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# Okara Yogurt Formulation as Functional Food to Prevent Stunting

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A R T I C L E I N F O

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A B S T R A C T

Okara is the waste produced during soybean tofu production. To reduce okara waste, it is converted into functional food. Okara yogurt is formulated as a functional food to prevent stunting. The problem in this study is how the okara yogurt formulation can produce protein levels, fat levels, carbohydrate levels, water levels, ash levels, and acidity for the nutritional fulfilment of stunting, how the lactic acid bacterial population in okara yoghurt, and how organoleptic testing of okara yogurt products. This study uses RAL with 6 treatments and 3 repetitions. The data was analyzed statistically using analysis of variance (ANOVA) and continued with the tukey test. Organoleptic tests on selected formulas are Y5 color with value (3.47), Y3 texture with value (3.50), Y3 aroma with value (3.50), Y3 taste with value (3.67) and Y5 liking with value (3.67) per 100 grams. In making okara yogurt, it is recommended to use the selected formula, namely Y3

## INTRODUCTION

Indonesia is still experiencing stunting which has a serious impact on children. Stunting is an indication of the beginning of the first 1000 days of life before and after birth (Rosmalina et al., 2018). Stunting occurs due to metabolic disorders. The condition of failure to thrive in children and decreased intelligence (IQ) are the main problems in stunting (Kemenkes, 2021; Supariasa, 2019). According to data quoted from the Kemenkes (2023), the prevalence of stunting in children in Indonesia has dropped to 17.8% compared to 21.6% in 2022. Although the stunting rate in Indonesia has decreased, the figure is still high considering the target of reducing stunting in the coming year by 14% and the WHO standard is below 20%. The condition of stunting begins with pregnant women who experience chronic lack of energy (KEK) causing low birth weight (BBLR) to be included in the stunting category (Kemenkes, 2021). Factors causing nutritional problems consist of many factors, one of which is nutritional problems due to poor parenting and diet of children under five, poor sanitary hygiene and not immunizing children under five completely (Juniar et al., 2022). With immunization, toddlers will receive additional food in the form of biscuits if the nutritional status of toddlers is lacking or falls into the category of malnutrition. Government action on supplementary feeding modification utilizes local food used to meet the needs of stunted or malnourished toddlers. Supplementary feeding modifications to toddlers first follow the formulation set by the World Health Organization including flour, milk, sugar, oil and water that are energized and protein (Irwan & Lalu, 2020). Meeting nutritional needs can be done in providing nutritional intake, one of which is fungional food.

Functional food is a food product that provides more benefits for the health of the body in addition to eliminating thirst and hunger (Yuniastuti, 2019). One of the functional foods is yogurt. In addition to the distinctive taste of yogurt, including functional foods because they contain nutrients for the body (Sumarmono, 2016). Some reasons yogurt includes functional foods including yogurt containing good bacteria, containing complete nutrients, containing bioactive compounds, can overcome lactose intolerance (Sumarmono, 2016). Yogurt is a dairy product that has gone through a fermentation process by lactic acid bacteria (Lactobacillus bulgaricus and Streptococcus thermopillus) (Mustika, 2019). Yogurt contains rich micronutrients such as calcium, potassium, zinc, phosphorus, magnesium, vitamin A, riboflavin, vitamin B5, vitamin B12 and vitamin D, as well as other nutrients. The high nutritional value of yogurt lies in protein, fat, energy and carbohydrates. Yogurt has two bacteria that function to convert lactose into lactic acid which can lower pH, thus, yogurt has a distinctive taste because it contains flavor components such as diacetyl, acetaldehit and carbon dioxide. In addition, yogurt functions and has benefits for the health of the body, one of which is to increase growth (Wulanningsih, 2022). The results of research conducted by Wulanningsih (2022), using rats as a demonstration showed that bacteria living in yogurt, especially Streptococcus Thermophilus, have expertise in increasing rat weight growth by increasing digestibility and absorption in the digestive tract.

