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The effect of cassava starch modified by various extraction agent on the consumers acceptability of bangkit cookies

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Abstract. One type of traditional cookies made from tapioca is bangkit cookies as a typical of the Malay community. The aim of this study was to determine the taste and consumer acceptance of the use modified tapioca fermented with the extract of emprit ginger, elephant ginger, red ginger, and curcuma on the bangkit cookies. This analysis used a randomized block design with two factors, factor 1, namely the type of ingredient extract with five types of extract: P1 = water, P2 = emprit ginger, P3 = elephant ginger, P4 = red ginger, and P5 = curcuma. Factor 2, namely the ratio of the amount of starch (Kg) to the volume of extract (L): C1 = 1:1, C2 = 1:2, and C3 = 1:3. The results showed, the factor 1 had a very significant effect and factor 2 gave a significant difference on the hedonic value of taste and general acceptance of bangkit cookies. The interaction of the two factors gave a significant effect on the hedonic value of the bangkit cookies taste. Based on the hedonic test of taste and general acceptance of bangkit cookies, it was found the P3C2 was the best cookies that was most liked by the consumer.

1. Introduction
Indonesia has a tropical climate which is very suitable for the development and cultivation of cassava (Manihot utilissima). Cassava is the third largest food crop commodity in Indonesia after rice and corn. There are various types of processing cassava into processed products as a form of support for food security and food diversification programs. One of them is processing cassava into tapioca flour [1]. Tapioca is starch taken from cassava and used as food. However, the use of natural tapioca is still very limited due to the physical and chemical properties of tapioca which are not universal enough to be used widely [2]. The disadvantages of using tapioca are that it requires a long cooking time, the paste is hard and not clear, it is too sticky and cannot stand with acid treatment [3]. This causes natural starch to be of limited use in industry so that it is necessary to modify tapioca. With the addition of modified starch, food products will have quality advantages, both in terms of physical appearance, taste, colour, and easier and faster processing [4]. The use of native tapioca in making bangkit cookies can be replaced with modified tapioca. However, modification of starch by fermentation usually results in a less preferred sour taste of fermentation. Therefore, starch is fermented using ginger and curcuma extract as a byproduct of the process of making ginger and curcuma starch, which contains essential oil components and gingerol which gives the characteristic taste and smell of spices to eliminate the characteristic sour aroma of starch fermentation.

Ginger emprit (Zingiber officinale var. Rubrum) or also called white ginger is a type of ginger that has a rhizome size larger than red ginger, slightly flat shape, white in colour, soft fibre, and less sharp
aroma. Its essential oil content is about 1.5% - 3.3% of the dry weight which gives ginger its distinctive aroma [5]. Elephant ginger (Zingiber officinale var. Roscoe) or large ginger has a large rhizome, yellowish white, fine fibrous and slightly less aromatic or less tangy [6]. Red ginger (Zingiber officinale var. Amarum) has red to light orange rhizomes with a sharp aroma and very spicy taste, dark green leaves and reddish green stems [7]. Some of the substances contained in ginger are 2% - 3% essential oil, 20% - 60% starch, oleoresin, organic acids. Oleoresin in ginger contains a volatile component (essential oil) which gives a distinctive aroma and a non-volatile component (gingerol) which gives a characteristic hot or spicy taste and contains natural antioxidants [8]. Curcuma (Curcuma xanthorrhiza Roxb) is one of a number of plants belonging to the Zingiberaeae family which has wet pseudo stems, is green or dark brown in colour and forms clumps of varying height [9]. The components of the compounds that act as antioxidants from the ginger rhizome are flavonoids, phenols and curcumin. In addition, ginger rhizome also contains starch, curcuminoids, crude fibre, ash, protein, minerals, essential oils consisting of d-camphor, cycloisoren, mirsen, tumerol, xanthorrhizol, zingiberen, zingeberol [10].

One type of cookies or pastries made from tapioca is bangkit cookies as a traditional cookie typical of the Malay community which can be found in Sumatra, especially Riau province. This bangkit cookies has a smooth, crunchy and fragile texture, is small in size and has a sweet taste which is one of the attractions for connoisseurs, both adults and children [11]. The use of native tapioca in making bangkit cookies can be replaced with modified tapioca. The starch is fermented using ginger extract (emprit, elephant, and red) and curcuma extract as a byproduct of the process of making ginger and curcuma starch, which contains essential oil components and gingerol which gives a characteristic taste and smell of spices to produce bangkit cookies with a distinctive taste and aroma of ginger and curcuma that is different from the usual bangkit cookies which only has a sweet taste.

2. Materials and methods

The raw materials used in this study were cassava obtained from Tuntungan, Medan, ginger and curcuma obtained from Pematang Siantar. Other ingredients are ingredients for making cookies in the form of margarine, butter, egg yolk, refined sugar, baking powder, powdered vanilla, and powdered milk obtained from Toko Kue Sari, Medan.

