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Formulation of Waxy Corn Flour and Gorocho Banana Flour on Making Cookies as Alternative Healthy Food

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Abstract

Cookies are the type of snack most people from child to adult-like. The objective of the research was to identify the best formulation of waxy corn flour and gorocho banana flour and to analyze proximate content and organoleptic test of cookies. The research used completely randomized design with 5 treatments consisting of A0 (100%, 0%, 0%), A1 = 60%, 25%, 15%), A2 (50%, 35%, 15%), A3 (40%, 45%, 15%), and A4 (30%, 55%, 15%). Data were analyzed with ANOVA statistical test. The results indicated that cookies formulation of 30% gorocho banana flour, 55% waxy corn flour and 15% wheat flour got the highest score with the best formulation at 5% level. Chemical analysis indicated that water content, ash content, protein content, fat content and carbohydrate content of the cookies are 3.37%, 3.62%, 9.27%, 0.73% and 83.01%, respectively. The crude fiber content of cookies ranged from 10.38% to 13.76%; the highest score was on formulation of 30% gorocho banana flour, 55% waxy corn flour, and 15% wheat flour. Sensory characteristic of cookies from organoleptic test include colour, texture, aroma and taste with score of 5.40, 6.03, 5.73 and 6.10, respectively, which indicates significant difference

Keywords: cookies, formulation, waxy corn flour, gorocho banana flour

INTRODUCTION

Cookies are the type of snack most people from child to adult-like. Cookies may be made from wheat flour. To reduce dependency on wheat flour, it is necessary a new alternative with ingredient of gorocho banana and waxy corn flour.

Gorocho banana (*Musa acuminata*, sp) is one of the banana plants that grow in North Sulawesi province. Gorocho banana is more popular than other bananas such as *latundan banana*, gros Michel banana, cooking banana, and *saba banana*. Gorocho banana is local banana that people in North Sulawesi and Gorontalo know. People in these regions have been convinced that gorocho banana is appropriate to consume by diabetic patients due to its insipid taste. Suryanto (2011) indicated that gorocho also contains phenolic, flavonoid, and tannin compounds and has antioxidant activity. Therefore, food diversity by using gorocho banana should be done.

Meanwhile, one of the corn varieties cultivated in Gorontalo province is waxy corn flour (*Zea mays* Ceratina). Waxy corn is alternative food containing fiber. The fiber content in waxy corn flour plays important role in keeping health and prevention of various diseases. Food fiber also helps to prevent cancer, particularly colon cancer and decreasing total cholesterol and glucose level (Suarni and Widowati 2007).

Related to many usages of gorocho banana flour and waxy corn flour in Gorontalo society, the research was done on cookies made of gorocho banana flour and waxy corn flour containing the high nutrient.

RESEARCH METHODOLOGY

Place and Time of the Research

This research was conducted for 3 months. Proximate test and crude fiber test was done in the Integrated Research and Testing Laboratory of Universitas Gadjah Mada. The organoleptic analysis was conducted in the Integrated Laboratory of Agricultural Faculty at Universitas Negeri Gorontalo.

Material and Instrument

Material

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Materials used in this research were waxy corn flour, goroho banana flour, wheat flour (blue triangle), palm sugar, margarine (Blue Band), vanilla, baking soda and egg,

Materials used for analysis were concentrated sulfuric acid, standard NaOH solution, pp indicator, acetic acid, distilled water, chloroform, H₂SO₄, HBO₃, HCl, KMnO₄, and ammonium oxalate solution.

Instruments used in processing were oven, thermometer, grinder, slicer, plastic container, glass baker, graduated cylinder, analytic balance, sieve, knife, stove, pan, topless, mixer, and container for drying. Instruments used for analysis were a spatula, petri dish, porcelain dish, crucible tongs, analytical balance, mortar, drier oven, Erlenmeyer flask, graduated cylinder, hotplate, test tube, kiln, desiccator, pipette, Kjeldahl flask, and Soxhlet.

