International Journal of Applied and Advanced Multidisciplinary Research (IJAAMR)
Vol. 1, No. 1, 2023 : 53-64

Organoleptic Characteristics of Soy Milk Powder with the Addition of RedGinger Extract (*Zingiber officinale* var. rubrum)

Jufrin Pagune[1]*, Riska Nabila[2],
Universitas Ichsan Gorontalo[1]
Universitas Islam Negeri Mataram[2]
Corresponding Author: Jufrin Pagune pagunej@gmail.com

A R T I C L E I N F O

Keywords: Extract, Red Ginger, Soy Milk, Organoleptic

Received : 12, July
Revised : 20, August
Accepted: 23, September

A B S T R A C T

Soy milk powder is one of the natural products used to diversify liquid soy milk. The objective of this research is to determine the best treatment based on organoleptic characteristics, specifically using the hedonic method or panelist preference test. This research employed a completely randomized design (CRD) with 4 treatments, each replicated 3 times: S0 = 500 ml soybean juice, S1 = 500 ml soybean juice + 20 ml red ginger extract, S2 = 500 ml soybean juice + 30 ml, and S3 = 500 ml soybean juice + 40 ml. The organoleptic test results for soy milk powder revealed that the aroma preferred most by the panelists was found in treatment S3 with a score of (3.9), the taste preferred most by the panelists were also found in treatment S3 with a score of (4.4), and the color preferred most by the panelists were found in treatment S0 with a score of (4.1).

INTRODUCTION

In Indonesia, it is certain that the consumption of soybeans will increase annually. This increase is attributed to several factors, such as the growing population, public awareness of food nutrition, and an increase in per capita income. The rising demand for soybeans by the community can be linked to thefulfillment of protein needs for individuals in the food items they consume (Aldillah, 2014).

The province of Gorontalo is capable of developing soybean cultivation (Sardianti, 2019). Soybean is one of the legumes categorized as a primary sourceof vegetable oil and plant-based protein. Soybean plants are utilized for their seeds, which contain proteins, fats, and other nutrients such as lecithin and vitamins (phytic acid) (Arisanti, 2020).

For human health, soybeans have beneficial effects because they are a good source of easily digestible protein. Soybeans contain vitamins A, E, and K, as well as various B vitamins. Additionally, they provide several minerals, including potassium (K), iron (Fe), zinc (Zn), and phosphorus (P) (Stefia, 2017).

One of the soybean-based products that offer many health benefits is plant-based milk. There are two types of soy-based plant milk: liquid plant milkand powdered plant milk. Soy milk powder is a dried, powdered form of soy milk produced through an evaporation process (Erfandi, 2018). Soy milk powder is a natural product used to diversify liquid soy milk products (Santosoet al., 2016).

About 80% of the protein content in soy milk is comparable to that of cow's milk. However, soy milk contains no cholesterol and is safe for consumption by individuals with lactose intolerance or allergies to lactose. Nevertheless, during the processing of soy milk, there is a reduction in protein content due to various factors such as the duration of soaking, the quantity of water used, and heat treatment, which can lead to protein denaturation. The greater the extent of protein denaturation, the lower the protein content in soy milk (Picauly et al., 2015).Furthermore, both liquid and powdered soy milk have a bland taste and aroma, which may not be preferred by some consumers (Pramitasari et al., 2011). The enzymatic activity of lipoxidase can contribute tothe development of this bland flavor in soybeans or their products (Zainuddin, 2014). To enhance the protein content and eliminate the bland aroma and tasteof soy milk, it can be formulated with an essence such as red ginger extract.

Red ginger is one of the most commonly found rhizomatous plants, used as an ingredient in cooking and herbal remedies. It is an herbal plant with greenish-red skin and relatively smaller in size compared to other

ginger varieties (Mulachela, 2021). Red ginger is also known for its antimicrobialproperties, which can extend the shelf life of products. It contains higher levels of *gingerone* and *gingerol* compared to other types of ginger, making it effective at inhibiting the growth of bacteria such as *Escherichia coli* and *Bacillus subtilis*.