2.1 Research methods

2.1.1 Making modified tapioca. Cassava is peeled, then washed under running water to clean the remaining dirt. Cassava that has been washed is cut into pieces, then the pieces of cassava are crushed using a shredder to produce tuber pulp. The resulting tuber slurry is then added with water in a ratio of 1:2. Then filtered pulp using a filter cloth so that it will produce pulp and water. Let stand for 12 hours until the starch settles. The remaining water is discarded from the starch deposits. The starch is deposited using water, ginger extract and curcuma extract. Then fermented for 16 days while covered with a filter cloth. The resulting sediment is separated from the water. The resulting starch is washed again with water and then deposited for 12 hours so that it settles. After that, dry it in the sun to dry. The dry starch is then crushed in a blender and sieved using an 80 mesh sieve to obtain fine starch granules.

2.1.2 Making bangkit cookies. The making of the bangkit cookies is done in the following way: stirring margarine, butter, powdered sugar and egg yolk using a low speed mixer for 2 minutes until it forms a smooth cream. Tapioca, powdered milk, baking powder, and powdered vanilla are added to the cream mixture and stirred manually until they are completely blended. The dough is formed into sheets using a roller pin to obtain a thin dough with a thickness of ±5 mm, then it is printed using a cookie mould to obtain a uniform size of 3x4 cm. The pieces of bangkit cookies dough that have been printed are placed on a baking sheet that has been smeared with margarine. Then it is burned using a toaster oven at a temperature of 155 °C for 30 minutes. The ripe bangkit cookies was removed from the pan, cooled at room temperature for 10 minutes, and packed in a plastic jar prior to taste sensory analysis and general
acceptance. The formulation of the bangkit cookies refers to [12] with a little modification can be seen in Table 1. and the process of making the bangkit cookies can be seen in Figure 1 below.

Table 1. Formulation of bangkit cookies from modified tapioca.

| Ingredients          | amount (g) |
|----------------------|------------|
| Tapioca              | 100        |
| Milk powder          | 9          |
| Powdered vanilla     | 1          |
| Baking powder        | 1          |
| Margarine            | 36         |
| Butter               | 14         |
| Fine granulated sugar| 40         |
| Egg yolk             | 9          |

Factor I: Type of extract
- P1 = Water
- P2 = Ginger emprit
- P3 = Elephant ginger
- P4 = Red ginger
- P5 = Curcuma

Factor II: The ratio of the amount of starch (Kg) to the volume of extract (L)
- C1 = 1:1
- C2 = 1:2
- C3 = 1:3

Gradually add the dry mixture to the cream mixture that has been mixed on low for 2 minutes

Mix dry ingredients well

Stir the mixture of dry ingredients and cream dough with a spatula until well blended

Sheet shaped with a roller pin and printed with cookies mould

Bake in the oven at 155 °C for 30 minutes

Bangkit cookies → Cooled then packaged

Sensory quality analysis was tested by 70 consumers (Hedonic test scale 1-7): Taste (after the bangkit cookies is eaten and swallowed) and general acceptance

Figure 1. Schematic of making the bangkit cookies.
2.2 Analysis of data
This research was conducted using a factorial randomized block design (RBD) consisting of two factors, where factor 1 was the type of extract (P) and factor 2 was the ratio of the amount of starch from sweet potato (Kg) to the volume of extract (L) (C) which was made 3 replications so that the total sample size became 45 samples. For comparison, natural tapioca obtained from immersion using water without fermentation was used with the same treatment.

3. Results and discussion

3.1 Consumer acceptance of the taste of the bangkit cookies
The interaction between the types of ingredients (water, emprit ginger extract, elephant ginger extract, red ginger extract, curcuma extract) and the ratio of the amount of starch (Kg) to the volume of the extract (L) (1:1, 1:2, 1:3) gave a significantly different effect (P<0.05) on the hedonic value of bangkit cookies taste, so that the LSR test was continued. In Figure 2, it can be seen that the bangkit cookies P3C2 made from modified tapioca with 2 litres of elephant ginger extract has the highest hedonic value of 5.952 while the cookies with the lowest taste hedonic value is found in the bangkit cookies P5C2 made from modified tapioca by immersion curcuma extract as much as 2 litres, namely 5.367.

Consumers prefer the bangkit cookies P3C2 because of the distinctive spicy taste of ginger that is not too strong or too sharp due to the low gingerol content in elephant ginger and the combination of other additional ingredients in making cookies. In elephant ginger, there is an oleoresin compound which contains a spicy flavour-forming component. The main spicy flavouring agent in ginger is gingerol [13]. According to [14], it is known that the content of (6)-gingerol elephant ginger is lowest compared to emprit ginger and red ginger, respectively, namely 9.56 mg/g, 22.57 mg/g, and 18.03 mg/g [14]. The bangkit cookies P5C2 is less liked by consumers due to the bitter and spicy taste in the cookies. This bitter, slightly spicy taste is caused by the curcumin content found in curcuma. Curcuminoid is a typical compound of curcumin which is yellow in colour and aromatic in nature so that if used too much in food it can cause the colour, flavour and smell of food to become sharper, namely yellow like yellow curcuma, the aroma and smell of curcuma, so that it can reduce public acceptance [15].

