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FIBER FORTIFICATION IN MODIFIED MUFFIN PRODUCTS MOCAF FLOUR AND OATMEAL

Muhammad Usamah Yusuf*, Wasiyem, Eliska
Public Health Study Program, Faculty of Public Health, Universitas Islam Negeri Sumatera Utara, Jl. William Iskandar Ps. V, Medan Estate, Percut Sei Tuan, Deli Serdang, North Sumatera 20371, Indonesia
*muhammadusamah09@gmail.com

ABSTRACT
MOCAF is a flour product that uses the principle of modifying fermented cassava cells and has a higher fiber content than wheat flour. The purpose of this study was to fortify fiber in muffin products by modifying using MOCAF flour and adding oatmeal, and organoleptic acceptable. This research method is a true experimental and Post-test only control group design. This research was conducted in 3 stages, namely the product development stage, acceptability test, and fiber content test. Fiber test results on modified muffins of 1.85 grams per 100 grams (1.85%). Based on the overall results, the acceptance test of modified muffins was acceptable in the community and the color aspect became the most desirable aspect by the panelists and fiber fortification on modified muffins was declared successful due to the increase in fiber content. Further research needs to be done in fiber fortification in muffin products, in order to further increase the fiber content in muffins significantly.

Keywords: fiber; fortification; mocaf; muffin; organoleptic

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INTRODUCTION

Passerie snacks or commonly referred to as Pastry Currently more and more widely circulated among the public because it tastes quite good and makes it which is still relatively easy. Patiseri comes from the French word "Patisserie" which means pastries or snacks. Patiseri can be interpreted as a science that studies continental, oriental and Indonesian cakes. Variations of patisserie are also formed with various techniques and different processing methods (Dinasty et al., 2020). The need for snacks is increasing in line with the changing times. Wheat flour food ingredients are often used in meeting the needs of processed foods including snacks in Indonesia. Wheat flour is flour derived from the grinding of wheat endosperm (Triticum aestivum). Wheat flour which is generally used as a basic ingredient for food contains gluten and also high water absorption and fiber content that tends to be low (Kusnandar et al., 2022).

Wheat flour made from wheat must go through the processing process again. The processing removes a lot of fiber and nutrient content and a lot through a chemical mixing process. So consuming wheat flour hardly provides any benefits for our bodies. On the other hand, the high gluten content in wheat flour can also have a negative and harmful impact on the body. If consumed too much, then gluten will adversely affect the digestive system, this can happen because gluten takes 6 hours to digest in the human body (Wisista, 2022). One snack that is

quite popular by using flour as a basic ingredient is muffins. Muffins are commonly known as cup-shaped cakes that are usually served in hot conditions and can be consumed as a heavy meal or snack. Muffins that are commonly developed today are classified as quick bread Because it uses chemical developers that can react quickly as a substitute for yeast which is a biological developer that reacts more slowly. Muffins It also has a dense texture, slightly lumpy in the fillings, and is similar in shape to a cupcake (Refiati, 2022)

Muffins are baked cakes that are usually small or only for one meal. There are two types of muffins that refer to different shapes and appearances. First, English muffins. English muffins are rolled, round and thin. The basic ingredients are made from bread dough fed with yeast. Second, American muffins. This type of American muffin uses baking powder and eggs as its developers. Muffins are molded into special muffin molds (Muffin Pan) where when the dough starts to rise it will bring out a crisp peak (Pangesti &; Ratnaningsih, 2022). But basically this muffin is still classified as a food that has a low fiber content. According to (United States Department of Agriculture 2020), quoted from (Ramadan &; Sofia Murtini, 2022). Regular muffins (plain muffins) contains only 0.8 g of total fiber per 100 g. The data shows Muffins In general, it has a fiber content that tends to be low.

