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LITERATURE REVIEW

Effects of Corn Silk (Stigma maydis) against Blood Glucose Levels of Type 2 Diabetes Mellitus Patients

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Abstract: According to WHO, in 2017 there are an estimated 425 million sufferers of diabetes mellitus. Indonesia is placed in the seventh rank in the world in 2015, with an estimated 10 million sufferers. To reduce the prevalence of type 2 diabetes mellitus, improvements need to be made, such as lifestyle modification and treatment. Most anti-diabetic drugs have high side effects. Corn silk is one of the natural ingredients that contain flavonoids, which can reduce blood fat levels. The dose of corn silk of 500 mg/kg BW is the best substance against diabetic rats from excessive weight loss. Therefore, corn silk can be calculated to have an anti-diabetic effect by using lipids, eliminating free radicals, and increasing antioxidant capacity.

Keyword: Diabetes Mellitus, Cornsilk, Antidiabetic

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder called The Silent Killer, because sufferers are often unaware of the disease, or know it after several complications arise from the disease. In general, according to the American Diabetes Association (ADA) in 2019, there are four diabetic classifications namely Diabetes Mellitus Type 1 (DM type 1), DM Type 2, Gestational DM, and DM specific types. Type 1 DM is caused by damage from pancreatic β cells so that it is unable to produce insulin, while Type 2 DM occurs due to insulin resistance resulting in progressive disruption of insulin secretion. Gestational diabetes mellitus is diabetes detected during the second or third trimester of pregnancy with no apparent cause. Furthermore, the specific type of diabetes is DM due to other causes, such as monogenic diabetes, genetic disorders in insulin action, genetic disorders in β cell function, pancreatic exocrine disease, and those triggered by drugs or chemicals (use of glucocorticoids in the treatment of HIV/AIDS, or after an organ transplant). Patients diagnosed with diabetes mellitus when the blood glucose is more than 200 mg/dl or fasting blood glucose more than 126 mg/dl or postprandial blood glucose 200mg / dl.[1,2]

Diabetes mellitus is still a global problem. According to the World Health Organization (WHO), diabetes mellitus is ranked seventh as the leading cause of death in the world. In 2017, there were an estimated 425 million people with diabetes mellitus, consisting of 98 million aged over 60 years and 327 million aged between 20 years and 64 years. This incident will

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continue to increase especially in low-middle income countries.[1,3]

In 2015, Indonesia was ranked seventh in the world for most DM sufferers after Mexico with an estimated total of 10 million sufferers and the second-highest percentage of deaths after Sri Lanka. According to the Ministry of Health of the Republic of Indonesia (MOH), the prevalence of people with diabetes mellitus over 15 years increased from 6.9% in 2013 to 8.5% in 2018, with the most cases found in DKI Jakarta Province (3.4%) which is mostly DM Type 2. [1,4,5]

The increasing prevalence of diabetes mellitus, especially Type 2 diabetes must be overcome immediately because it is estimated that in 2045 the number of people with DM will reach 629 million cases. To reduce the prevalence rate of Type 2 diabetes, several prevention measures such as lifestyle modification and treatment are made. Currently, insulin and oral anti-diabetes chemical drugs are often used as therapy for Type 2 diabetes. However, most of these drugs have some side effects such as hypoglycemia, lactic acidosis, liver, and kidney failure. Therefore, to reduce side effects, research is aimed at finding new compounds with better effectiveness and lower toxicity compared to oral anti-diabetic chemical drugs. This has encouraged research into traditional herbal medicines as alternative medicine that is recognized by WHO.[1,6]

One of the plants that can be used as herbal medicines for type 2 DM is corn silk (Stigma maydis) which is a waste from corn cultivation and is usually used by the Indonesian people as animal feed. Outside Indonesia, corn silk has long been consumed as an herbal remedy for gout, nephritis, kidney stones, obesity, cystitis, and prostatitis. Besides, it was reported that corn silk has hypoglycemic, anti-tumor, antioxidant, antifatigue, and anti-fungal properties. This is because in corn silk there are flavonoid compounds that play a role in reducing glucose levels in the blood.[6,7]

