

FORMULATION OF HERBAL HARD CANDY CONTAINS RED GINGER (*Zingiber officinale* var. *rubrum*) EXTRACT

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Red ginger rhizome (*Zingiber officinale* var. *Rubrum*) contains alkaloid, flavonoid, saponin, tannin, and triterpenoid that potentially as antibacterial and also gingerol, shogaol, and zingeron are efficacious as antioxidant. Red ginger used as a flavour of hard candy because the essential oils gives characteristic and ginger scent, and also the oleoresin gives spicy ginger flavor. This research aims to find the best formula of hard candy through the hedonic test includes organoleptic, water content, ash content, and hardness. This research used four formulas that are K (without red ginger extract), A (extract of 1%), B (extract of 1.75%), and C (extract of 2.5%). Hedonic test data analyzed by Kruskal-Wallis test shows the addition of red ginger extract make significant effect on organoleptic properties (color, scent, texture, and flavor). The results of water content test of K, A, B, and C formulas respectively are 0.0023; 0.0086; 0.0054; and 0.0045%. The results of ash content test are 0.0031; 0.0039; 0.0049; and 0.0072%. The results of hardness test are 16.8; 6.8; 10.1; and 19.3 Kgf. The best formula is A that organoleptic characteristic (color, scent, flavor, and texture) are most preferred by panelists then result the tests of characteristics are accordance with quality requirements.

Keywords: Formulations, characteristic, hard candy, *Zingiber officinale* var. *rubrum*

INTRODUCTION

Food products which combine functions of nutrition and health, which is called functional food had been widely developed. Marsono (2007) and Tri et al. (2002) write that functional food is a food product that provides benefits to health and has the ability to influence the physiological processes that promote health, prevent disease, or treat a disease. Hard candy is one of functional food which noncrystalline candy was cooked with high temperature (140-150°C) with hard texture and shiny appearance. The ingredients of hard candy are sucrose, water, and glucose syrup or sugar inversion (Winarno, 2004). Hard candy had been developed because the

simple manufacturing, long shelf, and has sensory pleasure. The main ingredients of hard candy are sucrose, water, glucose syrup (Amos and Purwanto, 2002). In addition to sugar-based, flavor ingredients is important in the formula because the composition of the main candy (sucrose, glucose syrup, and water) generally have no strong characteristic flavor. It was required flavor addition to obtain the sensation of flavor products (Wijaya, 2011).

Flavor is food additive that provide the scent and flavor (Nurwati, 2011). Natural or synthetic flavor can be used. But many indications showed that synthetic materials can be harmful to health, so the watchword of "back to

nature” can be the right choice (Yumas, 2010). One of the natural substances can be used as a candy flavor is red ginger rhizome. Previous studies on hard candy containing ginger extract has been done by Amin (2012), showed that hard candy with combination of ginger extract and extract of roselle. Lestari (2009) examines the organoleptic properties of hard candy gajah ginger with emprit ginger substitution. Siregar (2004) examined the effect of concentration ratio of glucose syrup and sucrose and long of ripening on the quality of ginger candy.

Red ginger extract composes of oleoresin containing volatile oils of gingerols, shogaols, α -zingiberene, β -bisabolene, β -sesquiphellandrene and ar-curcumene. Gingerols has been considered as a main substance responsible for the pungent smell of fresh ginger (Momin, et al., 2015). Oleoresin actives as antimicrobial, antioxidants, stable, and free from microbial or fungal contamination (Fakhrudin, 2008; Lestari, 2006; Yuliani and Sari, 2009). In addition, gingerol, shogaol, and zingeron has analgesic, anti-inflammatory, antibacterial, antioxidant, hypolipidemic, and hypocholesteramic activities (Kumar et al. and Ramundu, K., et al., 2011).

According to Akib et al. (2015) red ginger extract has antioxidant activity which classified as very strong with IC50 value of 44.48 ppm. In other studies, Akib, et al. (2015) reported that red ginger extract can inhibit the growth of bacteria

S. mutans concentration of 0.75, 1, 1.75, 2.5, and 4. Red ginger rhizome is commonly used as cold medicine, anti-nausea, indigestion, and antipyretic (Winarti, 2010). Based on researches above, red ginger can be used as flavor and provided health. Therefore, in this study conducted to formulate hard candy containing extract, measure the hedonic test and characterisation of hard candy containing extract, and found the best formula of hard candy containing red ginger extract.

