MULTI FACETED REVIEW ON KONJAC GLUCOMANNAN ABOUT EXTRACTION, ISOLATION, NUTRIENT AND ANTI NUTRIENT, USES AND APPLICATION

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ABSTRACT:

AIM: This study aimed to give review on multi-faceted review on konjac glucomannan about extraction, isolation, nutrient and anti-nutrient, uses and applications**.**

NUTRIENT AND ANTI NUTRIENTS: konjac glucomannan contains nutrient components such as calcium and magnesium etc., and anti-nutrient components such as hydrogen cyanide, oxalate, tannins etc

USES: Konjac glucomannan contains various pharmaceutical uses such as disintegration, thickening agent etc., and medicinal uses such as anti-bacterial, anti- fungal, anti – inflammatory activities etc.

CONCLUSIONS: Research has backed up the claim that consuming EFY corms helps control blood pressure, glycaemic index, cholesterol, and weight. The current knowledge of the EFY plant's botanical description, nutritional makeup, bioactive compounds found in the corms, their bioactivities, and health advantages.

KEYWORDS: Konjac glucomannan, nutrient, anti- nutrient, disintegration, topical cream preparation.

INTRODUCTION:

Elephant foot yam, or Amor phallus paeoniifolium syn. a campanulatus, is a herbaceous, perennial C3 crop. Medium to light soils with a sufficient amount of organic matter are ideal for elephant foot yam growth [1]. Many countries, including the Philippines, Java, Indonesia, Sumatra, Malaysia, Bangladesh, India, China, and South Eastern Asia, have long used it as a native staple cuisine [2]. Based on scientific research, EFY has a high content of sugar, protein, glucose, fiber, and other nutrients. It is also high in calcium, potassium and vitamin C [3]. Because it has several therapeutic properties and is widely utilized in Indian medicine, particularly ayurveda, EFY study is essential [4]. Important rheological and pasting qualities of the flour derived from EFY make it appropriate for use as a thickening agent, consistency enhancer, and quality enhancer for a variety of goods [5]. EFY has therapeutic qualities and is used to treat prostate disorders, hemorrhoids, tumors, coughs, splenic disease, and breathing issue [6]. To obtain EFY powder, traditional sun drying is favored; however, because to weather-related factors, the procedure is uncontrollable and slow. A more rapid, regulated, and cost-effective drying method that can be used to improve that country's production of better, more consistent products is hot air drying, also known as tray drying. EFY can gelatinize when heated with water, which raises the viscosity for the substance. EFY has the ability to thicken [7]. One such chemical modification agent that has FDA approval for use in food compositions is CA, which functions as a non-toxic and nutritionally safe modifying agent. It is well-known for having a multi-carboxyl structure that enables it to interact with starch's hydroxyl group, increasing its water resistance. But according to current research, the plasticization effect of CA causes an increase in water absorption at greater concentrations [8]. Assessing carbon accumulation, soil chemical, enzyme, and microbial activities, and investigating the relationship between soil enzymes, chemical, and microbial activities in an elephant foot yam-based intercropping system were the goals of the current study. Our hypotheses were as follows: there is a significant and positive correlation between the soil's chemical, enzyme, and microbial activities across all cropping systems; the increased microbial composition in an intercropping system leads to high soil chemical, enzyme, and microbial activity; and intercropping favors carbon accumulation over monocropping due to higher plant density [9].

Konjac glucomannan's source: Amorphophallus konjac, sometimes known as konjac, is a perennial plant that grows throughout Africa and Southeast Asia [10]. Typically, they are found in subtropical areas, mostly in Southeast Asia [11].

KGM's chemical characteristics:

KGM, a type of non-ionic hydrocolloidal dietary fiber, is derived from the readily available and plentiful konjac tubers[12].Depending on the genotype, it is made up of D-mannose and D-glucose joined by β-1,4 glycosidic linkages at a 1:1.4 molar ratio [13].Furthermore, some side chains link to mannoses via joint c-3, and acetyl groups randomly contribute to the c-6 position on the saccharide units along the molecule ~1 for every 19 sugar residues [14] .There could be side chains with a ~8% degree of branching. Additionally, the range of molecule weight for konjac glucomannans (KGM) is 500K to 2000K. These are soluble polysaccharides, or dietary fibres [15].

PHYSICOCHEMICAL PROPERTIES AND DETERMINATION SIZE OF PARTICLE:

The particle size was measured by the applications of master sizer 2000 with scirocco 2000. To determine the particle size, a chamber was filled with each 3.5g dried sample. Both the average and distributional particle sizes were presented.

All samples' lightness [L*] was measured using a Minolta spectrophotometer. Following the placement of dried samples inside an acrylic cylinder, measurements were made [16].

Visual inspection was used to assess transparency. Using a magnetic stirrer, dried materials were dissolved in distilled water (1.0g / 100g) for 30 minutes. [17].

ISOLATION AND PURIFICATION OF STARCH FROM ELEPHANT FOOT YAM:

KGM powder was washing three times in five volumes (V/W) of 50% ethanol and 0.1 % sodium azide.

↓

After the sample dissolving in the distilled water to produce at 0.6 % (w/v) hydrosol

↓

Then the sample was centrifuged at 16000 revolutions per min [RPM] for 20 minutes at 4-degree celcius.

↓

After following the addition of same volume at 95% ethanol (v/v) the hydrosol was precipated

↓

the precipitated was thoroughly cleaned with ether and absolute ethanol.

↓

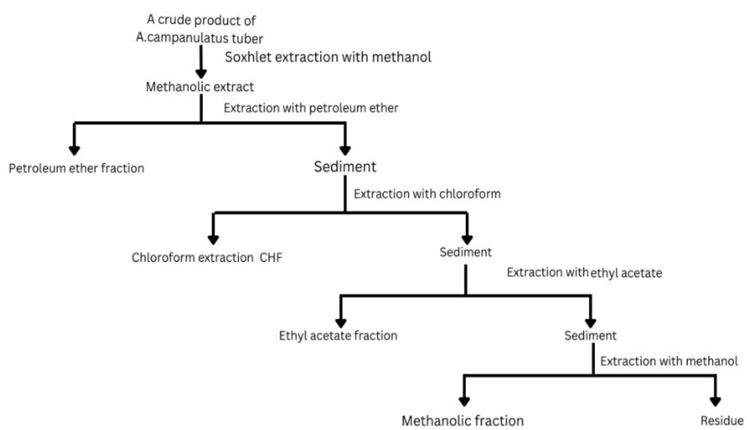
Then, the sample was freeze dried and used for further purposes [18]

EXTRACTION OF KONJAC GLUCOMANNAN FROM KONJAC GLUCOMANNAN FLOUR:

METHOD: 1

KF was treated to the extraction of konjac glucomannan using a straightforward centrifugation procedure. First, 0.3g/100ml of distilled water was used to dissolve aluminum sulfate.and 3.0g/100 ml of KF was added to the aluminum solution. The mixture was then agitated in a water bath with varying temperatures for 15 minutes. Before centrifugation (at 1500 g for 15 minutes at a regulated temperature of 25 degrees Celsius), the mixture was diluted three times. The mixture was filtered through cheesecloth three times, and ninety-five percent of the ethanol solution (supernatant: ethanol=1:1) was added to the supernatant as the precipitate was collected. Overnight, the coagulated glucomannan was steeped at 45 degrees Celsius. The dried sample was put through a screen sieve and then ground using a mortar. The dried sample was crushed using mortar and sieved through a 250-mesh screen. The sample that remained on the screen was then crushed using mortar and sieved through another screen. Components, morphology, particle size, colour values, and transparency were all examined in each sample.