Making muffins is also generally still made from wheat flour which contains high levels of gluten, so it cannot be consumed by everyone. Someone who has an allergy to gluten such as people with celiac disease (gluten intolerance) and Autism Spectrum Disorder (Autism) should avoid foods that contain gluten to prevent adverse effects that can further harm the body. Therefore, there is a need for alternative ingredients that can replace the use of wheat flour. The use of wheat-based wheat flour can be replaced with flour made from cassava, corn, and others (Rebecca &; Krisnadi, 2023). Cassava (Manihot esculenta Crantz) or often also called cassava is a source of carbohydrates and a type of local Indonesian food. As it is known that fresh cassava has The chemical composition consists of about 60% moisture content, 35% starch, 2.5% crude fiber (1.8 g), 1% protein content, 0.5% fat content and 1% ash content. Cassava is the most potential raw material to be processed into flour. One of the processed flours that use cassava is MOCAF flour (Sarno et al., 2022).

MOCAF (Modified Cassava Flour) commonly known as modified flour products that have been widely and commonly used in various food products. MOCAF flour is a derivative product of cassava using the principle of modification of fermented cassava cells, where the role of microbial enzymes dominates during fermentation. This flour is a flour commodity cassava (cassava) by fermentation technique. The resulting flour products have characteristics similar to wheat flour, which are white and soft and suitable for use as basic ingredients in the manufacture of food products. With characteristics similar to wheat flour, MOCAF flour can be an alternative commodity for wheat flour substitution so that wheat imports in Indonesia can be reduced (Anindita et al., 2020). MOCAF flour also has a higher fiber content than wheat flour. The fiber content in MOCAF flour can reach around 3.4% while the fiber content in wheat flour only ranges from 2-2.5% in a count per 100 grams. The lower fiber content in wheat flour results in wheat flour having softer characteristics and higher gelation than mocaf flour (Salim, 2024). The prospect of developing MOCAF flour from cassava in Indonesia is promising. This is supported by several factors, such as the potential of abundant cassava raw materials in Indonesia, more competitive selling prices than wheat flour, and the functional advantages of MOCAF better than wheat flour. In addition, the characteristics of MOCAF flour that are similar to wheat flour make it very suitable to replace wheat flour as a basic ingredient in the food industry (Helmi et al., 2020)

Subagio (2007) said, the thing that can distinguish MOCAF compared to cassava flour or tapioca flour is that MOCAF is processed through a fermentation process to modify cassava cells by utilizing lactic acid bacteria (BAL). This fermentation process produces different flour characteristics, even better than wheat flour and tapioca. Some of the characteristics of the flour include the degree of viscosity, gelability, rehydration power, color, aroma (Flavor), digestibility, high fiber content, and better dissolution and lower toxicity. The absence of gluten content in MOCAF makes this flour more tolerant for people with autism, diabetes, allergies, and digestive diseases. (Helmi et al., 2020) The addition of oatmeal as a modification to the ingredients for making muffins was also carried out in this study. Oats (Avena sativa) has been known since ancient Greece. Oats in Indonesia are also known as oatmeal. The structure of oat seeds is almost similar to wheat. Oats include complex carbohydrates and also contain high levels of fiber so that it takes longer to be digested by the body, which can help eat less by slowing digestion resulting in a longer satiety effect. There is a dietary fiber content of 10 g per 100 grams of oatmeal (Utami et al., 2020).

Based on the description above, researchers are interested in making processed muffin products that have a higher fiber content compared to ordinary muffins by substituting MOCAF flour as a basic ingredient and adding oatmeal as a modified ingredient that can add fiber to muffins. It is expected that this processed food product can be a healthy snack and has a higher fiber content than muffins in general and fiber fortification in this muffin can make this product an alternative in the prevention of diseases caused by fiber deficiency such as obesity, diabetes and digestive problems. The purpose of this research is to fortify (enrich the content) of fiber in muffin products by substituting basic ingredients using MOCAF flour and adding oatmeal as a modified ingredient that aims to get a higher fiber content than ordinary muffins and can be accepted among the community organoleptic (based on likes and desires).

METHOD

This research is a type of quantitative research conducted using true experimental research design and using Post-test only control group design. Then the results of this study are analyzed descriptively. This type of research is used to describe or describe existing data. This research is carried out in 3 stages, namely the product development stage (which includes the manufacturing process and product modification), acceptability test, and fiber content test. The research conducted was the substitution of MOCAF flour in making oatmeal modified muffins to untrained panelists. Muffin product samples were given to untrained panelists to perform an acceptability test using a hedonic test with a suspension method that was assessed in terms of color, aroma, texture, and taste. By using 5 rating scales, namely dislike, dislike, like, very like, and very, very like. The untrained panelists in this study were 32 students of the Faculty of Public Health UIN North Sumatra with criteria not to be sick and willing to take part in the organoleptic test process. The data from the acceptance test that has been collected will then be processed using SPSS Software to see the frequency distribution of the assessment of aspects of color, aroma, texture, and taste.

