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Purple Corn (*Zea mays indurata*) Ice Cream as an Immune Booster in The Pandemic Era

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ABSTRACT

The COVID-19 pandemic has had an impact on public health. Immune resistance was a crucial factor in the pandemic era considering all diseases that arise as self-limiting diseases. Food as a source of nutrients had a vital role as an immunomodulator. As an agricultural country with food production commodities that were still massive, agricultural products are needed to develop food innovations, such as purple corn. One of the nutritional contents of purple corn was the flavonoid group in the form of anthocyanin compounds as a source of antioxidants to increase the body's immunity and prevent diseases caused by viruses, fungi, and bacteria, as well as prevent atherosclerosis, gastric damage, cholesterol, obesity, and others. Anthocyanin compounds in purple corn 70mg/100 grams. Anthocyanins in purple corn are processed into healthy food in ice cream with the product label "Purple Corn Ice Cream". This research aims to help people choose food innovations that can help them increase their immunity in the Covid-19 pandemic era. This ice cream product was formulated and has gone through several tests. The anthocyanin test results showed that the sample contained anthocyanins. The sensory test results stated that this product had a soft texture, milky smell, light purple colour, and sweet taste, so it was accepted and received a positive response from the community. Based on the total questionnaire assessment results, 88% of respondents accepted, it was expected to be a nutritious food innovation, popular with people regardless of age, practical, and durable with the content of flavonoid anthocyanin compounds in purple corn, which can improve the body's immune system during a pandemic.

Keywords: Pandemic, Immune, Anthocyanin, Purple Corn, *Zea mays indurata*, Ice Cream

INTRODUCTION

Nowadays, The Corona Virus Disease nineteen (COVID-19) pandemic has overwhelmed healthcare systems around the world, especially in Indonesia. This situation appears to be a crisis for the country and

requires the government to manage the pandemic as soon as possible before it worsens. Instead, the government of Indonesia and many countries worldwide have taken steps to solve the impact of COVID-19 by creating sequence policies such as local lockdown and imploring people to do healthy lifestyle, physical distancing, using a mask, take a vaccine, and so forth. Nevertheless, COVID-19 is an infectious disease caused by a virus called SARS-CoV-2, and just like other infectious diseases, COVID-19 is classified into a self- limiting disease that is typically not affected by any medication and tends to persist. How long our body would take to recover from the COVID-19 is depending on how strong our immunity is and whether we have any serious health condition or not. That is why we need an immunomodulator intake as an immune booster to fight against the virus (Hidayah et al., 2014). Immunomodulator are substance that can modulate (alter or affect) the body's immune system in an average direction (Praworo, 2011).

One of the best ways to increase immunity and help to make it stronger is with some particular food. Certain nutrients in foods are vital in maintaining our health and boosting the immune system, such as flavonoids (Devagaran and Diantini, 2012). Purple corn contains high amounts of anthocyanin flavonoids, which is 70mg/100gram (PT. Advanta Seeds Indonesia, 2019). As an agrarian country, purple corn is one of the commodities cultivated quite massively in Indonesia, especially in the last decade. However, the utilization of purple corn into innovative food products, efficacious, and high selling value's products is still relatively rare. The population of purple corn in Indonesia is not as much as yellow and white corn, but the nutritional content is much higher than other genotypes (Nursa'adah et al., 2017). Purple corn contains anthocyanin, an antioxidant to boost the immune system, prevent atherosclerosis, disease blockage of blood vessels, lose the stomach to damage, inhibit tumour cells, improve eye vision ability, and serve as anti-inflammatory compounds that protect the brain from violence (Nursa'adah et al., 2017). The research results from Pamandungan and Ogie (2017) also reinforce that purple corn with a high anthocyanin content acts as an antioxidant compound in improving immunity and prevents several diseases such as cancer, cholesterol, and coronary heart.

The nutritional content of purple corn needs to be innovated through food to introduce purple corn as an alternative intake rich in efficacy, especially as an immunomodulator. This innovative food can be applied in products favoured by most society: children, adolescents, and adults, one of them is ice cream. Referring to the current research results, the consumption of ice cream continues to increase every year and make ice cream the most favourite food in all circles (Sianipar et al., 2016). Departing from above, we are interested in creating a food innovation in purple corn-based ice cream as a processed food that can be consumed to increase immunity during the COVID-19 pandemic.

MATERIALS AND METHODS

Research Design

This study used a descriptive research design with a qualitative approach. The data were collected using previous research related to the topic, laboratory tests, questionnaires, and several literature sources.

Tools and Materials

The ice cream ingredients were purple corn, fresh milk, water, sweetened milk, sugar, whip cream powder, vanilla extract, and SP.

All ingredients except purple corn were bought from mini market. Purple corn is

obtained from agricultural land owned by PT. Advanta Seeds Indonesia in Papar Village, Kediri City, East Java Province, Indonesia.

The tools used in making ice cream include mixer, blender, knife, freezer, pan, basin, strainer, stoves, and ice cream package. While the tools for the anthocyanin test were test tubes, bunsen, pipette, measuring glass, and beaker glass.