METHOD 2 :



PROCESSING METHODS INVOLVED IN ELEPHANT FOOT YAM:

In the industrial setting, there are primarily two types of processing: wet and dry. The dry processing procedure for konjac involves the following steps: washing, peeling, slicing, fixing, drying, grinding, and screening. Ordinary cells are broken first by mechanical crushing, in which starch, cellulose, and other impurities are gradually crushed into konjac fly powder. In contrast, idioblast will not be broken under general crushing conditions, still retaining the integrity of the particles. This is because idioblast and ordinary cells differ in composition, toughness, and hardness. The contaminants on the surface of the particles will continue to separate by high-intensity repetitive collision and friction; these impurities can subsequently be eliminated by sieve or wind separation, leaving behind translucent konjac flour particles [20]. The KGM wet processing principle is comparable to the dry process, with the exception that when it comes to undergoing different mechanical stresses like shear, impact, and extrusion, the wet process employs a liquid medium. Its benefit is that when konjac and liquid media come into contact, the soluble contaminants in the idioblast will progressively dissolve and be eliminated through solid-liquid separation, leaving only more pure glucomannan particles. However, KGM readily swells and agglomerates when exposed to water, necessitating the use of various blocking solvents such ethanol and isopropanol. For instance, the most popular technique for obtaining refined KGM in the laboratory is ethanol precipitation. Wet processing has improved viscosity, a greater yield, and an effective impurity removal rate as compared to dry processing [21]. Researchers prefer it more as it offers unquestionable benefits in terms of safety and environmental preservation. However, wet processing has seasonal requirements for konjac, and more importantly, has a high cost, which limits its utilization in the commercial processing of konjac flour. [22-23]

NUTRIENT COMPONENTS:

In the food chain, tubers are a high-value crop that are primarily consumed for their caloric worth. Although these EFY tubers are low in protein, they are high in other nutrients [24 - 25]. The tuber's protein content, 1.126%, falls between 0.85% and 2.7% for EFY tubers derived from Indian varieties. Nigerian yams have a greater crude fat content (0.01%–0.4%) than Indian EFY cultivars. The yams had a phosphorus value of 1443.33 mg kgG1. EFY was in the range of 20.89–247 mg/100 g in India [26]. There were 8535.76 mg kgG1 of calcium and 1512.28 mg kgG1 of magnesium in this tuber. Calcium (950 mg/100 g), iron (0.6 mg/100 g), and phosphorus (934 mg/100 g) are all high in EFY. Calcium (950 mg/100 g), iron (0.6 mg/100 g), and phosphorus (934 mg/100 g) are all high in EFY . EFY is a product with a high nutritional value that can supply a substantial portion of an individual's daily mineral needs through diet or feed. Calcium and phosphorus are two vital elements that the body requires in significant quantities. Minerals are involved in the creation of bones, muscular activation, acid-base reactions, and enzyme control, among other things [27].

Figure 1: Elephant foot yam

Table 1: 100 grams of elephant yam provides the following amount of nutrients: [28]

S.NO	NUTRITIONAL COMPONENT	VALUES
1	Water	69.6g
2	Energy	118kcl
3	Protein	1.53g
4	Total lipid [fat]	0.17g
5	Carbohydrate	27.9g
6	Ash	0.882g
7	Fibre	4.1g
8	Sugar	0.5g
9	Calcium	17mg

10	Iron	0.54mg
11	Magnesium	21mg

ANTI NUTRIENT COMPONENTS:

Yams include antinutrient elements such as phytate, hydrogen cyanide, tannins, and oxalate. Antinutrient factors can cause ephemerality or decreased output, lower feed intake, and induce intoxication in animals, among other effects.

OXALATE:

Oxalate anion has the chemical formulas C2O42− or (COO)22−. The oxalate found in yam plants is what gives them their bitter and astringent taste; yam eaters frequently itch their throats after eating the plant. Kidney stones include a large amount of calcium oxalate (CaC2O4). Consuming oxalate is known to decrease the body's availability of calcium, which could be harmful for women whose diets require more calcium. It has been suggested that dietary oxalate forms oxalate stones by reacting with calcium, magnesium, and iron to form insoluble oxalate salts [29]. Additionally, oxalates prevent the body from using minerals, making them unavailable [30].

The amount of oxalate in plants is influenced by a number of factors, such as the location of the plant, water, meteorological conditions, seasonal variations, and soil quality [31]. Yam had an estimated oxalate content of 31.876 mg/100 g [32]. The significant oxidation of oxalic acid is what gives it its mineral chelating properties. Oxalates and calcium combine to generate calcium oxalate, which is insoluble and prevents the absorption of calcium [33-34]. Due to calcium oxalate's tendency to aggregate in the kidney, oxalate from food can cause hypocalcemia. Renal failure, oral and gastrointestinal tract corrosion, and stomach hemorrhaging are the outcomes of consuming oxalic acid [35].

Less than 0.5% soluble oxalate in non-ruminant animals and less than 2% soluble oxalate in ruminant animals may be consumed. Due to the rumen's ability to digest oxalate, sheep and cattle are less affected [36]. Adults may die from oxalate poisoning even at low doses (40–50 mg). Yams and yam derivatives may have less oxalate when cooked or fermented. Sun-drying techniques can reduce the yam tuber's oxalate content by 26%–35% [37].

TANNINS

Plant polyphenols called tannins have the ability to react with metal ions to form chemicals and macromolecules like polysaccharides and proteins. EFY has a tannin content of 0.456% [38]. Proteins, carbohydrates, tannins, and flavonoids are all present in A. paeoniifolius extract. Proteins and tannins generate protein–tannin complexes, which are linked to reduced feed intake, growth rate, feed efficiency, digestibility of proteins, and net metabolizable energy [39]. When the tannin content was increased to more than 3%, the chicks' development, egg production, and mortality were all reduced (dietary levels of 0.64%–0.84% and 1.0%–2%, respectively) [40]. Fermentation is one way to reduce the amount of tannin. Putak meal has been shown to reduce the amount of tannin in fermented Chromolaena odorata in rumen content.[41].

HYDROGEN CYANIDE :

In EFY, hydrogen cyanide11 was discovered at a 35.878 parts per million concentrations. Plants contain large amounts of hydrogen cyanide (HCN), primarily in the form of cyanogenic glucosides [42]. Compared to cassava roots, which can have cyanide contents ranging from 75 to 350 parts per million (ppm) and potentially as high as 1000 ppm based on many factors such as weather, cultivar, fertilizer application, and soil conditions, EFY has a lower cyanide level [43]. Cyanide toxicosis is brought on by the inhibition of cytochrome oxidase, a terminal respiratory enzyme presents in every cell. When cytochrome oxidase is inhibited, the cells quickly run out of ATP. Cyanide poisoning symptoms include gasping for air, convulsions, agitation, staggering, paralysis, and death. Blood appears vivid red due to its high oxyhemoglobin content [44]. The enzyme linamarase found in the peel of the cassava root hydrolyzes cyanogenic glucosides to create very deadly hydrocyanic acid (HCN).[45]. Depending on body weight and nutritional health, the lethal dose of HCN for humans is between 30 and 210 mg kgG1 body weight, or 0.5 to 3.5 mg for an adult. The lethal dose for sheep and cattle is 2.0–4.0 mg kgG1 body weight. Cyanogens can be eliminated by a number of techniques, including as soaking, fermenting, and drying. Before being fed to cattle, hay and silage should be adequately cured to remove the majority of their cyanogenetic components [46].

