INTRODUCTION

The porang plant is indigenous to Indonesia and is frequently used and known by the locals. The porang plant has been used for a long time as food and exported as raw materials for industry because it produces minerals, vitamins, lipids, proteins, carbs, and dietary fiber. *Amorphophallus muelleri* is one of the four dominant porang plant species in Indonesia. *A. muelleri* is often also called badur (Java), porang, acung or acoan (Sunda), or kerubut (Sumatra).¹ Like other porang plants, *A. muelleri* has a fairly high glucomannan content (approximately 64-72%).² Glucomannan is a polysaccharide composed of D-glucose and D-mannose units.³ Dishes made with glucomannan are well-liked in many Asian and European markets since they are healthier.

Glucomannan has been known to have various benefits in the health field as it has antiobesity, anti-diabetic, laxative, prebiotic, and anti-inflammatory activities. Glucomannan can help people lose weight by lowering blood pressure, triglycerides, glucose, cholesterol, and other blood-related markers. Its extensive effects are controlling metabolism and preventing many chronic disorders.

Recently, the awareness about the health benefits of glucomannan has increased, so much research has been diverted towards the advancement and utilization of glucomannan from various species of porang plants.¹ This review examines the various beneficial health effects of the porang plant.

METHOD

The method used in writing this journal is collecting data from various sources, including online research journals such as Google Scholar, Pubmed and Science Direct. Based on the journal review, porang was shown to have several beneficial health effects, such as reducing body weight and obesity parameters, lowering blood sugar levels and HOMA-IR, and improving lipid profiles. Glucomannan in porang also has the potential to provide anti-inflammatory, immunomodulatory, anti-tumor, and adjunctive therapy as a laxative and prebiotic.

RESULT

**Characteristic of Porang Plant (A. muelleri)**

*A. muelleri* plant originally grew wild in the Andaman Islands, India. Then, it spread eastward to Burma, northern and southern Thailand, and Indonesia, including Sumatra, Java, Flores, and Timor islands. This type is commonly cultivated in Java. Porang belongs to the Araceae family, a shrub (herbaceous) plant. The taxonomy of porang is classified as follows: Kingdom: Plantae; Division: Magnoliophyta; Class: Liliopsida; Order: Arales; Family: Araceae; Genus: Amorphophallus; Species: Amorphophallus muelleri Blume.

Porang is a plant with tubers in the soil above the leaves and petioles. Porang has small leaves, pointed leaf tips, white, like *bengkoang*. At each meeting of branches and leaf axils, there are no bulbs. Cultivated porang plants must have good branches and leaf axils, there are no bulbs. Cultivated porang plants must have good branches and leaf axils, there are no bulbs. Cultivated porang plants must have good branches and leaf axils, there are no bulbs. Cultivated porang plants must have good branches and leaf axils, there are no bulbs.

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Chemical Properties of Porang Plant (A. muelleri)

Starch, mannan, crude fiber, free sugar, various polyoses, and calcium oxalate make up most of the carbs in porang.\(^5\) The amount of glucomannan in A. muelleri plants ranges from 64 to 72%, which is fairly significant.\(^2\) The amount of glucomannan varies based on the part of the tubers, their growth environment, and the harvest time.\(^5\) The polysaccharide glucomannan comprises D-mannose and D-glucose monomers that are 1,4-linked.\(^6\) Depending on the type of porang tuber, the manner of processing, and the amount of storage, one glucomannan molecule weighs between 200,000 and 2,000,000 daltons. It comprises 33% D-glucose and 67% D-mannose (1:1.6).\(^1\)

The plant from the genus *Amorphophallus* is high in soluble dietary fiber and has been utilized traditionally as food and medicine in Asian nations.\(^3\) In particular for adults, glucomannan can be used as an alternative to weight loss and obesity treatment.\(^8\) glucomannan is soluble in water and forms a viscous mass with significant expandability, a crucial characteristic. Additionally, glucomannan can solidify into a unique gel that is difficult to degrade. A transparent, thin layer (film) made of glucomannan can be created. Glycerin can be used to transform glucomannan into a water-repellent coating.\(^9\)

Like other *Araceae* family plants, porang tubers contain high calcium oxalate crystals and alkaloids. Porang tubers contain oxalic acid, a dicarboxylic acid with two C atoms in each carboxylic group. Oxalic acid in plants is stored in two forms, namely water-soluble oxalate and water-insoluble oxalate. Consumption of high amounts of oxalate can reduce the bioavailability of calcium in the body and cause kidney stones.\(^10\) Calcium oxalate crystals are also needle-shaped, causing the tongue and throat to feel itchy and hot when consumed. The presence of calcium oxalate is one of the limitations to the utilization of porang as food. However, most calcium oxalate can be removed through proper preliminary treatment before processing, such as soaking in salt or acid solution. This effort also needs to be made to process porang into glucomannan flour that will be used as food.\(^1\)

