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Galactagogue Instant Powder Combination of Papaya Leaves and Red Ginger for Breastfeeding Mother

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ABSTRACT

Background: Breast milk contains all the necessary nutrients for a baby in the first 6 months after birth. Nevertheless, coverage of exclusive breastfeeding in Indonesia is still low and volatile. Perception of insufficient breast milk is one of the causes of the failure of exclusive breastfeeding. Another factor for the most common cause of failure of exclusive breastfeeding before 6 months is that breast milk has not come out factor or milk production is not enough. One of the ways to help mother increase the milk supply is by encouraging her to try local galactagogues. Galactagogues are any food, beverage, or special herb believed to assist initiation, to maintain, and to boost excretion of breast milk. Papaya leaves contain quercetin compounds that can activate the prolactin hormone receptors, thereby increasing milk production. In addition, red ginger is also one of the local plants, which has a function as galactagogue.

Objective: The objective of this study was to analyze the differences organoleptic quality and quercetin content of galactagogue instant powder combination of papaya leaves and red ginger, as a functional beverage product development for breastfeeding mothers.

Materials and Methods: This research is an experimental research which directed on developing products, starting with the manufacture of three combined formulations in regard to the amount of papaya and red ginger used, i.e., F1 (50 g:100 g), F2 (87.5 g:62.5 g), and F3 (100 g:50 g). This study was involved by thirty untrained panelists.

Result: Kruskal–Wallis test showed that there is no difference in the level of preference between the color (0.617) and texture (0.968) combination formulas F1, F2, and F3 while there are difference in taste (0.000) and aroma (0.013). Analysis of quercetin contents showed that F1 contains 18.2 mg/100 g of quercetin; F2 20.6 mg/100 g of quercetin; and F3 21.5 mg/100 g of quercetin.

Conclusion: The more the amount of papaya leaves used, the greater the content of quercetin in the product. F3 was most preferred in regard to taste and color and contains 21.5 mg/100 g of quercetin.

Key words: Breast milk production, Breastfeeding mother, Flavonoid, Galactagogue, Quercetin, Papaya leaves, Red ginger

INTRODUCTION

Giving the right food early in life is essential for the survival, growth, and development, as well as the baby's health. Mother's milk is the best food to fulfill the baby's nutritional optimal growth.¹ Breastfeeding helps children to survive and thrive, enable the baby to fight infections, provide essential nutrients to the early development of their brains and bodies, and strengthen the bond between mother and baby.²

Breast milk is the only food or drink for babies and will needed for the first 6 months. Various researches have proved that breastfeeding has many benefits. Various researches have proved that breastfeeding has many benefits, more than just feeding the baby with breast milk but also has benefits for the whole family, psychological, economic, and protecting the health of mother and child. Breast milk encourages healthy growth, improves cognitive development, and has long-term health benefits, such as reducing the risk of overweight or obesity and

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the development of non-communicable diseases in the future.³ The World Health Organization in Global Nutrition Targets for 2025 targets an increase in exclusive breastfeeding in the first 6 months of life by 50% by 2025.⁴ Although breastfeeding has been associated with many positive health outcomes, but the dissemination of the implementation of exclusive breastfeeding as the first choice in providing nutrition for the infant is still full of challenges.⁵ Globally, the UNICEF based on the data in 2014 reported that only 43% of newborns in the world are put to the breast within 17 or commonly referred to as early initiation of breastfeeding. Only 38% of infants aged 0-23 months who are exclusively breastfed.⁶ Health surveys in the United States showed that 79.2% of the infants were breastfed while only 18.8% received exclusive breastfeeding for 6 months.⁷ The figure is still far from the expected target. However, breastfeeding has the potential to prevent about 800,000 deaths among children under 5 years if all children aged 0-23 months optimally breastfed.⁸