![Figure 2](image-url)

**Figure 2.** The relationship between the type of extract and the ratio of the amount of starch to the volume of the extract.
3.2 General acceptance of bangkit cookies

The effect of the type of extract (water, emprit ginger extract, elephant ginger extract, red ginger extract, and curcuma extract) had a very significant effect (P<0.01) on the hedonic value of the general acceptance of the bangkit cookies.

![Figure 3. The relationship between the types of ingredients and the hedonic value of the general acceptance of the bangkit cookies.](image)

The product photos produced from this research, namely the bangkit cookies can be seen in Figure 4 below. It is known that the treatment of the ratio of the amount of starch (Kg) to the volume of extract (L) of 1:2 (C₂) produces the best bangkit cookies.

![Figure 4. (a) water (without extract), (b) emprit ginger, (c) elephant ginger, (d) red ginger, (e) curcuma.](image)
4. Conclusions

Based on the hedonic value of taste and general acceptance of the bangkit cookies, it is known that the bangkit cookies made with 2 litres of modified tapioca soaking elephant ginger extract is the best kue bangkit which means that it is the most preferred by consumers.

References

[1] Mustafa A 2015 Analisis proses pembuatan pati ubi kayu (tapioka) berbasis neraca massa [Analysis of the process of making cassava (tapioca) based starch mass balance] Agrotek 9 pp 127-133

[2] Herawati H 2012 Teknologi proses produksi food ingredients dari tapioka termodifikasi [Process technology for the production of food ingredients from modified tapioca] Journal of Agricultural Research and Development 31 pp 68-76

[3] Koswara 2006 Food Modification Technology Food Ebook.

[4] Sari D P, Siregar D M and Sumardjono S 2012 Modifikasi tapioka dengan kombinasi proses hidrolisa asam laktat dan oksidasi hidrogen peroksida untuk meningkatkan daya kembang [Modification of tapioca with a combination of lactic acid hydrolysis and hydrogen peroxide oxidation to increase swelling] Journal of Chemical and Industrial Technology 1 pp 86-91

[5] Fathona D 2011 Kandungan Gingerol dan Shogaol, Intensitas Kepedasan dan Penerimaan Panelis terhadap Oleoresin Jahe Gajah, Jahe Emprit, dan Jahe Merah [Content of Gingerol and Shogaol, Pungency Intensity and Panelists Acceptance of Elephant Ginger Oleoresin, Ginger Emprit, and Red Ginger] Essay Bogor Agricultural Institute, Bogor

[6] Rukmana R 2000 Ginger Farming Equipped with Fresh Ginger Processing, Cultivation Series (Yogyakarta: Publisher Kanisus)

[7] Herlina R, Murhananto J, Endah T, Listyarini and Pribadi ST 2004 Efficacy and Benefits of Red Ginger: The Magic Rhizome (Jakarta: Media Pustaka)

[8] Ahmed R S, Seth V and Banarjee B D 2000 Influence of dietary ginger (Zingiber officinale Rosc.) on antioxidant defense system in rat: comparison with ascorbic acid Indian Journal of Experimental Biology 38 pp 604-6

[9] Uhl S R 2000 Handbook of Spices, Seasonings and Flavouring (USA: Technomic Publishing Co. Inc)

[10] Jayaprakhasha G K and Jagannmohan RL 2006 Antioxidant activities of curcumin, demethoxycurcumin, and bisdemethoxycurcumin Food Chemistry 98 pp 720-4

[11] Wijayakusuma M 2007 Healing with Temulawak (Jakarta: Sarana Pustaka Prima)

[12] Sari M S, Efendi R and Herawati N 2016 Karakteristik fisikokimia dan sensori kue bangkit berbahan pati sagu, tepung tempe dan tepung ubi jalar ungu [Physicochemical and sensory characteristics of bangkit cookies made of sago starch, tempeh flour and purple sweet potato flour] SAGO 15 pp 18-27

[13] Maryanti S 2018 Best-selling Cake Recipe for Catering Business (Jakarta: Gramedia)

[14] Kurniasari L., Hartati I and Ratnani R D 2008 Kajian ekstraksi minyak jahe menggunakan microwave assisted extraction (MAE) [Study of ginger oil extraction using microwave assisted extraction (MAE)] Momentum 4 pp 47-52

[15] Kiswanto 2005 Changes in Levels of Temulawak Rhizome Bioactive Compounds in Storage (Yogyakarta: INTAN)

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