PHARMACOLOGICAL PROPERTIES OF *AMORPHOPHALLUS KONJAC*- *A REVIEW*

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Summary

The present review describes the morphological, phytochemical and pharmacologyaspects of *Amorphophallus konjac* (Araceae). It is a perennial plant, growing from a large corm up to 25 cm in diameter. Most *Amorphophallus* will not tolerate freezing. *A. konjac*, however, will sometimes survive Connecticut winters outdoors when planted in the ground. *Amorphophallus konjac* is also used as a food preservative and as a thickening and carrying agent in pharmaceutical products. *Amorphophallus konjac* has an effect on diabetes as well. So, the present paper enumerates an overview of phytochemical and pharmacological properties, which may help the researchers to set their minds for approaching the efficacy and potency of herb.

Keywords: *Amorphophallus konjac*; Pharmacognosy; Phytochemistry; Pharmacological profile.

Introduction

Amorphophallus is a genus of plants in the Aroid family. They are native to much of Asia. Konjac was my first Amorphophallus and continues to be the easiest to grow. *Amorphophallus konjac* receives one of its common names, "Snake Plant", from the pattern on its petiole (stem). This unusual aroid is grown in many Eastern Asian countries as a food crop and is extremely popular in Japan as a supplement in soups and stews.

Amorphophallus konjac K. Koch ex N.E.Br. (Araceae) originates in South East Asia[1] and is distributed throughout Southern and South Eastern China and Vietnam. *Amorphophallus konjac* is found in nature from China and Vietnam and has been grown as a crop in southern China. In China and Japan, *Amorphophallus konjac* is cultivated as a source of flour and other uses, often as a source of food. To prepare it for cooking it is reduced to a block with a gelatin appearance and sold like tofu in many stores. Purportedly it will help clean toxins from the body. Studies have indicated the plant is useful in weight control as well as having medicinal properties for the control of constipation, high blood pressure, hypoglycemia and other conditions.

Konjac asthma or *konnyaku* asthma is a common form of occupational asthma in Japan, which has been associated with the inhalation of dust produced during the manufacture of konjac flour from konjac tubers [2, 3] . Konjac asthma has been reported in guinea pigs exposed via inhalation of the konjac antigen; however, respiratory parameters were not measured in this studies[4-6].

Amorphophallus konjac is a large, perennial exotic Asian plant. It grows a single, elongated center called a corm and a single large leaf that wraps around it. The corm is the part of the plant that is used, as well as its tuber, which is commonly called the konnyaku potato. Glucomannan is its scientific name, and its other common names include konjac mannan, devil's tongue, konjac, elephant-foot yam, snake plant and konnyaku. *Amorphophallus konjac* forms a gelatinous mass when mixed with water. When ingested, the body does not digest *Amorphophallus konjac*. Rather, the gelatinous mass moves through the digestive system, stimulating the peristalsis of the stomach and the intestines.

Amorphophallus konjac forms a gelatinous mass when mixed with water. The mass also grabs substances along the digestive tract as it moves through the digestive system. This property is why *Amorphophallus konjac* is often used as a natural laxative. Konjac is grown in India, China, Japan and Korea for its large starchy corms, used to create a flourand jelly of the same name. It is also used as a vegan substitute for gelatin.

Medical reports linking asthma and occupational exposure to airborne powder produced during the manufacture of konjac flour have been reported in the literature. This study was conducted to investigate whether exposure to food grade konjac flour, which is the end product of the manufacturing process, could produce respiratory hypersensitivity using an animal bioassay[7].

Fig: *Amorphophallus konjac*

Botanical name: *Amorphophallus konjac*
Synonyms: *Amorphophallus rivieri, Amorphophallus mairei* H.
Family: Araceae (arum), Arecaceae (palm)
Scientific Name: Glucomannan
Common name: Voodoo Lily, Snake Plant, Dragon Plant, Devil's Tongue, Snake Palm.
Part used: Whole plant, leaves, seeds, roots, flowers and fruits.
Habitant: The plant grows all over India in many forests and hills.

In Japanese cuisine, konjac (known as konnyaku) appears in dishes such as *oden*. It is typically mottled grey and firmer in consistency than most gelatins. It has very little taste; the common variety tastes vaguely like salt. It is valued more for its texture than flavor. Over the past two decades, purified konjac flour, commonly known as konjac glucomannan (KGM) has been introduced on a relatively small scale into the United States and Europe, both as a food additive and a dietary supplement. The latter is available in capsule form or as a drink mix and in food products. Clinical studies have demonstrated that supplementing the diet with KGM significantly lowers plasma cholesterol, improves carbohydrate metabolism, bowel movement and colonic ecology.

