

Physicochemical properties of snackbar *canna edulis* ker with additional butterfly pea extract as functional food

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Abstract

Lifestyle is a subset of secondary human requirements that can shift with the times or a person's desire to alter himself. Consuming unhealthy meals that have a significant impact on blood sugar levels, such as fast food, soft drinks, and other forms of food, is one of the lifestyle modifications. Fiber-rich, low-glycemic-index, sodium-free snack bars for diabetics should be manufactured from natural components. Diabetic snack bars, such as diabetes, have been developed specifically for diabetics. This study aims to make snack bars with low gluten so that they are safe for consumption by everyone, including those who are prone to diabetes mellitus. The study used an Experimental (Posttest Only Design) research design with three treatments of 1 mg, 1.5 mg, and 2 mg of butterfly pea flower extract. Then an analysis of antioxidant activity, protein, fiber content, total sugar, fat carbohirat, texture, and a prganoleptic test was carried out which included color, aroma and taste. Based on the results of the analysis, the results of F1 were obtained as the best formulation.

Keywords: butterfly pea flower extract; snack bar; *canna edulis* ker; antidiabetic.

Practical Application: The use of canna tubers as a substitute for wheat flour in the manufacture of snack bars.

1 Introduction

Lifestyle is a subset of secondary human requirements that can shift with the times or a person's desire to alter himself. Many people nowadays disregard their health, which includes a diet heavy in fat, salt, and sugar, as well as an unhealthy way of life (López-Portillo et al., 2022). Consuming unhealthy meals that have a significant impact on blood sugar levels, such as fast food, soft drinks, and other forms of food, is one of the lifestyle modifications. Changes in lifestyle and food consumption habits are contributing to an increase in degenerative illnesses, including diabetes mellitus.

As the prevalence of diabetes mellitus rises, so does the requirement for snacks to satisfy nutritional needs and manage blood sugar levels. Snack bars with healthful components are available and can be used as an alternative (Ihuoma et al., 2022). Diabetics cannot utilize all sorts of snack bars available in the community as a diversion. Fiber-rich, low-glycemic-index, sodium-free snack bars for diabetics should be manufactured from natural components. Diabetic snack bars, such as diabetes, have been developed specifically for diabetics.

Increased utilization of diverse local food items has been aided by technological and information advancements. The butterfly pea is one of the native cuisine components that has recently received a lot of attention (Heredia-Leza et al., 2022). The butterfly pea possesses anti-oxidant, anti-cancer, anti-inflammatory, antipyretic, and antidiabetic properties. Apart from being a

natural anti-diabetic, the usage of the butterfly pea flower boosts the consumption of Indonesian food.

Tubers are infrequently employed in Indonesian cuisine, despite the fact that their substance is extremely healthy for the body (Vasanth Rupasinghe et al., 2020). Canna tubers have the potential to be a source of carbohydrates with total carbohydrates reaching 22.60% dry weight. Canna tubers are commonly used for the production of starch or flour. The share of tubers that can be consumed is 65.00% of the total weight of the tubers (Koswara, 2013). Cannabis flour contains carbohydrates 85.20 grams per 100 grams and protein 0.70 grams per 100 grams and fiber content is 2.20 grams per 100 grams (Dianty, 2017).

Based on the foregoing, including butterfly pea extract and canna tuber flour as fundamental food components allows for the production of a functional snack bar. The snack bar product's availability is intended to be utilized as an alternate meal interval for persons with diabetes.

2 Methods

The research method used is a two-factor Randomized Block Design (RAK) method with three treatments (F1 = 50% canna flour, 1 mg butterfly pea extract, F2 = 60% canna flour, 1.5 mg butterfly pea extract, F3 = 70% canna flour, 2 mg butterfly pea extract) and 4 repetitions. The analysis carried out included

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levels of antioxidant IC₅₀, total sugar, protein, fat, texture, carbohydrates, fiber, and organoleptic.

