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The Effect of Adding Koro Benguk (*Mucuna pruriens (L). Dc.*) on Acceptance and Physical Properties of Ice Cream

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Abstract

Ice cream is a frozen food product made through a combination of freezing and agitation processes. Adding koro benguk beans will increase the ice cream's nutritional value, especially fiber. This research aims to determine the effect of the addition of Koro Benguk Beans (Mucuna pruriens (L). Dc.) on acceptance, physical properties, and tests for ice cream fiber content. Research methods included experiments to see the effect of adding koro benguk beans to ice cream on acceptability, including color, aroma, texture, and taste, as well as physical properties, including overrun, melting speed, and the ice cream emulsion stability test. The method used was the completely randomized design (CRD) non-factorial with 3 treatments; the addition of koro benguk beans was 30 g, 40 g, and 50 g of the total milk used with three repetitions each. Based on the ANOVA analysis, the following organoleptic test results were found: (1) on color, the highest value was 3.89 (like); (2) on taste, the highest value was 3.89 (like); (3) on aroma, the highest value was 3.70 (like); and (4) on texture, the highest value was 3.65 (like). Meanwhile, for the physical test, the following results were found: (1) on overrun, the highest value was 23.07; (2) on melting speed, the highest value was 8.09; (3) on emulsion stability, the highest value was 32.13; and (4) on fiber content, the highest value was 1.43. The addition of 30 g, 40 g, and 50 g of koro beans significantly affected the panelists' preference level, physical properties, and fiber content of ice cream. It is hoped that further research on koro bean ice cream will lead to the processing of koro bean porridge being better filtered to produce a smoother texture.

Keywords: acceptance, fiber, ice cream, koro beans

Introduction

Ice cream is a frozen food product made through a combination of freezing and agitation processes in a mixture of milk and dairy products, sweeteners, stabilizers, emulsifiers, and flavor enhancers (Novavanti, 2018). Most Indonesians are very fond of consuming ice cream. This is because ice cream tastes sweet, cold, and can increase appetite. Ice cream with the addition of milk fat will provide an advantage in getting a smoother texture. The addition of a stabilizer in the manufacture of ice cream provides many benefits. In addition, the stabilizer can also extend the shelf life because it can prevent the crystallization of ice cream during storage. The stabilizer also increases the ability to absorb water so that the ICM (Ice Cream Milk) becomes thicker and the ice cream product does not melt easily (Novavanti, 2018). Indonesia has a variety of local foods that have the potential as alternative food sources and need to be developed to support food security, such as corn, beans, and tubers, which are used as alternative food ingredients in several regions (Yusuf Sukman, 2017).

There are various types of beans with various colors, varieties, and shapes, which have the potential to add variety and nutrients to various patisserie products. Many things have been done to increase the number of types of nuts, such as koro beans, green beans, and red beans, but the utilization of these types of beans is not yet popular or not widely known by the public. To further

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optimize the use of koro as a food ingredient, it is necessary to develop an innovation that can process koro benguk into a delicious yet nutritious product with high selling value. One of the popular forms of processed protein sources is ice cream. Processing koro into ice cream products will increase people's preferences, add nutritional value and provide added value from koro benguk as a food ingredient (Widiantara, 2019).

Koro Benguk is a plant that belongs to the Fabaceae (Leguminoceae) family and is widely distributed in the tropics. Koro Benguk can grow in areas with a height of 3-15 m above sea level and is a creeping plant. The koro benguk bean plant has axially arranged flowers. Koro Benguk flowers are white, lavender, or purple. The fruit is a pod protected by hairy skin. On average, each pod contains about five to seven seeds. The pods are uniformly elliptical in shape, with a length of 1 to 1.0 cm, a width of 0.8-1-3 cm, and a thickness of 4-5 cm. Benguk has several varieties that are distinguished by the color of the seed coat, namely white, striped, and black (Widiantara, 2019).

In terms of nutritional content, koro benguk beans have a nutritional value that is no less high than other nuts. Benguk contains relatively high carbohydrates, protein, and fiber while having low-fat content. Benguk seeds are rich in alkaloid compounds, prurienidine, -sitosterol, glution, lecithin, vernolic acid, and gallic acid. Benguk has several other bioactive substances, including tryptamine, alkylamine, steroids, coumarin flavonoids, cardenolides, magnesium, copper, zinc, manganese, and iron. The part of the koro benguk plant that is widely used by the community is its seeds. The use of koro benguk seeds is almost the same as soybean seeds, namely as a source of food. Compared to soybean seeds, the protein and fat contents of koro benguk seeds are lower, but the carbohydrates and fiber are higher; thus, the koro benguk seeds have the potential to overcome degenerative diseases. The seeds of this plant (Mucuna pruriens (L). DC.) are high in protein and low in fat (Widiantara, 2019).