According to Pagune et al. (2023), the most suitable ginger variety to be used as an additive in soy processing is red ginger (*Zingiber officinale* var. rubrum). Besides serving as a deodorizer and antimicrobial agent, red ginger also contains a protein content of 12.3%. Therefore, soy milk powder formulated with red ginger extract will experience an increase in its protein content compared to soy milk powder without the addition of red ginger.

Based on the description, it is indeed advisable to conduct research on theutilization of red ginger in the production of soy milk powder. This is because red ginger not only adds a unique flavor and aroma that can eliminate thebland taste in legumes but also acts as an antimicrobial agent that can extend the shelf life of the product and increase the protein content of soy milk. Therefore, the research will focus on the Formulation of Red Ginger Extract (*Zingiber officinale* var. rubrum) in the Production of Soy Milk Powder. The soy milk powder aims to contain high protein levels and be lactose-free, making it more acceptable to the general public.

LITERATURE REVIEW

Soy milk is defined as a supplement (extra) in the form of a drink that can be consumed regularly and periodically according to the body's needs. Soy milkcan be consumed by all ages because it is cholesterol-free and does not contain lactose, making it an alternative for consumers who are allergic to lactose or cow's milk. The nutritional content of soy milk is almost the same as the nutritional content of cow's milk (Hidayah, 2018). Usually drying milk uses a spray dryer or roller dryer, but to apply it at home without a dryer, you can usethe crystallization technique with the help of granulated sugar. The longest shelf life of powdered milk can be up to 2 years if handled properly and does not need to be stored in the freezer because the water content in it is relatively low. However, it is easily oxidized by air, resulting in changes to the compounds contained.

Even though the shape and texture of powdered milk and liquid milk are different, in essence powdered milk is made from liquid milk or pure milk by going through several processes first. Powdered milk is produced by removing water or evaporating liquid milk. Usually this evaporation process using heat iscarried out to remove the water contained in the milk

while simultaneously deactivating bacteria without removing the compounds in the milk. The nutritional content between powdered milk and liquid milk is not much different, even though powdered milk has undergone various processes. Usually this vegetable milk is formulated with various essences, one of which isred ginger.

In general, red ginger is widely known by the public as a traditional medicine. Just like an antibiotic, red ginger has secondary metabolite components based on essential oils, flavonoids, terpenoids and phenols. Fresh extracts from the rhizome contain most of the essential oil components which are structured from germacron, cineole, α-pinene, α-farnesene, camphenene, dicamphor, caryophyllene-oxide, β-pinene and isocariophyllene which can provide antimicrobial compounds in inhibiting the rate of microbial production. (Nola, 2020).

METHODOLOGY

Tools and Materials

In the production of soy milk powder, several tools are used, including a blender, frying pan, saucepan, stove, knife, spatula, sieve, measuring glass, spoon, mixing bowl, and cheesecloth. The raw materials used in the productionof soy milk powder are soybeans and red ginger obtained from the traditional market in Tilamuta, Tilamuta district. There are also some additional ingredients in the production of soy milk powder, including sugar, salt, and water.

Research Design

The experimental research used a Completely Randomized Design (CRD) method with 4 treatments and 3 replications, modified from the study by Pramitasari et al. (2011).

The treatments consisted of: S0= 500 ml Soybean Juice,S1= 500 ml Soybean Juice + 20 ml Red Ginger Extract, S2= 500 ml Soybean Juice + 30 ml Red Ginger Extract, S3 = 500 ml Soybean Juice + 40 ml Red Ginger Extract

Research Procedure

Combine the soybean juice with red ginger extract according to the treatment specifications. Cook the soybean juice, which has been mixed with red ginger extract, over medium heat until the water content decreases. Stir continuously to prevent clumping in the soy milk. Once the soy milk has reduced in volume from its initial amount, add 5 grams of salt and continue stirring. Then, add 100 grams of granulated sugar with the purpose of preservation, providing sweetness, and inducing crystallization in the soy milk solution. Stir continuously and reduce the heat to prevent caramelization of thesoy milk. After the soy milk has started to solidify,

turn off the heat and stir until crystalline clumps form in the soy milk. Crush these clumps using a blender until they become fine granules. Next, standardize the granules for consistency using an 80-mesh sieve.
In the final step, package the soy milk powder in clean packaging.

