaceae, Fabaceae and Ranunculaceae families each and 1 plant belonged to Aristolochiaceae, Asphodelaceae, Alliaceae, Cucurbitaceae, Dryopteridaceae, Ericaceae, Iridaceae, Liliaceae, Melanthiaceae, Moraceae, Oleaceae, Primulaceae and Rutaceae families each. In once case (Fungi), the name of the plant was only applicable to the dynasty and did not imply species, genus and family (29). These plants were used in the form of poultice and kohl. All of the plants were introduced in the order of score (table 3).

Table 1. Scoring criteria

Scoring criteria	Score
Strong emphasis on cataract treatment using phrases like "the best medicine"	+3
Direct mention of the effect on cataract treatment without using emphasis words	+2
Implied mention of the effect on cataract treatment Mentioning the effect on cataract treatment with hesitation Quote from a scientist	+1

[DOR: 20.1001.1.15614107.1396.19.4.9.6]
[DOI: 10.22088/jbums.19.4.67]

Table 2. An example of table formation and scoring

Name of the plant	Ferula assa-foetida	+15
Al-Abnieh a Haghayegh al-Advieh	Use Cyamophila astragalicola on the eyes to prevent water	+2
al-Qanun fi'l-tibb	Use honey at the beginning of water flow is useful	+2
Noor El Ayoun	Use solvent such as resin is beneficial at the beginning of water flow	+3
Ikhtiyarat-e-Badiyee	Mix with honey and rub on eyes to increase eyesight. Highly beneficial at the beginning of water fall	+2
Tohfe- al- Momenin	Mix with honey and run on eyes to improve eyesight and white water fall	+2
Makhzan-ol-Advieh	Mix with honey and run on eyes to improve eyesight and white water fall	+2
Al-Mohit al-azam	Mix with honey and run on eyes in beneficial to improve eyesight and white water fall	+2

Table 3. Plants with positive effects on cataract treatment

Name of the plant	Mizaj	Score	Name of the plant	Mizaj	Score
Ferula assa-foetida	First, fourth, warm and last, second, dry	15	Lupinus albus	Last, first, warm and second, dry	6
Ferula Persica	Third, warm and dry	15	Nigella sativa	Third, warm, dry	6
Foeniculum Vulgare	First, third, warm and last, first, dry	13	Fungi	Third, cold, wet	6
Cyclamen europaeum	First, third, warm and last, dry	12	Arbutus unedo	Second, cold and dry	6
Allium cepa	Last, third, warm and first, dry with preferred moisture	12	Citrullus colocynthis	Fourth, warm and second, dry	5
Euphorbia helioscopia	Warm, dry in first and fourth	11	Commiphora myrrha	Last, third, warm and second , dry	5
Isatis tinctoria	Second, warm and dry	11	Crocus sativus	Second, warm and first, dry	4
Zataria multiflora	Last, second, warm and dry	10	Ruta graveolens	Third, warm and dry	4
Olea europaea	Second, warm and dry	10	Assarum europaen	Third, warm and second, dry	4
Caesalpinia bonduc	Last, second, warm and dry	10	Urginea maritima	Warm in third and dry in second with preferred moisture	4
Commiphora opobalsamum	First, third, warm and dry	10	Bursera graveolens	Warm and dry in second grade last	4
Ficus carica	First, warm and second wet	8	Euphorbia chamaesyce	Warm and dry in first, third	4
Origanum majorana	Last, second, warm and first, dry	8	Aloe barbadensis, A.littoralis,A. vera	Second, warm and dry	4
Hyssopus officinalis	Second, warm and last, dry	8	Raphanus sp.	First, warm and second, dry	4
Opopanax chironium	Warm and dry in third	8	Asparagus officinalis	First, warm and second, dry	4
Dryopteris filix-mas	Second, warm and dry	7	Anemone coronaria	Second, dry and wet	3
Marrubium vulgare	Second, warm and second, dry	6	Veratrum album	Middle, third, warm and dry	2
Tanacetum parthenium	Third, warm and second, dry	6	Lilium candidum	Third, warm and dry	2