PHYTIC ACID:

Phytic acid is a common type of phosphorus storage in seeds and serves as a potent chelator, producing protein, and mineral complex. When phytic acid chelates with minerals, phytotates are produced [47]. The phytate level of EFYs is 0.165%, which is higher than that of sweet potatoes (0.09%) and chips of cassava root (0.09%) and (0.1%) but lower in other crops, such as soybeans (9.2–16.7 mg) and sorghum (5.9–11.8 mg), and the tuber of the fake yam (0.39%) [48].

Because of its strong capacity to bind metal ions, such as phosphorus and zinc, phytic acid prevents these nutrients from being absorbed in the small intestine. It disturbs a range of metabolic processes [49]. Monogastric animals do not have access to the phosphorus in phytic acid. The insoluble phytate–mineral complexes that are formed when dietary phytate binds to minerals reduce the bioavailability of certain minerals. The microbial community is absent from the human small intestine, and the higher digestive system's phytate-degrading enzyme supply is similarly constrained. nt in vegetables decreases with increasing temperature and heating duration [50] after heating at 90°C, it decreases by 51% in sun-dried imitation yams and by 11%–25% in Pterocarpus mildbraedii [51].

CONVENTIONAL METHOD AND NOVEL TECHNOLOGY FOR REDUCTION OF ANTI NUTRIENT COMPONENTS :

Animals cannot obtain these minerals because plant diets contain both insoluble salts with calcium, magnesium, and iron ions and water-soluble salts with sodium, potassium, and ammonium ions [52]. The entire (soluble and insoluble) fraction of oxalates is removed from meals using hot acid (e.g., 2 M HCl, 80°C), while the soluble fraction is extracted from meals using hot water (80°C). By deducting soluble oxalate from the overall oxalate content, the amount of insoluble oxalate is determined. Insoluble oxalates are expelled in human feces after ingestion [53].

In the colon, soluble oxalates have the ability to bind to calcium and other minerals in an acidic to nearly neutral environment, blocking their absorption. After consumption, only 2%–12% of the total oxalate consumed is absorbed. The remaining free oxalate in the intestinal lumen combines with calcium to produce calcium oxalate, which prevents calcium from being absorbed. Unabsorbed oxalate in the gut is excreted as calcium oxalate in the stool. In the digestive tract, oxalate binds to cations such as calcium, iron, and magnesium to produce insoluble salts that reduce the bioavailability of these essential minerals. [54-55]

Second, after entering the body, soluble oxalate needs to be excreted in the urine. During this process, oxalates have the ability to bind to calcium and produce insoluble calcium oxalate, which builds up in the kidneys. Roughly 75% of kidney stones are estimated to be composed

of this calcium oxalate. [56].
Hypercalcuria, or the excretion of too much oxalate in the urine, is a major risk factor for this illness [57,58]. Eating dairy products high in calcium and avoiding high-oxalate diets will help minimize the development of calcium oxalate stones in the kidney, as nutrition plays a major role in stone development.In the food chain of Nigeria, tubers are a highly valued crop. They have been integral to the history of human cuisine, as they are often plucked from the wild and eaten by the world's poorest and most food insecure households [59]. Tubers are the least nutritious form of protein, however based on current data, they are largely eaten for their calories, which contain carbs, fat, fiber, and protein. It is challenging to assess whether tubers can be relied upon as reliable sources of nutrients due to the presence of an antinutrition component (oxalate), which prevents consumers from accessing the minerals in the tubers [60].

Yams are grown in tropical areas all over the world [61]. For the next 20 years, they will remain a source of energy and nutrition for over 2 million individuals living in developing nations. Yams include natural sources of diosgenin. Sex hormone levels are lowered by diosgenin. This led to the development of the female contraceptive pill, which is still among the most widely used and effective birth control options [62]. Dietary oxalate primarily comes from plants and plant-based products. Many meals made from plants have varying quantities of oxalate [63-64]

CONVENTIONAL METHOD :

BOILING :

The yam cubes were boiled in additional boiling water for 10, 20, 30, and 40 minutes (yam to water: 1:6). The yam cubes and soak water were separated after heating. After putting the yam cubes on blotting paper and letting them cool in the air, they were kept for later examination at -20°C. Investigations were conducted into additional characteristics such acridity, phenolic content, 2,2diphenyl-1-picrylhydroxyl (DPPH) activity, oxalate content (due to hydrothermal degradation), and sensory acridity. It was investigated how much yam solids were lost in the soaked water [65].

Effect of boiling on oxalate content of EFY

Plants contain soluble oxalate crystals, or salts of sodium, potassium, and ammonium. Oxalic acid is a salt of calcium, iron, or magnesium that is insoluble in water and that chelates metal ions [66]. A decrease in mineral bioavailability and the formation of calcium oxalate crystals in the kidneys, known as renal stones, are two of the65 most notable impacts of oxalates on the human body. Total oxalate levels in several Dioscorea species varied from 67 to 104 mg/100 g, but soluble oxalate levels varied from 37 to 85 mg/100 g [67]. The amount of soluble oxalate discovered in various EFY kinds ranged from 2.94 to 18.60 mg/100 g [68]. One of the best methods for making meals safer and more pleasurable for people is to boil them. The amount of oxalate in the food was significantly reduced after it was cooked. The soluble oxalate concentration dropped 40.9% from 12.97 mg/100 g (0 min boiling) to 7.66 mg/100 g (40 min boiling), while the total oxalate content (soluble and insoluble combined) dropped 48.7% from 72.39 mg/100 g (0 min oiling) to 37.14 mg/100 g (40 min boiling). This process also shows that as boiling time increased, both oxalates decreased, with the greatest reduction occurring during the first 10 min of boiling; the oxalate content in yam cooked for longer periods (20, 30, and 40 min) did not differ significantly from that obtained after the first 10 min of boiling. In a range of root crops, including wild yam, Japanese taro, and trifoliate yam tuber, boiling has been demonstrated to reduce oxalate. Thermal degradation/breakdown at higher temperatures, as well as oxalates leaching in the cooking water, could have caused the decline. Oxalate leaching is aided by the skin's weakening during the boiling process. Boiled root crops have been shown to have lower oxalates, such as wild yam, Japanese taro, and trifoliate yam tuber [69]. The decrease may have been brought on by oxalates leaking into the cooking water and thermal degradation/breakdown at higher temperatures [70]. The boiling process weakens the skin, which facilitates oxalate leaching [71]. We looked at how boiling, a popular cooking technique, affected A. paeoniifolius's oxalate and acridity problems. Boiling reduced sensory acridity and the amounts of soluble and total oxalate [72]. Simultaneously, there was a rise in solids lost in cook water and a drop in both total phenolic content and DPPH activity. concurrently with a rise in the solids lost in the cook water. Oxalates can be brought down to levels well below the recommended safe threshold of 71 mg/100 g by boiling EFY for 10 minutes [73].

NACL TREATMENT:

P0, the control yam, is either soaked in water and NaCl or soaked in a NaCl 5% solution. P1, P2, and P3 are immersed in a 10% solution, 10% solution, and 10% solution, respectively. Three different NaCl solutions (5%, 10%, and 15%) were soaked in yam slices for a duration of 60 minutes. For the 15% NaCl solution). Mayasari achieved the required concentration by optimizing the yam's oxalate content decrease [74].

