

Study of Corn Milk (*Zea mays saccharata* L) Glicemic Index (IG) as Anti-Diabetic Foods

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Abstract. Plants that have a low glycemc index, such as corn, can be an alternative food consumed by the public to prevent blood sugar levels from rising. Corn is not only low in the glycemc index but also rich in dietary fiber, fe, and beta-carotene (provitamin A). This study aims to examine the carbohydrate content and glycemc index (GI) of sweet corn milk (*Zea mays saccharata* L). This research uses descriptive quantitative analysis to describe the results of corn milk index values. This research was conducted in the Laboratory of Biochemistry, Department of Biology, Universitas Negeri Gorontalo, involving 8 respondents who met the respondent criteria. The criteria for the respondents in this study were (1) having a normal average body mass (BMI) = (18.5-25 kg/m²), (2) having no history of diabetes, (3) having a healthy body, and (4) being also not taking drugs. The glycemc index value was obtained by comparing the area under the curve between the reference food and the test food and then multiplying by 100. Based on the results of the study, the carbohydrate content of sweet corn milk was 8.79 g/100 mL, and the glycemc index (GI) value of sweet corn milk (*Zea mays saccharata* L) was 20.81. Based on these results, sweet corn milk (*Zea mays saccharata* L) belongs to the low glycemc index group.

1 Introduction

Sweet corn is a horticultural crop that is much loved by the public because of its sweet taste. In addition, corn has a significant role in meeting the nutritional needs of the community [1]. Corn is one of the plants with a low glycemc index that can be an alternative food that can be consumed by the public in order to minimize the increase in blood sugar levels. In addition, corn is a plant that is high in dietary fiber. Various studies up to 2008 have shown that fiber can improve blood glucose response and insulin index. In addition to having a low glycemc index, corn also contains functional food, namely: dietary fiber, Fe, beta-carotene (pro-vitamin A) [2]. Based on this, corn can be used as an alternative food with a low glycemc index to minimize the occurrence of diabetes. To increase people's interest in corn-based food, a new idea or innovation is needed for corn processing, one of which is to make corn milk products. Milk is a product that is in great demand by the public, because milk has a sweet and delicious taste.

Diabetes mellitus (DM) is a chronic disease with an increasing incidence throughout the world. This disease does not only affect adults, but also affects children. Diabetes mellitus is characterized by an increase in blood sugar levels due to impaired insulin action, impaired insulin production, or both. Based on the cause, diabetes mellitus (DM) is grouped into four types, namely type-1 DM, type-2 DM, other types of DM and diabetes in pregnancy or gestational. Diabetes Mellitus at this time has become a problem that must be

addressed by a country, where the disease is increasingly experiencing an increase. Around 80% of diabetes mellitus has the potential to die [3].

Based on data from the Gorontalo Provincial Health Office in 2020, there are 122 cases of Diabetes Mellitus in Gorontalo City, Bone Bolango Regency occupies 1695 diabetics. Then North Gorontalo Regency with 968 people with diabetes mellitus, Pohuwato Regency with 394 people, Gorontalo Regency with 341 people, Boalemo Regency with 118 people. Based on the data above, the total number of people with diabetes mellitus in Gorontalo Province is 3638 people [4]. Diabetes is often associated with a healthy lifestyle, one indicator of someone living a healthy lifestyle is maintaining a healthy diet. A good diet also has a good effect on the body, such as maintaining normal blood glucose levels. Food with a low glycemc index value can be an alternative food to minimize the occurrence of an increase in blood sugar in the body. This statement is in accordance with the statement of Kusbiantoro [5] in the SAGO journal Nutrition and health, foods with high glycemc index values such as potatoes, white rice, white bread, sugar and drinks that have a sweet taste can make blood sugar levels rise by quickly, whereas foods with low glycemc index values, for example, such as brown rice and whole wheat bread, can slow the increase in blood sugar levels. Foods that have a low glycemc index value can slow down the rate of glucose absorption and will suppress the secretion of the pancreatic insulin hormone so that blood sugar levels do not spike [6]. Some of the previous studied about corn

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milk did not examine the carbohydrate content and glycemic index value of sweet corn milk. Based on this, researchers have studied the carbohydrate content and glycemic index of sweet corn milk (*Zea mays saccharata* L). The purpose of this study was to determine the carbohydrate content and glycemic index value of sweet corn milk (*Zea mays saccharata* L).

