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PHARMACOLOGICAL STUDY ON ACACIA CATECHU WILLD W.S.R. TO ANTIDIABETIC ACTIVITY

Dr. Debnath Binita[1]* and Prof. Gupta Mradu[2]

[1]MD in Dravyaguna, IPGAE&R at SVSP, Kolkata.

[2]Pofessor, Principal and HOD, Dept. of Dravyaguna Vijanan IPGAE & R at SVSP, Kolkata.

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***Corresponding Author**
Dr. Debnath Binita
MD in Dravyaguna,
IPGAE&R at SVSP, Kolkata.

ABSTRACT

In the twenty first century Diabetes mellitus has became one of the largest silent killer. According to WHO, India is the country with the fastest growing population of diabetic patients. It is a medical condition in which there is accumulation of glucose in the urine and blood of the person due to declining activity of pancreatic β cell. India is a very rich source of medicinal plants. This is the high time to research on the antidiabetic property of various plants with lesser side effects. In ancient texts, Khadira is mentioned as Rasyana for the treatment of Prameha. This article will help the reader to understand the role of Khadira on type 2 Diabetes and thereby promote further research on the scope.

KEYWORDS: Khadira, Prameha, Rasyana.

1. INTRODUCTION

According to Rigveda, khadira is one of the important tree both of ritual and medicinal usage. Khadira (*Acacia catechu* Willd.) is very commonly used medicinal plant, widely distributed in the drier region of Sub Himalayan tract upto 1200 meter. In Charak samhita, Khadira mentioned as kusthaghna.[1] In Sushruta Samhita khadira has been described in Salasaradi gana. According to Sushruta, Khadira is used in Prameha, Rakta pitta, switra.[2] During the intense research, it is found that Khadira has multi targeted effect on various diseases like melanocholia, conjunctivitis, hymoptysis, dry cough, leprosy, leucoderma, helminthiasis, diarrhea, fever, foul ulcer and wound, pharyngodynia. Various research work has been carried out on Khadira and it has been found that it is a potent anti diabetic drug in type 2 diabetes. This review article gives detail information about khadira, its vernacular names,

ayurvedic property, botanical description, taxonomical classification distribution, chemical composition, pharmacological activity and its mode of action in Prameha (Diabetes).

2. AIM AND OBJECTIVES

Aim- to do literary review on Khadira and its mode of action on type 2 diabetes.

Objectives- to do a literary study on Diabetes and Khadira.

3. Taxonomical Classification

- Kingdom- Plantae
- Subkingdom- Tracheophyta
- Superdivision- Spermatophyta
- Division- Equisetopsida
- Order- Fabales
- Family- Fabaceae
- Genus- Acacia
- Species- Acacia catechu Willd.

4. Classical names- Khadira, Balpatra, Bahushalya, Dantadhawana, Raktasara, Yadniya, Gayatri

5. Vernacular name

- **Eng**.- Cutch tree;
- **Hindi** - Khair;
- **Beng**. - Khayar;
- **Guj**.- Kherio baval, Khair, Kathe, Kher;
- **Kan**.- Kalu, Kachu, Kaggali, Kanti, Kaggalinara, Kachinamara, Koggigida;
- **Mal**. - Karingali, Khadiram;
- **Mar.**- Kaderi, Khair,
- **Punj**.-Khair, Tam.- Karunkali, Kadiram, Karngalli;
- **Tel**.- Podalimamu, Kaviri, Kachu, Kadiramu, Sandra,
- **Assam-** Kharira, Khara, Khayar, Khoria, Kash.Kath,
- **Kon**. -Kathu;
- **Oriya** - Khoiru, Khaira,
- **Urdu** - Chanbe kaath.[50]

Namrupa Vigyana (Synonyms)