The NaCl solution significantly aids in the reduction of calcium oxalate. The results of soaking yam in various concentrations of NaCl solution were noteworthy. According to the research content of Ca oxalate (ppm), the various therapies have diverse Ca oxalate contents and varying percentage decreases in Ca oxalate content. With 102.44 ppm on average, the sample without soaking in NaCl solution (P0) had the highest Ca oxalate level, whereas the sample soaking in 10% NaCl solution had the lowest average Ca oxalate content, at 78.92 ppm.The greatest Ca oxalate level from P2 decreased by an average of 22.89%, while the lowest Ca oxalate content from P1 decreased by an average of 13.61%. The best method for lowering Ca oxalate levels was found to be soaking purple yam in a 10% NaCl (P2) solution. This solution can lower the greatest oxalate concentration, which is 22.89%. Since the average reduction in oxalate content is less than P2, which is 20.96%, raising the concentration of NaCl over 10%, i.e., 15% (P3), does not significantly affect the percentage of oxalate content drop. discovered that soaking Bogor taro in a 5% NaCl solution for 30 minutes and in a 7.5% and 10% NaCl solution for 60 minutes lowered the oxalate levels. Soaking taro in 10% NaCl for 60 minutes produced the best results, reducing the oxalate levels by 96.83%. The oxalate level decreased by 5% after adding salt at a concentration of more than 5%, or 7.5%, for 30 minutes, although this change was not statistically significant. while compared to soaking in 5% NaCl, which can reduce oxalate by 72.47%, the reduction in oxalate was reduced while soaking in 7.5% NaCl [75].

NOVEL TECHNOLOGY:

MICROWAVE:

Research is currently being done on a novel technique called microwave-aided extraction. In microwave-assisted extraction, plant metabolites are concentrated with solvents by the application of microwave energy. For the great majority of specimens, this strategy has proven to be safe due to its simplicity of handling and comprehension [76]. Although it is still in its early stages, research into the functional application of microwaves for the commercial development of phytoconstituents is currently ongoing[77]. In addition to heating organic molecules, microwaves cause dipole rotation, which destroys hydrogen bonds. Ion activity results from this, and because of the ions' higher kinetic energy and their quick direction shifts, there is friction between the ions and a heating effect. Additionally, the dissolution of hydrogen bonds facilitates the solvents' entry into the plant matrix [78-79]. The electromagnetic spectrum of light, which includes microwaves in microwave-assisted extraction, has wavelengths between one centimeter and one meter and frequencies between 300 MHz and 300 GHz [80].

These waves are energy and information carriers made up of two perpendicular oscillating fields. The initial use of microwaves is in their contact with specific materials that may absorb some of their electromagnetic energy and transform it into heat. For this purpose, commercial microwaves require 2450 MHz of energy, or around 600–700 W. Microwave oven was used to heat blanched slices of EFY for 1, 1.5, and 2 minutes at different power settings (300, 600, and 900 W) [81]. After being heated in a microwave, the EFY slices were moved to a hot air tray dryer and continuously dried at 60°C until their ultimate moisture content was 10% (db) [82]. A schematic illustration of microwave-assisted extraction in a closed vessel. The capacity of the food to absorb energy and reflect it back to the source of dissipation as heat is known as its dielectric properties, and these characteristics determine how hot food cooks in a microwave. The two processes involved in the microwave heating of food materials were "ionic conduction" and "dipole rotation."[83-84] Because these pathways produce heat-labile factors such as peptide bond hydrolysis, covalent bond splitting, disulfide bond exchange, or destruction, the heat generated within the food causes the antinutritional factors to diminish [85]

Microwave-assisted extraction in a closed vessel.

To be more precise, because of its heat-labile nature and the insoluble complex formation between phytate and other constituents, microwave treatment may only slightly reduce phytic acid. In addition, prior to microwave processing, the sample that has been soaked has the capacity to dissolve tannins in aqueous media and may only be reduced by microwave processing [86]. Tannic acids are water-soluble and thermally unstable phenolic chemicals that can be treated with microwaves for reduction. The possible cause of the oxalate breakdown during microwave processing could be heat stress, which eliminates all oxalate[87].

ULTRASONICATION:

Among other nonthermal food processing applications, ultrasound can aid in food preservation, improved mass transfer, support for thermal treatment, texture modification, and food analysis. Sound waves classified as ultrasonic (sometimes called supersonic) waves have frequencies between 20 and 100 kHz [88-89]. Ultrasound is the cause of liquid cavitation in liquid media, gaseous medium pressure fluctuations, and liquid movement in solid media. It's a kind of high-frequency vibration that causes shear forces and microscale fluid mixing [Ultrasonic cavitation has found favor in a range of applications, including chemical reaction amplification, oil emulsification, chemical and biological pollution elimination, microbe inactivation, and so on [90].

Depending on the frequency, the ultrasonication waves alternately create two different pressures in the liquid: compressions (high pressure) and rare fractions (low pressure). Smaller-sized vacuum bubbles or voids are created in liquid during the rare fraction cycle as a result of high-pressure ultrasonication waves. Microjets are created when the generated bubbles burst destructively during compression, reaching a maximum size at which they can no longer absorb energy [91]. The high temperatures and pressures produced during the cavitation bubbles' collapse phase caused the particles to degrade during ultrasonication. Moreover, the generation of reactive radical species from water molecules, including hydroxyl radicals, may cause an outbreak and reduce the amount of other composites in the matrix. Because tannin tends to precipitate proteins in food, it becomes an antinutritional agent that lowers the bioavailability of vital nutrients [92]. The amount of tannin in the food can be decreased by increasing the ultrasonication amplitude and treatment duration. As a result, the ultrasound promotes the leaching out of the sample's condensed tannin and helps convert hydrolyzable tannic acid into gallic acid, which lowers the sample's overall tannin concentration [93]. The sample's soaking duration and ultrasonic amplitude have a detrimental effect on the amount of phytate. A higher ultrasonic amplitude causes the sample to produce heat, which raises the temperature. The phytate content of the sample decreases because the heat accelerates the chemical breakdown of phytate to reduce inositol phosphate [94]. Oxalate and other polar chemical molecules are often more soluble and degraded at higher temperatures and longer treatment times. The hydroxyl radicals that diffuse out from the homolytic fission of water in cavitation bubbles oxidize these substances. This oxidation mechanism is normally improved by higher temperatures which facilitates the diffusion course. Moreover, fibers that combine with minerals and oxalic acid to form complexes including fiber, oxalate, and mineral were likewise adeptly broken down by ultrasonication waves. Thus, the dissolution of these fiber complexes may cause the oxalic acid that is produced in the liquid during ultrasonication to become even more soluble [95].

FORMULATIONS USING ELEPHANT FOOT YAM:

PREPARATION OF TABLETS:

Elephant foot yam starch's use as a tablet disintegrant was assessed and contrasted with regular corn starch.Tablets were made using a wet granulation method with a 2% w/v solution of polyvinyl pyrrolidone in ethyl alcohol as a binder. In order to reach the final weight of 200 mg, microcrystalline cellulose was utilized as a diluent, elephant foot yam starch and corn starch were utilized as disintegrants in concentrations of 2.5%, 5%, 7.5%, and 10% w/w, respectively, and 80 mg of verapamil hydrochloride was taken as the standard drug dose per tablet.[96]. Every solid ingredient was passed through an 80 mesh screen. individually weighed and well combined. A 2%w/v polyvinyl pyrrolidone solution was added to this mixture and combined to create the dough. After being extruded through a 20 grit filter, this mass was dried for 30 minutes in a tray dryer. The dried granules were then combined with 1% w/w magnesium stearate and talc for lubrication after being further sieved through an 18 mesh screen. As covered in powder flow characteristics, prepared granules were assessed for pre-compression parameters. A tablet compression machine (CIP, India) used a 9 mm punch to compress the granules. Elephant foot yam starch is present in formulations F1 through F4, and F5 through F8 includes regular corn starch. [97]

PREPARATION OF NANOCOMPOSITE FILM :

The fabrication of nanocomposite films was based on a prior investigation in which 200 milliliters of distilled water and 7 grams of elephant foot-yam starch were combined to create a 3.5% (w/v) solution. A preliminary investigation that found that 3.5% starch created a stronger and less brittle film than 3% starch led to the determination of this starch percentage.[98] According to Arifin et al., a solution of elephant foot and yam was progressively mixed with 5% w/v CMC while being constantly stirred. NCC was added at varying amounts (3, 5, and 7 weight percent) after CMC had dissolved [99]. Based on earlier research, which found that the best film was produced with a concentration between 2 and 7 weight percent, these changes were identified [100]. Preliminary research indicates that a 2 weight percent NCC concentration resulted in an elephant foot-yam starch film with fairly elastic qualities, but it broke more readily than a 3 weight percent film.[101] A magnetic bar was inserted into a beaker glass, and the mixture of CMC and NCC was heated while being swirled on a hot plate stirrer. 2% (v/v) sorbitol was added once the gelatinization paste temperature of 62°C was achieved. After agitating the film solution until it reached 79.5°C, it was degassed for 15 minutes in an ultrasonic bath and allowed to cool to 40°C. After pouring the solution into a 160 ml, 20 × 20 cm film plate, it was put in an oven set to 50°C for 20 hours [102].

