Sensory characteristics of sweet bread from the flour of minor tubers fermented with fungi and bacteria as flour composite flour

R Aprilianty, T Karo* and Ridwansyah

Department of Food Science and Technology, Faculty of Agriculture, Universitas Sumatera Utara, Medan, Indonesia.

E-mail: *teripkar@yahoo.co.id

Abstract. Wheat flour is the main raw material for making bread, but with the increase in flour imports, it is necessary to reduce flour by utilizing flour from local plants such as minor tubers which have nutritional value that is not less competitive than wheat flour. Minor tubers have high crude fibre content which can damage the texture, so fermentation is necessary to reduce the crude fibre content. The purpose of this study was to know the sensory characteristic of sweet bread to raw material minor tuber flour modified by fermentation using fungi and bacteria and to get flour that has good quality. This study used a randomized block design method (RBD) 2 factors, namely variations of tubers (V): (Taro tubers, Canna tubers, Arrowrot tubers) and types of microorganisms (M): (Trichoderma harzianum, Aspergillus niger, Bacillus subtilis). The results showed that the type of flour give different influences a very significant effect on the hedonic value of taste, aroma and colour while the texture was not significantly different. The best quality sweet bread and consumer acceptance are the V1M1 (60% Wheat flour: 40% Taro Flour fermented with bacteria Bacillus subtilis).

1. Introduction
The high demand for flour in Indonesia has increased in the value of wheat imports, therefore it be required to diversify bread by reducing the use of wheat flour through substitution with flour originating from local resources, especially in North Sumatra, such as minor tuber flour, namely taro tubers, canna tubers, and arrowroot tubers so that wheat imports in Indonesia can be reduced [1]. Minor tubers are less popular tubers and the result of harvest is not much and the benefit is not yet optimal [2]. Arrowroot has benefits for health, especially for diabetics because it contains a low glycaemic index compared to other types of tubers, arrowroot tubers are rich in fibre which functions to facilitate the digestive system [3]. Canna tuber has the advantage of being easy to digest and has a sweet taste so it is very good when used for food for sick people [4]. Taro tubers are easy to digest and have considerable potential in the manufacture of healthy food products [5]. Minor tubers (arrowroot tubers, canna tubers, and taro tubers) have a high crude fibre content so that they will produce a product with poor texture. Therefore, it is necessary to carry out fermentation to reduce crude fibre content by directly fermentation using microorganisms, the process is easier and the cost is cheaper. Cellulosic microorganisms are microorganisms that can degrade substrates containing cellulose. Cellulosic microorganisms can convert cellulose into simpler sugars to be used as a source of carbon and energy for metabolism and growth. This ability causes microorganisms to produce cellulase enzymes.
2. Materials and methods
The raw materials used in this study were Taro tubers obtained from Samura on Kabanjahe and Canna tubers obtained Lembah on Berastagi, and Arrowroot Tubers obtained from Tebing Tinggi. The microorganisms used for the fermentation process is *Bacillus Subtilis* bacteria obtained from the Microbiology Laboratory of the Faculty of Pharmacy, University of North Sumatra, yeast *Trichoderma Harzianum* and fungi *Aspergillus Niger* obtained from PPKS Marihat, Simalungun. Other ingredients used with wheat flour, sugar, instant yeast, shortening, milk *full cream* liquid, salt, *bread improver*, eggs, and *xanthan gum* which are obtained from Sari Cake shop, Medan.

2.1. Research methods

2.1.1. The process of modified flour. The process of modified flour is made using fermented tuber chips that have been treated by putting it in 1 L of the solution which has been added with a 3% starter for 48 hours, then washed and dried using the help of sunlight and flour.

2.1.2. The process of making sweet bread. The process of making sweet bread can be seen in Figure 1.

![Figure 1. Sweet bread making](image)

Bread making is done in the following way: Fermented minor tuber flour is mixed according to the treatment. Ingredients are prepared and weighed accurately. Dry ingredients, namely flour, yeast *instant*,
sugar, salt, and bread improver, and xanthan gum are stirred using a mixer low speed until homogeneous, then add liquid milk full cream little by little and keep stirring with a mixer until a dough form. While shortening is added while continuing to stir until a dough is formed. After that the dough is cut and weighed and shaped into a round shape and then put into a baking sheet that has been smeared with margarine, then let it stand for 60 minutes for fermentation. The bread dough together with the baking sheet is put in the oven at 165ºC for 35 minutes and cooled at room temperature for 25 minutes. After that, it is packed with polyethylene plastic packaging before being tested by the panellists.