Organoleptic test analysis was conducted using a hedonic scale method (Setyaningsih et al., 2010).

1. Water content analysis (Andarwulan et al., 2011)
2. Ash content analysis (Andarwulan et al., 2011)
3. Protein analysis (Andarwulan et al., 2011)
4. Fat analysis (Andarwulan et al., 2011)
5. Carbohydrate analysis (by difference)
6. Crude fiber analysis (SNI 01-2891-1992 method)

Working procedure

This research consists of three stages of goroho banana flour making, waxy corn flour making and cookies making

Stage I: making goroho banana flour (Sayangbati, 2012, modified)

Making goroho banana flour begun with blanching for 5 minutes at 80°C. The banana was cooled, peeled and weighted. Then, banana fruit was sliced using slicer with 0.1 cm thickness. The fruit slices were dried on the oven. It was then ground and sieved with 100 mesh sieve.

Steps II: making waxy corn flour (Qanitah, 2012, modified)

Process of making waxy corn flour begun with soaking waxy corn grain for 12 hours in the water, leaked through, sun ray drying, grind, and sieved with 100 mesh sieve. Flour resulted was sunray dried to reduce water content

Stage III: making cookies

Cookies were made by making the dough. Dough making begins with shaking butter and palm sugar, then added with egg yolk, mixed to homogenous. Then, it was added with waxy corn flour, goroho banana flour, wheat flour, skim milk and baking powder, mixed till homogenous. Then it was baked at 120°C for 30 minutes.

RESULT AND DISCUSSION

Result of an organoleptic test of cookies with ingredient of waxy corn flour and goroho banana flour

The organoleptic test is method to identify panelist response over cookies product. The organoleptic test was done with four parameters of color, texture, aroma and taste. The result of organoleptic test is described below.

Colour

Colour is a factor that human firstly considers in selecting food. Food having high nutrient, delicious taste and good texture will not be selected when it has no interesting colour. The bright colour of food gives more attractiveness to consumers (Fajiyati, 2012), in Sulthoniyah (2013).

Means result of the organoleptic test on cookies colour, aroma, texture and taste with different treatment is presented in figure 1.

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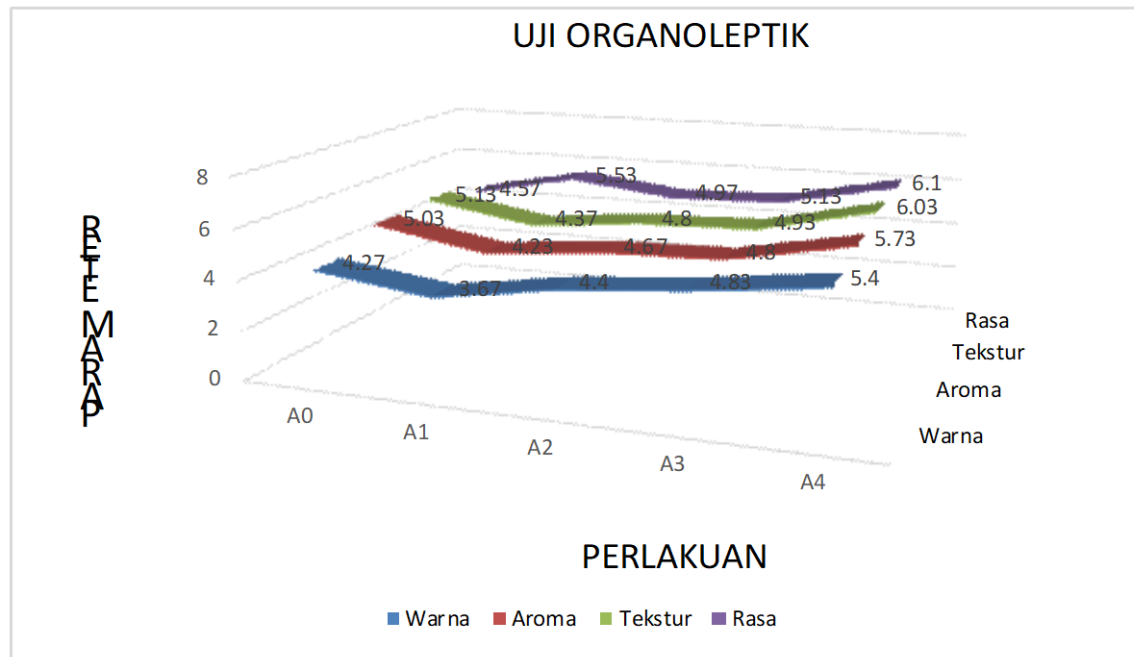


