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A Review on Pharmacological Activities of Starch in *Curcuma angustifolia* Roxb (East Indian Arrowroot)

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ABSTRACT

Curcuma angustifolia is a fast-growing rhizomatous annual herb that belongs to the family Zingiberaceae. It is one of over 80 species belonging to the genus Curcuma and is commonly known as tikhur or tavaksheeri in India. The plant is well known for its edible properties rather than its medicinal activities. It is generally used as a primary ingredient in cakes, puddings, and biscuits. The processing of the starch is an easy and less complex process, which can be done at home. Rhizomes of *Curcuma angustifolia* have been found to contain secondary metabolites such as alkaloids, flavonoids, terpenoids, phenols, tannins, saponins, curcumin, steroids, glycosides, and oils. It also contains starch, glucose, sugar, sesquiterpenoids, and curcuminoids. Starch obtained from *Curcuma angustifolia* is well known for its use in ulcers and other gastrointestinal disorders. Powdered rhizome along with milk is used to treat burning micturition or urination, difficulty in micturition, fever, acidity, gastric reflux disorder, and diarrhoea. Beyond that, the plant is reported to have other activities including, antimicrobial, antioxidant, antiproliferative, antidiabetic, and anticancer activities. The current review aims to make accessible updated information on the therapeutic uses, and pharmacological activities of starch in *Curcuma angustifolia*.

***Keywords*:** *Curcuma angustifolia*, Pharmacological activity, Rhizome, Starch, Zingiberaceae.

INTRODUCTION

The genus Curcuma is a perennial rhizomatous flowering plant belonging to the family Zingiberaceae, which is native to tropical and subtropical regions. The name Curcuma, which means "yellow", is derived from the Arabic word "kurkum". The name refers to the colour of the rhizome. Curcuma is substantially cultivated in the tropical and subtropical regions of Asia, Australia, and South America. Curcuma species have traditionally been used for both the prevention and treatment of diseases.[1]

Curcuma angustifolia is one of over 80 species belonging to the genus Curcuma. It is a fast-growing rhizomatous herb of the family Zingiberaceae, commonly referred to as white turmeric. This species is native to the Indian subcontinent and is more commonly known as East Indian Arrowroot or Narrow-leaved Turmeric in English.[2]The vernacular names of the plant is (Sanskrit)-Tavakshira, tavaksheera, payaksheera, tavakshiri, vamsalocana, (Hindi)-Tekhur, tikhur, theksura, thavsasheera, thikora, thavakheera, (English)-East Indian arrowroot, Curcuma starch (Kannada)-Kaadu arrow root, kovegida, kove hitting gida, thavakeela, (Telugu)-Gaddalu, (Tamil)- Kisangu, araukizhangu, kooa, artimavu, kookai, kua, (Malayalam)-Koova, kuva-kizhanna.[3]

Generally, the term "arrowroot" refers to the easily digestible starch obtained from the rhizome of *Maranta arundinacea* (West Indian arrowroot). *Curcuma angustifolia* produces starch similar to

Maranta arundinacea. The rhizome of the plant contains mostly carbohydrates, which are processed to obtain the commercial starch known as 'tikhur'. The rhizome is highly valued as an article of diet. The plant's main source of nutrition comes from the rhizomes, and the starch from the rhizomes is highly digestible, making it ideal for infants, and children with weak bodies. The starch is used for the preparation of several foods, such as barfi, halwa, khoa-jalebi, and sarbat.[4] It is recommended for patients with ulcers and other gastrointestinal disorders. Due to its soothing effect, it is used as a diuretic and in the treatment of chronic ailments such as colitis, diarrhoea, dysentery, and peptic ulcers.[5]

PHYTOCHEMICAL CONSTITUENTS

Rhizomes of *Curcuma angustifolia* have been found to contain secondary metabolites such as alkaloids, flavonoids, terpenoids, phenols, tannins, saponins, curcumin, steroids, glycosides, and oils.[6] It also contains starch, glucose, sugar, sesquiterpenoids, curcuminoids (curcumin, desmethoxycurcumin and bisdemethoxycurcumin), curcumol, zederone, fyranodiene, pyrocurzerenone, procurcumenol, curcumanolide A&B, gum, and fat.[7]The major constituents in the rhizome oil were, germacrone, α-pinene, α-elemene , α-elemenone , germacrene, and caryophyllene.[8]The leaf and rhizome extract also contains Curzerenone, 14-hydroxy-δ-cadinene, γ-eudesmol acetate, and camphor.[9]

