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'CAMERUNIS' COOKIES ARE A NUTRITIOUS SNACK THAT CONTAINS A COMBINATION OF MOCAF FLOUR, BROWN RICE FLOUR, AND CINNAMON, WITH A LOW SUGAR CONTENT

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Abstract

Nutritionists frequently encounter difficulties in offering low-sugar snacks to individuals with diabetes due to their frequent snacking habits. Camerunis cookies are a recent advancement in the realm of culinary snacks, crafted with mocaf flour, brown rice flour, and cinnamon. These ingredients are renowned for their low glycaemic index. The purpose of this study is to alter low-sugar cookies for individuals with diabetes mellitus (DM) by including locally sourced ingredients. We employed a Completely Randomised Design (CRD) as our study methodology, seeing it as a genuine experiment. We conducted an experiment where we utilised 4 different procedures and replicated each treatment twice in order to create cookies. We prepared cookies by utilising locally sourced ingredients, specifically mocaf flour, brown rice flour, and cinnamon. Prior to conducting the Kruskal-Wallis test, we perform physical and organoleptic testing on the cookies. The panellists showed a preference for cookies treated with D due to their higher quantities of sugar, fibre, and antioxidants compared to other cookie formulae. Cookies Formula D can be a suitable low-sugar snack for individuals with DM.

Keywords: Camerunis Cookies, Low-Sugar Snack, Diabetes Mellitus.

INTRODUCTION

Diabetes mellitus (DM) is a persistent metabolic condition caused by insufficient insulin production by the pancreas or the body's inability to adequately use the insulin it produces[1]. Insulin is a hormone that plays a crucial role in maintaining the equilibrium of sugar levels. This has led to a rise in diabetes cases worldwide, including in Indonesia, on an annual basis[2]. According to the Organisation International Diabetes Federation (OIDF), the occurrence of DM is expected to progressively climb with age, reaching 578 million by 2030 and 700 million by 2045[3,4].

Snacking habits in people with diabetes mellitus today suggest a complex interplay between food choices influenced by multiple factors, including glycaemic control, personal preferences, and external circumstances such as the COVID-19 pandemic[5]. Research indicates that snacking is a common practice among patients diagnosed with both type 1 and type 2 diabetes, with a substantial majority partaking in this behaviour irrespective of their specific insulin treatment6. Curiously, the decision to have a snack is typically a voluntary one and is not typically influenced by treatment recommendations [6].

Cookies are highly popular treats due to their crisp texture when broken and the firm consistency of their cross-section[7]. The cookies are crafted utilising locally sourced ingredients such as mocaf flour, brown rice flour, and cinnamon, with the intention of making them accessible to the community, particularly individuals with DM[8]. Mocaf

flour shares the same attributes as wheat flour, being white, soft, and lacking the odour of cassava. Additionally, it is rich in calcium and fibre, free from gluten, and low in fat. Brown rice, which contains antioxidants, has the ability to protect non-communicable diseases such as coronary heart disease, cancer, diabetes mellitus, and high cholesterol levels[9,10]. Brown rice has a significant amount of dietary fibre, which has the ability to reduce blood sugar levels and hinder the absorption of glucose from food. Cinnamon, containing the chemical Methylhydroxychalcone polymer, can regulate blood sugar levels by enhancing insulin sensitivity in the body[11,128].

METHOD

This study used the Completely Randomised Design (CRD) technique, with 2 experimental replicates. The research methodology employed is actual experimental research. The research was carried out at the Food Technology Laboratory of the Nutrition Department of Poltekkes Kemenkes Yogyakarta to conduct organoleptic testing of cookies. The nutritional content testing was conducted at the Chem-Mix Prtama Laboratory Yogyakarta. The cookie recipe was created with a total of 4 ingredients, which are as follows:

Table 1: Formulation of Cookies made from Wheat Flour, Mocaf Flour, Brown Rice Flour, and Cinnamon (Camerunis)

Formulation	Wheat flour	Mocaf Flour	Brown Rice Flour	Cinnamon
T_{100}/A	100	-	-	-
$T_{65}M_{10}B_{20}K_5$/B	65	10	20	5
$T_{50}M_{15}B_{25}K_{10}$/C	50	15	25	10
$T_{35}M_{20}B_{30}K_{15}$//D	35	20	30	15

Description :

T : Wheat Flour

M : Mocaf

B : Brown Rice Flour

K : Cinnamon

A panel of 30 moderately trained panellists, who are students in the nutrition department at Poltekkes Kemenkes Yogyakarta in their sixth semester, conducted an organoleptic test on cookies. The test evaluated the cookies based on their colour, scent, texture, and taste. The data analysis involved employing descriptive analysis and statistical tests, specifically the Kruskal-Wallis test, which is suitable for non-parametric data. This research has obtained permission from the ethical commission of Yogyakarta Poltekkes Kemenkes with the assigned number e-KEPK/POLKESYO/0782/X/2021.