Breast milk contains all the necessary nutrients for the baby in the first 6 months after birth. Nevertheless, coverage of exclusive breastfeeding in Indonesia is still low and volatile. Health Statistics Profile in 2015 showed the percentage who ever breastfed toddler in Indonesia in 2014 reached 94.2% but with the high number has no say in the coverage of exclusive breastfeeding. The percentage of children aged 2-4 years who received only breast milk until the age of 6 months is only 38.09%.⁹ Many beliefs and attitudes toward the meaning unfounded breastfeeding makes the mother did not give exclusive breastfeeding in the first 6-month period to their babies. The fear that the milk produced is not enough or they have poor quality often affect our mother cannot breastfeed exclusively. Perceptions of insufficient breast milk is one of the causes of the failure of exclusive breastfeeding in the world.¹⁰ Research conducted at Tegal 2014 showed that 51.1% of capital experienced perceptions of insufficient breast milk. Another factor for the most common cause of failure of exclusive breastfeeding before 6 months is that breast milk has not come out factor or milk production is not enough.¹¹ This may occur before the mother can breastfeed well, especially the first few weeks after childbirth. For that, mom needed help and support to breastfeed and maintain milk production. One of the ways to help mother increase the milk supply by encouraging her to try lactogogue/local galactogogues.³ Galactogogues (or lactogogues) are drugs or other substances that are believed to assist initiation, maintenance, and expenditure of breast milk.¹²

Papaya leaves has a function as a natural galactogogue. Papaya leaf function is typically used by the Java community where when a mother has a problem with breastfeeding will often use papaya to increase production and the taste of breast milk.¹³ Jamu is believed to help increase production and nourishing breast milk, used between 1 and 2 years after giving birth, and this practice is considered by many as a form of traditional mother of spacing births.¹⁴

Papaya leaves contain carbohydrates, protein, amino acids, cardiac glycosides, saponin glycosides, flavonoids, alkaloids, phenolics, and iridoids.¹⁵ Phenolic compounds in the papaya extract of which is protocatechuic acid, coumaric acid, caffeic acid, 5,7-dimethoxycoumarin, kaempferol, and quercetin.¹⁶ The *in silico* approach suggests novel target for breast milk production, 5 phytochemical compounds selected from 157 molecules naturally galactogogues, namely Sesamin,

Trifoliol, Limonin, Quercetin and Kaempferol and it proves can produce more milk production by activating the prolactin receptor.¹⁷ Papaya leaves as natural ore herbal galactogogue are kaempferol and quercetin-containing compounds that can activate the hormone prolactin receptors so that they can increase milk production.

Besides papaya, red ginger also has many benefits for the mother after giving birth, one of them being galactogogue. The compounds gingerol, shogaol, and gingerone are known to inhibit the cyclooxygenase enzyme, causing a decrease in the formation or biosynthesis of prostaglandin.¹⁸ Studies conducted at a hospital in Thailand, involving 104 mothers undergoing the process of Caesarean, consisting of 51 mothers in the experimental group and 53 mothers in the control group, results that ginger drinks can increase the quantity of breast milk and reduce flatulence in mother after undergoing a cesarean delivery process.¹⁹ In addition, research conducted in Perth, Australia, shows herbal ginger into the second largest after fenugreek consumed breastfeeding in increasing milk production.²⁰

Product development for breastfeeding mothers based on local food as galactogogue is still rarely done in Indonesia. Papaya leaves and red ginger has a function as herbal galactogogue that needs to be developed and analyzed in depth. This product is expected to be used as functional drinks in powder form that is practical and hygienic for breastfeeding mothers so that they can increase milk production. With this product anyway, they hopefully able to contribute to increase the coverage of exclusive breastfeeding and simultaneously also support the growth of the baby order in order to prevent nutritional problems such as wasting and stunting.

The objective of this study was to analyze the differences organoleptic quality and quercetin content of galactogogue instant powder combination of papaya leaves and red ginger, as a functional beverage product development for breastfeeding mothers.

MATERIALS AND METHODS

This study applied experimental study design that conducted to develop formulations of galactogogue instant powder made from papaya leaves (*Carica Papaya* Linn) and red ginger (*Zingiber officinale* Var. *Rubrum*). This research was conducted in February until July 2016 held at the faculty of Public Health Nutrition Laboratory of Airlangga University and on untrained panelists. The dependent variable in this study was organoleptic quality (which included color, aroma, texture, and taste) and quercetin content. The independent variable in this study was the proportion of papaya leaves and red ginger. Each formula uses the same additives such as sugar, palm sugar, cinnamon powder, salt, pandan leaves, and water. The formula is processed into powder form instant beverages based on modification manufacture instant drinks of red ginger.²¹ The material composition of each formula is presented in Table 1.