PROCESSING OF THE STARCH

The rhizomes are generally harvested from November to January. The partially dried yellow-coloured leaves are indicative of the harvesting stage. The rhizomes are dug up from the soil and detached from the plant using a knife. Cleaned and washed rhizomes are kept in water overnight at room temperature. Soaking enhances the tenderness of the rhizome, which facilitates easy grinding. The peeled rhizomes are grated either by rubbing on a strong stone surface or by rubbing over rough steel screens or sieves to form a paste-like mass. The pulp obtained is converted to a solution by adding water in a ratio of 1:2 (pulp: water) and then filtered through a muslin cloth. Keep the filtrate for sedimentation for 8–10 hours and the supernatant is drained. The white, wet mass of starch is diluted with water again, and the sedimentation and decantation process is repeated 6–8 times. The number of decants improves the colour of the starch. The white, thick, semi-solid mass of starch obtained is sun-dried. The dried starch is ground or pulverized to get a fine powder.[10]

NUTRITIONAL VALUE

Curcuma angustifolia is cultivated by tribals in Orissa and North-eastern India for starch, which is a food and medicine in the Indian system. The starch is easily digestible and highly nutritious. Thus, it is used as a nutritional food supplement and a substitute for true arrowroot powder. *Curcuma angustifolia* has been reported to be a rich source of carbohydrates, fats, proteins, vitamins, and minerals.[11]The powdered starch mixed with water or milk is used as a nutritious meal. A drink including the starch of *Curcuma angustifolia* can be used as a replacement for breast milk for babies and as a nutritional drink for growing children.[9]

MEDICINAL USES

The starch along with milk or water is used to treat burning micturition or urination, difficulty in micturition, fever, acidity, and gastric reflux disorder. As per Ayurveda, it is used to improve strength and immunity. Taken along with hot water and honey, is used to treat cough and dyspnoea. Being a good astringent, it can be used for diarrhoea, dysentery, and colitis. It is an effective remedy for oedema due to its diuretic action. Tuber powder is used in reducing intestinal inflammation and as a carminative, astringent, and cardiotonic.[12]

It is also found to be used for bleeding disorders, jaundice, excessive thirst, liver diseases, asthma, TB, weight loss, and anaemia. Rootstock is used as a tonic, which is useful in leprosy, burning sensation, asthma, jaundice, leucoderma, stones in the kidney, and blood disorders.[13] The rhizome is used in intestinal diseases like peptic ulcers and colitis. The essential oil extracted from different parts of this species has antifungal, antibacterial, antioxidant,[14] and antimycotic activities.[15]

PHARMACOLOGICAL ACTIVITY

Anti-ulcerogenic activity:

The anti-ulcerogenic activity of the starch of *Curcuma angustifolia* was tested against pyloric ligation-induced gastric ulcers in albino rats. The anti-ulcer activities were assessed by determining ulcer index and biochemical estimation of the gastric contents. The study showed a significant decrease in the volume, increase in the pH, reduced free acidity of gastric juice, and decreased peptic activity.[16]

Another study evaluated the acute toxicity potential of the *Curcuma angustifolia* and *Maranta arundinacea* along with their assessment for adaptogenic and anti-ulcer activity against forced swimming-induced hypothermia and gastric ulceration in rats. Adaptogenic and anti-ulcer activities of the test drugs were assessed by examining and comparing changes in rectal temperature, ponderal changes, ulcer index, and histopathological parameters in the test drug group and in the stress control group. Both the drugs did not produce any toxicity even up to the maximum dose level of 4400 mg/kg.[17]

Hyperacidity (Amlapitta):

The starch obtained from *Curcuma angustifolia* along with *Maranta arundinacea* is known as Tugaksheeree, which is used to treat amlapitta. Both the drugs did not produce any side effects.67 patients with Amlapitta were studied to determine if Tugaksheeree is effective. The efficacy of the drug Tugaksheeree was studied through internal administration of the starches of *Curcuma angustifolia* in Group I and *Maranta arundinacea* in Group II with the dose of 4 g t.i.d. with water for 30 days. Both drugs were found effective in treating amlapitta.[18]

CONCLUSION

Curcuma angustifolia is a perennial plant with wide pharmacological activities. The available literature reports that *Curcuma angustifolia* was found to have secondary metabolites such as alkaloids, flavonoids, terpenoids, phenols, tannins, saponins, curcumin, steroids, glycosides, and oils. In general, the entire plant has different pharmacological effects, but the starch obtained from the rhizome is predominant. The starch can be used as a medication as well as food. Starch is found to be effective in hyperacidity and ulcers. Furthermore, the plant was found to have antimicrobial, antioxidant, antiproliferative, hepatoprotective, and anticancer activities.

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