### Objective

To produce okara yogurt formulations that can prevent stunting.

## LITERATURE REVIEW

Production in solid form which still has a fairly high protein content (Sakti Essy et al., 2022). Okara has a pale white color, brittle texture and almost no flavor. Okara is commonly used as a food ingredient in traditional cuisine. Okara has a higher insoluble dietary fiber content than soluble dietary fiber. The use of soybean-based products such as agri-food waste such as okara has a fairly high potential for added value. Okara not only contributes as waste, but also increases the economic and nutritional value of food and beverages. Besides being able to improve, okara is very functional to maintain health. Increasing consumer demand and awareness of the health benefits of soy-based foods contribute to soy-based products as functional foods. This is because 1 kg of soybeans used to make tofu and soy milk produces 1.2 kg of wet okara (Feng et al., 2021). Tofu dregs have a lot of water content that is high enough to cause the waste cannot be stored for too long, while tofu dregs are only recognized by the public for animal feed. By knowing that the content of tofu pulp is still high in nutrients, utilization as a functional food ingredient needs to be done by processing it into tofu pulp flour (Putri et al., 2022). So that okara flour can be developed into a health drink in the form of okara yogurt as one of the health drinks intended to meet nutritional needs.

## METHODOLOGY

The research conducted was experimental using the Complete Randomized Design (RAL) method with 6 (six) treatments and 3 (three) analysis repeats, so that 18 experimental units were obtained, with the following types of treatment:
Y0 = without addition of okara flour (control)
Y1 = addition of 1% okara flour (w/v)
Y2 = addition of 2% okara flour (w/v)
Y3 = addition of 3% okara flour (w/v)
Y4 = addition of 4% okara flour (w/v)
Y5 = addition of 5% okara flour (w/v)

### Sample Size and Sampling Technique

The samples used were pasteurized fresh milk and okara flour with the addition of lactic acid bacteria.

### Sample Preparation of Okara Flour

The preparation of okara flour samples modifies the method used (Sunartaty & Nurman, 2017) which begins with weighing 1 kg of fresh okara. Then fresh okara is steamed for 20 minutes. After the okara steaming is completed, the next stage is okara squeezing. Okara squeezing aims to reduce the water content contained in okara. The squeezed okara is then dried using sunlight for 3 days. The dried okara is then mashed using a blender and sifted using a 100 mesh sieve, so that okara flour is obtained.

**Lactic Acid Bacteria Preparation**

The preparation of lactic acid bacteria samples modifies the method used by (Adrianto et al., 2020) which begins with BAL counting with back slooping. Where yogurt starter (diamond) is taken as much as 10 ml. The 10 ml starter is then taken and put into the BHI (Brain Hearth Infussion) medium and incubated for 24 hours with a temperature of 37 ° C. After the incubation stage is complete, then incubate again using ose needles to MRS medium (de Man, Rogosa, Sharpe bocillon) for 24 hours at 37 ° C.

**The Instrument For Data Collection**

The tools used in making okara yogurt are thermometers, digital scales, ovens, blenders, 100 mesh filters, stainless pans, stoves, stirrers, basins, measuring cups, funnels, coolers or freezers, clean washcloths and packaging. The chemical tools used are micropipettes, analytical balances, test tubes, test tube racks, drip pipettes, measuring flasks, cups (pyrex), a set of centrifuges, biurets, measuring flasks, aluminum foil, UV-Vis spectrophotometry and NDJ-1 viscometer.

**Intervention (Only for Experimental Study)**

Researchers mixed ingredients such as okara flour with the use of 0% w/v, 1% w/v, 2% w/v, 3% w/v, 4% w/v and 5% w/v, fresh milk 100 ml and sucrose 15 g until the solution became homogeneous. The next step is pasteurization for 15 seconds with a temperature of 80 ° C. Then cool the product at 40°C. Next, the product is inoculated with yogurt starter (diamond) 5% w/v of the amount of pasteurized milk. After inoculation is complete, the next step is to incubate the product at 37°C for 24 hours.