The results of formulations were tested with organoleptic test toward thirty untrained panelists using a four hedonic scale: (1) do not like, (2) lack of like, (3) quite like, and (4) like. In the presentation, as much as 20 g powder mixed with warm water was served to panelists. The quercetin content collected through laboratory analysis with thin layer chromatography method.

Data from the analysis of quercetin content presented descriptively. Organoleptic test was analyzed using Kruskal–Wallis test, and if there are treatment effects, then further test *Post-hoc* with Mann–Whitney test was performed.

RESULTS

Fondness Level to Color

A preference level of color by untrained panelists on galactogogue instant powder showed that F5 is a combination formula with the highest average score. The average value of the three formulas ranged from 2.56 to 2.80 qualifies almost enough likes. Distribution of a preference level of color according to the formulas is shown in Figure 1. Based on statistical analysis using Kruskal–Wallis test, it showed the value of significance level (P) = 0.617 > 0.05 α (Ho accepted) which means that there is no difference in the level of preference between the color combination formulas F1, F2, and F3.

Fondness Level to Aroma

A preference level of aroma is influenced by the basic materials used in the manufacture of processed food. Distribution of a preference level of aroma according to the formulas is shown in Figure 2. Based on statistical analysis using Kruskal–Wallis test, it showed the value of significance level (P) = 0.013 < α 0.05 (Ho rejected) which means that there is a difference between the level of preference color combination formulas F1, F2, and F3. Post Hoc Test used to see any paired comparison of between two group formulas. There is a difference between the level of preference scent formula and formula F1 and F2, F2 and F3. While the for formulas F1 and F3, there is no color preference level to differences between products.

Fondness Level to Texture

A level preference of texture (solubility of powder in warm water) by untrained panelists has a distribution average value of 3.30 to 3.33, which means untrained panelists pretty like the texture of this formula. Kruskal–Wallis test results showed the P = 0.968 > α of 0.05 means (Ho accepted) which means that there is no difference in texture between the level of preference combinations formula F1, F2, and F3. Distribution of a preference level of texture according to the formulas is shown in Figure 3.

Fondness Level to Taste

The average value of lowest to highest sequentially each at F2(2.13), F1(2.83), and F3(3.36). Distribution of a preference level of taste according to the formulas is shown in Figure 4. Based on data analysis with Kruskal–Wallis test P = 0.000

Table 1: The composition according to type of formula

Ingredient	F1	F2	F3
	w	w	w
Papaya leaves (g)	50	87.5	100
Red ginger (g)	100	62.5	50
Sugar (g)	275	275	275
Palm sugar (g)	31	31	31
Cinnamon powder (g)	1	1	1
Salt (g)	1	1	1
Pandan leaves	½ leaf	½ leaf	½ leaf
Water (ml)	125	125	125

with $\alpha = 0.05$ means (Ho rejected) which means that there is a difference between the level of preference color combination formulas F1, F2, and F3. The *Post-hoc* test with Mann–Whitney test. Mann–Whitney test showed that there are differences in taste preference level