Figure 1. Means result of organoleptic test over cookies colour, aroma, texture and taste.

Note:

A0: 100% wheat flour, (control)

A1: 60% goroho banana flour, 25% waxy corn flour, 15% wheat flour

A2: 50% goroho banana flour, 35% waxy corn flour, 15% wheat flour

A3: 40% goroho banana flour, 45% waxy corn flour, 15% wheat flour

A4: 30% goroho banana flour, 55% waxy corn flour, 15% wheat flour

Based on the result, the highest score was on treatment A4 (30% goroho banana flour, 55% waxy corn flour and 15% wheat flour). It is expected due to more usage of waxy corn flour than goroho banana flour, producing light brown cookies according to its specific original ingredient. The lowest score was on A1 treatment (60% goroho banana flour, 25% waxy corn flour, and 15% wheat flour). Analysis of variant over colour indicated that F_{cal} was greater than F_{stat} , $P \leq 0.01$. It indicates that the ratio between waxy corn flour, goroho banana flour and wheat flour give significant effect on cookies colour. Use of great goroho banana flour dominated cookies colour producing dull brown, so panelist less like the colour. It agreed to Uller et al. research (2017) on "physiochemical characteristic of semprong cookies from goroho banana flour (*Musa acuminata* L) and sago flour (*Metroxylan sabo*, *Rottb*) that use of 100% goroho banana flour had dull brown effect and occurred due to non-enzymatic browning as maillard reaction. Duncan test was conducted at 5% significant level. The average brown colour of cookies indicated panelist likeness that increased along with addiction of waxy corn flour and decreased in goroho banana flour.

Flavor

The flavor may be defined as something observable with smell sense. To produce flavor, substance should be able to vapor and little solve in water. The result of the means of panelists' likes on cookies flavor is presented in figure 1.

The highest score was on treatment A4 (30% goroho banana flour, 55% waxy corn flour and 15% wheat flour). Analysis of variant over flavor indicated that F_{cal} is greater than F_{stat} , $P \leq 0.01$. Duncan test on a 5% significant level indicated that cookies flavor at A1 and A4 treatments were significantly different, while treatment A0, A2 and A3 were not significantly different. It is due to dry cookies flavor was determined by comparison of material component used such as additional matter and flour type. Treatment using greater waxy corn flour caused cookies having more protein contribution that may affect flavor of the cookies. It agreed to Suarni and Firmansyah (2005) suggesting that protein content in waxy corn flour was 9.11%, while protein in goroho banana flour was 5.16% (Nurali et al. 2012).

Texture

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Texture plays an important role in selection of a product. The texture test is a sensing test using touch. According to Kartika et al. (1998), texture is pressure sensation that is observable with mouth (when it is bitten, chewed and swallowed) or touching with finger. It is due to consumer desire texture according to product type that will increase consumer acceptance over the product. Data on evaluation of cookies texture is presented in figure 1.

Analysis of variants on texture indicated that F_{cal} was greater than F_{stat} . Therefore, ration between waxy corn flour, goroho banana flour and gave significant effect on texture valuation on cookies. Duncan test at 5% significant level indicated that cookies texture on Treatment A1 and A4 was significantly different, while treatment A0, A2 and A3 were not significantly different. the highest score is on treatment A4 (30% goroho banana flour, 55% waxy corn flour, and 15% wheat flour). It was caused by the use of greater waxy corn flour affecting cookies' texture. Waxy corn flour gave better crispiness. It is carbohydrate source containing great amylopectin. It agreed to Subekti et al. research (2008), indicating waxy corn flour has almost 100% amylopectin. Therefore, use of greater waxy corn flour can give influence cookies texture due to high amylopectin content. According to Winarno (2008), high amylopectin can improve texture on food stuff.