१.खदिरः(भा०)खदतिस्थिरंतिष्ठतिहिनस्तिचरोगानिति; 'खदःस्थैर्येहिंसायांच' ।

२. कण्टकी (भा०)-कण्टकाःसन्त्यस्य।

३. कुष्ठघ्नः (अ०)-कुष्ठंहन्तीति।

४. गलरोगनुत् (सो०)-गलरोगनाशकः

५.गायत्री(भा०)-गायन्तंत्रायते, यज्ञेप्रयोज्यत्वात्, गलरोगेहितत्वाच्च।

६.जिह्मशल्यः(सो०)-जिह्माःवक्राः शल्याःकण्टकाअस्य।

७. दन्तधावनः (भा०)-दन्तधावनेप्रयुक्तत्वात्।

८.बहुशल्यः(भा०)-बहवःशल्याः कण्टकाअस्य।

९. बालपत्रः (भा०)-ह्रस्वपत्रत्वात्।

१०. मेदोघ्नः (सो०)–मेदोहरः।

११. यज्ञियः (भा०)-यज्ञेप्रयुज्यमानः।

१२. रक्तसारः (भा०)-रक्तवर्णः सारोऽस्य।

१३. सारद्रुमः (रा०)-सारवान्वृक्षः।

6. Botanical Description

Acacia catechu Willd. Is a medium sized throny deciduous tree upto 3 to 15 m hight, stem straight and grayish brown, dark grey to dark grayish brown bark, exfoliating in narrow strips brown and red in side. Leaves are bipinnately compound with 9 to 30 pairs of pinnae. Infloroscence cylindrical, axillary pedunculate spike. Flowers are actinomorphic to zygomorphic, 5 to 10 long sessile, pentamerous, creamy whitish to pale yellow campannulate calyx of 1.5 mm length and a corolla of 2.5 to 3 mm length. A. catechu heartwood is light red turning brownish red to nearly black with age and attached with whitish sapwood. The gummy extract of the wood is called katha or cutch which is mostly shining black or brownish mass, hard and brittle and breaks easily.

7. Distribution

Throughout the sub Himalayan tract upto 1200 m.mostly found in Punjab, north eastern states, Madhya Pradesh, Gujarat, Maharastra, Andhra Pradesh and Tamil nadu.

8. Chemical constituents

On phytochemicals screening of methanol extract of *A. catechu* heartwood.

Flavanoids-Epigallocatechin, epicatechingallate, Catechin (-) epicatechin, epigallocatechingallate, rocatechin, phloroglucinol, procatechuic acid, catecutannic acid,

quercetin. tannins, terpenoids, triterpenoids, alkaloids, ascorbic acid, and carbohydrates were tested positive, while leaf extract showed the presence of resins and saponins additionally. In another study, methanol extract of plant bark showed the presence of alkaloids, carbohydrates(d galactose and i-arabinose), flavonoids, tannins(Gallic acid, d-rhamnose), Glycosides (Poriferasterol, poriferasterol acylglucosides) and steroids.[3]

9.Rasapanchaka of Khadira

- Rasa: Kashaya, Tikta
- Vipaka: Katu
- Veerya- Sheet
- Guna: Laghu, Ruksha
- Prabhav- Kushdhaghana (Useful in skin diseases).
- Doshghnata- Kaphapittshamak
- Karma – Vranaropak, Shophahar, medoghna, Pramehaghna.

10. Samprapti of Prameha

According to classic Ayurvedic literature,all types of Prameha start with the derangement of Kapha that spreads throughout the body and mixes with fat (Meda). Meda is having properties similar to that of Kapha. Kapha mixed with fat passes into urinary system thereby interfering with normal urine excretion.[7] Vitiated Pitta, Vata and other body fluids (Malas) also involve in this blockage. This blockage is believed to be the cause of frequent urination observed in diabetes. Prameha left untreated may lead to deranged development of body tissues and impaired carbohydrate, protein and fat metabolism. The involvement of tissues (Dushyas) all Dhatus except Asthi leading to damage of blood vessels, kidneys, eyes and nerve also has been mentioned in Ayurveda as major complications of Prameha.

