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_Earth_Environ._Sci._980_01204
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Submission date: 03-Apr-2023 02:22PM (UTC+0700)

Submission ID: 2054410214

File name: 2. Purnasari_2022_IOP_Conf._Ser. _Earth_Environ._Sci._980_012043.pdf (739.86K)

Word count: 2794

Character count: 14343

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Effect of banana flour and tempeh flour on sensory characteristics of prebiotic snack bar

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Abstract. Prebiotic snack bar is a food innovation in the form of a bar that contains a source of functional nutrients that can improve chronic small intestinal inflammation syndrome (pediatric environmental enteropathy) in stunting children, increase the absorption of nutrition, and then improve the nutritional status of stunting children. The aim of this research was to determine the sensory characteristics of snack bar with any level of banana flour and tempeh flour addition. Sensory analyses were carried out on flavor, color, taste, texture and overall of the snack bar. The results showed that the ratio of banana flour : tempeh flour (95% : 5%) was more acceptable in terms of flavor (3,89), color (3,60), taste (3,91), texture (3,77) and overall (4,00). The result also showed that the addition of tempeh flour and banana flour to the formulation snack bar had a significant effect ($p \leq 0,05$) on the sensory quality of prebiotic snack bar

1. Introduction

Stunting or short based on height compared to age index of the standard population ($<-2SD$) is still a health problem in Jember Regency. The 2016 Nutrition Status Monitoring survey data stated that Jember is the district with the second highest stunting incidence in East Java (percentage stunting 39.2%) [1]. Stunting infant is at risk of growing short in adolescence. Children who are stunted at an early age (0-2 years) and remain short at 4-6 years of age have a 27 times risk of staying short before entering puberty [2].

Stunting children suffer a chronic inflammatory syndrome in the small intestine, which is called pediatric environmental enteropathy (PEE). This chronic inflammation causes a characteristic shortening of the villi and reduces the absorptive surface of the intestine. The result is a reallocation of nutrients needed for growth and development of children as well as disruption of hormonal pathways that regulate bone growth activity. Chronic inflammation is hypothesized to affect brain development and then induce negative cognitive effects [3].

Risk factors for stunting children are lack of nutritional intake, incidence of diarrhea and infectious diseases such as cough and flu [4]. Stunting children generally experience frequent episodes of diarrhea [5,6] Diarrhea is associated with high levels of pathogenic bacteria in the gastrointestinal tract. The composition of the gastrointestinal microbiota during diarrhea changes to a higher composition of pathogenic bacteria compared to probiotics in the gastrointestinal tract [7,8].

The right intervention for stunting children is to provide functional foods that contain prebiotics so that it can improve intestinal function in the absorption of nutrients and can improve the immune system [9]. Functional foods can be made using local food sources of prebiotics that are easily available. These local foods include *kepok* banana (*Musa paradisiaca*) and tempeh soy bean.

Tempeh from yellow soybean has been known as a functional food. Yellow soybean being fermented using fungus *Rhizopus sp* (*R. oryzae*, *R. stolonifer*, *R. oligosporus*) [10]. Tempeh can



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stimulate the growth of digestive bacteria (microflora), especially from the genus *Bifidobacterium* and non-pathogenic *E. coli*. The growth of microflora bacteria that colonize in the digestive tract can recreate the balance of microflora so that it becomes one of the mechanisms to prevent diarrhea and relieve diarrhea symptoms [11]. Banana kepok (*Musa paradisiaca*) is a natural prebiotic that contains inulin and fructooligosaccharides (FOS) compounds. The properties of inulin as a prebiotic are also considered as “colonic foods” for the intestinal microflora [12].

Interventions are still needed even after passing the First 1000 Days of Life (HPK) to prevent the increase in stunting rates. This study aims to determine the sensory characteristics of snack bar with any level of banana flour and tempeh flour addition.

1.1. Material

The main ingredients used were banana kepok flour and tempeh flour obtained from "Kusuka Ubiku" Jogjakarta. The ingredients for making the snackbar were sugar, margarine, egg yolk, crispy rice, almonds, raisins, vanilla, and salt. The tools used were digital scales, bowls, spatulas, rolling pins, baking trays, cutters, and oven.

1.2. Methods

The snack bars making process refers to Indrawan's research (2018) which has been modified [13]. The stages of making snack bars were weighing the materials, mixing process stage I and stage II. Stage I were mixing banana kepok flour, tempeh flour, and salt. Stage II were mixing margarine and sugar, added the egg yolks then mixed all them. Then, mixed stages I and II, then added almonds, rice crispies, and raisins. The dough is molded and then baked in an oven at 150°C for 40 minutes. After 40 minutes, the snack bars were cooled at room temperature at ± 28-30°C for 20 minutes.

2. Analysis

2.1. Sensory Evaluation

Sensory tests performed include hedonic tests and hedonic quality tests. The panelist was asked to evaluate according to five sensory attributes, consisting of flavor, colour, taste, texture, and overall. The hedonic test rating scale ranges from 1 to 5 (criteria from dislike to like very much). Sensory testing using 35 panelists.

2.2. Statistical Analysis

Statistical analysis was performed using SPSS (version 16.0). One way ANOVA test was used to obtain the significant difference between each factor. Duncans multiple range test (DMRT) at p ,0.05 was performed to compare means between sample.