MAIN BODY

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia, which occurs due to abnormal insulin secretion, insulin action, or both. Chronic hyperglycemia in people with DM associated with damage or failure of several organs.[8]

Broadly speaking, Type 2 DM is caused by eight organs (ominous octets), namely failure of pancreatic beta cells to produce insulin, so antidiabetic drugs that work on this pathway are meglitinide, sulfonylureas, DPP-4 inhibitors, and GLP-1 agonists. Severe insulin resistance can trigger the process of gluconeogenesis in the liver which causes an increase in basal glucose production in the liver (hepatic glucose production). then metformin drugs are needed that function to suppress the process of gluconeogenesis., Increased the process of lipolysis and free fatty acid levels (free fatty acids) in plasma, which occurs due to fat cells that are resistant to anti-lipolysis from insulin, will stimulate the process of gluconeogenesis as well. Also, free fatty acids can interfere with insulin secretion so that it requires the drug thiazolidinedione that works in this pathway. [9]

Disruption of tyrosine phosphorylation is also one of the causes of diabetes mellitus because it can cause decreased glycogen synthesis, decreased glucose oxidation, and disruption of glucose transport in muscle cells. The drugs that

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work on this pathway are thiazolidinedione and metformin. The intestine serves as a place of absorption of food, one of which is carbohydrates, ie polysaccharides will be broken down into monosaccharides through the performance of the α-glucosidase enzyme. This solution causes an increase in blood glucose, so root is needed as an inhibitor of the enzyme α-glucosidase. A-pancreas cells play a role in synthesizing glucagon which in the fasting state will increase in plasma. This increase causes hepatic glucose production to increase significantly compared to normal individuals. Drugs that play a role in this pathway are GLP-1 agonists, DPP-4 inhibitors, and aniline which inhibits glucagon secretion. The kidneys function to filter about 163 grams of glucose a day, which will be reabsorbed through SGLT 1 and SGLT 2. Drugs that work in the SGLT-2 pathway are dapagliflozin. The brain, the last organ that plays a role in DM Type 2, functions as an appetite suppressant. Insulin resistance causes food intake to increase, so it takes drugs that work on this pathway namely GLP-1 agonists, bromocriptine and amylin.[9]

Corn (Zea mays) is one of the important food ingredients that is often found in Indonesia. Corn is a family of grasses (Gramineae) which has a life cycle of 80-150 days which is divided into two stages. The first stage is the stage of vegetative growth and the second stage is the stage of generative growth. In general, corn has a height of 1 m to 3 m, but several varieties can reach a height of 6 m.[10]

Corn has the following taxonomy.[10]
Kingdom: Plantae
Division: Spermatophyta
Subdivision: Angiospermae
Class: Monocotyledoneae
Ordo: Graminae
Family: Graminaceae
Genus: Zea
Species: Zea mays L

Corn hair (Stigma maydis) resembles a soft, light green or brownish yellow thread measuring 10-20 cm from a female flower in corn. Corn silk contains protein, vitamins, carbohydrates, salt (Ca2+, K+, Mg2+, and Na2+), steroids (sitosterol and stigmasterol), alkaloids, saponins, tannins, and flavonoids. Corn hair has been extensively studied able to reduce blood glucose levels.[11]

In a study by phytochemical screening examination of corn silk, the results showed that corn hair contains flavonoids and steroids (Table 1).[12]

Tabel 1. Phytochemical Screening Results of Corn Hair (Stigma maydis)[12]

Category	Result
Alkaloid	-
Flavonoid	+
Tannin	-
Quinone	-
Steroid/triterpenoid	+
Saponin	-

(+) = Simplisia reacts positively to the tested reagents
(-) = Simplisia reacts negatively to the reagents tested.