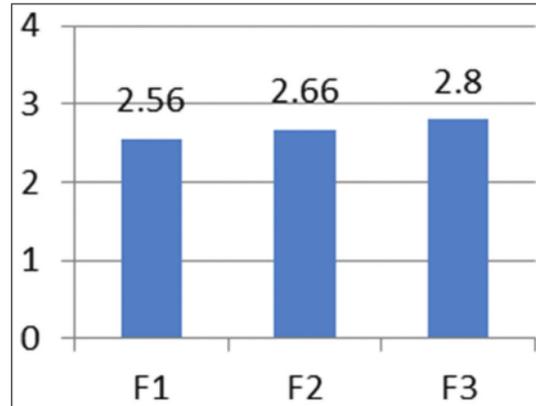


Figure 1: Average value of preference level of color

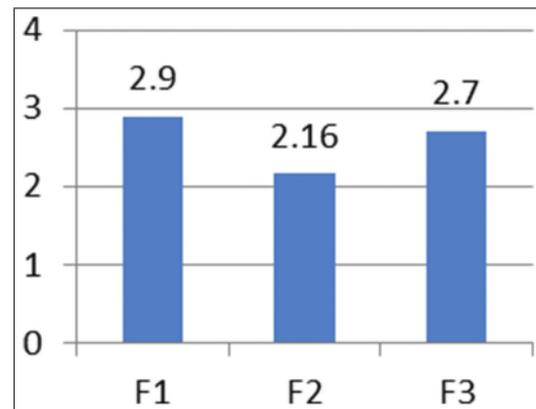


Figure 2: Average value of preference level of aroma

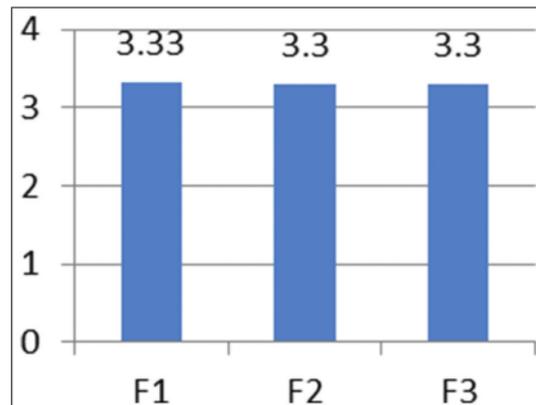


Figure 3: Average value of preference level of texture

among all combination formulas, namely, formulas F1 and F2, F1 and F3, and F2 and F3.

Quercetin Content

Quercetin is a flavonoid active compounds which include both flavonols. Quercetin as phytochemical compounds acts as a natural galactogogue by activating receptors of the hormone prolactin. Results of laboratory tests show that F3 has the highest content of quercetin being 21.5 mg/100 g. The content of quercetin in each formula instant powder combination can be seen in Table 2.

Based on the above table, it shows the results that the greater number of papaya leaves in the manufacture of galactogogue instant powder combination formula, the greater the content of quercetin in the product.

DISCUSSION

Fondness Level to Color

Color at a highly processed food determines the quality of the product. Assessment of color is done by evaluation using the senses of sight, so the color is a factor that is the fastest in the provision impression like whether or not the panelists to the formula presented. Results of the study showed the value of the highest average rate of 2.80 favorite color on the formulation of a combination of instant powder that is on F3 which is a formulation with a ratio of the number of papaya leaves and red ginger of 2:1. Instead the lowest value, average value is the combination formulas F1 with a composition ratio of 1:2 between papaya and red ginger.

This indicates that the panelists nearly enough like the F3 product. The more the number of papaya leaves are added to the formulation of a combination of instant powder drinks produced galactogogue and then become more solid green for the green color of the leaves of papaya increasingly dominant.

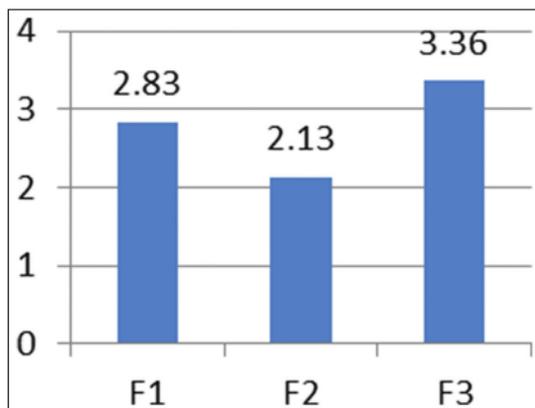


Figure 4: Average value of preference level of taste

Table 2: Quercetin content

Nomor	Formula	Quercetin (mg/100 g)
1	F1	18.2
2	F2	20.6
3	F3	21.5

High drying temperature and time accompaniment long on leaf-based material will make the results of increasingly concentrated steeping drinks, because more and more pigment chlorophyll and carotene are oxidized soluble in water.²² The green color in plants caused by the content of the dye in it is called the natural pigment chlorophyll.²³