MORPHOLOGY

A. konjac produces a large divided leaf (its big brother is *Amorphophallus titanum* which can get more than 20 feet (6 meters) tall and the leaf is said to grow up to 8 feet (2.5 meters) wide. Although the single leaf may appear to be a bunch of leaves, the smaller divisions are correctly known as leaflets which are supported by a rachis that extends from the petiole. A botanical description of konjac is given below.

Perennial with globose tuber to 30 cm in diameter, producing rhizomatous offsets to 50 cm long and 3 c m thick. Solitary leaf with smooth dull pink-white petiole to 1 m long, marbled dark green and dotted white, with highly dissected blade to 2 m across, bearing pointed elliptic leaflets 3 t o 1 0 c m long and 2 to 6 c m wide. Peduncle to 1.1 m long coloured as petiole. Erect, broadly triangular, funnel-shaped, fluted spathe, 10 to 60 cm long and 10 to 55 cm across, with wavy margins; outer surface rough, dull brown-green with black-green spots; inside maroon-brown. Spadix maroon, narrowly conic, 15 cm to 1.1 m long, emitting foetid odour for several days[8].

All aroids produce an inflorescence. In a fully mature plant the colorful inflorescence has been reported to grow as large as 1 meter (three feet) tall. The inflorescence of an *Amorphophallus* species is known as being unisexual in which the spathe consists of two sections, both wrapped around the spadix with a constriction separating the two sections. The upper portion of the spathe is called the limb or blade while the lower is a convolute tube or chamber. Although the spathe of the inflorescence may have the appearance of a "flower", it does not scientifically qualify as one since it is a modified leaf surrounding a spadix. On the spadix the tiny male and female flowers occur in separate regions or zones. The zone of female flowers occurs at the very bottom of the spadix hidden within the lowest portion of the spathe known as the spathe tube or floral chamber. On *Amorphophallus konjac* the sterile flowers produce a pungent pheromone (odor) which attracts insect pollinators in exactly the same fashion as bisexual species. Although not terribly foul, the odor can last one to two days. Within the upper spathes blade or limb, occurs the zone of fertile male flowers.

Fruit jelly: Konjac can also be made into a popular Asian fruit jelly snack, known variously in the United States as lychee cups. Some konjac jelly snacks are not of a size and consistency to pose any unusual choking risk, but are nonetheless affected by the government bans. Some products that remain in the Asian markets have an increased size, unusual shape, and more delicate consistency than the round plug-like gels that were associated with the choking incidents. The snacks usually have warning labels advising parents to make sure that their children chew the jelly thoroughly before swallowing.

PHYTOCHEMISTRY

Dormant corms o f *A. konjac* contain 49–60% (w/w) glucomannan, 10–30% (w/w) starch, 2.6–7% (w/w) inorganic elements (aluminum, calcium, chromium, cobalt, iron, magnesium, manganese, phosphorus, potassium, selenium, silicon, sodium, tin and zinc), 5–14% (w/w) crude protein, 3–5% (w/w) soluble sugars, 3.4–5.3% (w/w) ash and a s mall amount of alkaloids (trigonelline) and saponin at their stem base[9]. Organic compounds such as β-carotene, choline, niacin, riboflavin and thiamine as well as serotonin and its derivatives namely cis-N-(p -coumaroyl) serotonin and trans-N-(p- Coumaroyl) serotonin have also been identified in the fresh corm tissue[10]. The composition of mature corms varies with species, origin and growing conditions. Of the nine *Amorphophallus* species cultivated in China, *A. konjac* and *A. albus* have glucomannan as their main storage carbohydrate[11].

Konjac glucomannan (KGM) is extracted from the tuber of *Amorphophallus konjac* native to China. Primary components of the tuber mainly contain KGM. KGM is a high molecular weight polysaccharide consisting primarily of mannose and glucose sugars and is a source of soluble dietary fiber[12].