PREPARATION OF KONJAC GLUCOMANNAN GEL :

Alkaline Processing:

Numerous investigations have demonstrated that the acetyl groups in the KGM molecular chain determine a number of KGM features, including its gelation property . Alkaline processing is the most used technique for creating KGM gels because original KGM cannot produce gel. Alkaline processing of KGM yields deacetylated KGM (Da-KGM), which can be utilized to create thermally irreversible gels. The gelation velocity will rise in tandem with an increased elastic modulus as the degree of deacetylation increases. This is because the KGM molecular chain becomes self-crimping instead of semi-crimping as a result of deacetylation. The KGM molecules self-aggregate as a result. Da-KGM sols must typically be heated in order for the KGM molecules to polymerize during the creation of KGM gels. However, additional post-processing techniques (freeze-thawing, freeze drying, etc.) and additives (graphene oxide, sodium montmorillonite, carbon nanotube, etc.) are employed to further enhance the qualities of KGM gels. Furthermore, Da-KGM can be utilized as a component to improve the characteristics of other gels.
Da-KGM-based hydrogels have been prepared using the freeze-thaw process, which is a popular and efficient hydrogel preparation technique. [103] We also know that by freeze-drying frozen hydrogels, aerogels can be produced. Freeze is the most important procedure for freeze-thawing and freeze-drying methods, this is due to the network of gels will be formed in this procedure, and the ice crystal grow under freezing can control the porous structure of network pre-freezing temperature has a great influence on the formation of ice crystals. In summary, the lower temperature, the smaller ice crystals and the more uniform spherical shape. Moreover, the scanning electron microscope (SEM) images in Figure 1 shown that the pore size of aerogels also closely dependent on pre-freezing temperature, this is due to the vacuum sublimation of ice crystals Due to the weak properties, pure Da-KGM hydrogel prepared by freeze-thawing method cannot meet actual applications, therefore, some additives are used in the procedure. graphene oxide (GO) is a common additive for enhancing properties of materials, [104] successfully prepared KGM/GO hydrogels by alkaline processing followed

freeze-thawing, KGM/GO hydrogel showed a compact structure and decreased pore size comparing with pure KGM hydrogel [105]. The porous structures of KGM/GO hydrogel had great specific surface area, and provided a possibility for drug storage and sustained delivery. Moreover, this structure also showed the interaction between KGM and GO, and it was agreement with other characterizations. At the same time, KGM-based aerogels can be made using the freeze-drying approach using Da-KGM. Ye et al. created a number of Da-KGM-based aerogels that shown good dye and arsenic absorption properties[106]. Using the sol-gel technique and freeze-drying, magnetic Fe and Mn oxides (Mag-FMBO) with sodium montmorillonite (Na+-MMT)-reinforced Da-KGM-based aerogels were created. The functional additives in that work were Mag-FMBO and Na+-MMT. Although all of the composite aerogels showed a lot of porous structure, the rougher surfaces will result from the increased inclusion of Mag-FMBO [107].. By carbonizing above Mag-FMBO containing Na+-MMT-reinforced KGM-based aerogels, KGM-based magnetic carbon aerogels were successfully created. These aerogels demonstrated exceptional adsorption performance towards cationic methylene blue (MB) and anionic methyl orange (MO), with maximum MO and MB uptake capacities of 7.42 mg/g and 9.37 mg/g, respectively . When Mag-FMBO containing Na+-MMT-reinforced KGM-based aerogels was prepared, GO was added to create Da-KGM/GO/FMBO composite aerogels. Although every sample of composite aerogels showed a lot of porous structure, the amount of GO present had a big impact on the surfaces of the composite aerogels [108]. Hydrogels of Da-KGM-polymer complexes can be made in addition to KGM-based gels using the freeze-thaw (or freeze-drying) process. Zhou et al. successfully created wheat starch gels using KGM and minimal Na2CO3 concentrations , and the morphological structure of the gels was examined using confocal laser scanning microscopy (CLSM). According to the results, Na2CO3 promoted the formation of fiber-like extensions around scattered swollen starch granules by KGM and amylose interaction, and led the phase dispersion of KGM-starch gels. the impact of the two heating techniques on the structure and quality of KGM-Alaska pollock surimi protein composite gels and used the CLSM and SEM to measure the microstructure, elongation, and dispersion of KGM in protein chains as well as the microstructure of the mixed gel. [109] The microstructure and interaction of KGM and protein molecular chains were examined by drying KGM and protein differently. The gel produced by microwave heating has a significant elongation rate, as seen by the CLSM in Figure 2A. The KGM and protein formed a good network structure, and the KGM network structure was drawn into filaments The SEM in Figure 2B confirms that microwave heating can produce a more swollen network structure with distinct gullies and a robust skeleton. also prepared KGM-Alaska pollock surimi protein composite gels through high-temperature treatment (120 °C). The SEM images of the gels showed that all of them had a network structure, but the composite gels contained denser and more uniform network structure than pure surimi protein gel. In particular, the composite gels with higher deacetylation of KGM would lead more compact network frames and smaller holes in the network.[110]

Borate Cross-Linking

prepared a series of organic borate cross-linked thermally irreversible KGM gels. The gel network was formed by the cross-linking reaction between the borate ion dissociated by the organic borate and the cis-diol hydroxyl group on the mannose unit of the polysaccharide chain. The rheological properties of the composite gel were studied by dynamic viscoelasticity measurements. The gelation kinetics of the gel was studied, and the critical gelation point of the gel was accurately determined by the Winter-Chambon standard. This group studied how temperature and the ratio of composite materials affect shear storage modulus (G'), loss modulus (G''), and sol-gel transition point. The Winter-Chambon standard accurately explained the critical gel-sol temperature of the composite gel.[111]

Electric Field Preparation

In the presence of sodium tungstate, electrochemically reversible KGM-tungsten (T) hydrogels were successfully prepared using a direct current (DC) electric field. The effects of voltage, electric processing time, KGM concentration, and sodium tungstate concentration on the gel's rheological characteristics and structure were investigated[112]. The pH experiment demonstrated that when DC electric fields were applied, the KGM sol containing Na2WO4·2H2O next to the positive electrode become acidic and the negative electrode alkaline. WO42− ions were changed into isopolytungstate ions in an acidic environment. Raman and Fourier Transform infrared spectroscopy (FT-IR) investigations demonstrated that isopolytungstate ions were cross-linked with the –OH group at the C–6 position on the KGM sugar unit and adsorbed on the KGM molecular chain. According to the frequency scanning data, the gel's storage and loss modulus, or viscoelastic modulus, rises as voltage, electric processing time, and sodium tungstate concentration do. The gel's viscoelastic modulus falls as the KGM concentration rises. The resultant gel has high thermal stability, according to the temperature scanning measurement.[113] Ultimately, the mechanism of gel formation was proposed, and this work may pave the way for creating and manufacturing KGM gels and polysaccharide gels by DC electric fields.