**Data Collection Process**

The main ingredients used in making okara yogurt are pasteurized fresh milk packaging of 1000 ml and okara flour 200 g. Fresh okara is obtained from a tofu factory in the area of Jl. Pucuk Sari Cokroaminoto Denpasar which is freshly cooked and clean with yogurt starter (diamond) in which there are (Lactobacillus bulgaricus and Streptococcus thermopillus). This research was carried out at the Joint Laboratory of Dhyana Pura University and the Laboratory of the Faculty of Agriculture, Warmadewa University. The study was conducted for 1 month from June-July 2023.

**Data Analysis**

In the research data analysis technique, organoleptic test results were collected and then tabulated using the SPSS statistics for windows program, statistical analysis test data using the ANOVA variety test with a 99% confidence degree to determine the effect of treatment on variables (Agatha, 2020). Then the ANOVA test results were then tested using the Tukey test (Agatha, 2020).

**RESULTS**

Hedonic test results using the senses as the main tool used by panelists to assess color, texture, aroma, taste and liking for the test product. Okara yogurt as a testing product with different formulations in each sample. Based on organoleptic tests, the formula used is Y0 without treatment (control), Y1 to Y5 with the addition of okara flour. In the process of discussing the test results, data processing was carried out using hedonic tests on okara yogurt based on several indicators such as color, texture, aroma, taste and preference for okara yogurt quality testing. From the organoleptic results of five indicators in six formulations, hedonic test results were obtained as follows in Table 1.

Table 1. Okara Yogurt Organoleptic Test Results

| | Treatment | | | | | |
|---|---|---|---|---|---|---|
| | Y0 | Y1 | Y2 | Y3 | Y4 | Y5 |
| Color | 3.23 | 3.23 | 3.10 | 3.30 | 3.33 | 3.47 |
| Texture | 3.07 | 2.93 | 3.10 | 3.53 | 3.20 | 3.43 |
| Aroma | 3.13 | 3.00 | 3.23 | 3.53 | 3.37 | 3.40 |
| Taste | 3.53 | 3.27 | 3.40 | 3.70 | 3.13 | 3.37 |
| Favorite | 3.27 | 3.27 | 3.40 | 3.63 | 3.40 | 3.67 |

From the results of the hedonic test with color parameters, it can be shown that the highest average value in the color treatment sample is in the okara Y5 yogurt formulation. That means the color of okara yogurt with the Y5 formulation is quite popular with most panelists in one experiment. The mean value of the hedonic test of the color treatment sample at Y5 was 3.47 with a standard deviation of 0.819. This value means that most panelists really like the color of okara yogurt with the addition of 5% okara flour w/v.

The results of the ANOVA test with color parameters obtained a significance probability value (P) of 0.586. This figure is greater than the significance limit used in this study, which is 0.05. Based on the formulation of the hypothesis test, the test results show H0 is accepted. This means that there is no real difference in the treatment of okara yogurt color with the addition of okara flour, whether processed using Y0, Y1, Y2, Y3, Y4 or Y5 formulations. This explanation is confirmed by graphing the average value of the color sample hedonic test as shown in Figure 1.