Flavonoids contained in corn silk have the potential to stimulate the activation of insulin thereby reducing blood glucose levels. Besides, flavonoids also act as the body's exogenous antioxidants that function to repair damaged body cells by completing the lack of electrons possessed by free radicals so that free radicals are stable and prevent oxidative stress. Reduced oxidative stress in the body can reduce insulin resistance thereby preventing the development of pancreatic β cell damage. Flavonoid compounds work by stimulating

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glucose uptake in peripheral tissues, regulating the activity of the enzymes involved so that it can improve glucose tolerance by reducing levels of GDP.[13]

Flavonoids are phenol compounds that are most commonly found in plant tissues with a chemical structure C6-C3-C6 consisting of one aromatic ring A, one aromatic ring B and a heterocyclic middle ring containing oxygen.[14]

Research shows that the effective hypoglycemia effect on corn silk is at a dose of 1.04g / kg BW. Experiments together with alloxan can reduce blood glucose levels in animals try Swiss Webster mice.[15]

The antidiabetic effect of corn silk was evaluated by measuring blood glucose levels, oral glucose tolerance test, total cholesterol and triglycerides in rats induced by streptozotocin for 4 weeks showed results that the dose that can reduce blood glucose, total cholesterol and triglyceride levels were 100- 500 mg / kg.7 Blood glucose levels after being given corn silk according to the dose showed hypoglycemic effects compared with controls ($p < 0.05$) and there was no significant difference ($p > 0.05$) when compared with positive controls (600 mg/kg BW dimethyl biguanide). The blood glucose level in diabetic rats shows that corn silk can increase glucose tolerance in diabetic rats. These results indicate that corn silk can be useful as an anti-diabetic agent.[7]

Other results showed that corn silk with a dose of 300 mg/kgBW to 500 mg/kgBW did not cause side effects in normal mice and has potential as an antidiabetic, antioxidant, and antihyperlipidemic agent. In this study also explained that for four weeks, the symptoms of polydipsia, polyphagia, and weight loss from diabetic rats had been reduced and a dose of 500 mg/kgBW was the best dose in preventing diabetic rats from losing weight, so it can be concluded that corn silk has Antidiabetic effect by regulating lipid metabolism, eliminating free radicals, and improving antioxidant capacity.[6]

Similar results were also obtained from the study of Guo et al. Presented in Table 2.[11]

Tabel 1. Effects of Corn Silk on Blood Glucose in Mice[11]

Group	Blood Glucose (mmol/L)
Group control	21.2 ± 2.1
Dosage (4.0 g/kgBW)	11.5 ± 2.1
Dosage (2.0g/kgBW)	15.6 ± 3.0
Dosage (1.0g/kgBW)	18.9 ± 2.8
Dosage (0.5g/KgBW)	19.9 ± 2.7

Blood glucose levels decreased after administration of corn silk at doses of 2g/kgBW and 4g/kgBW ($p < 0.05$). But the group treated with low-dose corn silk (0.5 and 1.0 g / kgBW) did not achieve the same results. Corn silk can help release insulin from β cells that are still alive, and also from β cells that are recovered by corn silk. The β cells of mice given corn silk (4 g / kgBW) partially recovered. But this still requires further research.

DISCUSSION

Diabetes mellitus in Indonesia is the second leading cause of death in the world after Sri Lanka. The prevalence of diabetes mellitus is increasing every year. Several actions have been taken, one of them by taking oral antidiabetic chemical drugs. But many oral chemical drugs cause side effects, so research is needed that aims to

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look for new compounds with better effectiveness and lower toxicity than oral antidiabetic chemicals. One of the plants that can be used as an oral antidiabetic drug is corn silk (Stigma maydis). Corn silk has flavonoid compounds that function to reduce blood glucose. This is evidenced in several studies, both in-vivo and directly on humans, that is, after being given corn silk there is a decrease in blood glucose.

CONCLUSION

Corn silk has a significant effect in reducing blood glucose levels. The dose of corn hair (Stigma maydis) which is effective in reducing blood glucose levels is 300mg/kgBW to 500mg/kgBW. The best dose of corn silk in preventing diabetic rats from losing excess weight is 500mg/kgBW so it can be concluded that corn silk has an antidiabetic effect by regulating lipid metabolism, eliminating free radicals, and improving antioxidant capacity.

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