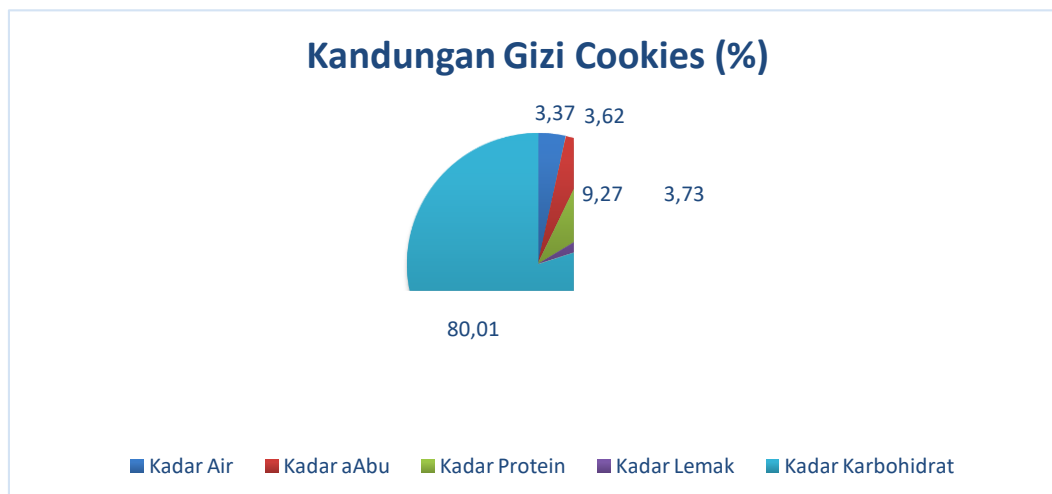
Taste

In general, food stuff does not only consist of one taste, but it is a combination of various tastes that result in intact taste. Taste of these cookies is also integration of taste of its ingredient. Data on panelist assessment on likes rate over cookies taste is presented in figure 1.

Based on the result of the organoleptic test on taste parameter, the highest score was on treatment A4 (30% goroho banana flour, 55% waxy corn flour, and 15% wheat flour). Analysis of variants indicated that F_{cal} was greater than F_{stat} . It is due to comparison ratio between waxy corn flour, goroho banana flour and wheat flour give significant effect on taste valuation on cookies. Further Duncan test at 5% significant level indicted that cookies taste in treatment A0 and A4 are significantly different. While in treatment A1, A2 and A3, their tastes are not significantly different. It is caused by formulation factor of material used in making cookies. Greater use of waxy corn flour compared with goroho banana flour play important role in taste of cookies resulted. According to Mahendradatta and Tawali (2008), waxy corn has sweet taste, silken texture, interesting appearance and characteristic aroma that other corns do not have so people like it.

Proximate Analysis on Cookies made of Goroho Banana Flour and Waxy Corn Flour

Proximate analysis was intended to identify chemical content of water, ash, fat, protein, carbohydrate and crude fiber. Proximate analysis functions as a quality assessment of food stuff that will be analyzed. Cookies analyzed are the best ones from organoleptic test namely treatment A4v (30% goroho banana flour, 55% waxy corn flour and 15% wheat flour). Chemical content of cookies is presented in Figure



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Figure 2. Chemical conent of cookies resulted from the best organoleptic test: 30% goroho banana flour, 55% waxy corn flour and 15% wheat flour

Water content

The water content of food stuff relates greatly to product durability against damage, enzymatic activity and chemical activity indicated with pungent odor, and non-enzymatic reaction that induces change in organoleptic characteristic, appearance, texture, taste and its nutrient content. In addition, water content determined acceptability, freshness and food durability (Winarno, 2008).