RESULT AND DISCUSSION

A. Organoleptic test results of 'Camerunis' cookies

The evaluation of organoleptic tests is utilised as a foundation for determining the optimal composition of Camerunis cookies. This test is evaluated from multiple perspectives including colour, scent, taste, and texture, utilising a Likert scale with a range of 7. Figure 1 displays the outcomes of the organoleptic test.

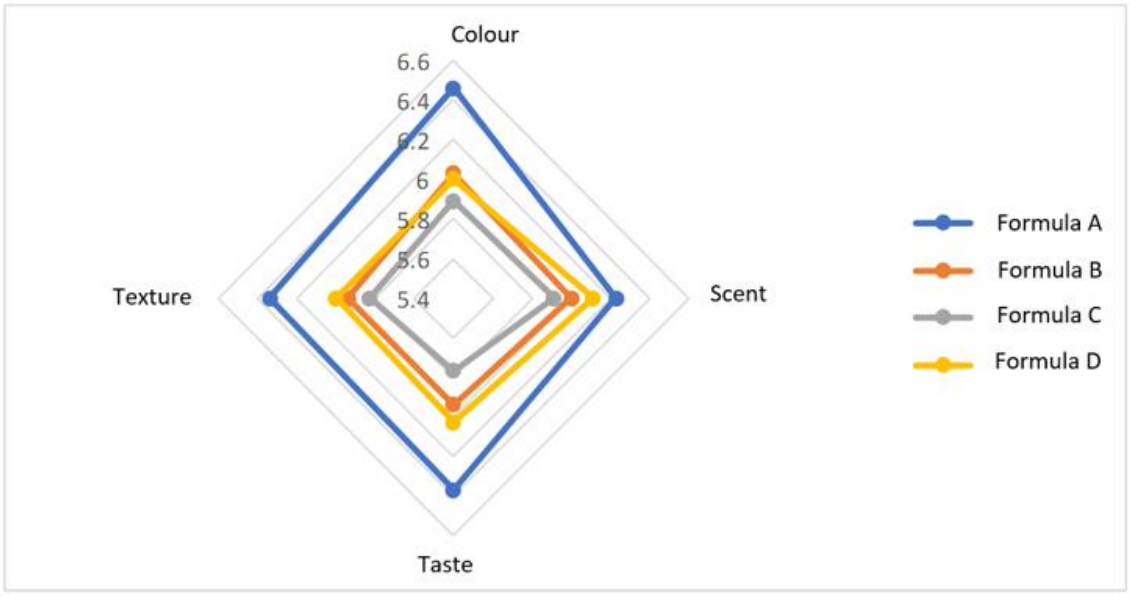

Figure 1: Spider Web uji organoleptik *Cookies* "Camerunis"

Figure 1 demonstrates that cookies formulated with A serve as the control group. Panellists' preferences are determined by evaluating the colour, scent, taste, and texture of the cookies. The panellists as a whole favoured treatment B for the colour aspect of cookies, which included a mixed formulation of mocaf flour, brown rice flour, and cinnamon. However, for the features of aroma, taste, and texture, the panellists chose treatment D.

The ingredients employed in the production of the pastries have an impact on the colour aspect. The colour of the cookies becomes progressively brown as more brown rice flour and cinnamon are added. The colour of the biscuits will also be influenced by the caramelisation process during the baking process[13–15]. The fragrance of 'Camerunis' cookies is affected by the use of mocaf flour, which shares the same scent as the "musty" perfume produced by the fermentation of cassava, the primary ingredient in mocaf flour [16]. The addition of cinnamon powder also impacts the fragrance of cookies. Among the various cookie formulae, formula C was found to be less preferred in terms of scent.

The 'Camerunis' cookies have a predominantly intense cinnamon flavour. The inclusion of cinnamon powder serves to diminish the unpleasant 'musty' scent and enhance the quality of the cookies. Increasing the concentration of cinnamon powder in the cookies will intensify the cinnamon flavour [8,17]. Cookies are defined by their crisp texture. The texture of cookies is determined by the primary components used in their preparation, including mocaf flour and brown rice flour[16,18].