Action of Khadira in Prameha- Though all the three dosas are involved in the Prameha disease, in classics it defined as the kaphavata predominant disease. Due to the predominance of vata vishamagni occurred. The improper agni influence aam production in the body. Due to apathy ahar vihar kapha, mamsa, meda get aggravated and causes the obstruction i.e. Margavarodha. The khadira having the pramehaghna properties mentioned in the ayurvedic classics. The also have the kaphahara, Pittahara properties hence helpful in the samprapti vighatan of the disease. the kasaya rasa clears the channels also helps in sthirikaran of Dhatus, it also helps in kleda upasoshana. Khadira has ‘Tikta’ rasa in addition to

Kashayarasa. Tiktarasa has predominace of Akasha and Vayu mahabhoot. So it has ability of penetrate the sukshma srotas. Katu vipaka stimulates the jatharagni and regularize the Mandagni thus helps to increases the digestion. Laghu, Ruksha Guna produces Rukshana and Shoshana effect and they are having opposite qualities to that of Kapha and Medas which is the main entity of the Pathogenesis of Prameha. Laghu and Ruksha guna clears the Mala, Kleda from strotas and alleviates. So the Khadira is capable of correcting the Dhatu vitiation (Saithilyata). Due to Kashaya rasa, sheet Veerya and Ruksha guna, it acts as sthambhaka hence performs Mutrasangrahaniyakarma ie. Reduces the amount of Mutra thus restore the normal Ambu. Due to its properties this drug can reach at cellular level and help to reduce meda and Kleda. Thus, helps in breakdown of Pramehasampranti and reduces related symptoms. Properties of Khadira has Pramehaghna (Anti-diabetic), Mehaghna(Anti-obesity) and Vrana ropan (wound healing) properties which are well explained in ayurvedic classics.

According to classics Khadira with Prameha correlation

Preparation of khadira	**Carak samhita**	**Sushruta samhita**	**Harita samhita**	**Chakradutta**
1.Khadira kwatha	Kaphaja prameha (c.ci-6/26)	Sanair meha (su. Ci-11/8)	Prameha pidaka(H.s. tritiya-28/26)	Madhumeha (C.D -33/12)
		Kshoudra meha(su.ci-11/9)	Prameha(H.S.Tritiya-28/33)	Prameha pidaka(C.D-33/49)
2.Trikantakadi kwatha	Vataja Prameha (C.Ci-6/38)	–	–	–
3. sarodaka	Prameha(C.Ci-6/48)	–	–	–
4. Salasaradileha	–	Prameha(Su.ci-13/10)	–	–
5. loharishta	–	Prameha (Su.ci-13/12)	–	–

Pharmacological Activity

❖ **Antimicrobial Activity**

Study showed Acacia catechu Willd leaves Extract is found to possess broad-spectrum antimicrobial activity Results showed AC has antimicrobial activity by inhibiting common human pathogenic organisms like Staphylococcus aureus (Gram positive), Escherichiacoli, Pseudomonas aeruginosa, Klebsiella pneumoniae, and Salmonellatyphi (Gram negative) and fungi like Candida albicans, Aspergillus niger supporting its use in traditional medicine. Acacia catechu Willd leaves, Bark, root extract also possess Anti mycotic activity. The bark

extract showed an inhibitory effect on the growth of fungi such as Piricularia oryzae and Colletotrichum falcatum.[61]

❖ **Antioxidant Activity**

Study of 70% methanol extract of heartwood extract of Acacia catechu showed significant antioxidant activity, iron chelating and DNA protective activity which is partly due to the phenolic and flavonoid compounds present in it Standard methods like The dot?blot assay, TLC study and the DPPH assay showed that the AC extract is a highly effective antioxidant. Catechin, rutin and isorhamnetin are reported as free radical scavengers and these compounds largely contribute to the biopotency of Acacia catechu.

❖ **Antidiarrheal activity**

Antidiarrhoeal activity was evaluated in albino rats after inducing diarrhea with castor oil.1 The antidiarrhoeal property of the ethyl acetate extract of Acacia catechu appears to be due to its tannin content, which has astringent property.

❖ **Antipyretic activity**

The antipyretic effect of Acaciacatechu is due to presence of flavonoid compounds, as some flavonoids are predominant inhibitors of cyclooxygenase or lipooxygenase.