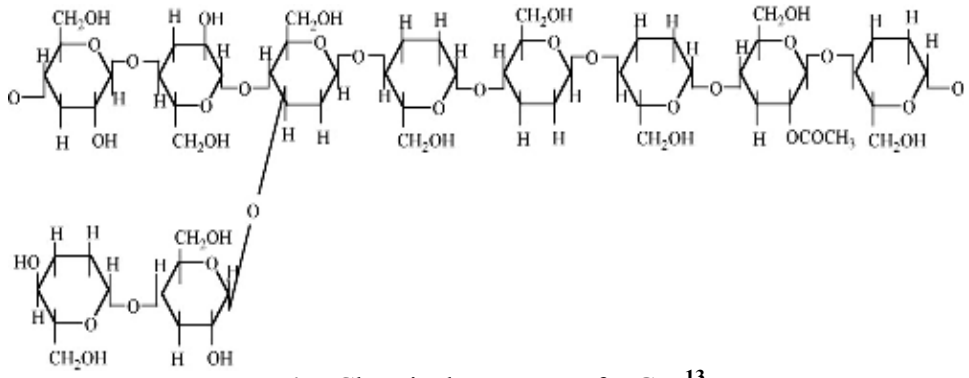

Fig: Chemical structure of KGM[13]

PHARMACOLOGICAL ACTIVITIES

***Antidiabetic activity*:**

Amorphophallus konjac has an effect on diabetes as well. Its ability to move through the digestive tract very slowly also slows down carbohydrate absorption. This slowed absorption will keep the blood sugar at a moderate level. *Amorphophallus konjac* also acts to trap food and waste residues as it moves through the digestive system. This internal scrubbing opens the pores along the digestive tract, which in turn increases absorption. It also regulates absorption. Its presence can also block substances that are easily reabsorbed such as excess bile acids. The digestive regulatory quality of *Amorphophallus konjac* makes it a natural, alternative agent in the treatment and regulation of diabetes and high cholesterol[14].

Anti-obesity activity:
Amorphophallus konjac promote weight loss when used in conjunction with either a normal caloric or a hypocaloric diet. The possible mechanisms of action of konjac glucomannan KGM for weight loss are by promotion of satiety via induction of cephalic and gastric-phase signals, delayed gastric emptying and slowed bowel transit time due to the increased viscosity of gastrointestinal content, as well as reduced rate of food absorption in the small intestine leading to attenuated postprandial glucose and insulin surges[15, 16].

Laxative activity:
Dietary fibre has a significant role to play in the management of constipation and an average intake of about 18–27 g/day of fibre has shown to be effective in treating constipation. The mechanism responsible for the laxative effects of dietary fibres include the increase of colonic content leading to colonic propulsion which promotes defecation; the stimulation of colonic motility by fibres and end products of fibre fermentation as well as an increase in bowel movement[17].

Anti-inflammatory activity:
In addition to the documented therapeutic effects of KGM as previously mentioned, recent research has also focussed on the therapeutic effects of KGM for the treatment of atopic diseases such as atopic dermatitis, asthma and allergic rhinitis. Four week-old NC/Nga mice, a well known animal model of atopic dermatitis, diets containing 5% each of KGM powder, highly purified KGM, low-viscous KGM, pulverised KGM (PKGM) and re-granulated fine KGM for 8 weeks. It was reported that the development of skin inflammation and hyper-IgE production were suppressed in mice fed only on the PKGM diet, through systemic down regulation of IFN-α, a positive regulatory cytokine of atopic skin inflammation[18].

Prebiotic activity:
Studies to examine the effects of KGM and KGM oligosaccharides (KGMO) produced by acid hydrolysis on caecal microflora in Balb/C mice. KGM and KGMO significantly increased bifidobacteria counts at weeks 2 and 4, respectively, compared with cellulose (control). By contrast, KGM and KGMO significantly decreased caecal *Clostridium perfringens* only at week 4. In the dose-dependent study, KGMO caused larger increases in faecal total anaerobe counts at the 2.5% and 5% levels compared with KGM, and it was more bifidogenic at each fibre level. These data suggest that supplementing the diet with 5% (w/w) KGM or KGMO for 4 weeks is sufficient to enhance the population of *Bifidobacteria*, associated with decreased *C. perfringens* and *Escherichia coli*. The prebiotic effect of KGM has also been demonstrated in humans in studies performed by Chen and colleagues to examine the effects of KGM supplements in both healthy and slightly constipated adults[19-21].

Conclusion

The multiple benefits of *Amorphophallus konjac* made it a true miracle of nature. Numerous studies have been conducted on different parts of *Amorphophallus konjac,* but this plant has not yet developed as a drug by pharmaceutical industries. A detailed and systematic study is required for identification, cataloguing and documentation of plants, which may provide a meaningful way for the promotion of the traditional knowledge of the herbal medicinal plants.

The present review reveals that the plant is used in treating various ailments. It elicits on all the aspects of the herb and throws the attention to set the mind of the researchers to carry out the work for developing its various formulations, which can ultimately be beneficial for the human beings as well as animals.

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