2 Material and method

2.1 Materials and tools

This research was conducted in the Biochemistry Laboratory of the Department of Biology, State University of Gorontalo, involving 8 respondents who met the criteria to become research respondents. The criteria for becoming a respondent in the study are as follows:

1. Have a normal body mass index (BMI) 18.5-25 kg/m²)
2. Has no history of diabetes
3. Have a healthy body
4. Also not taking drugs

The research method used in this research is descriptive quantitative by describing the results of the index value of corn milk. The procedure for making corn milk uses the Process of Making Corn Milk Muhajir et al, (2014) with a few modifications. The process of making corn milk in this study was in Figure 1.

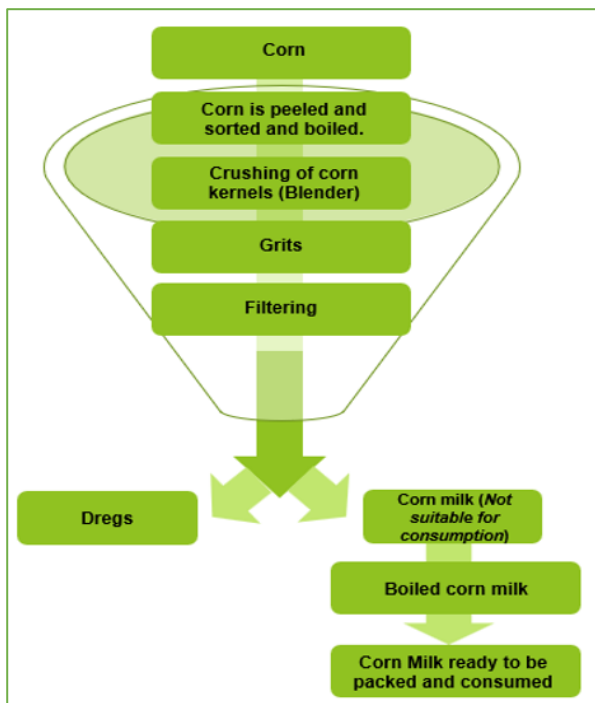


Fig. 1. Process diagram for making corn milk (adapted by Muhajir *et al* 2014).

Corn was shelled and sorted to avoid caterpillars and then washed, then boiled for 20 minutes, then the corn would be crushed by means of a blender. The corn in the blender is added with enough water, after the crushing process is complete. It will produce corn grits, then enter the filtrate stage. The grits are filtered using a

cloth. After the filtering process is complete, dregs and corn milk will be produced, but the milk is not suitable for consumption. After the filtering stage, then the corn milk is boiled without the addition of any substance or solution (pure corn milk). After the boiling process of corn milk is complete, corn milk will be produced which is ready to be packaged and consumed [7].

The object of this research is the glycemic index value of corn milk. The glycemic index value is obtained by comparing the area under the curve between the reference food and the test food and then multiplying it by 10. The calculation of the glycemic index (GI) value uses the following formula [8] :

$$GI = \frac{\text{The area under the blood glucose curve of the test food}}{\text{The area under the reference food blood glucose curve}} \cdot 100 \quad (1)$$

To calculate the area under the curve, the formula is used (Brouns et al. in Avianty and Fitriyono, 2014):

$$L = \frac{\Delta 30t}{2} + \Delta 60t + \frac{(\Delta 30 - \Delta 60)t}{2} + \Delta 90t + \frac{(\Delta 60 - \Delta 90)t}{2} + \Delta 120t + \frac{(\Delta 90 - \Delta 120)t}{2} \quad (2)$$

Information :

- L = Area under the curve
- t = Time interval for blood collection (30 minutes)
- Δ30 t = Difference in blood glucose levels 30 minutes after loading with fasting
- Δ60 t = Difference in blood glucose levels 60 minutes after loading with fasting
- Δ90 t = Difference in blood glucose levels 90 minutes after loading with fasting
- Δ120 t = Difference in blood glucose levels 120 minutes after loading with fasting

3 Results and discussion

3.1 Carbohydrate

Carbohydrates are one of the nutrients needed by the body and function as energy producers. Based on the type, carbohydrates are divided into 2 types, namely simple carbohydrates and complex carbohydrates. The results of testing the carbohydrates in sweet corn milk are presented in Table 1.