Cross-Linking of Metal Ions after Modification

Gel microspheres constructed from (2,2,6,6-tetramethylpiperidine-1-oxyl) TEMPO oxidized KGM (OKGM) were used to create a photoresponse delivery system; Fe3+ cross-linked the COO– group, allowing for the incorporation of functional components. To liberate the embedded components, the microspheres were exposed to (simulated) sunshine, which caused them to disintegrate[114]. Proton titration and FT-IR spectroscopy have shown that the OKGM's oxidation degree (DO) may be precisely regulated between 15% and 80%. Since the high COO concentration led to high density cross-linking of the strong gels, OKGM with a DO of 80% was chosen to make the microspheres. As the pH rises and the quantity of salt falls, the OKGM particles' electrokinetic potential rises as well. According to FT-IR spectroscopy, the two modes coordinated by the COO−–Fe3+ created cross-linking, which was 31.6% by single-tooth binding and 68.4% by bridging. As a result, the OKGM microspheres' special qualities make it possible for them to be used in light-controlled biocompatible delivery sy1stems[115]

ROLE OF KGM IN COSMETICS:

In vitro research was done on the symbiotic relationship between probiotic bacteria and konjac glucomannan hydrolysates (GMH), which inhibits the growth of the acne-causing bacteria Propionibacterium acne. Testing was done on every strain of probiotic bacteria.[116] They all had the ability to stop the growth of the skin bacterium species, and the addition of GMH prebiotic greatly ($P<0.01$) increased the inhibition. In light of the fact that topical or systemic medications are currently the primary form of acne treatment, it is worthwhile to investigate the biotherapeutic properties of GMH and specific probiotics in advance of their potential application as therapeutic or preventative symbiotic for the treatment of acne infections.[117]

They developed a hair composition with glucomannan and keratose quaternary ammonium derivatives that have a great conditioning and moisture-retaining effect without making hair sticky [118]. They also created a variety of hair styling products that contain glucomannan that are less sticky and give hair a natural gloss and smoothness. Additionally, they created a type of water-insoluble glucomannan gel particles that can be used as gentle. The smooth surface and skin were unharmed by the dried gel particles. As a result, they worked well as scrubbers.
This type of makeup featured a long-lasting makeup effect, didn't leave the skin feeling sticky, and had pigments coated with water-soluble glucomannan [119]

Quick-drying hand disinfection gels were created. The gels were created by combining gel-forming polymers, thickening agent glucomannan, and EtOH solutions. After applying the gels evenly to the hands, they were rubbed off without being washed. A composition of cosmetic remover based on organic solvents that gelled with a synthetic metal silicate gelling agent to a viscosity of 25–100,000 centipoises. Konjac glucomannan may be an appropriate gelling agent [120].

PHARMACEUTICAL APPLICATION OF KONJAC GLUCOMANNAN :

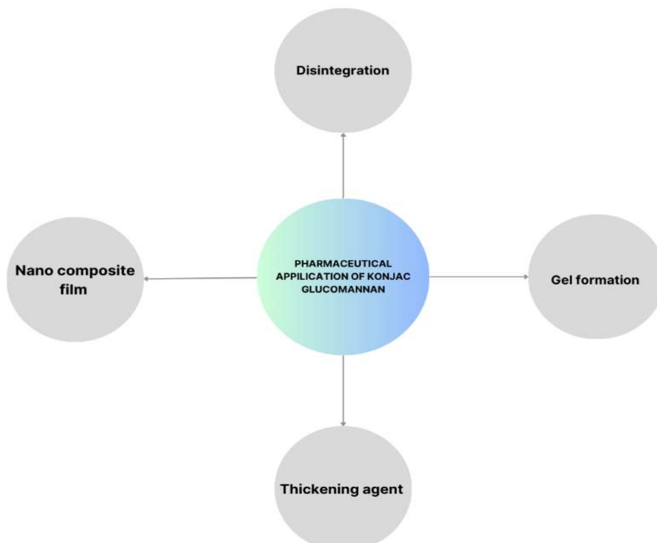


Figure 2 : pharmaeutical uses of KGM

MEDICINAL USES OF KONJAC GLUCOMANNAN :