Research Parameters

The parameter for this research is sensory evaluation or organoleptic testing. Sensory evaluation aims to determine the degree of acceptability of a product, making it appealing to panelists (consumers) or assessing their likability. The hedonic method is used for this evaluation, involving the assessment of taste, aroma, and color of the resulting product. There were 30 panelists who were asked to evaluate the product based on their level of liking.

In the hedonic method, scores are assigned as follows: very like (5), like (4), somewhat like (3), dislike (2), and very dislike (1).

RESEARCH RESULT AND DISCUSSION

Organoleptic test is a food product evaluation method that involves using human senses to determine panelists' responses to the product being tested. Thetesting method used is the hedonic method (liking test), which includes assessing the aroma, taste, and color of the resulting soy milk powder. In this testing method, 30 panelists are asked to provide evaluations based on theirlevel of liking (Haryanto, 2017).

Aroma

According to Zulistina (2019), one of the most important indicators in determining product quality is aroma. Aroma has an important role in determining the degree of research and quality of a food ingredient. Apart fromthat, consumers tend to judge the deliciousness of a food from the appearance of odorous substances which are volatile (evaporate). The level of panelists' preferences for aromas can be seen in Figure 1.

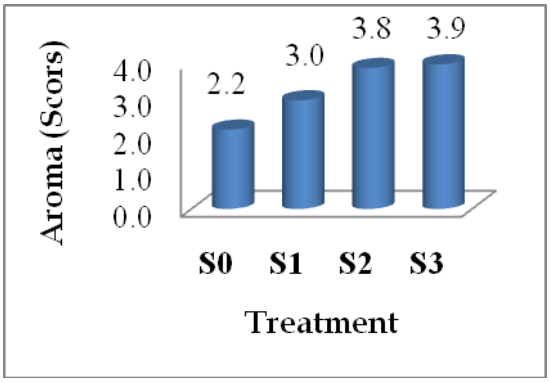

Figure 1. Organoleptic aroma test results on powdered soy milk

Based on the picture above, it shows that the panelists' most preferred aroma was in the S3 treatment with 40 ml red ginger extract formulation with a score of 3.9 (rather like it) compared to the other treatments, while the panelists' least favorite was the soy milk aroma in the S0 treatment without the red ginger extract formulation. with a score of 2.2 (dislike). This is because the higher the red ginger extract formulation in powdered soy milk, the more distinctive the aroma will be so it can influence the panelists' acceptance of powdered soy milkin terms of aroma compared to the S0 treatment without the red ginger extract formulation.

The aroma experienced a change due to an increase in the formulation of red ginger extract in powdered soy milk which tended to increase the panelists'assessment. The aroma of red ginger is caused by the content of essential oil compounds with the main components being zingiberene and zingerol which causes the distinctive aromatic smell of red ginger to appear (Srikandi et al., 2020).

The addition of red ginger extract can influence the panelists' acceptance and impression of powdered soy milk. In essence, powdered and liquid soy milk has a unique aroma and taste of soybeans so that the essence formulation in the form of red ginger extract can influence consumers' impressions. The more the formulation given, the more aromatic the typical red ginger is, which comes from a mixture of zingerone, shogaol and essential oil compounds (Wulandari and Swasono, 2022).

Based on Tarwendah's statement (2017), aroma compounds are volatile, so they easily reach the olfactory system at the top of the nose, and require sufficient concentration to be able to interact with one or more olfactory receptors. The distinctive smell of red ginger in powdered soy milk is a form of volatile substance that causes a response when the compound enters the nasal cavity and is felt by the olfactory system.

Zuhrina (2011), states that the aroma in food and its processed products isa very strong attraction so that it can stimulate the human sense of smell andwill arouse appetite. This aroma is caused by the presence of volatile compounds as a reaction to enzyme activity or can also be formed without the help of enzyme reactions. This concentration is also caused by the volatile nature of the aroma itself, other factors due to the natural interaction between aroma components and nutritional compounds in the food such as fat, protein, carbohydrates or the very relative consumer acceptance.

The results of further honest significant difference (BNJ) tests showed that the aroma value of powdered soy milk had a very significant effect (α>0.01).

