

CORN SILK TEA EXTRACT AS ANTIDIABETIC: A REVIEW

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ABSTRACT

Diabetes Mellitus type 2 usually occurs in people who are overweight and have less physical movement. Usually, that disease triggers by sedentary lifestyle. Patients with diabetes mellitus are characterized by high blood glucose levels (hyperglycemia) due to a lack of insulin secretion, insulin action, or both. Decreasing blood sugar levels can be done in several ways, namely by diet and consumption of drugs. One of the efforts to help speed up diabetes treatment is to consume corn silk tea. Corn silk is one part of corn that has not been fully utilized and contains flavonoids, which are believed to reduce blood glucose levels. Flavonoids in corn silk reduce blood glucose levels by stimulating insulin secretion by pancreatic β cells, activating insulin receptors, and repairing damaged pancreatic β cells through antioxidant activity; flavonoids also inhibit the breakdown of carbohydrates. The process of making corn silk tea can be done in several procedures. Before making, corn silk can be dried or not dried; making the extract can be boiled for a long time or only for a short time. The difference in the manufacturing process affects the tea content and its effect on blood sugar levels. Corn silk tea that has been formulated to be drunk regularly in a repetition can reduce blood sugar levels in respondents with high blood sugar levels.

Keywords: Diabetes mellitus, functional drinks, corn silk

INTRODUCTION

Most people use corn for consumption with various kinds of processing. The part of corn that is often used is the fruit, while during the processing process, there are parts of the corn that have not been used effectively, such as corn silk. Corn silk is considered more as a food industry waste as a result of cleaning corn during processing. However, based on previous research, corn silk has chemical properties that are beneficial to the body's health.

One of the chemical composition in corn silk that can be used to lower blood sugar levels is flavonoids. Flavonoids are a class of compounds that can treat Diabetes Mellitus type 2. Diabetes Mellitus type 2 usually occurs in people who are overweight and have less physical movement. Usually, that diseases triggers by sedentary lifestyle. Patients with diabetes mellitus are characterized by high blood glucose levels (hyperglycemia) due to

lack of insulin secretion, insulin action, or both (Sudoyo, 2009).

The efficacy of flavonoids has been widely researched and scientifically proven to reduce blood glucose levels significantly. Therefore, corn silk is processed into the main ingredient in making functional drinks that can help lower blood sugar levels and help accelerate the healing of diabetes mellitus.

CORN SILK

Corn silk is defined as the female flower of corn arranged in a cob inside the axillary of the leaf. Each corncob has a stalk with short segments with leaves which are the bandages and the cobs. The pistil is arranged in several rows on the cob (Haryadi, 2011). Meanwhile, the definition of corn silk from other sources, namely the pistil and stalk of the fruit of *Zea mays* L., is in the form of slender, limp, slightly shiny threads, with a length of 10-25 cm and a diameter of approximately 0.4 mm. Corn silk (silk) as a result of elongation of the ducts from

the mature ovary on the cob. Corn silk grows to a length of 30.5 cm or more so that it extends from the end of the cob. Silk length of maize on corn cobs and corn husks (Subekti *et al.*, 2008).

Based on research, corn silk contains protein, vitamins, carbohydrates, calcium salts, potassium, magnesium, and sodium, essential oils, steroids such as sitosterol and stigmasterol, and antioxidant compounds such as alkaloids, saponins, tannins, and flavonoids (Nuridayanti, 2011). It was further explained that one of the antioxidant compounds is a flavonoid compound. The flavonoid compounds that can be isolated from corn silk extract are the maysin, c glycosylflavones. In addition, it also contains volatiles, terpenoids, cinnamic derivatives, glucose, rhamnase, sodium, potassium, zinc, iron and chloride (Hasanudin *et al.*, 2012).

Besides containing antioxidant compounds, corn silk has properties as traditional medicine. The benefits contained in corn silk can be obtained through processing from corn silk, one of which is herbal drinks. Herbal drinks consist of herbal plants that are consumed in the form of drinks, namely infusions of plant parts that are boiled or brewed with boiling water. Herbal drinks are famous for their aroma, antioxidant properties, and their application in the health sector (Ismiati, 2015).

THE PROCESS OF MAKING CORN SILK TEA

Based on literature review there are various ways to make corn silk tea and corn silk extract. The manufacturing process is not always the same. There are some differences in both the procedure, the materials and tools used. The manufacturing procedure is often different, such as the drying process, including the temperature and time. There are boiling, including boiling time and medium temperature, the brewing process, and others. Besides, there are also differences in the raw materials used, such as corn silk from different corn varieties. Most previous studies used corn silk from the maize variety, which is characteristic of the area around the study site. These differences positively affect the results of research both in terms of content, quality, and benefits of corn silk tea and the effects obtained after the consumption.