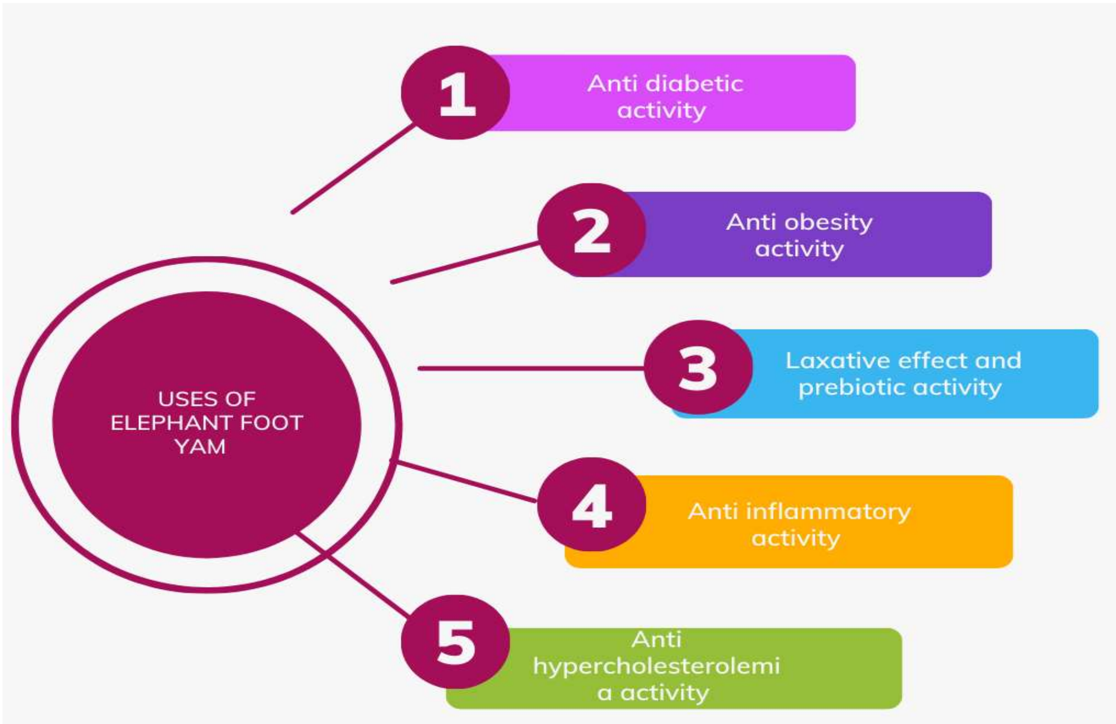


Figure 3: Medicinal uses of KGM

1.Anti-diabetic activity

One of the earliest illnesses is diabetes mellitus, which was initially identified 3000 years ago by the ancient Egyptians [121]. Diabetes is a long-term metabolic disease caused by insulin resistance along with increasing failure of insulin secretion and malfunctioning pancreatic β-cells [122] . Reduced sensitivity of insulintarget tissues to normal amounts of circulating insulin is known as insulin resistance. Furthermore, in insulin-resistant organisms, the amount of glucose tolerance is mostly determined by the severity of insulin resistance and the pancreas' ability to effectively manage this abnormality [123]. Diabetes is thought to have three main causes: genetics, weight increase from overeating, and decreased physical activity. Overeating causes the pancreatic β-cells' ability to secrete insulin to be severely impacted, which in turn causes insulin resistance and obesity [124]. Soluble dietary fibers in general and KGM have positive effects on serum glucose levels because of their delayed stomach emptying and delayed diffusion of glucose in the intestinal lumen. When a KGM-rich diet (0.7 g KGM/100 kcal intake) is consumed daily, the KGM supplement has been shown to lower blood glucose and cholesterol levels in healthy, diabetic, and hypercholesterolemic patients . By altering the pace at which nutrients are absorbed by the small bowel, it can postpone the emptying of the stomach and thus boost insulin sensitivity [125]. Eating dishes made from konjac guarantees that dietary sugar is absorbed gradually, which lowers blood sugar increase. Therefore, individuals with diabetes can effectively manage their condition by consuming foods enhanced with glucomannan [126]. Water-soluble KGM fiber was utilized to treat a cluster of coronary heart disease risk factors, including hyperlipidemia, hyperglycemia, and hypertension, in T2DM patients over an 8-week period. The KGM flour, which is known to include 69% active high-viscosity glucomannan, 15% polysaccharides, and 16% additional excipients by weight, was the primary ingredient in the 15% KGM biscuits that the patients enjoyed. Eleven diabetic patients—six women and five men—participated in this investigation. Within a minimum of three years, all patients experienced problems from type 2 diabetes, hypertension, and hyperlipidemia. In vitro investigation demonstrated that the KGM diet improved glycemic control in the diabetic patients. Therefore, compared to conventional treatment alone, a diet that included high-viscosity glucomannan-containing biscuits along with traditional coronary heart disease treatment (i.e., a low-saturated fat diet + medication therapy) improved metabolic control in high-risk type 2 diabetes patients [127].They examined the effect of KGM supplements (3.6 g/day) administered for 28 days on blood lipid and glucose levels in type 2 diabetic patients with hyperlipidemia and the likely reason for the drop in blood lipid levels. Based on dry weight, the diet containing konjac powder consisted of 80% glucomannan, 8.0% starch, 3.8% fat, 3.4% protein, 3.1% moisture, and 1.7% ash. Body weight, blood glucose, and cholesterol levels all dramatically lowered with KGM treatment when compared to placebo. These results point to the potential therapeutic benefits of 3.6 g/day (0.24 g/100 kcal) of the KGM supplement for patients with type 2 diabetes who have hyperlipidemia. In terms of how the supplement works, it may lower hypercholesterolemia by lowering cholesterol and bile acids through their excretion in the feces, as well as potentially raising glucose levels [128]. In a similar vein, investigated the impact of adding KGM polymer to both control and palatable test biscuits (without the polymer). The primary findings were notable improvements in systolic blood pressure (BP), serum lipids, and glycemic management as compared to control biscuits. KGM may therefore be a safe traditional dietary and pharmaceutical treatment for individuals with T2DM who have risk factors for CVD.

2.Anti-obesity activity

In today's world, obesity is very common. Obesity is significantly correlated with a number of illnesses linked to high blood pressure, stroke, and ischemic heart disease. Research has unequivocally demonstrated that obesity and cardiovascular disease are related, and being overweight increases the risk of heart disease because of high cholesterol deposits. Additionally, metabolic disorders such as dyslipidemia, type 2 diabetes, and metabolic syndrome are associated with this risk factor [129-130]. Glucomannan has been shown in numerous human studies to accelerate weight reduction, improve lipid metabolism, and reduce the rising of postprandial plasma glucose levels. KGM enhanced the excretion of bile acids and cholesterol from the feces while inhibiting the formation of hepatic cholesterol in animal experiments [131]. Apart from its impact on food's glycemic index, KGM may also be advantageous for lowering cholesterol in both diabetics and non-diabetics [132]. In mice with obesity. investigated the encouraging and advantageous effects of partially alkali gelled liquid konjac (LK) powder. Over the course of 80 days, male C57BL/6J mice were given a high-fat diet supplemented with 2.5% or 5% LK powder. Administration of LK led to a significant reduction in triglyceride buildup, liver cholesterol, and serum insulin levels. Therefore, by lowering serum cholesterol levels and abdominal fat formation as well as by preventing lipid buildup in the liver, the LK-enriched diet reduced obesity. In a study conducted by overweight men were given an 8-week diet supplemented with glucomannan along with a full body training regimen. The men's weight loss, body composition, blood parameters, and physical performance were all evaluated. For eight weeks, a group of twenty-two overweight, inactive males followed a diet that included 1500 mg of glucomannan in addition to either no activity or a resistance and endurance exercise regimen. [133].

3. Laxative effect

Like other dietary fibers derived from other sources, KGM is regarded as a “bulk-forming laxative” that facilitates digestion. Products made from the konjac plant that contain flour made from it are excellent providers of dietary fiber. In addition to improving normal intestinal flora (dietary fiber is digested by intestinal bacteria to make short chain fatty acids) and stimulating peristalsis (bowel movement), dietary fiber absorbs water, allowing swelling and growing stool volume . Defecation is made easier by all of these qualities. Glucomannan in the stomach eliminates harmful compounds and lengthens their retention period, which better shields the gastric mucosa. As a result, it purges the stomach of all waste and toxins. The special qualities of konjac gel fiber have been the subject of numerous studies; the findings indicate that konjac helps the body's natural peristalsis function more efficiently, reduces constipation pain by softening stool, and speeds up the rate at which waste is eliminated [134-135]. They investigated the colonic ecology of seven constipated individuals and the impact of the KGM supplement on their bowel habits in a diet-controlled linear trial. Less than one bowel movement per day occurred for the seven patients. The trial was divided into three phases: a 7-day adaption phase, a 21-day KGM supplementation (1.5 g) period, and a 21-day placebo or control period. They discovered that in constipated adults, the prebiotic activity of KGM specifically boosted the growth of Lactobacilli and Bifidobacteria. It has been discovered that KGM-induced Bifidobacteria and Lactobacilli growth effectively promotes bowel movement [136-137]. According to these results, adding a small amount of KGM (4.5 g/day) to low-fiber diets enhanced the colonic ecology and caused a 30% increase in the frequency of bowel movements in people who were somewhat constipated. The effects of KGM supplementation on children with functional constipation, whether or not they had encopresis, were assessed [138].

4.**Prebiotic activity**

Since the introduction of the prebiotic idea in 1995, there has been a significant interest from the scientific community and industry to identify food components that have prebiotic actions. Two crucial requirements for potential prebiotics. Food ingredients must first demonstrate resistance to upper gastrointestinal digestion and absorption. The second requirement is that the host intestinal microbiota ferments these meals, and that fermentation favorably promotes the development and/or activity of human health-promoting bacteria [139-140]. Using batch cultures injected with human faces. investigated the prebiotic activity of a KGM hydrolysate (GMH) in vitro. After fermentation with GMH and inulin, the populations of Bifidobacterium, Lactobacillus, and Atopobium grew. The combination of inulin and GMH produced a good short-chain fatty acid profile by specifically stimulating the growth of gut bacteria. They assessed the prebiotic potential of KGM that was hydrolyzed by enzymes. They contrasted how several strains of Lactobacilli and Bifidobacteria grew in response to hydrolysates of konjac, pectin, xylan, and inulin. The MRS agar medium was supplemented with these hydrolysates individually, and the agar containing the KGM hydrolysate showed increased colony development. Furthermore, a substantial microbiological growth was seen when KGM was hydrolyzed in UHT milk. Therefore, a novel prebiotic that can be added to food products is the KGM hydrolysate [141-142]

5.**Anti-inflammatory activity**

Apart from its numerous health advantages, scientists have found that KGM contains some antioxidants and anti-inflammatory substances that may be helpful in the management of rheumatoid arthritis [143] . According to certain research, KGM can effectively treat thyroid conditions as well as some tumors. A recent discovery supports the use of KGM for wound healing as well [144]. discovered that dietary pulverized KGM reduced allergy rhinitis-like symptoms in mice that had been inoculated and sensitized by ovalbumin applied intranasally. The mice fed with pulverized KGM exhibited significantly reduced frequency of sneeze as compared to the control group. This study so demonstrated that PKGM is a healthy meal that guards against seasonal pollinosis, which mimics a nasal allergy. The impact of PKGM on intestinal immunity in mice with colitis produced by oxazolone (OXA) was investigated. The C57BL/6 (B6) mice were given either PKGM or control diet starting two weeks before the colitis was induced by administering OXA. PKGM purposefully lessened the colitis caused by OXA. Decreases in the number of NK1.1+ T cells facilitated the activation of Th1-polarized immune responses linked to this impact [145].