The making of oatmeal modified muffins was carried out at the researcher's house (srigunting complex block 5A Sunggal), and the fiber content test was carried out at the laboratory of the Center for Standardization and Industrial Services (BSPJI) Medan. This research will be conducted in March-April 2024. The process of making oatmeal modified muffins is done by mixing dry ingredients and wet ingredients. The first process is by first mixing dry ingredients into one consisting of 130 grams of MOCAF flour, 50 grams of palm ant sugar, 1 tsp baking powder, 2 tsp oatmeal, 50 grams of fiber cream (as a substitute for milk) and as a flavor

variant add choco chips to taste. The second process is by mixing the wet ingredients in another container consisting of 2 eggs, 1 tsp vanilla essence and 50 gr butter that has been melted and cooled for a while first. After the dry material and wet material are thoroughly mixed separately, pour the wet material into the dry material container and stir until evenly distributed. After all the ingredients are mixed evenly, pour the dough into the muffin pan and sprinkle choco chips on the surface of the dough according to taste. Preheat the oven then bake the dough at about 160-180°C for 25-30 minutes (until the dough is fully cooked).

RESULTS

From the results of the acceptability test conducted on 32 untrained panelists who are FKM UINSU students on oatmeal modified muffin products, the results of the frequency distribution were obtained as follows.

Table 1.
Distribution of Acceptability of Color Aspects in MOCAF Modified Oatmeal Muffins

Evaluation	f	%	Valid Percent	Cumulative Percent
Do Not Like	0	0	0	0
Do Not Like it Much	1	3,1	3,1	3,1
Like	8	25,0	25,0	28,1
Really Like	18	56,3	56,3	84,4
Very Very Like	5	15,6	15,6	100,0
Total	32	100,0	100,0	

Table 1 which presents color aspects, that of the 32 panelists, the majority of panelists really liked the color of muffins as many as 18 panelists (56.5%). Then the least is those who expressed dislike for the color of the muffin as much as 1 panelist only (3.1%) and there were no respondents who did not like the color of this muffin product.

Table 2.
Distribution of Acceptance Aspects of Aroma in MOCAF Modified Oatmeal Muffins

Valuation	f	%	Valid Persen	Cumulative Percent
Do Not Like	0	0	0	
Do Not Like it Much	1	3,1	3,1	
Like	11	34,4	34,4	37,5
Really Like	15	46,9	46,9	84,4
Very Very Like	5	15,6	15,6	100,0
Total	32	100,0	100,0	

Based on the frequency distribution in table 2 which presents aroma aspects, dominated by panelists who really like the color of the muffin, which is as many as 15 panelists (46.9%), then the least are panelists who express dislike for the aroma of this muffin product which amounts to only 1 panelist (3.1) and no panelist who expresses dislike the smell of this muffin product.

Table 3.
Distribution of Acceptability of Texture Aspects in MOCAF Modified Oatmeal Muffins

Valuation	f	%	Valid Persen	Cumulative Percent
Do Not Like	0	0	0	0
Do Not Like it Much	1	3,1	3,1	3,1
Like	13	40,6	40,6	43,8
Really Like	15	46,9	46,9	90,6
Very Very Like	3	9,4	9,4	100,0
Total	32	100,0	100,0	

Based on the frequency distribution in table 3 which presents the texture aspect, that of the 32 panelists, the majority of panelists chose very much like the texture of the muffins as many as

15 panelists (46.9%), then the least were those who expressed dislike for the texture of the muffins which were only chosen by 1 panelist, and there were no panelists who expressed dislike about the texture of this muffin product.