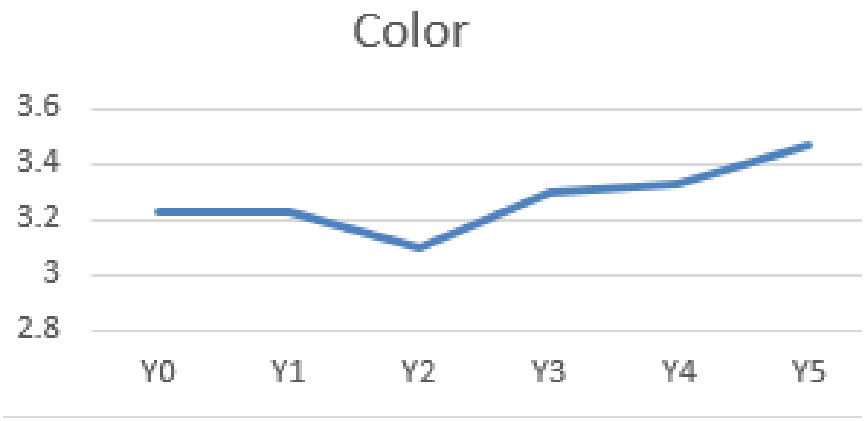


Figure 1. Gaverage Value of the Color Sample Hedonic Test as Shown

Based on Figure 1, it can be concluded that most of the 30 panelists tend to prefer Y5 in the color treatment of okara yogurt with the addition of okara flour. For these color treatment parameters, most panelists did not distinguish tangibly okara yogurt from Y0, Y1, Y2, Y3, Y4 and Y5 formulations. The next parameter to be tested is texture treatment. The average value of the hedonic test to determine the difference obtained based on texture parameters can be seen from Table 1.

From the results of the hedonic test with texture parameters, it can be shown that the highest average value in the texture treatment sample is in the okara Y3 yogurt formulation. That means the texture of okara yogurt with the Y3 formulation is quite popular with most panelists in one experiment. The mean value of the hedonic test of texture treatment samples at Y3 was 3.53 with a standard deviation of 0.776. This value means that most panelists really like the texture of okara yogurt with the addition of 3% w/v okara flour.

The results of the ANOVA test with texture parameters obtained a significance probability value (P) of 0.062. This figure is greater than the significance limit used in this study, which is 0.05. Based on the formulation of the hypothesis test, the test results show H0 is accepted. This means that there is no real difference in the treatment of okara yogurt texture with the addition of okara flour, whether processed using Y0, Y1, Y2, Y3, Y4 or Y5 formulations. This explanation is confirmed by graphing the average value of the hedonic test of texture samples as shown in Figure 2.

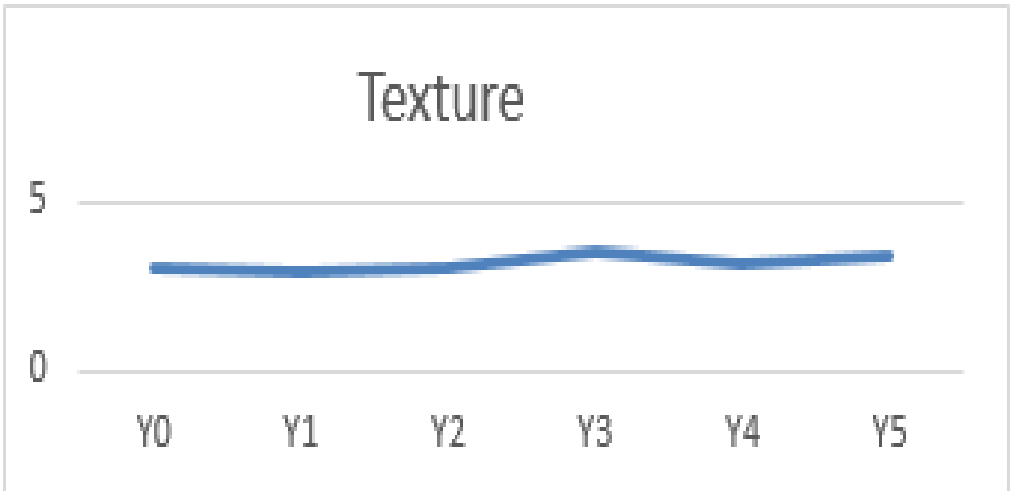


Figure 2. Graphing The Average Value of the Hedonic Test of Texture Samples as Shown

Based on Figure 2, it can be concluded that most of the 30 panelists tend to prefer Y3 in the texture treatment of okara yogurt with the addition of okara flour. For these texture treatment parameters, most panelists did not distinguish tangibly from okara yogurt with Y0, Y1, Y2, Y3, Y4 and Y5 formulations. The next parameter to be tested is the aroma treatment. The average value of the hedonic test to determine the difference obtained based on aroma parameters can be seen from Table 2.