Based on the results of research by Akbar *et al.* (2019), the process of making corn silk extract begins by sorting the corn to remove the damaged parts and dirt. The sorted corn silks are washed with running water, which functions to remove other impurities that are stuck and not visible, then the corn silk is drained. The washed corn silk is then reduced in water content by drying it so that microbes cannot grow in it. The obtained corn silk is dried in the sun for 2-3 days 5 long. Corn silk that has been dried then made into powder using a blender. This is done to uniform the sample size and reduce the sample's surface area, which can cause the breakdown of the cell wall by the solvent faster and simultaneously, thus optimizing the extraction process. The fine corn silk powder is then extracted by boiling it with water for 5 minutes with 10 ml of water to add 1 gram of corn silk. The stew of corn silk is then filtered using a filter cloth to separate the residue.

Whereas in the research of Hidayah *et al.* (2019), there are differences in the manufacturing process. Making tea involves the preparation of raw materials, which includes purchasing corn silk from the farmer and drying. Corn silk weighing 150g is dried at 50oC, then boiled in 300 ml of boiling water for 5 minutes, then filtered without adding sugar. In this study, dry corn silk was not mashed first but instead went straight to the boiling stage. The formulation used is 1:2 corn silk water ratio.

In Garnida *et al.* (2018) research, making tea begins with preparing eight weeks old sweet corn silk. Raw material sorting is the initial step that needs to be done to get quality corn silk. The sorted material is stored in a basin and washed in running water to clean up other scraps or dirt. Then it is drained, which is intended to reduce the water content in the corn silk that has been washed. The corn silk that has been drained is then divided into the first tray for a drying temperature of 60oC, with a drying time of 5 hours. The drying temperature affects the vitamin C level and the color of the corn silk herbal tea brew. The 60oC drying temperature gives an ash content of 4.31%, vitamin C content of 1.40%, flavonoid content of 0.04% (w / w).

Meanwhile, based on Kusumastuti (2017) research, making corn silk tea with the

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Zea mays L species begins with the drying process. Before boiling, the collected corn silks are dried, then as much as 5g of dry corn silk is boiled in 100 ml of water, which has a temperature of 70 oC. After that, brew it for 5 minutes and filter it to be given to older adults with diabetes mellitus.

CHEMICAL CONTENT OF CORN SILK

Corn silk contains chemical compounds that are useful for health. One of the substances in corn is beta-sitosterol, which is useful for reducing blood cholesterol levels (Harun *et al.*, 2011). Corn silk (*Zea mays* L.) also contains flavonoid compounds that function to stimulate insulin activation, thereby lowering blood sugar levels. Flavonoids as exogenous antioxidants for the body can stimulate the repair of damaged cells in the body by stabilizing free radicals and complementing the lack of electrons in free radicals that can cause oxidative stress. Reducing oxidative stress can reduce insulin resistance to sugar, thereby preventing pancreatic β cell dysfunction (Koloay *et al.*, 2015).

Flavonoids are polyphenolic compounds, which are slightly acidic and can dissolve in bases. Because they have polyhydroxy compounds (hydroxyl groups), making it polar to dissolve in polar solvents such as methanol, ethanol, acetone, water, butanol, dimethyl sulfoxide, dimethyl formamide. The presence of a glycoside group attached to a flavonoid group tends to cause flavonoids to dissolve easily in water. Flavonoids are red, purple, blue, and yellow substances found in plants (Ritonga *et al.*, 2013).

BENEFITS OF CORN SILK TEA AS AN ANTIDIABETES

The role of flavonoids is significant in fighting diabetes mellitus than other treatment methods (Mohan and Nandhakumar, 2014). Flavonoids can regenerate pancreatic beta cells and help stimulate insulin secretion (Dheer and Bhatnagar, 2010).

Flavonoids reduce blood glucose levels by stimulating insulin secretion by pancreatic β cells, activating insulin receptors, and repairing damaged pancreatic β cells through antioxidant activity. Flavonoids can also inhibit the breakdown of carbohydrates into

glucose and inhibit glucose absorption in the small intestine (Hanhineva *et al.*, 2010).

Flavonoids affect carbohydrate metabolism in several ways. First, flavonoids interfere the amylase enzyme's function, an enzyme in saliva that starts the process of digestion of carbohydrates, because it causing in impairing of carbohydrate break down. Second, flavonoids inhibit the action of the enzymes sucrose and glucosidase, which are essential for the digestion of carbohydrates in the small intestine. The result is a reduction in carbohydrate absorption and a lower blood glucose level. This is why corn silk is useful in breaking down gallstones, by reducing carbohydrate levels in the body. Since carbohydrates are the primary source of body fat, flavonoids reduce the amount of cholesterol that enters the gall bladder, absorb excess fat in gallstones and reduce the possibility of new stones forming and prevent the buildup of cholesterol against other stones that have formed (Indriani *et al.* 2010).