METHOD OF RESEARCH

The research was conducted in December 2014 until March 2015 at the Laboratory of Pharmacy, Faculty of Pharmacy, University of Halu Oleo.

The tools were oven (Froilabo), rotary vacuum evaporator (Buchi), water bath (Stuart), sugar thermometer, analytical balance (HWH), electric chopper, funnel, Erlenmeyer flask, measuring glass (Pyrex), beaker glass, hot plate, a pipette, flask, mortar, pestle, pans, knives, wooden spoons, candy molds, spatulas, glass jars, and bottles.

The materials were red ginger rhizome, ethanol, chloroform, filter paper, distilled water, aluminum foil, salt, clear plastic, glucose syrup (CV. Tristar), and sucrose (Gulaku®).

1. Preparation of samples

Samples of red ginger rhizome (*Zingiber officinale* R. var. Rubrum S.) obtained in Regency of South Konawe.

Ginger harvest on old dried plants (10-12 months) then collected, washed, cleaned, cut into 0.5-1.0 cm, dried, chopped, and prepared for further research (Balitro, 2011).

2. Extraction of ginger rhizomes

Ginger dry powder macerated by ethanol 96% in ratio of 1:4 (w/v). Then filtered and solvent evaporated in a rotary vacuum evaporator (at 40 °C). The filtrate which does not evaporate were ginger oleoresin (Akib, 2015)

3. Formulations of Hard Candy

Making of hard candy according to the design formulas that have been made (Akib, 2015)

Table 1. Formulation of Hard Candy

Compounds	Concentration (% b/b)			
	A	B	C	D
Sucrose	40	40	40	40
Glucose	40	40	40	40
Distilled water	18.6	17.85	17.1	19.6
Salt	0.4	0.4	0.4	0.40
Ethanol extract of red ginger	1	1.75	2.5	-

Sucrose was dissolved in boiled water and heated to 110°C then glucose syrup was added then stirred constantly to 140°. Red ginger rhizome extract was added and dough poured into the mold (Yumas. 2012) and taken when temperature get lower. (Akib, 2015)

4. Hedonic Test of Hard Candy

Conducted by analyzed a test according to appearance, color, scent, flavor, and texture, using a hedonic scale as follows: (1) strongly dislike; (2) do not like; (3) neutral; (4) like; (5) strongly like

(Andriani, 2012). Untrained panelists of 30 judged allowed only simple tools such as the organoleptic properties. (Anonymous, 2013)

5. Characterisation of Hard Candy

a. Measurement of hardness hard candy (Nurwati, 2011): Hard candy was put into space of sample then rotator pressure was moved that pressed the candy so candy will break. Hardness value will shown by rotating needle pointing toward certain numbers.

b. Measurement of water content of hard candy (AOAC, 2007): Empty porcelain cup was dried in oven for 30 minutes at a temperature of 105°C, then put into a desiccator which contains silica gel cooling for 15 minutes, then weighed to constant weight. Hard candy of 2 grams put in porcelain cup, then dried in an oven for 6 hours at a temperature of 100-102°C and then weighed to constant weight sample (A). Furthermore, the sample put into a a desiccator for 15 minutes to cool to room temperature, then weighed (B).

$$\text{Water content (\%)} = \frac{A-B}{A} \times 100\% \dots (1)$$

c. Ash content measurement (Dirjen POM RI, 2000): Dried covered porcelain cup was weighed (C), hard candy of 2 g put into cup (B), then burned at a temperature of 550°C to gray ashes, cooled at desiccator, and weighed to obtain a permanent and stable weight (A).

$$\text{Ash content (\%)} = \frac{B-C}{A} \times 100\% \dots (2)$$

6. Data Analyze

Organoleptic test data were analyzed by Kruskal-Wallis test using the software Statistical Package For Social Science (SPSS) version 22. Data test results water content, ash content, and hardness are presented in descriptive quantitative.

RESULT AND DISCUSSION

1. Formulation of Hard Candy

Refer to Akib (2015) hard candy formulation was made into three treatment groups (concentration of extract of 1; 1.75; and 2.5%) and one control group (no adding of extract). The concentration of sucrose, glucose, and water based on the research results Nurwati (2011) and Nurramdhan (2012) in which the ratio of sucrose and glucose syrup is 1:1 by 40%. Sucrose was sweetener, texture-forming, preservatives, filler, and flavor-forming. Glucose syrup was controlling crystallization of sugar, adding density, and adjusting the sweetness level of hard candy. Glucose syrup can increase the viscosity of the candy, so candy remains sticky and reduces migration of carbohydrates. Salt was avoid caramelization of the dough because of warming that has exceeded the sugar melting point (160°C). In addition to causing the brown color dough, caramelization damage the active substance of the extract.