6.Anti-hypercholesterolemia

Konjac glucomannan have demonstrated the best potential for decreasing LDL cholesterol, encouraging weight loss, and helping diabetic control when taken with or prior to meals. A high-viscosity KGM-rich diet improves lipid profile and glycemic control, indicating possible therapeutic benefit in the management of insulin resistance syndrome [146]. This is indicative of the extraordinarily high viscosity of its solutions; 1% glucomannan (GM) solutions have a viscosity that is approximately ten times higher than that of guar gum solutions and more than a hundred times higher than that of pectin solutions [147]. After analyzing the viscosity of kojac glucomannan, came to the conclusion that glucomannan seemed to be the fiber most appropriate for use as a dietary supplement in the treatment of diabetes, hyperlipidemia, constipation, and excess weight [148]. In a different investigation, they assessed the impact of konjac flour on baboons given a western diet on plasma fibrinogen, serum and liver lipid, glucose tolerance, insulin response, and liver glycogen. A group of twelve male baboons, weighing an average of 1973 kg, were chosen and given a western diet consisting of 400 g daily. The food was fed for nine weeks in a crossover, randomized sequence with a stabilization phase in between treatment periods, supplemented with or without konjac glucomannan (5%) or sodium propionate (2%). They came to the conclusion that, after nine weeks, baboons fed an unsupplemented western diet had considerably higher serum total cholesterol levels than baboons provided a supplemented diet [149]. Additionally, when baboons were fed diets supplemented with konjac flour, there was a reduced area under the glucose tolerance curve and a 30% decrease in liver cholesterol levels. It used a randomized crossover study spanning 21 days to examine the effects of a KGM (10 g/day) supplement combined with plant sterols (1.8 g/day) on the lipid profile and cholesterol biosynthesis in mildly hypercholesterolemic subjects with (18 individuals) and without (16 individuals) type 2 diabetes. When compared to the control (3.6070.16 mmol/l) in non-diabetic subjects, overall plasma LDL-C valu. Al-Ghazzewi FH, Tester RF. Effect of konjac glucomannan hydrolysates and probiotics on the growth of the skin bacterium Propionibacterium acnes in vitro. They were significantly lower following the KGM diet (3.1670.14 mmol/l) and combination treatments (2.9570.16 mmol/l).

Individuals with type 2 diabetes investigated the impact of a konjac glucomannan and chitosan complex on the lipid profile of twenty-one overweight individuals with normal cholesterol levels. For a duration of 28 days, the subjects were provided a supplement containing 2.4 g/day of KGM and chitosan in equal proportions, without altering their usual dietary or exercise regimen. Serum lipid levels were assessed on day 7 of the first supplementation period and day 28 of the last supplementation period. It was indicated that this supplement was a powerful cholesterol lowering agent since it reduced serum cholesterol (TC, 7%; LDL-C, 10%) to a degree greater than that of most soluble fibers in a population that was predicted to be unresponsive (overweight normocholesterolemic patients). It would be impossible to determine, though, if the effects were caused by the KGM, chitosan, or the combination of the two that was employed in this investigation. [150]

Elephant foot yam –Alkaline Xylanase

After cellulose in plant cell walls, xylan is the second most prevalent carbohydrate and makes up 30–35% of the entire dried mass of plants. The complete breakdown of xylan is achieved through the utilization of multiple enzymes, including endo β-1,4 xylanase, β-xylosidase, α-arabinofuranosidase, and acetyl xylan esterase.[151] The end products of these enzyme reactions are D-xylose and xylo-oligosaccharides. Extracellular enzymes called xylanases are produced by a variety of microorganisms, including actinomycetes such as Thermomonospora antranikiran, yeasts, fungi, and bacteria such as Aspergillus, B. subtilis, and Aspergillus. [152]

Because they are mycelial and require less water than bacteria, fungi are more successful than bacteria at producing enzymes in SSF. Xylanase is widely used in the food, biorefinery, animal feed, pulp and paper, and textile sectors[153]. It is a reasonable choice for the production of many valuable and profitable products, including sugar syrups, single-cell proteins, and liquid and gaseous fuels. Compared to submerged fermentation, enzyme synthesis with SSF has several financial advantages, including lower startup and operating costs, increased product output, and a more efficient fermentation medium.[154]

In order to improve biotechnological processes, a number of studies successfully reported on the manufacture of xylanase utilizing an experimental design model based on Response Surface Methodology [155]. Peels from a wide variety of fruits and vegetables, such as lemons, apple pomace, cassava, pomegranates, mausambi, and bananas, have been employed as solid substrates to produce xylanase [156]. EFY peels are a potentially valuable biowaste that is underutilized but has the potential to be exploited as a substrate for the synthesis of important enzymes and other valuable industrial products like xylitol and bioethanol [157]. It does, however, include a few anti-nutritional elements, such as the possibility of itching due to oxalates. Thus, further research is required to employ the agro-residue elephant foot yam peels for the synthesis of beneficial commercial chemicals [158].

CONCLUSION:

The enormous underground spherical corms of the elephant foot yam (Amorphophallus paeoniflorins) are produced by this tropical crop belonging to the Araceae family. It is the oldest crop that has been produced and has historically been used to treat a variety of illnesses. It also provides a significant amount of food for developing nations. In the human diet, the corms of the elephant foot yam (EFY) can be used as a source of dietary fiber, protein, minerals, vitamins, and carbs. The EFY corm's high dietary fiber content, low fat content, and various vitamins (A, B, niacin, etc.) and minerals (potassium, phosphorus, and iron) make it an excellent ingredient for food products with added value. The bioactive components of EFY corm, such as its phenolic acids, flavonoids, tannins, saponins, glucomannans, triterpenoids, and phytosterol, have piqued the interest of food scientists since they have the potential to both prevent and treat ailments. The literature has documented the various benefits of bioactive compounds found in EFY corms, including their anti-inflammatory, gastroprotective, hepatoprotective, anticancer, antibacterial, analgesic, and anti-inflammatory properties. EFY corms have the potential to be used in the current situation as a source of bioactive components to prevent cancer, heart disease, diabetes, obesity, and inflammation. Research has backed up the claim that consuming EFY corms helps control blood pressure, glycaemic index, cholesterol, and weight. The current knowledge of the EFY plant's botanical description, nutritional makeup, bioactive compounds found in the corms, their bioactivities, and health advantages. The tuber has the medicinal qualities of konjac glucomannan including disintegrant, binder, gelling agent, thickening agent, film forming, emulsifier and stabilizer. The anti-nutrient property present in the elephant foot yam such as oxalate, tannin, hydrogen cyanide and phytic acid has been reduced because they have irritating property.

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