The manufacture of telang extract refers to Sunyoto et al. (2018) namely by means of fresh telang flowers dried using a vacuum dryer, then extracted using the ultrasound method for 90 minutes, Then the liquid extract is dried using a spray dryer by adding meltodextrine as a filler. Making canna flour is made by canna in thin pieces then dried using a cabinet dryer and mashed, after smooth then filtered using 80 mesh.

The process of making snack bars refers to Pradipta (2011) which has been modified. Making a cannabis flour snack bar with butterfly pea extract begins with weighing dry ingredients, namely cannabis flour, refined sugar, skim milk according to the formula and then mixed after that weighing the wet ingredients, namely eggs and margarine and then mixed and stirred until smooth so that the snack bar dough is obtained. Then printed with a size of 10 cm × 3 cm with a thickness of 1.5 cm. After that, the dough is put into a baking sheet that has been lined with baking paper. Then it is baked in the oven at 120 °C for 25 minutes. Once cooked, the snack bar is refrigerated for 10 minutes.

3 Results and discussion

3.1 Organoleptic test

The results of the statistical test of preference for the color of the canna tuber snack bar are shown in Table 1.

Based on the results of the statistical analysis of the three formulations of adding butterfly pea extract to organoleptic canna bulb snack bars, there was no significant difference in each treatment. This can be seen from the test results, namely a for F1, F2 and F3.

Color is a sensory attribute that can be measured using the sense of sight. Evaluation of product sensory quality can be tried by looking at the shape, dimensions, clarity, turbidity, pattern, and surface properties (Chusak et al., 2019). Based on Table 1, the average value produced ranges from slightly like to very like (6.83-7.00), the color of the snack bar is influenced by the anthocyanin pigment contained in the butterfly pea flower extract.

The butterfly pea flower extract snack bar is made with 3 formulations that produce a green color, this is in line with (Lakshan et al., 2019). Butterfly pea extract at pH 1 produces a pink color, at pH 4 produces a purple color, at pH 7 produces a blue color, and at pH 10 green color. So it is known that the anthocyanins in the butterfly pea flower have various colors, including red, purple, blue, and green. The color produced from the butterfly pea flower extract in the 3 formulas did not produce a significant difference because the use of the gram balance of the butterfly pea flower extract was not too much.

Although the average value produced spans from slightly like to very much like (6.70-6.90). Even though the butterfly pea flower has a unique scent, using it in a ratio of 1 mg to 2 mg does not affect the aroma. Another advantage of the butterfly pea flower, according to Cui et al. (2020), is that it has very little flavor and scent, which may diminish the sensory value.

A squeeze of lime, lemon, pineapple, and other citrus fruits may easily mask the flavor and scent. Food temperatures of less

than 20 °C or more than 30 °C, according to Gao et al. (2020), might impair the sensitivity of the human sense of smell, causing panelists to miss the usual fragrance of snack bars.

There is no substantial variation in taste preferences based on Table 1, yet the average value obtained varies from somewhat like to like (6.90-7.09). The snack bar developed in this trial had a somewhat sweet taste. The addition of butterfly pea flower extract to the three treatments did not affect the taste of the final snack bar, indicating that adding pea flower extract to the snack bar did not alter the snack bar's normal flavor. According to study by Lonz (2021), panelists dislike sweet meals since they are accustomed to them.

3.2 Chemical analysis of Antioxidant Activity

Based on Table 2. Each formulation has an influence on antioxidant activity, the more butterfly pea extract added to the antioxidant activity the higher. Blois defines antioxidant qualities as "very strong" if the IC₅₀ value is less than 50 ppm and "strong" if the IC₅₀ value is between 50 and 100 ppm. However, using the DPPH, ABTS, and FRAP methodologies, Tuan Putra et al. (2021) found that the antioxidant activity of butterfly pea flower is still lower than that of mangosteen peel (*Garcinia mangostana*), *Ardisia colorata* fruit, and jamblang fruit (*Syzygium cumini*).