Based on the result of the research, percentage of water content on cookies with formula of 35% goroho banana flour, 55% waxy corn flour and 15% wheat flour was 3.37%. It proves that water content of cookies in this research is safe for storage because it has complied to SNI requirement for cookies of 5% maximal water content.

Ash content

Ash content measurement was intended to identify mineral content within cookies (Winarno, 2008). The result of the ash content test indicated that cookies have water content of 3.62%. it is caused by ash content of goroho banana flour was 2.29% (Nurali et al., 2012) and ash content of waxy corn was 1.99% (Suarni and Firmansyah, 2005). It resulted in ash content that complied SNI 01-2973-1992 requirement for cookies (minimal 1.5%).

Protein content

Protein is an amino acid source containing C, H, O and N that fat and carbohydrate do not have (Winarno, 2002). The result of proximate test indicates protein content 9.27%. it is caused by protein content of 9.11% on waxy corn and 5.16% on goroho banana producing high protein content on cookies (9.27%). protein content on waxy corn and goroho banana was 9.11% (Suarni and Firmansyah, 2005) and 5.16%, respectively (Nurali et al., 2012). Protein content obtained was affected by formulation of ingredients mixed in making cookies consisting of waxy corn flour, goroho banana flour and wheat flour and due to heating on cooking making process causing denaturation of protein in the cookies. Protein content obtained is enough to meet standards according to SNI 01-2973-1992 (minimal protein content of 9%).

Fat content

Fat is a source of high calorie (9 kilocalories each gram). In addition, fat is also natural source of vitamin soluble in oil (Vitamin A, D, E, and K) (Sudarmadji, 1992). Based on result of test, fat content of cookies was 3.73%. The content is lower than quality requirement of cookies in SNI with minimal fat content of 9.5%. The low fat content may be influenced by its component in which goroho banana flour has 0.97% fat content (Nurali et al., 2012), while waxy corn flour has 4.97% fat content (Suarni and Firmansyah, 2005). Low fat content in cookies has higher value for diabetic and cholesterol patients that avoid excessive fat. So it is healthy food for cholesterol patients.

Carbohydrate content

Carbohydrate is the main calorie source and some carbohydrate groups produce fiber useful for digestion and play important role in determining characteristic of food stuff. Based on result of tests, the highest carbohydrate content was 80.01% at treatment formulation A4 (30% goroho banana flour, 55% waxy corn flour and 15% wheat flour). Carbohydrate on corn is starch component, while other components are pentosan, crude fiber, sucrose, and reducing sugar. According to Suarni et al. (2005), carbohydrate content on waxy corn flour was 79.28% and carbohydrate content of goroho banana flour was 75.18% (Nurali et al., 2012), while wheat flour contains 77.2% carbohydrate. Obtained carbohydrate content (80.01%) was influenced by material formulation mixed in cookies making. The carbohydrate content complies quality standard for cookies by SNI 01-2973-1992 of minimal 70%.

Crude fiber

Fiber comes from the cell wall of various vegetables and fruits. In chemical perspective, cell wall consists of some carbohydrate types such as cellulose, hemicellulose, pectin and non carbohydrate such as polymer lignin, food fibers or dietary fiber that is consumable part of plant composed of carbohydrate having characteristic of resistant to digestion process and absorption in human small intestine and undergoing fermentation a part or whole in colon (Santosa, 2011). Fiber is non nutrient element. There are two types of fiber: dietary fiber and crude fiber.

Crude fiber is a plant fiber that is not soluble in water. Based on test results on cookies, the highest score was on treatment A4 (30% goroho banana flour, 55% waxy corn flour and 15% wheat flour). It is due to waxy corn and goroho banana flour has great crude fiber content: 23-24% for waxy corn (Winarno, 2008)

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and $\pm 2\%$ for goroho banana flour (Sondah, 1990). The crude fiber content of each treatment has higher score than standard fiber for cookies according to SNI (minimal 0.5%). It is positive value for the cookies as healthy food. The result of crude fiber test is presented in figure 3.