[DOR: 20.1001.1.15614107.1396.19.4.9.6]
[DOI: 10.22088/jbums.19.4.67]

Discussion

In this study, 36 plants were found from 22 different families, which were somehow involved in the treatment of cataract. Ferula assa-foetida, Ferula Persica and Foeniculum Vulgare from Apiaceae family were on top of the list. This variety allows the physician to choose another plant in cases of inaccessibility, incompatibility with patient, getting used to and loss of the effect of the drug, while considering the conditions of the patient (21). Treatment with medicinal plant is not the only option for cataract treatment in Persian medicine and other methods such as food and behavior modification, drug therapy and surgery have also been proposed in Persian medicine according to disease stage.

At the first stages of the disease and while the blurred vision is not severe yet, the problem can be solved with food and behavior modification and using drug and surgery is only necessary at the final stages. However, surgery is considered to be the best and most effective method today (13).

The interesting point in these findings is the evolution of identifying effective plants, increasing from 7 plants in Al-Abnieh a Haghayegh al-Advieh to 31 plants in Al-Mohit al-azam. This shows the dynamic and active nature of this type of medicine. In the study of Shabaninejad et al., about three references of al-Qanun fi'l-tibb, al-Mansouri fi al-Tibb and Ferdous al Hakmeh, cataract was explained and 21 effective plants were mentioned regardless of priorities and the order. 12 plants in their study (Foeniculum Vulgare, Ferula Persica, Ferula assa-foetida, Euphorbia helioscopia, Bursera graveolens, Citrullus colocynthis, Olea europaea, Origanum majorana, Raphanus sp., Veratrum album, Crocus sativus and Commiphora myrrha) were in common with our study. 9 other plants (Dorema ammoniacum, Gypsophila struthium, Teucrium polium, Carthamus tinctorious, Acacia Senegal, Petrochelidon fulva, Capsicum frutesens, Viola odorata and salix aegyptiaca) in the seven refernces of this study had no qualified description regarding their medical effect on cataract (13). We searched some databases to find newer studies about the effect of these 36 plants on cataract and found three articles about Nigella sativa, Foeniculum Vulgare and Allium cepa. Javadzadeh et al. demonstrated that controlled use of Allium cepa extract can significantly prevent induced cataract in mice (30). In the studies of Taysi et al. and Demir et al., the effect of Nigella sativa on radiation induced cataract in rats was proved (31, 32). In the study of Dongar et al., Foeniculum Vulgare extract proved to be effective on induced cataract in rats (33). These tree studies may be an initial support for the claim of Persian medicine regarding the effect of these three plant, while more investigation is required. Among the findings, the effect of Lupinus on cataract was stated with the phrase “makes safe or secure), which might indicate the preventive aspect of the plant and we can study this plant from this aspect.

Defining criteria, scoring and arranging the plants can provide researchers with an arranged list. However, ranking the plants for clinical use has other considerations such as accessibility, being cheap, being native, less complications, better taste, easy to make and long-term maintenance, which can change the rank of a plant in the list (21). This study gave us clues about the most prominent medications effective in cataract treatment from 4 to 13th century AH and continued use of these plants in recent centuries indicates their significance in cataract treatment. However, plants that achieve better scores are not necessarily the most effective ones. Introducing medicinal plants in this study does not mean permission for clinical use and it is suggested that each plant be a topic for methodological clinical studies and in case there is enough evidence, they can be used for patients.

Acknowledgments

Hereby, we express our deepest sense of gratitude and indebtedness to Deputy of Research and Technology, Persian Medicine Research Center and Faculty of Paramedicine, Mazandaran University of Medical Sciences for their support.