Health Benefits of P Porang Plant (A. muelleri)

**Antiobesity Agent**

It has been hypothesized that glucomannan protects against visceral adiposity and obesity. The effects of porang flour administration on body weight and food intake in rats on a high-fat diet were studied experimentally. The results showed significant differences (p=0.000) in body weight and food intake between the treated and control rats. According to growth data,\(^11\) Glucomannan was found to have dosage-dependent effects on final body weight, body weight gain, and food efficiency ratio in mice fed a diet. Lowering lipid buildup in the liver and abdominal fat organs may explain these findings. With liquid glucomannan supplementation, measurable weight decreases in mesenteric and retroperitoneal fat were seen.\(^12\) Researchers think consuming glucomannan for a longer period and at a larger dosage leads to even more pleasing physical outcomes. One study found that participants who consumed glucomannan for fourteen days experienced a reduction in waist circumference and the intensity of their hunger/satisfaction.\(^13\) This is because glucomannan in porang flour has gel-forming properties and can increase viscosity in the gastrointestinal tract and can also slow down peristalsis, causing a decrease in contact between food and the gastrointestinal tract, which triggers satiety signals in the brain and slows down gastric emptying.\(^14\)

Weight loss is also due to the molecular mechanism of glucomannan in triggering lipolysis in tissues. Glucomannan is a water-soluble fiber that is not digested but fermented in the ileum and colon into short-chain fatty acid (SCFA) form. SCFA activates free fatty acid receptor-2 (FFAR2), which triggers free fatty acid receptor-2 (FFAR2), triggering dissociation and activating the G\(\alpha\)o protein, which inhibits adenylylate cyclase and cyclase and decreases the production of cyclic adenosine monophosphate (cAMP) from ATP, thereby decreasing the activity of protein kinase A (PKA). Decreased PKA activity will trigger dephosphorylation and deactivation of hormone-sensitive lipase (HSL) in adipose tissue. In addition to suppressing Akt phosphorylation and lipid storage in adipose tissue, FFAR2 activation by SCFA also suppresses insulin signaling in adipose tissue and activates lipid and glucose metabolism in other tissues.\(^15\)

**Hypolipidemic Agent**

Researchers discovered in one study that glucomannan administration could help diabetic rats maintain their body weight, which may be related to improved insulin sensitivity and glycemic control. Serum fasting blood glucose and insulin levels were measured in the study, and the Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) was computed. The glucomannan treatment resulted in noticeably reduced blood glucose and lowered HOMA-IR levels compared to the model group.\(^12\) The mechanism of action of glucomannan is linked to several scientific literatures documenting the effects of fiber foods on glucose homeostasis, lipid metabolism and caloric intake. Fiber can induce greater satiety than other polysaccharides through the intrinsic physical effects of fiber, including clumping, gel formation, altering the viscosity of gastric contents, modulating gastric motor function and improving postprandial glucose levels and insulin response. These conditions will cause a delay in gastric emptying, modification of gastrointestinal myoelectric activity, slow transit time in the colon, decreased diffusion of glucose through the impermeable layer, and reduced contact with the digestive enzyme alpha-amyrase.\(^13\)

**Hypoglycemic Agent**

Porang glucomannan supplementation (25, 50, and 100 mg/200g BW) for 28 days resulted in lower levels of total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL), and higher levels of high-density lipoprotein (HDL), demonstrating an improvement in blood lipid profiles in high-fat and high-carbohydrate diet-induced metabolic syndrome rats.\(^16\) These outcomes are associated with reduced MetS
symptoms brought on by dyslipidemia or hypertriglyceridemia. In mice given liquid glucomannan, there was a reduction in serum cholesterol levels, and there was a significant difference between the groups receiving 0 and 5% liquid glucomannan. Lipidomics analysis based on ultra-performance liquid chromatography and quadrupole time-of-flight mass spectrometry was performed to investigate how konjac glucomannan therapy affects lipid metabolism. Glycerolipid (diacylglycerol, monoacylglycerol, and triacylglycerol), fatty acyl (acylcarnitine and hydroxyl fatty acids), sphingolipid (ceramide and sphingomyelin), and glycosphingolipid (GPL) metabolic disturbance was decreased by the glucomannan treatment.

**Laxative**
There hasn’t been much research done on glucomannan’s laxative properties. However, in one study, the glucomannan supplement significantly increased the mean defecation frequency (number/day), wet stool weight (g/d), and dry stool weight (g/d), respectively, by 27.0% (p 0.05), 30.2% (p 0.05), and 21.7% (p 0.05). By likely increasing stool volume, glucomannan enhanced the frequency of defecation in healthy persons who were eating a low-fiber diet. Glucomannan would then promote the development of lactic acid bacteria and colonic fermentation. Another study found that the laxative glucomannan combination promoted defecation in constipated mice by probably increasing short-chain fatty acid metabolism and 5-HT hormone release.