From the results of the hedonic test with aroma parameters, it can be shown that the highest average value in the aroma treatment sample is in the Y3 okara yogurt formulation. That means the aroma of okara yogurt with the Y3 formulation is quite popular with most panelists in one experiment. The mean value of the hedonic test of texture treatment samples at Y3 was 3.53 with a standard deviation of 0.776. This value means that most panelists really like the aroma of okara yogurt with the addition of 3% w/v okara flour

The results of the ANOVA test with texture parameters obtained a significance probability value (P) of 0.278. This figure is greater than the significance limit used in this study, which is 0.05. Based on the formulation of the hypothesis test, the test results show H0 is accepted. This means that there is no real difference in the treatment of okara yogurt aroma with the addition of okara flour, whether processed using Y0, Y1, Y2, Y3, Y4 or Y5 formulations. This explanation is confirmed by a graph of the average value of the hedonic test of the aroma sample as shown in Figure 3.

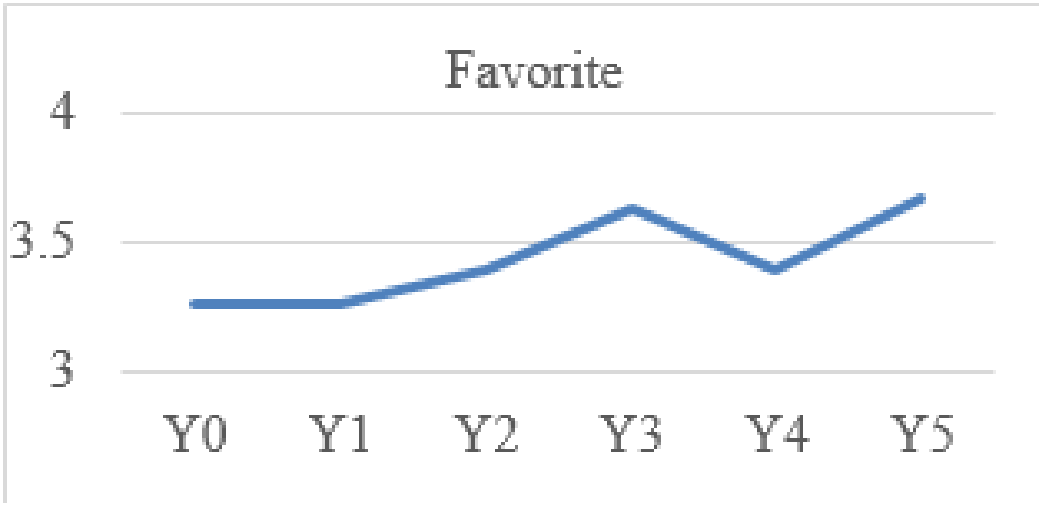


Figure 3. Graph of the Average Value of the Hedonic Test of the Aroma Sample as Shown

Based on Figure 5, it can be concluded that most of the 30 panelists tend to prefer Y3 in the favorability treatment of okara yogurt with the addition of okara flour. For these favorable treatment parameters, most panelists did not distinguish okara yogurt from Y0, Y1, Y2, Y3, Y4 and Y5 formulations.

**DISCUSSION**

Stunting is an indication of the beginning of the First 1000 Days of Life (HPK) before and after birth (Rosmalina, 2018). So that okara flour can be developed into a health drink in the form of okara yogurt as one of the health drinks intended to meet nutritional needs.