2.2. Analysis of data
This research was conducted using a randomized block design (RBD) consisting of two factors, namely:
Factor I: Tuber Varieties (V), it consist of :
- $V_1 = $ Taro tubers
- $V_2 = $ Canna tubers
- $V_3 = $ Arrowroot tubers
Factor II: Types of microorganisms (M), it consist of :
- $M_1 = $ Bacillus subtilis (BS)
- $M_2 = $ Aspergillus niger (AN)
- $M_3 = $ Trichoderma harzianum (TH)

The resulting bread was analysed for its sensor characteristics. Sensory characteristics include taste, aroma, colour, and texture using the 1-7 scale hedonic test. The resulting data were analysed statistically using analysis of variance (ANOVA), and if the comparison of flour gave a significantly different effect, a further test was carried out with the Duncan test.

3. Results and discussion
The type of composite gives a significantly different effect on taste, aroma, colour, while the texture was not significantly different. Meanwhile, the types of microbes and the interaction between types of composite flour and types of microbes had no significant effect on taste, aroma, colour, and texture.

3.1. Consumer acceptance of the taste of sweet bread
The test results with the LSR of the effect of the type of composite flour (taro tuber flour, canna flour, arrowroot tuber flour) on the organoleptic taste of sweet bread can be seen in Figure 2.

![Figure 2](image-url)

The results showed that $V_1$ had the highest organoleptic taste value, namely 5.9111 (neutral-like) and $V_2$ had the lowest taste organoleptic value, namely 4.922 (somewhat like-neutral). The hedonic value of
wheat flour was 6.38 which showed the panellists’ preference. Hedonic value $V_1$ the closest to wheat flour sweet bread and treatment $V_1$ produced the most preferred taste by panellists compared to other sweet bread. The value of taste preference can be influenced by sweet bread which has a distinctive aroma. Taste occurs due to chemical stimulation responses by the taste buds which cause the interaction of aroma, taste, and texture properties as a whole food taste [6].

3.2. Consumer acceptance of the aroma of sweet bread
The test results with the LSR effect of the type of composite flour (taro tuber flour, canna flour, arrowroot tuber flour) on the organoleptic aroma of sweet bread can be seen in Figure 3.

![Figure 3. The effect of composite flour (taro root flour, canna tuber flour, arrowroot tuber flour) on the hedonic value of sweet bread aroma.](image)

The results showed that the $V_1$ the highest organoleptic aroma value, namely 5.5996 (neutral-like) and the $V_2$ had the lowest aroma organoleptic value, namely 4.8519 (slightly like-neutral). The hedonic value of wheat flour aroma was 6.4 which showed the panellists preference. The hedonic value of $V_1$ the closest to the white flour sweet bread and the $V_1$ produced the most preferred aroma by the panellists because the $V_1$ used taro flour which has a distinctive taro aroma that the panellists like. Meanwhile, the aroma of the other treatments has a pleasant aroma so that it is less liked by the panellists. The unpleasant smell caused by the oxidation of fat causes hydroperoxide to appear during the healing process which causes the unpleasant smell to be stronger [7].

3.3. Consumer acceptance of the colour of sweet bread
The test results with LSR of the effect of the type of composite flour (taro root flour, canna flour, arrowroot tuber flour) on the organoleptic aroma of sweet bread can be seen in Figure 4. Figure 4 shows the average value of the highest panellists’ preference for sweet bread in treatment $V_1$ ranged from 5.933 (slightly liked) and the lowest on treatment $V_3$ around 5.4074 (neutral). The colour of sweet bread that was most favoured by the panellists was treatment $V_1$. This is because the treatment $V_1$ has a slightly lighter colour compared to other bread which has a dull colour.
Figure 4. The effect of composite flour (taro root flour, canna tuber flour, arrowroot tuber flour) on the hedonic value of the colour of sweet bread.

4. Conclusions
Based on the hedonic value of taste, aroma and colour of sweet bread, it is known that sweet bread with 40% formulation of fermented taro tuber flour, 60% wheat flour fermented with bacteria, *Bacillus Subtilis* is the best sweet bread which means that it is most liked by consumers.

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