In the process of making hard candy, the extract was added at final

stage of heating. This was done so as not to damage the active substance of the extract for heating can cause a volatile compound and degraded. Hard candy packaging must be done quickly to prevent absorption of water from the air which causes the moisture candy increases, thus affecting the decline in the quality of hard candy that is easily damaged and watery (Nurwati. 2011).

2. Hedonic Test of Hard Candy

In order to determine the consumer acceptance, hedonic testing did by appearance, color, scent, flavor, and texture. Color is important component in determining the quality of acceptance of a food product. A food product is considered bad and good texture will not be eaten if the colors are less unsightly or have deviated from the color it should be. Visually appear is first factor to determine the quality of food. The value of color hedonic test results are presented in Figure 2.

Based on results, hard candy with the addition of red ginger extract had an average value of 2.90 to 4.13. Highest value against hard candy color is obtained in formula A with the addition of red ginger extract 1%, while the lowest value obtained in formula C with the addition of red ginger extract of 2.5%. Hard candy colors are generally brown. The brown color comes from red ginger rhizome extract. The higher the concentration added, the more concentrated the resulting hard candy colors. It is also the

lead at a concentration of 2.5% preference level panelists decreased. Panelists prefer hard candy with clear brown color.

Scent is a substance or a particular component that has several functions in the food which can improve, make more valuable or acceptable, attractive consumer preferences toward the food. Tests on the scent is considered important because it can quickly provide an assessment of whether or not a product is accepted by consumers. The value of scent hedonic test results are presented in Figure 3.

Based on hedonic test of scent conducted by panelists, hard candy with the addition of red ginger extract had an average value of 3.43 to 4.16. Highest value against hard candy scent is obtained in formula A with the addition of red ginger extract 1%, while the lowest value obtained in formula C with the addition of red ginger extract of 2.5%. The higher the concentration of extract given, preference level panelists for scent decreased. Concentration of 2.5 % ginger scent that led to increasingly sharp spicy on the nose so that the lower the level of preference panel.



Figure 2. Avarage value of color

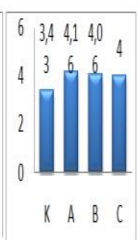


Figure 3. Avarage value of scent

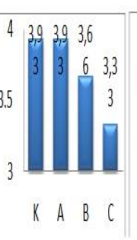


Figure 4. Avarage value of flavor



Figure 5. Avarage value of texture

Taste or flavor involved by tongue senses. The flavor is difficult to understand completely because everybody have diverse tastes. Generally food is not only composed of a group of taste alone, but a combination of various flavors of integrated causing food taste delicious. The taste is one of the factors that affect a person's admission to a food. Think in general can be divided into salty, sweet, bitter, and sour. Hedonic test of flavor aimed to determine the level of response from the panelists about the favorite against the hard candy in each formula. The value of flavor hedonic test results are presented in Figure 4.

Based on results, hard candy with the addition of red ginger extract had an average value of 2.46 to 4.3. Highest value against hard candy flavor is obtained in formula A with the addition of red ginger extract 1%, while the lowest value obtained in formula C with the addition of red ginger extract of 2.5%. The higher the concentration of extract added, preference level panelists for flavor decreased. This is because at a concentration of 2.5% flavor hard candy is very spicy and bitter. According IMACRI (2010) in the ginger spicy flavor comes from the compound gingerol and shogaol. Panelists preferred blend of sweet and spicy flavors. The amount of sucrose given balance of red ginger extract 1% on a hard candy in formula A. Sucrose can improve the scent and flavor by establishing a better balance between

spicy, bitter, and salty. Sucrose also serves to provide sweetness and tenderness which have high solubility.

Texture is a quality parameter that was influencing the characteristics of hard candy. It has a relationship with the chewing taste. The value of texture hedonic test results are presented in Figure 5. Based on hedonic test of texture conducted by panelists, hard candy with the addition of red ginger extract had an average value of 3.33 to 3.90. Highest value against hard candy texture is obtained in formula A with the addition of red ginger extract 1%, while the lowest value obtained in formula C with the addition of red ginger extract of 2.5%. Generally The higher the concentration of extract added, preference level panelists for texture decreased. The higher concentration red ginger extract produced more viscous texture.