[DOR: 20.1001.1.15614107.1396.19.4.9.6]
[DOI: 10.22088/jbums.19.4.67]

References

1.Rajavi Zh, Javadi MA, Daftarian N, Safi S, Nejat F, Shirvani A, et al. Clinical practice guideline for management of adult cataract; customized for Iranian population. Bina J Ophthalmol. 2014;19(3):183-204.[In Persian]

2.Olson RJ, Braga-Mele R, Chen H, Kevin M. Pineda MR, MD, James P. Tweeten, David C. Musch. American Academy of ophthalmology. cataract in the adult eye (2011). Avalible at: http:// one. Aao. Org/ preferred- practice pattern / cataract-in-adult-eye-ppp-october-2011. Assessed septamber 19,2013.

3.Riordon –Eva, Paul. Vaughan & Asbury's General Ophthalmology. Translate: K. Abri Aghdam. 18th ed. Tehran: Tehran University of Medical Sciences. 2011.p.183.

4.Javadi MA, Feizi S. General ophthalmology. Tehran: Farhang farda. 2015.p.180-1. [In Persian]

5.Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, Pokharel GP, et al. Global data on visual impairment in the year 2002. Bull World Health Organ. 2004 Nov; 82(11):844-51.

6.Huang W, Hung G, Wang D, Yin Q, Foster PJ, He m. Outcomes of cataract surgery in urban southern china: the liwan Eye study. Invest Opthalmol Vis Sci. 2011 Jan; 52(1):16-20.

7. Milan K, Eric D. Femtosecond laser will be the standard method for cataract extraction ten years from now. Survey of ophthalmology. 2015 Feb; 60(4):356-60.

8.Sheikh Rezaee MR, Ahmadzade Amiri A, Noroozpoor Deilami K, Farokhfar A, Sanjari Araghi A, Mousavi SJ, et al. The Effect of Cataract Surgery on Intraocular Pressure Change: Extracapsular Cataract Extraction vs. Phacoemulsification. J Mazand Univ Med Sci. 2012; 22(86): 143-8. [In Persian]

9.Ahmadzadeh amiri A, Noroozpoor dailami K, Sheikh Rezaei MR, Eshaghi M, Farokhfar A. Comparison of sodium diclofenac and betamethasone eye drop in preventing cystoid macular edema after extra capsular cataract surgery. J Mazandaran Univ Med Sci. 2003, 13(39): 48-54. [In Persian]

10.Ghodrati MR , Shakeri A, Farnoush N, Shakeri A. Effect of Remifentanil on Intra-Ocular Pressure in Cataract Surgery under General Anesthesia with Isoflurane. J Babol Univ Med Sci. 2009-2010; 11(5): 16-21. [Persian]

11.JurjaniYamani, Abu ruh Muhammad bin Mansur. Nur Al-uyun. Tehran: Miras-e Maktoob; 2013. P.534-49. [In Persian]

12.Ibn-e- sina (Avicenna Husain). Al Qanun Fit-teb (The canon of medicine) Book 1&2. Beirut: Lebanon; 2009. V1.p. 397-490. V2.p.21-430.[In Arabic]

13.Shabaninezhad E, Zargaran A, Mehdizadeh A, Khalili MR. Cataract in traditional persian medicine manuscripts 9-11th Centuries AD(Canon, Mansuri- fi Teb and Ferdos al-Hekmah). Bina J Ophthalmol. 2013; 18(3):344-8.

14.World Health Organization. National policy on traditional medicine and regulation of herbal medicine: Report of a WHO global survey.2005; 1-16.

15.Nejabat N, Maleki B, Nimrouzi M, Mahbodi A, Salehi AR. Avicenna and cataracts: A new analysis of contributions to diagnosis and treatment from the Canon. Iran Red Crescent Med J. 2012; 14(5):256-70.

16.Etezad Razavi M, Sharifi M, Khalife M, Nahle H. Diagnosis and management of ocular disorders in Iranian and Islamic traditional medicine of middle ages. Bina J Ophthalmol. 2013; 19(1):63-71.