One of the challenges of using koro benguk is the toxin naturally contained in the seeds of koro benguk, namely cyanide. Cyanide in its free form is cyanide acid (HCN). HCN is a compound that includes volatile, colorless, and bitter. HCN has a boiling point of 25.7°C. In its free state, HCN is very soluble in water. Due to its solubility properties, which are very soluble in water, HCN is very easy to remove from food. Cyanide compounds are found in foodstuffs as part of a sugar component (cyanogenic glucoside) or as a naturally occurring compound. The washing process in running water and sufficient heating is very effective in preventing the formation of toxic HCN. The cyanide found in raw benguk seeds is hydrogen cyanide (HCN), which is 11.05 mg/100 g. The cyanide content in koro benguk seeds can be reduced by soaking the koro benguk seeds for 3 days and then changing the water every day. The cyanide content in koro benguk will decrease to 0.3 mg/100 g (Barreto, I. F., 2019). Therefore, the selection of ice cream with the addition of koro benguk beans is because ice cream contains high fat. Thus, adding koro benguk beans will increase the nutritional value of ice cream, namely in the form of fiber, so the ice cream does not only contain fat but adds value to other nutrients, such as fiber and protein, without adding more fat content (Barreto, I. F., 2019).

Based on these problems, this "Koro Bean Ice Cream" is one of the new products that can increase the nutritional value of ice creams, and the author wants to investigate further "The Effect of Adding Koro Benguk (Mucuna pruriens (L). DC.) on Acceptance and Physical Properties of Ice Cream."

Methods

This research is an experimental study to see the effect of adding koro benguk beans to ice cream on acceptability including color, aroma, texture, and taste, as well as physical properties, including overrun, melting speed, and the ice cream emulsion stability test. Completely Randomized Design (CRD) non-factorial with three treatments, namely the addition of koro benguk beans was 30 g, 40 g, and 50 g of the total milk used with three repetitions each.

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The organoleptic test research was conducted at the Food Laboratory, Department of Nutrition, Poltekkes, Ministry of Health, Aceh. The research consisted of two parts: the preliminary test and the main research. The preliminary test was conducted in August 2021, and the main research was conducted in May 2022. The physical test analysis was carried out at the researcher's house in May 2022, and the Chemical Fiber test analysis was carried out at the Agricultural Laboratory of Syiahkuala University in May 2022.

Results
Organoleptic Test
The acceptability of ice cream with the addition of koro beans was assessed using organoleptic tests and the hedonic scale method to determine the extent to which the panelists' preferences for ice cream with the addition of koro beans were different in color, taste, aroma, and texture.

Table 1. Koro Nut Ice Cream Organoleptic Test Average

Treatment	Color	Flavor	Scent	Texture	Average
Addition of Koro Benguk, 30 g	3.81 [b]	3.41 [a]	3.63 [a]	3.22 [a]	3.51
Addition of Koro Benguk, 40 g	3.45 [a]	3.70 [b]	3.62 [a]	3.46 [b]	3.55
Addition of Koro Benguk, 50 g	3.89 [b]	3.89 [b]	3.70 [a]	3.65 [b]	3.78

Physical Properties
Table 2. Overrun Test Average, Melt Rate and Emulsion Stability Koro Nut Ice Cream

Treatment	Overrun	Melting Rate	Emulsion stability	Average
Addition of Koro Benguk, 30 g	23.07 [c]	8.09 [a]	25.97 [a]	19.04
Addition of Koro Benguk, 40 g	16.67 [b]	7.22 [b]	26.47 [a]	16.78
Addition of Koro Benguk, 50 g	14.28 [a]	5.49 [c]	32.13 [b]	17.3

Fiber
Table 3. Koro Nut Ice Cream Fiber Test Average

Treatment	Average
Addition of Koro Benguk, 30 g	1.09 a
Addition of Koro Benguk, 40 g	1.22 a
Addition of Koro Benguk, 50 g	1.43 b

Discussion
Organoleptic Value
Color
Color is a material property that is ascribed to the spread of the light spectrum. Color is not a substance or object, but a person's sensory because of the stimulation from a light source that falls on the sense of sight. Color is a physical property of food ingredients that can lead to consumer attachment and gives the impression of liking or disliking food products. In addition, color can also be used as an indicator of freshness or maturity. Whether the mixing or processing method is good or not can be indicated by the presence of a uniform and even color (Alifhia, N. D., 2022).
Based on the organoleptic test on color, the following Mung results were found: (1) the ice cream with the addition of 30 g of koro beans has a milky-white color; (2) the ice cream with the addition of 40 g of koro beans has a yellowish-white color; and (3) the ice cream with the addition of 50 g of koro beans has a white-yellow color. The color difference in the ice cream is influenced by the number of