B. Total sugar content of 'camerunis' cookies

The total sugar content refers to the combined amount of monosaccharides and oligosaccharides present in a food. Monosaccharides are basic sugars consisting of a single polyhydroxy aldehyde or ketone. Oligosaccharides are carbohydrates consisting of two to three sugar molecules. Disaccharides refer to oligosaccharides consisting of two sugar molecules, whilst trioses refer to oligosaccharides composed of three sugar molecules [19,20].

Table 2: Total Glucose Content of Cookies

Defferal	Total Glucose (%)			
	A	B	C	D
I	19,31	19,02	18,21	17,67
II	19,22	19,06	18,30	17,76
Mean	19,26 ± 0,06[a]	19,04 ± 0,03[b]	18,25 ± 0,06[c]	17,71 ± 0,06[d]

Description :

a,b,c,d = different letter notation indicates there is a difference at the Duncan test level ($p<0,05$)

Table 2 indicates variations in the overall sugar content across treatment A, B, C, and D. Increasing the proportion of ingredients such as mocaf flour, brown rice flour, and cinnamon in the combination will result in a decrease in overall blood sugar levels. Formula D has the most minimal aggregate sugar concentration in comparison to the other formulae, thus rendering it more advisable for those with DM as a snack option.

C. The fibre content of 'camerunis' cookies.

Dietary fibre is a component of plants that consists of carbohydrates and is not easily broken down or absorbed in the small intestine. Instead, it goes through a process of partial or complete fermentation in the large intestine[21]. Dietary fibre has various health advantages, including weight management or prevention of obesity, diabetes control, prevention of gastrointestinal problems, decrease of colon cancer risk, lowering of blood cholesterol levels, and protection of cardiovascular disease [22,23].

Table 3: Total dietary fibre content of cookies

Defferal	Dietary fibre content (%)			
	A	B	C	D
I	6,99	5,85	7,03	7,86
II	7,14	5,82	7,19	8,06
Mean	7,06 ± 0,10a	5,83 ± 0,02b	7,11 ± 0,11a	7,95 ± 0,144c

Description :

a,b,c = Different letter notations indicate differences at the Duncan test level ($p<0.05$)

Treatment D of the cookies had the highest dietary fibre content, averaging at 7.95%. On the other hand, treatment B had the lowest fibre level, averaging at 5.83%. The dietary fibre content of cookies generally rises in proportion to the higher proportion of brown rice and the use of a blend of mocaf flour. The reason for this is that mocaf flour contains 6 grammes of dietary fibre, which is more than the 4.6 grammes found in brown rice flour and significantly higher than the 0.3 grammes found in wheat flour [18]. The statistical test results, with a significance level of $p<0.05$, indicated that there were significant variations in total dietary fibre levels between treatments B and D. However, no significant differences in total dietary fibre levels were observed between treatments A and C.

D. Antioxidant content of ‘camerunis’ cookies

Antioxidants are substances that have the ability to trap free radicals derived from sources such as smoke, dust, pollution, and unhealthy eating habits. Antioxidant chemicals contribute an electron to unstable free radicals, thereby neutralising them and preventing interference with the body's metabolism [7,24].

Table 4: Antioxidant Content of Cookies

Defferal	Antioxidant Content (%)			
	A	B	C	D
I	17,72	23,12	37,79	48,24
II	17,61	23,24	38,03	48,12
Mean	17,66 ± 0,08a	23,180 ± 0,08b	37,910 ± 0,16c	48,180 ± 0,08d

Description :

a,b,c,d = different letter notation indicates there is a difference at the Duncan test level ($p<0,05$)

Cookies treatment D exhibited the highest antioxidant levels, with an average of 48.18%. On the other hand, Cookies treatment A, specifically the control Cookies in the T100 mixture, had the lowest antioxidant levels, with an average of 17.66%. This demonstrates that the level of antioxidants in cookies rises in proportion to the rising ratio of mocaf flour, brown rice flour, and cinnamon added. The statistical tests indicate that there are variations in antioxidant levels among the treatments A, B, C, and D.

Summary

'Camerunis' cookies that are most liked by moderately trained panelists are formula D when viewed from the aspects of aroma, taste and texture, while seen from the most preferred colour is cookie B. The more the number of ingredients added to the cookies, the more the total sugar content (%), fibre content and antioxidants.

Suggestıon

Based on the results of sensory tests, sugar analysis, dietary fibre analysis, and antioxidant analysis, cookies formulated with variations in the mixing of mocaf flour, brown rice flour, and cinnamon have been developed as snacks for individuals with diabetes mellitus (DM) who need to consume low-sugar, high-fiber, and antioxidant-rich foods. These cookies are referred to as formulation D.

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