Judging from the color aspect, the Y5 sample as an okara yogurt product has a bone white color. Based on the results of experiments with adding okara flour, it has given a color change to the existing okara yogurt. From the results of a study of 30 panelists, it was found that the change in color of bone white did not have a real effect. Most panelists thought the Y5 color was more attractive than the colors in the other samples. According to research conducted by (Fransiska & Deglas (2017), the more the proportion of adding tofu pulp flour to stick products will have brown color specifications. The same is the case with the addition of okara flour to okara yogurt, where the more additions, the more yellowish white bones will be.

Based on texture, some panelists can accept the Y3 formulation in okara yogurt products. The okara yogurt formulation has a fairly high okara flour content, not a little and not much so that it can provide a soft texture quite well in okara yogurt products. However, panelists were able to assess a marked difference. Especially on snack bars with F1 and F2 formulations. Because of that assessment, most panelists could not accept snack bar products with F0 formulations that have a fairly hard product texture. As for snack bars with F4 and F5 formulations, some panelists considered that there was no difference in texture with F3 formulation snack bars. According to Fransiska & Deglas (2017), the more addition of tofu pulp flour, the higher the liquid absorbed resulting in the texture of the stick cake becoming less crispy and less dry. This is due to the

nature of the fiber that easily absorbs water. While research conducted by (Rachmayani et al., 2017), also shows explanations related to snack bars. The higher the use of tofu pulp flour, eating will produce snack bars that are hard in texture.

Based on the aroma aspect in the Y3 sample, it was highly preferred by the panelists. The addition of okara flour causes the aroma in okara yogurt tends to be no different. The addition of okara flour to okara yogurt products has a langu aroma. This means that most panelists can distinguish stronger scents between Y0 to Y5 samples. However, there was actually a small percentage of panelists who felt a noticeable difference in the smell. Especially for panelists who don't like the smell of okara. That is what makes the organoleptic assessment of aroma more precise in the control sample (Y0), which in the product does not use okara flour.

According to (Dunya et al., 2023), that the aroma of all okara cookie treatments is known that the more okara flour is added, the more it will smell langu aroma on the okara cookies. This is due to the presence of liposigenase compounds that can cause a certain aroma in soybeans. So, the aroma of okara cookies smells langu. So with the addition of okara flour to yogurt products, okara has differences in terms of aroma.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the taste aspect, some panelists chose okara yogurt products with the Y3 formulation. The formulation has a sour taste like yogurt and a little sweet that is very soft because there is a combination of okara flour, fresh milk and sucrose, which is 3% b / v : 100 ml : 15 g. The end result of the Y3 product does have a dominant taste that is slightly sweet and sour, although okara flour has been added which can reduce the sweetness of milk and sucrose. According to research conducted by Wijawa & Sukweenadhi (2023), the more the addition of flavored soybean pulp flour to peanut cookies tends to be bitter in soybeans produced by glycoside compounds. So that the more percentage of adding okara flour, the more bitter the taste of the okara yogurt. But because the addition of okara flour is also balanced with milk and sucrose which are predominantly sweet, the bitter taste can be disguised.

Based on the liking aspect, most panelists will rely on the taste rating of each product. If a snack bar product has a sweet taste in their personal opinion, then panelists will tend to give a good assessment also on the aspect of liking. Conversely, if the product tastes bad or does not taste sweet enough, then the favorability value tends to decrease automatically. It also happens in the aspect of texture. Samples that have a soft texture will be much preferable to samples with a hard texture.

The assessment on the favorability aspect is subjectively dependent on how the panelists conclude which sample is preferred and which is preferred based on the previous four aspects. This can be seen from the results of the panelists' assessment that prefers F2 in terms of color and texture. In terms of aroma, F4 is preferred. In terms of taste, F1 is more preferred. Therefore, the results of the panelists' favorability aspect tend to choose the F2 sample as the preferred product.

## FURTHER STUDY

This research still has limitations, so it is necessary to carry out further research related to the topic Okara Yogurt Formulation as Functional Food to Prevent Stunting in order to improve this research and add insight to readers.

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