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additions of different koro beans. The average values of the color test on ice creams in the treatment of adding 30 g, 40 g, and 50 g of koro beans, which were given by the panelists, were 3.81, 3.45, and 3.89, respectively. The ANOVA test results showed that there is an effect on ice cream analysis with the addition of 30 g, 40 g, and 50 g of koro beans. A calculated F-value of 4.756 was obtained, with a significant level (P value) of $0.011 < 0.05$. It was then continued with Duncan's test, and it was found that the most significant difference, in terms of color, was in the treatment with the addition of 40 g of koro beans, which resulted in a slightly lighter color. Therefore, the most preferred treatment was the addition of 50 g of koro beans.

Flavor

The taste of a product is crucial in determining its acceptability. The taste of food comes from the ingredients added during the manufacturing process, so it produces either a good or bad taste. Taste has five basic tastes: sweet, salty, sour, bitter, and umami. The five kinds of taste are influenced by the level of concentration of food ingredients that do not only consist of one taste. A combination of various flavors creates a complete taste (Alifhia, N. D., 2022). Based on the organoleptic test on the taste with the addition of 30 g, 40 g, and 50 g of koro beans to ice cream, it was found that each flavor has a strong milky taste, and the most dominant taste of koro beans is the treatment with the addition of 50 g of koro beans. In the ice cream treatment with the addition of 30 g of koro beans, the panelists gave a somewhat favorable response (3.41). The ice cream treatment with the addition of 40 g of koro beans gave a favorable response (3.70), and the ice cream treatment with the addition of 50 g koro beans gave responses like (3.89). The results of the ANOVA test are that there is an effect of ice cream analysis with the addition of 30 g, 40 g, and 50 g of koro beans with a calculated F value of 3.171 with a significant level (P value) $0.046 < 0.05$ where continued Duncan's test that the most different treatment in terms of taste was the addition of 30 g of koro beans with a slightly like taste, so the most preferred treatment was the addition of 50 g of koro beans.

Scent

Scent is the most difficult sensory property to classify and explain because of its huge variety. The aroma of a food product is a determinant of product quality and public acceptance (Alifhia, N. D., 2022). Scent determines the delicacy of the food. In terms of aroma, it is more concerned with the five senses of smell. The aroma spread by food is a very strong attraction and is able to stimulate the sense of smell so that it arouses the appetite (Natasya, N., 2019). Based on the organoleptic test on aroma, with the addition of 30 g, 40 g, and 50 g of koro beans on ice cream, it was found that each aroma treatment had a distinctive aroma of milk and koro beans. The ice cream with the addition of 50 g of koro beans received a favorable response (3.70). Then, the ice cream with the addition of 40 g of koro beans, the panelists gave a favorable response (3.63). Finally, the ice cream with the addition of 30 g of koro beans, the panelists gave a favorable response (3,62). The results of the ANOVA test were that there was no effect of ice cream analysis with the addition of 30 g, 40 g, and 50 g of koro beans with an F value of 3.473 with a significant level (p-value) $0.800 > 0.05$. The most preferred treatment in terms of aroma is the addition of 50 g of koro beans.

Texture

Texture is a pressure sensor that can be observed with the mouth when bitten, chewed, swallowed, or touched. Texture depends on the physical state, size, and shape of the product. Texture research can be in the form of a hard texture, and softness (Alifhia, N. D., 2022)
The texture and consistency of an ingredient will affect the taste caused by the material (Natasya, N., 2019).

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Based on the organoleptic results on the ice creams texture, the following results were found: (1) the texture produced in the ice cream with the addition of 30 g of koro beans was soft; (2) the texture produced in the ice cream with the addition of 40 g of koro beans was slightly rough; and (3) the texture produced in the ice cream with the addition of 50 g of koro beans was coarse. The ice cream with the addition of 30 g of koro beans received a somewhat favorable response (3.22). Then, the ice cream with the addition of 40 g of koro beans also received a somewhat favorable response (3.46). Finally, the ice cream with the addition of 50 g of koro beans received a favorable response (3.65). The result of ANOVA is that there is an effect of ice cream analysis with the addition of 30 g, 40 g, and 50 g of koro bean porridge with a calculated F value of 3.473 with a significant level (P value) 0.035 <0.05 where continued Duncan's test that the most different treatment in terms of texture was the addition of 30 g of koro beans with a slightly like texture so that the most preferred treatment was the addition of 50 g of koro beans.