17.Rafieian–kopaei M, Baradaran A. Plants antioxidants: from laboratory to clinic. J Nephropatol. 2013;2(2):152-3.

18.Rafieian-kopaei M. Medicinal plants and the human needs. J Herb Med. Pharmocol. 2012; 1(1):1-2.

19.Sreelakshmi V, Abraham A. Anthraquinones and Flavonoids of Cassio toraleaves ameliorate sodium selenite induced cataractogenesis in neonatal rats.The Royal Society of Chemistry. 2016; 7:1087-95.

20.Noroozpour Dailami K, Azadbakht M, Lashgari M, Rashidi Z. Prevention of selenite- induced cataractogenesis by hydroalchoholic extract of Echium amoenum: An experimental evolution of the Iranian traditional eye medication. Pharm Biomed Res. 2015; 1(4):40-7.

21.Ghaffari F, Naseri M, Khodadust M. Traditional Iranian medicine and the need for its revival and development. Teb Tazkiyeh. 2010; 19(3):63-71.

[DOR: 20.1001.1.15614107.1396.19.4.9.6]
[DOI: 10.22088/jbums.19.4.67]

22.Haravi M. Al-Abnieh an Haghayegh al-Advieh. Tehran. Tehran University Press.1968. p.37-189.[In Persian]
23.Ansari Shirazi AH. Ekhtiarat Badiee. Tehran: Chogan.2013. p.31-323.[In Persian]
24.Hakim Moumen SM. Tohfeh al-Momenin. Tehran: Nashr Shahr; 2008. V1.p.131-778. V2.p.390,481.[In Persian]
25.Aghili Khorasani SM. Makhzan-AL'Aldvieh. Tehran: Entesharat Bavardaran; 2002. p.130-889.[In Persian]
26.Nazem Jahan MAK. Mohit-e-Azam. Tehran: Almai; 2015. V1.p.178-846. V2.p.871-1652.[In Persian]
27.Mozaffarpur S.A, Naseri M, Esmaili Doki MR, Bijani A, Kamali Nejad M, Yousefi M, et al. Presentation effective single herbal drugs on constipation in Iranian traditional medicine. Quart J Med His. 2011; 3(6):76-9. [In Persian]
28.Mozaffarpur S.A, Khodadust M, Shirafkan H, Yousefi M, Mirzapor M. Introducing a model for prioritization of drugs, based on Iranian traditional medicine references. Quart J Med His. 2014; 6(19): 11-28. [In Persian]
29.Azadbakht M, Azadbakht M. Medical plant systematic (According to APG). Tehran: Arjmand. 2013. [In Persian]
30.Javadzadeh A, Ghorbanihaghjo A, Bonyadi S, Rashidi MR, Mesgari M, Rashtchizadeh N, et al. Preventive effect of Onion juice on selenite-induced experimental cataract. Indian J Ophthalmol. 2009; 57:185-9.
31.Taysi S, Abdulrahman ZK, Okumus S, Demir E, Demir T, Akan M, et al. The radioprotective effect of Nigella sative on nitrosative stress in lens tissue in radiation-induced cataract in rat. Cutaneous Ocular Toxicol. 2015; 34(2):101-6.
32.Demir E, Taysi S, Al B, Demir T, Okumus S, Saricicek E, et al. The effect of Nigella sative oil, thymoquinone, propolis, and caffeic acid phenethyl ester on radiation-induced cataract. Wiener Kilinische Wochenschrift. 2016; 128(8): 587-95.
33.Dangare V, Kulkani C, Kondawar M, Magdum C, Haldavnekar V, Arvindekar A. Inhibition of aldose reductase and anti-cataract action of trans-anethole isolated from Foeniculum vulgare Mill. Fruits Food Chem. 2012; 132(1):385-90.

[DOR: 20.1001.1.15614107.1396.19.4.9.6]
[DOI: 10.22088/jbums.19.4.67]