The role of antioxidants is to repair cells that have been damaged by free radical oxidation in the pancreas. Antioxidants act by enhancing mitochondrial performance in pancreatic cells, allowing pancreatic beta cells to continue releasing insulin while remaining stable.

3.3 Protein content

Based on Table 3. There is an increase in protein levels in each formulation, but the addition of butterfly pea extract does not have a noticeable different effect from the silverware, because the perotein content in butterfly pea is not too high so it does not have an effect on every treatment. Formulation 3 had the

Table 1. Organoleptik of SnackBar Canna Edulis Ker.

Treatment	Color	Aroma	Taste
F1 (1 mg butterfly pea flower extract)	6.83 ± 0.02 ^a	6.83 ± 0.02 ^a	6.96 ± 0.02 ^a
F2 (1.5 mg butterfly pea flower extract)	6.86 ± 0.03 ^a	6.70 ± 0.01 ^a	6.90 ± 0.02 ^a
F3 (2 mg butterfly pea flower extract)	7.00 ± 0.03 ^a	6.90 ± 0.03 ^a	7.06 ± 0.02 ^a

Note: The average treatment marked with the same letter states that it is not significantly different at the 5% test level according to Duncan's test.

Table 2. Statistical Test Results of Antioxidant Activity.

Treatment	Antioxidant Activity IC ₅₀ (ppm)
F1 (1 mg butterfly pea flower extract)	318.59 ± 0.04 ^a
F2 (1.5 mg butterfly pea flower extract)	348.37 ± 0.01 ^b
F3 (2 mg butterfly pea flower extract)	377.23 ± 0.03 ^c

Description: The average value of the treatment marked with the same letter states that it is not significantly different at the 5% test level according to Duncan's test.

highest protein content of 8.68% with the addition of 2 mg of butterfly pea flower extract and the lowest was Formula 1 with the addition of 1 mg of butterfly pea flower extract. This is because the mixture of butterfly pea flower extract is the least compared to the other treatments, so it can be said that the more eggplant extract mixed into the snack bar, the higher the protein content. The protein content in F3 can contribute 15% i.e. 56 g. Protein can reduce blood sugar spikes in the body because it takes a long time to digest. Protein can inhibit the digestion of carbohydrates in the intestine so that glucose production will decrease which results in a decrease in blood sugar.

3.4 Fiber content

Based on Table 4. There is an increase in fiber levels in each formulation, but the addition of butterfly pea extract does not have a noticeable different effect from the silverware, because the fiber content in butterfly pea is not too high so it does not have an effect on every treatment. Dietary fiber has many benefits for the body, controls body weight, helps prevent colon cancer, and helps in controlling blood sugar (Bolek, 2020). The highest fiber content is found in F1 at 1.83%.

From the results of the analysis of the fiber content, it shows that the average fiber content in the snack bar contained is sufficient to contribute to the recommended fiber requirement, which is 3.6%.

3.5 Total sugar level

Based on Table 5. There is an increase in total sugar levels in each formulation, but the addition of butterfly pea extract does not have a noticeable different effect from the silverware, because the butterfly pea flower did not contain sugar, the statistical test

Table 3. Statistical Test Results of Protein Content.

Treatment	Protein Content (mg/g)
F1 (1 mg butterfly pea flower extract)	8.02 ± 0.01 ^a
F2 (1.5 mg butterfly pea flower extract)	8.35 ± 0.02 ^a
F3 (2 mg butterfly pea flower extract)	8.68 ± 0.03 ^a

Description: The average value of the treatment marked with the same letter states that it is not significantly different at the 5% test level according to Duncan's test.

Table 4. Statistical Test Results of Fiber Content.

Treatment	Fiber Content (%)
F1 (1 mg butterfly pea flower extract)	1.83 ± 0.03 ^a
F2 (1.5 mg butterfly pea flower extract)	1.54 ± 0.02 ^a
F3 (2 mg butterfly pea flower extract)	1.81 ± 0.02 ^a

Description: The average value of the treatment marked with the same letter states that it is not significantly different at the 5% test level according to Duncan's test.