Taste

Taste is formed due to sensations originating from chemical stimuli that can be received by the sense of taste which is a combination of the ingredients that form and their composition in food and is said to support the taste and determine the quality of a product (Pramitasari et al., 2011). One of the most important factors in determining the level of consumer preference in receiving afood product is taste. The following level of panelists' preferences for taste can be seen in Figure 2.

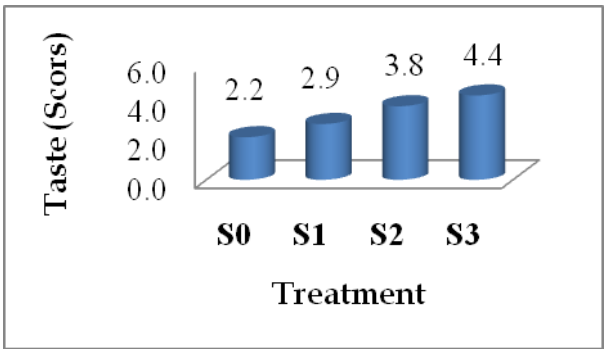

Figure 2. Organoleptic taste test results on powdered soy milk

Based on the picture above, it shows that the panelists' preferred taste for powdered soy milk is the S3 treatment with the addition of 40 ml of red ginger extract, with a score of 4.4 (like). Meanwhile, the treatment that the panelists did not like in terms of taste was treatment S0 (control) with a score of 2.2 (dislike). This shows that the taste of powdered soy milk in the S3 treatment tends to have a more typical taste of red ginger so that the resulting taste is much different from powdered soy milk in general.

The taste of a food ingredient comes from the ingredients themselves andif it has been processed, the taste is influenced by the ingredients added in theprocessing process. The more red ginger extract formulations there are inpowdered soy milk, the more it creates a different taste in the powdered soymilk and the distinctive spicy taste of ginger is able to disguise the unpleasanttaste caused by the activity of the lipoxyginase enzyme (Pramitasari et al., 2011).

Pramitasari et al., (2011), stated that red ginger has an oleoresin compound which consists of several components such as resin, shogaol and zingerol whichgives a distinctive spicy taste to ginger. Zingerol is a compound that gives ginger its distinctive taste and is a good antioxidant and anti-inflammatory agent. This compound is found in the yellow oil which appears as a result of squeezing the red ginger rhizome, and when it is cooked, the zingerol will change the compound into zingerone so that the spicy taste of the ginger will beminimized but not in large quantities

(Sulaiman, 2016). Therefore, powdered soy milk formulated with red ginger extract does not taste too spicy.

The panelists' acceptance in terms of taste was influenced by the formulation of the red ginger extract. Basically, the panelists know that soy milkgenerally only has a typical soybean taste, but when essence is added it can givethe panelists the impression that the spicy taste typical of red ginger is a form ofdiversification in processed powdered soy milk and can provide benefits to consumers because according to Fadli (2023), red ginger extract in powdered soy milk is not only an essence to disguise the unpleasant taste of soybeans, butred ginger extract can protect the digestive system from bacteria, reduce cholesterol, and strengthen the body's immune system. The anti-bacterial agents contained in fresh red ginger extract can fight bad bacteria in the body, such as Escherichia coli, Salmonella enterids, and Staphylococcus aureus. Apart from that, red ginger is also antimicrobial which can extend the product's shelf life. The gingerone and gingerol content of red ginger is higher than other ginger, soit can inhibit the development of bacteria in powdered soy milk.

Taste is referred to as a biological perspective because it is a sensation produced by a material that is about to enter the mouth and is produced by compounds that interact with tongue receptors in the oral cavity. There are several things that influence the different sensitivity and intensity of taste of thepanelists. The age factor influences the sensitivity of the sense of taste and is considered a physiological factor. Another factor that can influence the human senses (tongue) on the taste of a product is the papillae. In this papilla there aretaste buds which have the function of receiving stimulation so that there are differences in the panelists' assessments because each person has different tasteintensities (Triastini, 2018).
The results of further honest significant difference (BNJ) tests showed that the taste value of powdered soy milk had a very significant effect ($\alpha>0.01$).