Ice Cream Formulation

The first step in making ice cream was to peel and wash purple corn with clean water. Then the purple corn was blended with fresh milk and sweetened condensed milk until smooth. Next, the mixture was filtered and boiled until thicked. Next, the mixture cooled at room temperature. After the mixture cooled, it was mixed by adding whip cream and SP using a mixer for 10 minutes. Put the mixture in the freezer at a temperature of 1°C for 24 hours. Then remove the ice cream mixture from the freezer and mix again for 5 minutes until the mixture becomes smooth. Put the ice cream mixture into the package. Finally, put the ice cream into the freezer until frozen. The formulations of the ingredients for ice cream making ca n be seen in Table 1.

Research Variables

The independent variable used in this research was purple corn, while the dependent variables were anthocyanin, HCl reagent, and NaOH 2M.

Research Sample

The total panellist needed to try "Purple Corn Ice Cream" are 50 males and females of various ages, based in Malang, East Java, Indo. Panellist are randomly selected.

Organoleptic Test

The organoleptic test is a how-to test using the senses of humans as the primary tool for measurement receptivity to the product (Ningrum et al., 2017). An organoleptic test was carried out by preparing a test sample of purple corn and ice cream products. The senses used in assessing the nature of senses are the senses sight, touch, smell, and taste. Panelists were asked to explain purple corn and ice cream products' organoleptic (texture, color, smell, and flavor).

Hedonic Test

The hedonic test is used to measure the level of preference for a product. This preference is called the hedonic scale. Panelist shows their level of preference for each sample by choosing the category in accordance (Ningrum et al., 2017). Panellists used in the hedonic test was an untrained panellist of 50 people in the Malang area. Panellists were chosen randomly and came from various age groups. A sensory test was carried out using the questionnaire Google Form. Parameter tested in the form of texture, colour, aroma, taste, and total acceptance. The panellist's hedonic test scores started from (immensely dislike) to 5 (very much like).

Anthocyanin Test

Anthocyanin test used to determine the anthocyanin content in purple corn and product "Purple Corn Ice cream." Firstly, the sample was heated with 2M HCl for 2 minutes using a temperature of 100 °C, the colour of the sample was observed. If the red colour in the sample does not change (constant), it indicates a positive of anthocyanins. In the second step, the sample was mix by adding 2M NaOH dropwise. When the red colour changes to green blue and fades slowly, it indicates a positive of anthocyanins (Lestario et al., 2011).

RESULTS AND DISCUSSION

The organoleptic test is used to examine the physical appearance of the raw

material for purple corn and ice cream products, including texture, smell, colour, and taste (Table 2, 3).

The hedonic test was used to check the panelists' preferences regarding ice cream products. Thepopulation in this hedonic test is men and women who live in the Malang area with an age range from toddlers (3 years) to old adults (44 years), total of 50 panelists. The percentage of male panelists is 62%, and the percentage of female panelists is 38%.

Parameters tested in the hedonic test include texture, colour, smell, taste, and overallassessment of ice cream. Parameters were assessed using a score of 1-5 (very dislike-very much like) with a total of 50 panellists from various age groupsthrough the google form media (Table 4).

Based on the test results for filling out the question number 1 questionnaire, one panellist did not like it, five panellists were neutral, 21 panellists liked it, and 23 panellists liked the texture of the product "Purple Corn Ice Cream." The results of filling out the number 2 questionnaire, two panellists do not like it, eight panellists are neutral, 17panellists like it, and 23 panellists like the colour of the product "Purple Corn Ice Cream." The results of filling out the number 3 questionnaire show that one panellist does not like, nine panellists are neutral, 18panellists like, and 22 panellists like the smell of the product"Purple Corn Ice Cream." The results offilling out the number 4 questionnaire show that one panellist strongly dislikes it, twopanellists do not like it, 17 are neutral, 15 panellists like it, and 15 panellists like the taste of the product "Purple Corn Ice Cream." The processed product frompurple corn "Purple Corn Ice Cream" has good organoleptic (texture, colour, smell, and taste) to enjoy itby various ages, from children to old adults. Based on the results of filling out questionnaire number 5,there are six neutral panellists, 23panellists like, and 21 panellists who like the product "Purple Corn Ice Cream" as a whole. It proves that the processed purple corn product "Purple Corn Ice Cream" has received a positive response from the widercommunity.

Anthocyanin Test

Anthocyanin test was conducted to determine the secondary metabolite compoundsof anthocyanins in purple corn. The anthocyanin test was carried out using a phytochemical screening method. The samples tested were purple corn powder and ice cream products. The anthocyanin test results can be seen in the Figure 2.

Based on the anthocyanin test results using thephytochemical screening method, purple corn taken from thecultivation of the Malang area waspositive for anthocyanin. This positive result was indicated by the samples' colour changing (a and b) from purple to red on the heating reaction and the 2M HCl reagent. Meanwhile, the addition of 2M NaOH (c and d) has a positive result indicated by a change in the colour of the samplefrom purple to green. However,there is a difference in the positiveresults in the purple corn sample and the ice cream product.