❖ **Hypoglycaemic activity-** In type 2 diabetes, insulin is secreted in lesser amounts than required, thus causing much of the sugars to remain in the blood stream. Acacia also increase the level of beta cells, thus encouraging them to secrete more insulin. This is helpful for type 2 diabetes mellitus. It is also help to lose body weight. Its adrenergic amine content stimulates beta- receptors to break down the lipids in the body. This, in turn, enhances the rate of metabolism as cholesterol is broken down and hunger is curbed.

❖ **Hepatoprotective activity**

Acacia catechu also possesses hepatoprotective property found in the heartwood. During trials, an ethyl acetate extract in male rats decreased CCI4-induced elevated enzyme levels in acute and chronic models of liver damage. The results indicated some form of repair of the structural integrity of the hepatocyte cell membrane or regeneration of damaged liver cells. Decreased levels of serum bilirubin after treatment with the extract in both acute and chronic liver damage indicated the efficacy of the extract in restoring normal functional status of the liver and the protective action of the extract was further substantiated by histopathological

observations The hepatoprotective activity of A. catechu could be due to the presence of bioflavonoids which have hepatoprotective and antioxidant properties.

❖ **Immuno modulatory activity**

Study on Wistar albino rats shows that the aqueous extract of Acacia catechu have significant effect on both the cell mediated and the humoral immunity The exact constituent(s) responsible for the immunomodulatory effect is not known. However, the catechins, by virtue of their antimicrobial, anti-inflammatory, antiviral, and antioxidant effect may be the main constituents responsible for their activity.

8. chemical compositions of Khadira and its action on Prameha

Flavonoids: It is important antioxidant which help to promote several health effects. Flavonoids in Diabetes usually alternate the diabetes treatment by reducing the aldose reductase, thus it regenerate the pancreatic cells and enhance insulin release and increasing calcium ion uptake. The role of flavonoids are quite important in fighting with complications of diabetes mellitus than any other method of treatment. Also, Flavonoids stimulated glycogen synthesis in rats soleus muscle through mechanisms well known to insulin signal transduction.

Saponins- Saponins have been found having Pharmaceutical properties of anti-inflammatory, anti-fungal, anti-bacterial, antiviral and anti-diabetes. In the aspect of anti-diabetes, saponins activates AMPK in a calcium-dependent manner, thus regulating gluconeogenesis and glucose uptake. Saponins effectively alleviated hyperglycemia in diabetic rats by upregulating the expression of glucose transporter type 4(GLUT4) while down- regulated the expression of G6P in insulin signal pathway.

Triterpenoids- The therapeutic approach of Triterpenoids to treating DM is to decrease postprandial glucose levels. It can be achieved through the inhibition of α- glucosides and α-amylases which delay the absorbance of carbohydrates in postprandial insulin level.[28] Bitter principle- Compound stimulate peripheral and skeletal muscle glucose utilization and inhibites intestinal glucose uptake and shows hypogyacemic effect.

Important preparation of Khadira

i. Khadiradi vati
ii. Khadiraristha

iii. Khadiradi tailam
iv. Amritastaka
v. Astangadasangalanha
vi. Kusthakalamla rasa,
vii. Kustha shailendra rasa,
viii. Krimivinasana rasa,
ix. Arshoghnivati
x. Palosabijadi churna
xi. Kasisadi grita
xii. Jatyadi grita
xiii. Nimbapatradi upnaha

CONCLUSION

It can be concluded that Khadira (Acacia catechu Willd.), having tikta, kasya rasa, Laghu-rukhsna guna, katu vipaka, it mainly acts as vataharaa. It is having the opposite qualities to that of kapha and Medas. Hence it acts as Pramehahara. Acacia catechu has a lot of potential chemicals which has medicinal usage in Prameha. Active chemical ingrediants like flavonoids, saponins etc. are helpful in regeneration of β cell of pancrease, thus increases the production of insulin which helps to control the glucose level in the blood. Acharya has already mentioned the use of Khadira in the management of Prameha, thousands years back. This article help to explore its immense potentials in the management of Diabetes mellitus in human studies which are need of the hour.

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