Color

Research on the quality of food commodities can be carried out in the main way, namely sight by recognizing or assessing the shape, size, freshness and color. Color is a very important component in determining the quality or degree of acceptability of a food ingredient and is used as an organoleptic attribute of a food ingredient (Zulistina, 2019). The level of consumer acceptance of color can be seen in Figure 3.

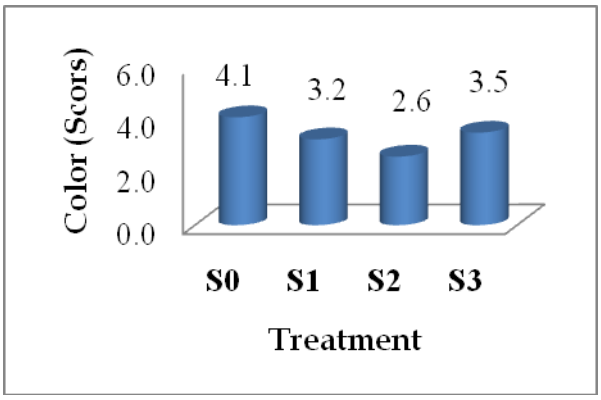

Figure 3. Color organoleptic test results on powdered soy milk

The level of panelist acceptance based on the picture above shows that in the S0 treatment without the red ginger extract formulation the panelists liked the most in terms of color with a score of 4.1 (like) while the lowest level of panelist preference was in the S2 treatment with the 30 ml red ginger extract formulation, namely with a score of 2.6 (dislike). The difference in scores is dueto the ratio of red ginger extract and granulated sugar added. The addition of red ginger extract affects the color of the powdered soy milk produced, but the color change is more influenced by the heating process during processing or in other words, the browning process caused by the heating activity of granulatedsugar in making powdered soy milk.

According to Pramitasari et al, (2011), soy milk formulated with red ginger extract tends to be white and slightly brownish in color because the brownish color is obtained from the color resulting from the extraction of red ginger. The ratio of water added during the extraction process of red ginger also affects the brownish color of the extraction results, the more water added, the results willbe pale in color, conversely, if the concentration of water added is small, the extraction results will also have a deeper color because the brownish color is obtained from the original color of the ginger rhizome. In this way, the slightly brownish white color can reduce the panelists' level of favorability, although itis still acceptable to the panelists.

The color change in powdered soy milk is also caused by the browning reaction of granulated sugar which is heated, where the sugar burns easily (Haryanto, 2017). This browning process is called a non-enzymatic process which is caused by processing at hot temperatures. The caramelization processin sugar occurs due to the activity of reducing sugars and protein constituents (amino acids) which have undergone a heating process at high temperatures over a long period of time. High temperatures can change water molecules intoglucosan. This breakdown process causes the sucrose

liquid to melt, followed by a polymerization process which gives a brownish color to the powdered soymilk (Arsa, 2016).

In food products, the browning process can result in color changes with browning as well as the formation of aroma and taste due to the Maillard reaction. Food products that go through a non-enzymatic browning process notonly provide changes in color, aroma and taste, but the product can also act as an antioxidant or a property needed to prevent oxidation reactions in products containing fat. The formation of compounds in this process is influenced by several factors, namely the type of reducing sugar, type of amino acid, the ratio between reducing sugar and amino acids, temperature, pH, water content and water activity (Hustiany, 2016).

Rifkhan et al., (2016), explained that color is a product property that can be viewed as an objective physical property and a subjective sensory property. Socolor can be measured objectively with physical instruments such as Chromameter, Tintometer, Whiteness Meter, or measured subjectively with organoleptic tests that use humans as subjects to assess the color of the sample. This difference in assessing the quality of a food ingredient objectively and subjectively has become a factor in comparing the quality of a product based on the equipment used. In this organoleptic test, the assessment tool or instrument is a panelist using sensory functions, so that the criteria are assessed based on subjective impressions. This subjective impression has a different assessment for each panelist, therefore this organoleptic test is often called a hedonic test or the panelist's acceptance of the product based on the impression received by the human senses and the panelist's level of liking. Therefore, it is necessary to carry out an analysis that combines objective and subjective assessment characteristics.