The ice cream product had a lighter cheerful colour than the purple corn sample caused by reduced levels of anthocyanins while making ice cream products. Although the content of anthocyanin compounds in purple corn is quite large, processing treatments such as heating can reduce anthocyanin content in processed products. The heating result is the loss of some nutrients, especially labile ones such as ascorbic acid, anthocyanins, and beta-carotene (Budiarto, 1991).

Anthocyanins are natural dyes belonging to the flavonoid group with three carbon atoms bonded by an oxygen atom to connect two benzene aromatic rings (C6H6) in the main structure. As a bioactive compound, the arrangement of conjugated double bonds in the anthocyanin structure

makes anthocyanins function as natural antioxidant compounds in humans (Barrowclough, 2015). Anthocyanins can scavenge various types of reactive oxygen-derived free radicals, such as hydroxyl (OH*), peroxyl (ROO*), and single oxygen (O2*) (Azima et al., 2014). These free radicals in the body are formed by pro-oxidative enzyme systems, lipid oxidation, irradiation, inflammation, smoking, nicotine, other chemicals, and air pollution.

Antioxidants from anthocyanins have benefits in preventing various degenerative diseases, such as cardiovascular diseases, such as atherosclerosis, by inhibiting and reducing cholesterol levels in the blood caused by LDL oxidation (Wallace, 2011). The anthocyanin acylation process can increase antioxidant activity (Sari et al., 2015). Research says that anthocyanin is a valuable antioxidant to protect the body from free radical attacks and boost the immune system, prevent atherosclerosis, disease blockage of blood vessels, lose the stomach from damage, inhibit tumour cells, improve eye vision ability, and serve as anti-inflammatory compounds that protect the brain from violence (Nursa'adah et al., 2017).

According to laboratory results conducted by PT Advanta Seeds, the anthocyanin content in purple corn is 70 mg/100 gram, which means that in the total ice cream formulation, which is 500 grams of purple corn, there are 350 mg anthocyanins. This amount is quite large, so it has the potential to be processed into food products amid the urgency of the COVID-19 pandemic.

In addition, anthocyanins have high anti-viral, anti-fungal, and anti-bacterial activities (Hidayah et al., 2014; Saira and Kamran, 2017). Several types of flavonoids, such as anthocyanins, are thought to have biological activity in inhibiting several coronavirus proteins or preventing lung inflammation and cytokine storms which are severe consequences of SARS-CoV-2 infection (Tutunchi et al., 2020). Because it has many benefits, theflavonoid anthocyanin compoundscontained in purple corn have the potential to be used to improve the body's immune system during the COVID-19 pandemic.

CONCLUSION

Purple corn and "Purple Corn Ice Cream" products were positive for anthocyanins in Acid and Base test. In addition, "Purple Corn Ice Cream" products received a positive response from the public that can be seen from the total acceptance of ice cream by 88%.

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Figure 1. "*Purple Corn Ice Cream*" and purple corn

Table 1. The ice cream ingredients

Ingredients	Unit
Fresh milk	1000 ml
Purple corn	500 g
Water	300 ml
Sweetened condensed milk	200 g
Sugar	200 g
Whipe cream powder	150 g
Vanilli extract	1 tsp
SP	1 tsp

Table 2. Purple Corn Organoleptic Test Results

Parameter	Description
Texture	Hard seeds
Smells	No smell
Color	Blackish purple
Flavor	Tasteless

Table 3. "*Purple Corn Ice Cream"* Organoleptic Test Results

Parameter	Description
Texture	Soft
Smells	Milky
Color	Violet
Flavor	Sweet

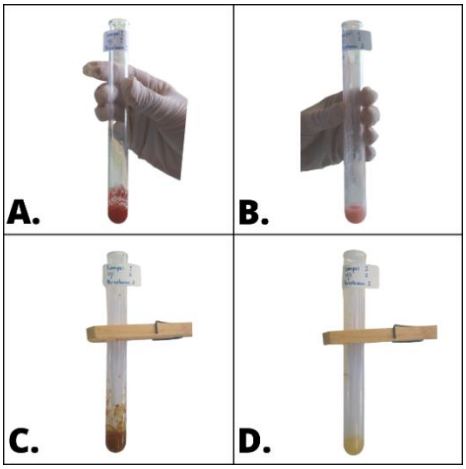

Figure 2. Anthocyanin test 1 of purple corn sample (a), Anthocyanin test 1 of Purple Corn ice cream sample (b), Anthocyanin test 2 of purple corn sample (c), Anthocyanin test 2 of Purple Corn ice cream sample (d)

Table 4. Hedonic Test Results

Questions	1	2	3	4	5
Texture of the product	0 (0%)	1 (2,2%)	5 (10%)	21 (42%)	23 (46%)
Color of the product	0 (0%)	2 (4%)	8 (16%)	17 (34%)	23 (46%)
Smell of the product	0 (0%)	1 (2,2%)	9 (18%)	18 (36%)	22 (44%)
Taste of the product	1 (2%)	2 (4%)	17 (34%)	15 (30%)	15 (30%)
Rate of the product	0 (0%)	0 (0%)	6 (12%)	23 (46%)	21 (42%)