3. Result and Discussion

3.1. Hedonic Test

The hedonic test is a testing activity carried out with several panelists aiming to determine the value of people's preferences for snack bars. The hedonic test was carried out with a scoring scale preference test by 35 untrained panelists. Parameters used for hedonic test are aroma, color, taste, texture and overall snack bar. Panelis preference is shown in **Table 1**. Based on the ANOVA analysis, it was shown that there was no significant difference in hedonic values ($P>0.05$) between F1, F2, F3 and F4

on the flavor parameter. However, in the parameters of color, taste, texture, and overall there were significant differences ($P < 0.05$) between F1, F2, F3, and F4.

Table 1. Hedonic test of prebiotic snack bar

	F1	F2	F3	F4
Flavor	3.89 ± 0.87 ^a	3.43 ± 1.01 ^a	3.69 ± 0.90 ^a	3.60 ± 0.97 ^a
Color	3.60 ± 0.60 ^b	2.97 ± 0.86 ^a	3.60 ± 0.88 ^b	3.23 ± 0.94 ^{ab}
Taste	3.91 ± 0.85 ^b	3.23 ± 1.14 ^a	3.86 ± 0.97 ^b	3.11 ± 1.11 ^a
Texture	3.77 ± 0.87 ^b	3.17 ± 0.98 ^a	3.40 ± 0.88 ^{ab}	3.14 ± 1.09 ^a
Over all	4.00 ± 0.77 ^b	3.34 ± 0.97 ^a	3.89 ± 0.90 ^b	3.26 ± 0.95 ^a

Mean value ± standard deviation. Means within a column sharing followed by the same letters do not differ statistically from each other ($P < 0.05$)

Note : F1(95% banana flour : 5% tempeh flour), F2(90% banana flour : 10% tempeh flour), F3(85% banana flour : 15% tempeh flour), F4 (80% banana flour : 20% tempeh flour)

Based on **Table 1**, it is shown on the flavor parameter, panelists indicate the level of likes. snackbar with a composition of 95% banana flour and 5% tempeh flour was preferred by panelists to other compositions. This is due to the greater the addition of banana flour, the resulting snackbar has a banana flavor. On the color parameter, the composition of the snackbar preferred by the panelists was the composition of 95% banana flour and 5% tempeh flour. The color of the snackbar that the panelists like is pale brown. This is because a little tempeh flour is added. The more tempe flour that is added, the more the color of the snackbar gets brown. The color difference is caused by a non-enzymatic browning reaction due to heating [14]. The acceptance of the taste on the snackbar that the panelists liked was indicated by the composition of 95% banana flour and 5% tempeh flour with the highest score of 3.91. This composition gives a sweet taste because more banana flour is added than tempeh flour. The acceptance of the texture and overall on the snackbar that the panelists liked was indicated by the composition of 95% banana flour and 5% tempeh flour with the highest score of 3.77 and 4.00. The resulting texture is soft. Based [15] The most preferred snackbar texture is that it is soft, easy to bite and chew.

3.2. Hedonic Quality Test

Hedonic quality test is an organoleptic test that can be used to measure the level of preference for a food product. The level of preference measured is a preference for a particular attribute or preference for a food product as a whole [16]. The results of the hedonic quality test are shown in **Table 2**.

Table 2. Hedonic quality test of prebiotic snack bar

	F1	F2	F3	F4
Flavor	1.66 ± 0.76 ^a	1.91 ± 0.89 ^a	1.71 ± 0.79 ^a	1.94 ± 0.91 ^a
Color	2.80 ± 1.05 ^a	2.37 ± 1.11 ^a	2.66 ± 1.08 ^a	2.83 ± 1.22 ^a
Taste	1.77 ± 0.91 ^a	2.29 ± 1.07 ^b	2.00 ± 0.77 ^{ab}	2.34 ± 0.99 ^b
Texture	3.74 ± 0.89 ^b	3.49 ± 0.85 ^{ab}	3.23 ± 0.97 ^a	3.06 ± 0.97 ^a

Mean value ± standard deviation. Means within a column sharing followed by the same letters do not differ statistically from each other ($P < 0.05$)

Note : F1(95% banana flour : 5% tempeh flour), F2(90% banana flour : 10% tempeh flour), F3(85% banana flour : 15% tempeh flour), F4 (80% banana flour : 20% tempeh flour)

Based on **Table 2**, it is shown that the addition of tempe flour and banana flour did not have a significant effect on the aroma and color attributes. Meanwhile, the taste and texture attributes have a significantly different effect. The highest value representing the taste of the prebiotic snackbar at the composition of 80% banana flour and 20% tempeh flour. The higher the concentration level of the addition of tempeh flour, the more bitter the resulting taste. This is due to changes in the content of isoflavone glycoside compounds to aglycones in tempe during the drying process [17].

Based on [15], SnackBar texture is soft, easy to bite and chew. This is obtained by F1 which is the composition of 95% banana flour and 5% tempeh flour. The higher the concentration of addition of tempe flour, the harder of texture. Tempe flour has a protein content of 46.1% [18]. Enhancement protein content increases the hardness of the snackbar. Protein has hydration properties that can increase the water absorption of the snackbar. The increased water absorption causes the water to evaporate when roasting leaving an empty space so that the snackbar becomes more crispy [19].

4. Conclusion

Based on the results of the study, the addition of banana flour and tempeh flour had a significant effect on the taste and texture of the prebiotic snackbar. In the hedonic test, it was found that the results of adding banana flour and tempeh flour had a significant effect on the level of preference for color, taste, texture, and overall. Meanwhile, the aroma attribute does not have a significant effect. SnackBar products with a composition of 95% banana flour and 5% tempeh flour have the highest panelist acceptance rate compared to other compositions. This is due to the soft texture of the snackbar, easy to bite and chew, the sweet taste and the pale brown color.

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