The results of further honest significant difference (BNJ) tests showed that
the color value of powdered soy milk had a very significant effect ($\alpha>0.01$).

CONCLUSIONS

From the results of the organoleptic test, the panelists' preferred treatment for powdered soy milk was in treatment S3 with a score of (3.9) for aroma, in terms of taste in treatment S3 with a score of (4.4) and for color in treatment S0 with a score of (4, 1).

ADVANCED RESEARCH

This research still has limitations so further research needs to be done on this topic.

REFERENCES

Abdillah, F. (2018) *Protein : Pengertian, Sifat Dan Fungsi*. Available At:Https://Ruangguru.Com/Blog/Pengertian-Sifat-Fungsi-Protein (Accessed: 9 July 2019).

Anonim (2021) *Mengenal Susu (Definisi, Komposisi Dan Jenis, Dinas Pertanian*

Anonim (2018) *Nilai Gizi Susu Bubuk*. Available At:

Astawan, M. (2019) *Sehat Dengan Hidangan Kacang Dan Biji-Bijian*. I. Depok:Penebar Swadaya.

Ernawati, S. (2010) *Stabilitas Sediaan Bubuk Pewarna Alami Dari Rosela (Hibiscus Sabdariffa L.) Yang Diproduksi Dengan Metode Spray*. Institut Pertanian Bogor.

Haryanto, B. And Si, S.P.M. (2017) 'Pengaruh Penambahan Gula Terhadap Karakteristik Bubuk Instan Daun Sirsak (Annona Muricata L .) Dengan Metode Kristalisasi', *Jurnal Penelitian Pascapanen Pertanian*, 14(3), Pp. 163– 170.

Hidayah, S.R. (2018) *Uji Kandungan Gizi Protein Dan Karbohidrat Es Krim Susu Kedelai Dengan Penambahan Tepung Kacang Merah*. Universitas Brawijaya.

Https://Nilaigizi.Com/Gizi/Detailproduk/1067/Susu-Bubuk (Accessed:9 July 2022).

Https://Www.Scribd.Com/Doc/289731334/Resume-Analisis-Warna.

Humaira, K.D. (2015) *Analisa Warna*. Available At: *Jurnal Farmasi*, 1(1). Available At: Jom.Unpak.Ac.Id.

Nola, K. Ulum. S.P. Dianti Pratiwi. N. Alfiah Zahra Dan Febry (2020) 'Potensi Jahe Merah (Zingiber Officinale Var.Rubrum) Sebagai Anti Bakteri', *HealthScience Growth Journal*, 5(2), Pp. 17–30. Available At: Journal.Uniska.Ac.Id.

Pagune, J., Laboko, A.L., and Zainuddin, A.(2023)" FormulasiEkstrak Jahe Merah (Zingiber Officinale Var.Rubrum) Pada Pembuatan Susu KedelaiBubuk",*Jurnal : Agricultural Review, 2(1), pp. 1-9. doi*

Picauly, P., Talahatu, J. And Mailoa, M. (2015) 'Pengaruh Penambahan Air Pada Pengolahan Susu Kedelai Effect Of Water Addition In The Processing Of Soya Milk', *Jurnal Teknologi Pertanian*, 4(1), Pp. 8–13.

Putri, M. (2019) *Khasiat Dan Manfaat Jahe Merah*. Jawa Tengah: Alprin.

Rahmadani, S. (2015) 'Optimasi Ekstraksi Jahe Merah Dengan Metode Maserasi', *Semarang*. Available At: Dispertan.Semarangkota.Go.Id (Accessed: 9 July2022).

Swari, R. Candra (2020) *Manfaat Jahe Merah Untuk Kesehatan Dari Pencernaan Hingga Kesuburan*. Available At: Hellosehat.Com/Nutrisi/Fakta-Gizi/Manfaat-Jahe-Merah-Kesehatan/ (Accessed: 9 July 2022).

Wattimena, C.V.M. Dan L. (2020) 'Jumlah Total Mikroba Susu Kedelai DenganPenambahan Sari Jahe Merah Selama Penyimpanan', *Jurnal Median*, 12(2),Pp. 50–56. Available At: Https://Doi.Org/Http://Doi.Org/Md.V12i2.561.