Table 4.
Distribution of Acceptability of Taste Aspects in MOCAF Modified Oatmeal Muffins

Valuation	**f**	%	Valid Persen	Cumulative Percent
Do Not Like	0	0	0	0
Do Not Like it Much	2	6,3	6,3	6,3
Like	7	21,9	21,9	28,1
Really Like	15	46,9	46,9	75,0
Very Very Like	8	25,0	25,0	100,0
Total	32	100,0	100,0	

Based on the frequency distribution in table 4 which presents the taste aspect, that out of 32 panelists, more panelists chose the level of liking the taste of this muffin product with a total of 15 panelists (46.9%), then the least was choosing less like for the taste of muffins as many as 2 panelists (6.3%), and no panelists who expressed dislike the taste of this muffin product. Based on the data from the frequency distribution above, it can be seen that the color aspect of this muffin product is the most desirable aspect and more acceptable to the panelists with a percentage of 56.3% at the level of very like, compared to the other three aspects, namely aspects of aroma, texture and also taste which each percentage is only 46.9% at the level of very like.

Table 5.
Fiber Content Test Results

No	Product Name	Parameter	Test Results	Test Method
1.	Muffin Modifikasi Oatmeal	Crude Fiber	1,85%	SNI 01-2891-1992

Based on the results of fiber content tests conducted at the laboratory of the Center for Standardization and Industrial Services (BSPJI) Medan on oatmeal modified muffin products, the results of fiber content were obtained at 1.85 grams per 100 grams (1.85%).

DISCUSSION

Color Value

Based on the acceptability test of the color produced by muffins made with MOCAF flour and the addition of oatmeal showed the highest score of 18 (56.3%). With categories very likes. Color is usually the first impression in the assessment of product quality using the sense of sight. Panelists will be more interested in tasting the product if it has an attractive color as it will arouse their curiosity about the food. The color of this muffin product is slightly brownish due to combustion poses and the addition of palm ant sugar which has a significant role to make the color of this muffin browner. The color of this modified muffin tends to be darker than ordinary muffins *(plain muffins)* which have a more golden or yellowish color and tend to be lighter.

This is in line with the results of the study (Fakhirani, 2019) which states The results of the panelists' assessment of color, the criteria that received the highest assessment were brown in all treatments from T3 with a percentage of 60.0%, T2 with a percentage of 56.7%, and T1 with a percentage of 53.3% The appearance of brown color in muffins can be caused by a number of factors, one of which occurs due to the maillard reaction. Maillard reactions are also known as non-enzymatic browning reactions. Its hot atmosphere creates nitrogen polymers, which give food its brownish color. In addition, the addition of palm sugar that changes the product to a brownish color is another significant influence.

Aroma Value

Based on the acceptability test of the aroma produced by muffins made with MOCAF flour and the addition of oatmeal showed the highest score of 15 (46.9%). With categories very likes. Scent is a subjective assessment of quality using the sense of smell. From the general smell, consumers know what ingredients are used in the product. The distinctive aroma of sweet potatoes produced from MOCAF flour in making muffin products is not too significant because it is covered by the aroma of additional ingredients such as vanilla essence and butter. While in ordinary muffins *(plain muffins)* the aroma produced is only pure from additional ingredients. This research is in line with the results of the study (Hanafiah, 2023) explain On the aroma parameter, all brownies were favored by the panelists but the highest score was given by the panelists at P2. The resulting aroma is still typical of chocolate. The increase in MOCAF and banana flour with a composition of 40% wheat flour, 40% MOCAF and 20% male banana flour has little effect because it is covered by the aroma of chocolate bar additives. an increase in the proportion of banana flour and MOCAF flour and a decrease in the composition of wheat flour do not affect the aroma of brownies, because the aroma of banana flour and MOCAF is affected by additional ingredients such as chocolate and margarine so that the aroma is more dominant.