Formula F1 has the lowest average value of the preference level between the color combination formulas developed galactogogue instant powder. This may be due to the comparison of the dominant red ginger mixed golden yellow with a slight green color of papaya leaves, the caramelization reaction resulting from heating sugar as an additive which forms a brown color resulting in a brownish-green color in the formula F1. The intensity of the brightness of the red ginger juice beverage products tend to decrease (dark) due to rising temperatures and longer extraction time of extraction, as well as the addition of other colors in an object that will lower the brightness value.²⁴

Fondness Level to Aroma

A person's level of aroma associated with the stimuli received by the sense of smell. The sense of smell has cells that constitute the olfactory organ detection smell/aroma that comes from food. Aroma chemicals are molecules that evaporate and float in the air. The results showed the average value of the level of preference aroma formulations were highest combination F1 (2.90). F1 is a combination of instant powder formulations with the ratio between the number of red papaya and ginger for 1:2. Number of red ginger has a huge contribution to the level of preference the scent by the panelists. This is because the red ginger contains essential oils are included in this type of oil evaporates and becomes a component that provides a distinctive aroma. The total weight of red ginger is used when the analysis of each treatment should be the same in order to produce the same essential oils and no distinction of functional beverage aroma.²⁵

Aroma in the formulation of a combination with a number of papaya leaves more preferably less panelists, probably due to the scent of leaves that still smells. It is the same as the functional beverage soursop leaves with treatment without the addition of red ginger have the aroma off flavor high as soursop leaves have less savory aroma that is unpleasant aroma and can be felt when the process of brewing the leaves of the soursop.²⁶ To overcome this, it is necessary so as to reduce the characteristic flavor of the leaves smell.

Fondness Level to Texture

Texture of beverages also affects the acceptability of the product. Texture of the visits is the solubility of instant powder in warm water which is then presented as a functional beverage. A level assessment of texture (solubility of powder in warm water) by untrained panelists has a distribution average value of 3.3 to 3.63 being entered on criteria ranging from pretty like up to like. This is consistent with research that showed that all formulations are made into instant ginger drink red rapidly dissolves in water so fast in the presentation.²¹ Free solubility powder drinks are also one of the factors that determine the nature of instant drinks.

Fondness Level to Taste

Taste is one parameter determining the preference level panelists to a product that may affect acceptance for the products produced. Rating of a flavor-related component material captured by the sense of taste (tongue). The results

of the highest average value on a combination formulation are the formulation F3 at 3.36. The taste is influenced by several factors, namely chemical, temperature, concentration, and interaction with other flavor components.²⁶ Although the ratio of the amount of papaya leaves is greater than the red ginger, formula F3 combination is favored by panelists compared to F1 and F2. This may be influenced by the process Blansir conducted in papaya leaves before processing the manufacture of instant powder. Blansir process is intended to reduce the bitter taste of papaya leaves.

Quercetin Content

Quercetin is a flavonoid active compound and as well as phytochemical compounds that act as a natural galactogogue by activating receptors of the hormone prolactin. F3 has the highest content of quercetin was 21.5 mg/100 g. The more the number of papaya leaves to the formula, the greater the content of quercetin in the product. The content of quercetin on papaya leaf extract of 0.04 mg/g.¹⁶ Quercetin is a phytochemical compound found in natural galactogogue that has a role in activating the hormone prolactin receptor and has low toxicity.¹⁷ Besides that, mother's milk also contains quercetin. The existence of flavonoids in samples of breast milk (ASI), which the compound quercetin and kaempferol are found in all the samples that quercetin as much as 32.5 to 108.6 nmol/L and kaempferol as much as 7.8 to 71.4 nmol/L.²⁷

CONCLUSION

Some galactogogues have earned reputation and recognition by the public and professionals as an alternative approach to increase the production of breast milk. Galactogogues are any food, beverage, or special herb believed to assist initiation, to maintain, and to boost excretion of breast milk. Papaya leaves contain quercetin compounds that can activate the prolactin hormone receptors, thereby increasing milk production. In addition, red ginger is also one of local food that has a function as galactogogue. The results showed that the more the amount of papaya leaves used, the greater the content of quercetin in the product. F3 was the most preferred in regard to taste and color and contains 21.5 mg/100 g of quercetin.

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