**Prebiotic**
A recent study looks into porang glucomannan’s prebiotic properties. For an in vivo experiment, four groups of Wistar rats were created. Each group received treatment for 14 days using the conventional AIN-93 (standard), porang glucomannan, commercial konjac glucomannan, and inulin diets. The bacterial population and chemical makeup of the digesta were assessed after the intervention. The investigation showed that porang flour produced 18.05% of glucomannan with a purity of 92.69%. Comparing Porang glucomannan to commercial glucomannan, it showed better solubility (86.4%) and acetylation levels (13.7%) but lower viscosity (5400 cps), water holding capacity (WHC) (34.5 g/g), and degree of polymerization (DP) (9.4). Porang glucomannan added to the diet lowered the pH of the fecal content, increased the generation of total short-chain fatty acid (SCFA), and stopped *Escherichia coli* from growing. The study suggested that porang’s glucomannan could be employed as a functional food.

**Anti-inflammatory**
A study looked at glucomannan’s anti-inflammatory properties in diabetic model rats. The significantly elevated level of C-reactive protein (CRP) (p 0.05) in the plasma of Type 2 Diabetes Mellitus rats demonstrated the presence of an inflammatory response. After receiving glucomannan treatment, the blood CRP levels dropped (p 0.05), and the results were comparable to those of the treated group. Additionally, glucomannan attenuated endothelial damage and decreased inflammation, as shown by lower levels of CRP, tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6) and vascular cell adhesion molecule-1 (VCAM-1). As shown by decreased levels of myeloperoxidase (MPO) activity and malondialdehyde (MDA) and greater levels of glutathione peroxidase (GSH-Px) and superoxide dismutase (SOD), it also simultaneously lowered oxidative stress.

**Immunomodulatory potency**
The immunomodulatory potential of glucomannans has been encouraging. A detailed investigation was done into how well glucomannans from various sources activated macrophages. By raising immune effector molecule production, improving macrophage endocytosis and phagocytosis, and specifically promoting the development of the M1 phenotype, glucomannans stimulated the immunological activation of macrophages. Further supporting evidence for glucomannans’ immunological activation of macrophages came from the involvement of the nuclear factor-B (NF-B) and mitogen-activated protein kinase (MAPK) signaling pathways. A considerable immune activation impact of glucomannans was seen in macrophages, and the differences in immunological activation were closely correlated with the acetyl concentration and molecular weight. In another work, recombinant autolysin formulations with Montanide ISA266, alum adjuvants, and glucomannan as a polysaccharide were used in a systemic mouse infection model to examine the protective efficacy and immunological features. According to the study’s findings, glucomannan can trigger immunological responses and will be employed as an adjuvant in creating vaccines.

**Anti-tumor**
Glucomannan may reverse multi-drug resistance (MDR) in HepG2/5-FU cells, which are known to be resistant to the chemotherapeutic medication 5-fluorouracil (5-FU). This was the topic of a recent study. The study used several techniques, such as cell viability tests, gene expression analysis, apoptosis evaluation, and an animal model, to evaluate the effects of glucomannan.

The findings showed that glucomannan dramatically decreased the viability of HepG2/5-FU cells when combined with 5-FU. This was accomplished by reducing the expression of MDR1 and P-glycoprotein 1, two proteins linked to drug resistance. Additionally, glucomannan induced apoptosis by increasing the expression of BCL-2, cleaved caspase-3, and Bax and decreasing the activity of genes involved in cell proliferation (cyclin A, cyclin B1, and CDK2).

Moreover, glucomannan exerted its effects by inhibiting AKT signaling and increasing the expression of p53. In an animal model of tumor growth, glucomannan demonstrated its ability to impede the development of HepG2/5-FU cells effectively. These findings suggest that KGM holds promise as a potential therapeutic agent to overcome 5-FU resistance in HepG2/5-FU cells by targeting AKT signaling and modulating p53 expression.

**CONCLUSION**
Porang plant (*Amorphophallus muelleri*) contains a high level of glucomannan. Glucomannan is a water-soluble fiber
that can form gels, increase viscosity, and expand. It is low in calories, which is useful in the health sector. It can be used as an alternative diet for patients with obesity, type 2 diabetes mellitus, and dyslipidemia. Glucomannan in porang also has anti-inflammatory and immunomodulatory effects. Recent studies show the potential antitumor effects of glucomannan. In addition, the porang plant can help adjuvant therapy as a laxative and prebiotic.

CONFLICT OF INTEREST

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