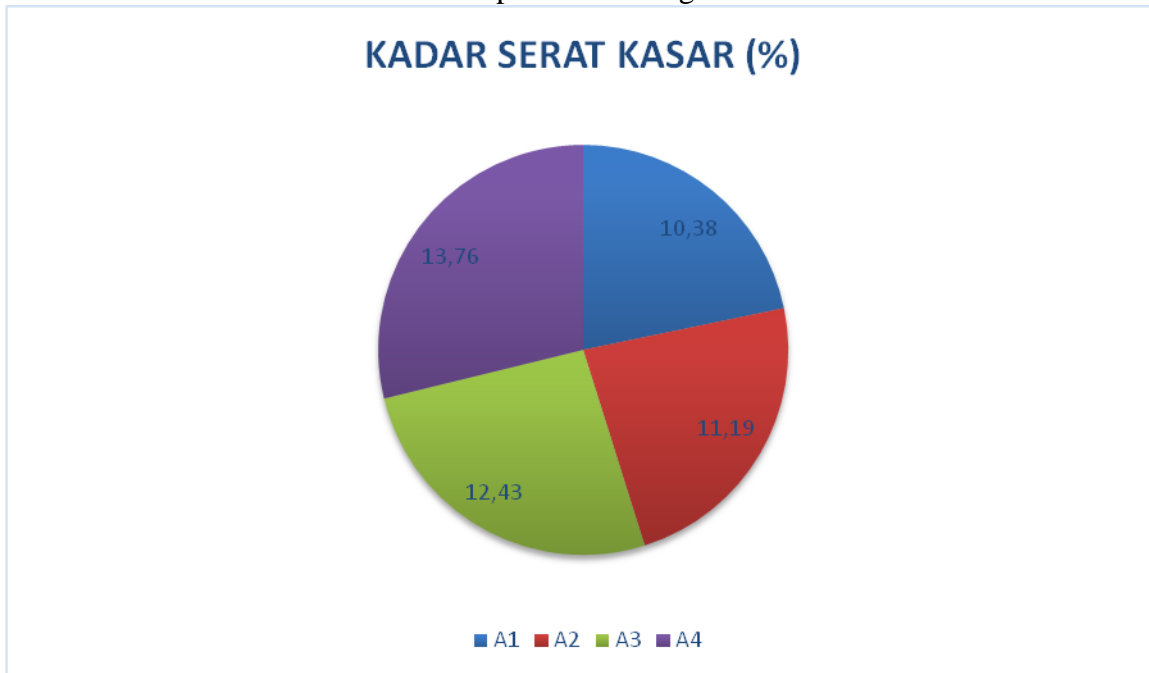


Figure 3. Result of crude fiber test on cookies

Note:

- A1: 60% goroho banana flour, 25% waxy corn flour, 15% wheat flour
- A2: 50% goroho banana flour, 35% waxy corn flour, 15% wheat flour
- A3: 40% goroho banana flour, 45% waxy corn flour, 15% wheat flour
- A4: 30% goroho banana flour, 55% waxy corn flour, 15% wheat flour

CONCLUSION

Results of the research indicate

1. Formulation of cookies with ingredient of goroho banana flour and waxy corn flour on treatment of 30% goroho banana flour, 55% waxy corn flour and 15% wheat flour have water content 3.37%, ash content 3,62%, protein content 9.27%, fat content 3,73%, carbohydrate content 80.01% and crude fiber 13.76%
2. Sensory characteristic of cookies with formulation treatment of 30% goroho banana flour, 55% waxy corn flour and 15% wheat flour is formula the panelists most like based on organoleptic test including colour (5.40), texture (6.03), aroma (5.73), and taste (6.10).
3. Formulation of waxy corn flour and goroho banana flour in making cookies with treatment A4 (30% goroho banana flour, 55% waxy corn flour, and 15% wheat flour) is cookies as an alternative healthy food.

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