Results of analysis using Kruskal Wallis aims to see the formula has same or different color, scent, flavor, and texture level. Level of color, scent, flavor, and texture level give significantly different results ($P < 0.05$). The real influence of all the formulas for color seen visually panelists and relative. The higher concentration of red ginger extract, the lower the preference level panelists. This is because at a concentration of 2.5% flavor hard candy is truly dark, very spicy and bitter, more sharp spicy scent, and more viscous. Panelists preferred blend of sweet and spicy flavors. The amount of

sucrose given balance of red ginger extract 1% on a hard candy in formula A. Sucrose can improve the scent and flavor by establishing a better balance between taste spicy, bitter and salty. Sucrose also serves to provide sweetness and tenderness which have high solubility.

3. Characterisation of Hard Candy

The other characteristic of hard candy is water content. Based on water content measurement of hard candy, all formulas K gives a yield which suitable with ISO standards (2010) about the quality requirements of hard candy. The higher the concentration of extract given, preference level water content decreased. The highest level of water content contained in the formula A (extract 1%) while the lowest water content contained in the formula K (no adding extract). The art of making candy with satisfactory durability depend on the manufacture of products with minimum water content. The higher the concentration of the extract given the lower the water content of sweets. This is because the higher the concentration of red ginger extract given result fewer water added. Low water content was allegedly caused by factors other than raw materials also influenced by the cooking temperature. Sugar solution is used as the main ingredient of hard candy made by heating at high temperatures will harden and decreased water content. This is in accordance with Winarno (2008), when the sucrose solution was evaporated so concentration

and boiling point will increase. This situation will continue so all the water evaporates and make liquid sucrose melts.

Water content related by hardness of product. Hardness is a solid food product properties in terms of rupture resistance due to compressive force that is not deformed. Changes in hardness to a certain extent can be a clue feasibility hard candy is consumed (Mahardika et al., 2014). Hard candy hardness test results are presented in Figure 7. Based on hardness test data, formula K (without extract) found hardness values of 16.8 kgf. This result is not much different from the results of research conducted by Nurwati (2011), the formula without extracts pedada fruit with glucose and sucrose ratio of 1: 1 gave a hardness values of 17.7 kgf. The higher hardness value was Formula C (2.5% extract) providing hardness values of 19.3 kgf. The higher concentration of red ginger extract added was increased the hardness value of hard candy. Candy hardness values was influenced by water content. The higher water content of the candy showed the lower hardness value.

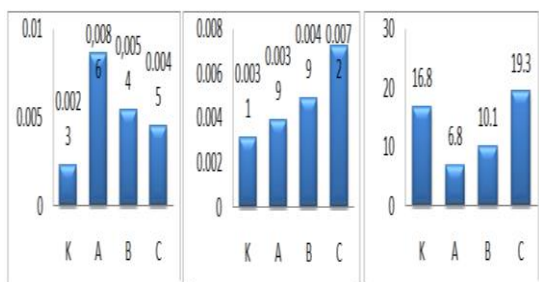


Figure 6. Value of measurement of water content

Figure 7. Value of measurement of ash content

Figure 7. Value of measurement of hardness testing

Water also greatly influences quality of hard candy. The high water content will cause hard candy can not hardly enough and easily melts (Ramadan, 2012). The high water content results bacteria, fungi and other microbes multiply and make chemical, color, scent, and flavor changes.

Other quality requirement on confectionary product is ash content. Ashes are the organic substance waste products of burning organic materials. Usually, these components consist of potassium, calcium, sodium, iron, manganese, and magnesium (Mahardika et al., 2014). The result of hard candy ash content is presented in Figure 6. Based on test data ash content of hard candy formula K gives lower value and formula C gives higher value. The higher concentration of red ginger extract added was increased the ash content value of hard candy. It is caused by a high purity of sucrose and glucose syrup used. Purity of the raw materials used can be seen in the resulting hard candies have high clarity. Sugar with higher purity and low ash will produce candy with good clarity or appearance similar to water. The ash content is caused by minerals in the red ginger rhizome are calcium and magnesium.

CONCLUSION

Based on the results of hedonic tests, water content, ash content, and hardness measurement the best formula

of hard candy contains red ginger extract ie formula A (extract of 1%)

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