Physical Properties
Overrun
    Overrun is one of the most important qualities in ice cream products. Overrun is the amount of increase in volume caused by the entry of air into the ice cream mixture. Air bubbles formed can be maintained because they are covered by a layer of fat globules in the emulsion system. Overrun can be generated due to stirring or shaking. The amount of shaking of the ice cream affects the swelling power of the ice cream. Overrun ice cream ranges from 60-100%, and good ice cream generally has an overrun of 80%. The overrun of ice cream produced by the factory is between 70-80%, while for the manufacture of ice cream in the home industry, it is usually around 35-50% (Alifhia, N. D., 2022). The analysis test of the results of the overrun of koro bean ice cream, in the treatment of adding 30 g of koro bean porridge, the average overrun was 23.07%. Then, the treatment of adding 40 g of koro bean porridge averaged 16.67%. Lastly, the treatment of adding 50 g of koro bean porridge averaged 14.28%. With the addition of koro beans, the overrun is lower. The results of the ANOVA test showed that there is an effect on ice cream with the addition of 30 g, 40 g, and 50 g of koro beans. A calculated F-value of 671.7 was obtained, with a significant level (P-value) of 0.00 < 0.05. It was continued with Duncan's test, and it was found that each treatment is in a different notation. Therefore, the best overrun is the addition of 30 g of koro beans compared to the other two treatments, with the standard overrun at around 35 to 50%.

Melting rate
    Melting rate is the time it takes for ice cream to melt completely at room temperature after freezing. Melting ice cream can be divided into two types, namely, melting in the mouth and melting when the ice cream is at room temperature. When heat from room temperature penetrates the structure of ice cream, the ice cream will dissipate latent heat, where this latent heat is the heat needed to change the shape of an object at a constant temperature. Therefore, in the first 10 minutes, there was a fairly high increase in the melting rate. When the temperature of the ice cream with the ambient temperature reaches the same point, the melting rate continues to increase steadily until the 20th minute, and after that, it decreases (Putri, L. J. K. 2021).
The analysis test results of the melting speed of koro bean ice cream in the treatment of adding 30 g of koro bean porridge had an average melting speed of 8.09 minutes, the treatment of adding 40 g of koro bean porridge the average melting speed of 7.22 minutes and in the treatment of adding 50 g of porridge koro beans average melting speed 5.49 minutes. The results of the ANOVA test are that there is an effect of ice cream analysis with the addition of 30 g, 40 g, and 50 g of koro beans with a calculated F value of 246.1 with a significant level (P value) of 0.00 < 0.05 where Duncan's test continues that each treatment is in different notations. Therefore, the best melting speed is the

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addition of 30 g of koro beans compared to the other two treatments when compared to the standard melting speed of ice cream, which is around 10 minutes.

Emulsion stability

Emulsion stability indicates the durability of the ice cream dough to the separation of milk protein and milk fat. An emulsion that is stable if no separation occurs. Emulsion stability is usually indicated by two conditions, namely, the process of cream formation and phase separation. One way to maintain the stability of ice cream is to increase its thickness by adding a stabilizer to the ice cream mixture (Ntau et al., 2021). Analysis test of the results of the stability of the koro bean ice cream emulsion in the treatment of adding 30 g of koro bean, the average emulsion stability was 25.97%. In the treatment of adding 40 g of koro bean, the average emulsion stability was 26.47%, and in the treatment of adding 50 g of koro bean, the average emulsion stability was 32.13%. The results of the ANOVA test are that there is an effect of ice cream analysis with the addition of 30 g, 40 g, and 50 g of koro beans with a calculated F value of 107.75 with a significant level (P value) $0.00 < 0.05$ where Duncan's test continued that the best and most stable ice cream in the emulsion stability test was the addition of 50 g of koro beans when compared between the other two treatments.

Fiber Content

The fiber content of ice cream in the treatment of adding 30 g of koro beans with an average value of 1.09, the addition of 40 g of koro beans with an average value of 1.22, and the addition of 50 g of koro beans with an average value of 1.43. The results of the ANOVA test are that there is an effect on the analysis of ice cream with the addition of 30 g, 40 g, and 50 g of koro beans with a calculated F-value of 12.493 with a p-value of $0.007 < 0.05$ where Duncan's test continued that ice cream with the addition of 50 g of koro beans had high fiber compared to the other two treatments.

Conclusion

The addition of 30 g, 40 g, and 50 g of koro beans significantly affected the panelists' preference level, physical properties, and fiber content of ice cream. It is hoped that further research on koro bean ice cream with the processing of koro bean porridge is better filtered to produce a smoother texture.

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