Table 1. Sweet Corn Milk Carbohydrates.

Nutrient content	Ingredients (100 mL)
Carbohydrate	8.79 g

3.2 Glycemic Index

The glycemic index is the response to blood sugar levels when finished consuming a food compared to the same amount of reference carbohydrates [9]. To find out the value of the glycemic index of a food, humans are needed as subjects or respondents. The characteristics of the respondents considered in this study were age, body mass index (BMI) and health status. In this study, the average age of the respondents was 21.62 and the average BMI was 21.02. Age is one of the factors considered in this study, this was done because age is closely related to increased blood glucose levels. Increasing age in an individual is followed by progressive shrinkage of pancreatic β cells, resulting in fewer hormones being produced and causing an increase in glucose levels [9]. The criteria for respondents in this study are presented in Table 2.

Table 2. Characteristics of Research Respondents.

Respondents	0 Min ute	30 Min utes	60 Min utes	90 Min utes	120 Min utes
IKM	97	102	89	104	99
DRS	80	83	84	84	83
ARNs	74	74	74	74	76
RACE	78	119	90	76	80
MSB	91	99	92	86	95
ALJ	74	83	80	76	78
ENJOY	74	78	78	84	83
NNR	72	104	74	78	80
Average	80	92.75	82,62 5	82.75	84.25

Table3. Blood Glucose Levels of Research Respondents.

Respondents	Glycemic Index
IKM	54.54
DRS	26.19
ARNs	0.37
RACE	40.46
MSB	9.67
ALJ	10.91
NYD	5.14
NNR	19.21
Average	20.81

The Glycemic Index value of Sweet Corn Milk (*Zea mays saccharata* L) is presented in Table 4.

Table 4. Corn Milk Glycemic Index.

Name	Gender (F/M)	Age (Years)	Weight (kg)	Height (m)	BMI (kg/m ²)
IKM	M	21	46	1.55	19,1
DRS	M	22	63	1.70	21,8
ARNs	F	23	47	1.52	20,3
RACE	F	21	56	1.52	24.2
MSB	M	22	60	1.70	20.8
ALJ	M	20	56	1.65	20.5
NYD	P.S	23	44	1.49	19.8
NNR	P.S	21	63	1.44	21.7
Average		21.62	52.12	1.57	21.02

Based on the results of testing carbohydrates in sweet corn milk (*Zea mays saccharata* L), the carbohydrate value of sweet corn milk was 8.79 g/100 ml. Carbohydrate intake in a person is closely related to an increase in blood sugar levels. this is in accordance with previous research [4] there is a significant relationship between carbohydrate intake and blood sugar control in type II diabetics.

The glycemic index is the response to blood sugar levels when finished consuming a food compared to the same amount of reference carbohydrates. To determine the value of the glycemic index, that is by comparing the area under the glycemic response curve of the test food with the area under the glycemic response curve of the reference food [9]. Based on the results of calculating the average area under the curve of the test food (corn

milk) and the reference food (pure glucose) for each research respondent, the average GI (Glycemic index) of sweet corn milk was 20.81. The results of this calculation show that the glycemic index value of corn milk is in the low category [10]. In general, the GI value (Glycemic index) of food is divided into three groups, (GI ≤ 55), medium (GI 56-69), and high (GI ≥ 70). The value of the glycemic index in a food consists of 3 categories, foods with a low glycemic index are at , (GI ≤ 55), medium (GI 56-70), high (GI ≥ 70) [11]. Furthermore, in general, the range of food glycemic index is ≤ 55 which is included in the low category, 55-70 is in the medium category, ≥ 70 is in the high category [12].

In general, foods that raise blood glucose levels quickly have a high GI, while foods that raise blood sugar levels slowly have a low GI. In the journal SAGO Nutrition and Health revealed that foods with high glycemic index values such as potatoes, white rice, white bread, sugar and drinks that have a sweet taste can make blood sugar levels rise quickly, otherwise food with a low glycemic index value, for example, brown rice and whole wheat bread can slow the increase in blood sugar levels. Foods with a high glycemic index have an effect on increasing speed and increasing the amount of blood glucose quickly [13].

4 Conclusion

Based on the results of research that has been done, corn milk (*Zea mays saccharata* L) can be used as an antidiabetic food. This is because sweet corn milk has a low sugar content the average value of the glycemic index is 20.81 and belongs to the low category.

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