Texture Value

Based on the acceptability test of the aroma produced by muffins made with MOCAF flour and the addition of oatmeal showed the highest score of 15 (46.9%). With categories very likes. Texture is a subjective assessment of quality based on the sense of touch. This acceptability test is related to the appearance of the product which can affect the overall panelists' assessment of the muffin products presented. The texture of a food ingredient will affect the taste caused by the material. In making muffins using MOCAF flour, the resulting texture is slightly dense and fibrous and tends to be dry because there is no gluten content that serves to increase the chewiness of the dough. While in ordinary muffins *(plain muffins)* the texture tends to be softer due to gluten content. This research is in line with the results of the study (Arifin et al., 2023) which states that based on the results of statistical analysis, the treatment of the ratio of breadfruit flour and banana flour composition in making white bread has a real influence ($P \leq 0.05$) on the texture of the white bread produced. The texture of white bread gets denser as breadfruit flour increases and more tender as banana flour is used. This is because breadfruit flour does not contain gluten which makes the nature of bread tend to be dense. The hardness of bread is caused by a decrease in bread volume due to a decreased rate of development and due to reduced gluten levels so that the gas that can be held decreases. If the amount of gluten in the dough is small, it causes the dough to be less able to withstand gas, so the pores formed in the dough are also small. As a result, the dough does not rise properly, then after burning is complete, it will produce a product that tends to be dense.

Taste Value

Based on the acceptability test of the taste produced by muffins made with MOCAF flour and the addition of oatmeal showed the highest score of 15 (46.9%). With categories very likes. Taste is a subjective assessment of quality using the sense of taste or taste buds. Taste is one of the determining factors in the assessment of a product acceptable or not by the panelists. The taste produced from MOCAF flour in making muffins has no effect. The taste of muffins is influenced by the addition of other ingredients such as palm ant sugar, *choco chips,* and butter so that the taste caused tends to be sweet. Plain *muffins generally* also have a sweet taste obtained from additives such as sugar and others. This research is in line with the results of the study (Fakhirani, 2019) which states the results of the panelists' assessment of taste, the criteria that get the highest rating for sweetness in T2 treatment with a percentage of 60.0%

and T1 treatment with a percentage of 53.3%, and for slightly sweet taste in T3 treatment with a percentage of 53.3%. No influence from muffins yellow pumpkin flour and MOCAF flour to the resulting taste. The taste of muffins is influenced by the addition of other ingredients such as palm sugar, margarine, eggs and soy juice. The ingredients added will give a generally sweet taste to muffin products.

Fiber Content

According to (United States Department of Agriculture 2020), quoted from (Irsyad 2022). *Plain muffins* contain a total of 16 g of fat and 0.8 g of total fiber per 100 g of plain *muffins*. The data shows *muffins* in general have a fiber content that tends to be low. From the test results of the fiber content obtained by this oatmeal modified muffin product, which is 1.85 grams per 100 grams, so that the modifications made in this study succeeded in increasing the fiber content of muffins compared to the fiber content of ordinary muffins *(plain muffins)* due to the fortification process by substituting MOCAF flour as a basic ingredient to replace wheat flour which is generally used in making muffins, as well as the addition of oatmeal as a modification ingredient.

For Indonesians, individual fiber needs vary depending on age and gender. Individual fiber requirements based onDaily Value(RDA) in women aged 19-29 years as much as 32 grams per day, while men as much as 37 grams per day, so it is expected that this modified muffin can be an alternative additional food in meeting the adequacy of daily fiber. (Ministry of Health, 2022). By eating about 7 muffins of this modification, it can obtain a fiber content of 6.4 grams or 20% of the daily fiber intake that must be met. As mentioned earlier, MOCAF flour also has a higher fiber content compared to wheat flour. The fiber content in MOCAF flour can reach around 3.4% while the fiber content in wheat flour only ranges from 2-2.5% in a matter per 100 grams (Salim, 2024). The addition of oatmeal as a modification to the ingredients in making muffins is also done because oats include complex carbohydrates and also contain high fiber content so that it takes longer to be digested by the body, which can help eat less by slowing digestion so that it causes a longer satiety effect (Utami et al., 2020). The fiber content in oatmeal modified muffins is even better than some fruits such as grapes that only have a fiber content of 0.9 grams in 100 grams, and also tomatoes that only have a fiber content of 1.5 grams in 100 grams.

CONCLUSION

Based on the results of research on acceptability tests that include assessment of color, aroma, texture and taste, the majority of panelists chose a very like assessment and it can be concluded that the substitution of MOCAF flour and oatmeal modification in making muffins can be very well received among the public, and fiber fortification in modified muffins of MOCAF flour and oatmeal was declared successful because of the increase in fiber content in modified muffins Compared to plain muffins from 0.8 grams per 100 grams, to 1.85 grams per 100 grams.

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