Flavonoids work by stimulating glucose uptake in peripheral tissues, regulating the activity and expression of enzymes involved in carbohydrate metabolic pathways, and acting like insulin by affecting insulin signaling so that it has an impact on reducing fasting blood sugar (Cazarolli *et al.*, 2008). Flavonoids also modulate lipid metabolism, thereby reducing the complications of DM due to abnormalities in lipid profiles and insulin resistance (Zhao *et al.*, 2007).

Flavonoids are protective against damage to β cells as insulin producers and can increase insulin sensitivity. Antioxidants can suppress beta-cell apoptosis without altering the proliferation of pancreatic beta cells. The action mechanism inhibits GLUT2, inhibiting the enzyme phosphodiesterase, and reducing oxidative stress in people with Diabetes Mellitus. Another mechanism is the ability of flavonoids, especially quercetin, to inhibit GLUT 2 (the major transporter of glucose in the intestine under normal conditions) in the intestinal mucosa to reduce glucose absorption. This results in a reduction in the absorption of glucose and fructose from the intestine, so further lowering the blood glucose levels (Ajie, 2015).

Another research study was conducted on the effectiveness of corn silk extract on reducing blood sugar levels of male white rats

Wistar strain induced by alloxan. The result was that corn silk extract had the effect of reducing blood sugar levels and the most effective dose was 2.52 g / KgBW (Koloay *et al.*, 2015). Several previous studies have shown that corn silk has the potential to reduce blood glucose levels in Wistar rats, but these studies have not been able to prove the effectiveness of corn silk extract in reducing fasting blood glucose in humans with type 2 diabetes mellitus (diabetes mellitus).

Based on the results research by Akbar *et al.* (2019) the best formula is tea with 40% corn silk content, because it gives the best consumer response. The water, ash, protein, fat, and carbohydrate content in this formula were 99.6%, 0.20%, 0.14%, 0%, and 0.06%, respectively. Corn silk tea also contains 0.03% flavonoid compounds. The chemical content of corn silk tea is considered to have the potential to be used as an alternative for functional drinks.

In Hidayah *et al.* (2019), it was found that 150 g of corn silk tea dried at 50 oC and boiled with 300 ml of water for 5 minutes and drunk regularly for 14 consecutive days can reduce sugar levels blood in respondents as much as 58 g / dl. This study's results can prove the theory of functional food in reducing fasting blood sugar levels in type 2 diabetes mellitus patient. Corn silk tea can be used as a supporting therapy in reducing fasting blood sugar levels in type 2 diabetes mellitus patient.

Meanwhile, based on the research of Kusumastuti (2017), it was found that the average intake of 100 ml of corn silk tea with 5 grams of dry corn silk consumed by a sample of people with diabetes for seven days showed a significant effect on blood sugar levels. All samples are 34 people consist of 26 womens and 8 mens. Samples classified into 3 age group, 51-55 years n=9, 56-60 years n=11 and 61-65 years n=14. Drink corn silk tea regularly affects reducing blood sugar levels. This is because the more flavonoids that are consumed, the more optimal it will work in reducing blood sugar levels.

The average value of blood sugar levels before and after treatment is shown in the table below:

Table 1. Blood sugar levels before and after administration of corn silk tea

	$x \pm SD$ (mg/dl)	Difference (mg/dl)
Before	228,99 ± 14,88	
		21,15 ± 1,63
After	207,84 ± 16,51	

Source : Kusumastuti (2017)

The results in table 1 shows that the average blood sugar level before treatment was 228.99 ± 14.88 mg/dl and after treatment, the average blood sugar level was 207.84 ± 16.51 mg/dl, the difference in blood sugar levels was 21.15 ± 1.63 mg/dl. This result was due to the effectiveness of the corn silks processing, specifically dried corn silk. According to Wulandari (2009), dry corn silk has an optimal antioxidant activity compared to wet corn silk. In addition, the flavonoid content will also increase at a brewing temperature of 60-80°C.

CONCLUSION

Corn silk is defined as the female flower of corn arranged in a cob inside the axillary of the leaf. Corn silk (*Zea mays* L.) contains flavonoid compounds that function to stimulate insulin activation, thereby lowering blood sugar levels. Corn silk can be processed into functional drinks by several processes. The differences in manufacturing process include procedure, materials, and tools affects the tea content and its effect on blood sugar levels. Corn silk dried before being boiled has a high flavonoid content compared to wet corn silk. Corn silk tea that has been formulated to be drunk regularly can reduce blood sugar levels in respondents with high blood sugar levels.

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