Table 5. Statistical Test Results of Total Sugar.

Treatment	Total Sugar (%)
F1 (1 mg butterfly pea flower extract)	4.12 ± 0.02 ^a
F2 (1.5 mg butterfly pea flower extract)	4.41 ± 0.01 ^a
F3 (2 mg butterfly pea flower extract)	4.29 ± 0.02 ^a

Description: The average value of the treatment marked with the same letter states that it is not significantly different at the 5% test level according to Duncan's test.

of total sugar content did not demonstrate a significant difference, as shown in Table 5. When corn sugar is added, the percentage of total sugar content is calculated; the average value achieved is 4.12. According to Alyaa et al. (2021), offering a snack bar with natural sugar is preferable to giving pure glucose, which might cause blood sugar levels to rise in high responders. According to the American Diabetes Association (2014) and the World Health Organization (2016), snack bar products contain up to 25 grams of added sugar, making them 16.48 percent sugar.

3.6 Carbohydrate

Based on Table 6. The cannabis tuber snackbar with the addition of butterfly pea extract did not have a noticeable different effect on the carbohydrate content in the snackbar, it all happened because of the low carbohydrate content in butterfly pea extract.

3.7 Texture

Based on Table 7. The results of the analysis on snack bar show the cannabis tuber snackbar with the addition of butterfly pea extract it does not have a noticeable different influence on the texture. Changes in texture occur due to gluten content. Butterfly pea extract does not contain gluten so it does not change the texture of the snackbar.

3.8 Fat

Based on Table 8. The fat content analysis in the cannabis tuber snackbar with the addition of butterfly pea extract did not have a noticeable different effect on the fat content in the snackbar, it all happened because of the low fat content in butterfly pea extract.

Table 6. Statistical Test Results of Carbohydrate Content.

Treatment	Carbohydrate (%)
F1 (1 mg butterfly pea flower extract)	11.38 ± 0.01 ^a
F2 (1.5 mg butterfly pea flower extract)	11.39 ± 0.02 ^a
F3 (2 mg butterfly pea flower extract)	11.40 ± 0.02 ^a

Description: The average value of the treatment marked with the same letter states that it is not significantly different at the 5% test level according to Duncan's test.

Table 7. Statistical Test Results of Texture Content.

Treatment	Texture (Cf)
F1 (1 mg butterfly pea flower extract)	4.14 ± 0.02 ^a
F2 (1.5 mg butterfly pea flower extract)	4.15 ± 0.01 ^a
F3 (2 mg butterfly pea flower extract)	4.16 ± 0.01 ^a

Description: The average value of the treatment marked with the same letter states that it is not significantly different at the 5% test level according to Duncan's test.

Table 8. Statistical Test Results of Fat Content.

Treatment	Fat (%)
F1 (1 mg butterfly pea flower extract)	11.38 ± 0.02 ^a
F2 (1.5 mg butterfly pea flower extract)	11.39 ± 0.01 ^a
F3 (2 mg butterfly pea flower extract)	11.40 ± 0.02 ^a

Description: The average value of the treatment marked with the same letter states that it is not significantly different at the 5% test level according to Duncan's test.

4 Conclusion

The balance of butterfly pea flower extract in canna bulb snack bars with three treatments: F1 (1 mg butterfly pea flower extract), F2 (1.5 mg butterfly pea flower extract), and F3 (2.5 mg butterfly pea flower extract) (2 mg butterfly pea flower extract). The organoleptic test analysis of snack bar items with the inclusion of butterfly pea flower extract revealed no significant alterations in color, taste, scent, or texture. The results of the antioxidant activity test revealed a significant difference, with F1 having the highest antioxidant activity of 318.59 ppm. The results of the protein content analysis revealed a significant difference between F1 and F3, with F3 having the highest protein content, while the content of dietary fiber and total sugar content in the canna tuber snack bar revealed no significant difference.

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