Formulations and characteristics of cookies made of organic red bean, soybean, and sago composites-based flour

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Abstract

Cookies are a food product favored by people of all ages. Meanwhile, composite flour is flour from several types of raw materials, such as tubers, nuts, cereals with or without wheat flour, or cereals with or without wheat. The composite flour is used as a raw material for food processing, such as bakery and extrusion products. This research was an experimental study using a completely randomized design (CRD). The organoleptic test was employed to examine the smells, tastes, textures, and colors of organic red bean, soybean, and sago composites-based flour. The physical properties test examined the swelling power test. Then, the collected data were analyzed using the analysis of variance (ANOVA) from a completely randomized design to determine statistically significant treatments. If a relationship had been founded, the next step was continued to Duncan's test. The results of this study indicated that the addition of composite flour in the cookies significantly brought different effects. Formula 1 with the addition of 30% composite flour had the best taste, odor, and texture. However, its color was not better than formula 2, without any addition of composite flour. This study suggests that a further intervention formula should investigate the mixing of the resulted colors or use natural dyes to improve the color of cookies

Keywords: composite flour, cookies, red bean, sago, soybean

Introduction

Consumption of wheat flour in Indonesia increased by 7% in 2016. The trend of wheat flour consumption has begun to grow since 2013, and it only decreased by 1% in 2014 and 2015. The export values of wheat flour, wheat flour-made products, and wheat flour products reached US$736.38 million in 2015, and the largest value of wheat flour was approximately US$608.12 million (APTINDO, 2016). There are several alternatives to reduce dependence on wheat imports, such as replacing the role of wheat flour as the main raw material for cookies or utilizing local foods, such as red beans, soybeans, and sago, in food products. Composite flour refers to flour from several types of raw materials, such as tubers, nuts, cereals with or without wheat flour, or cereals with or without wheat; the composite flour is used as an ingredient of cake and extrusion products (Widowati, 2009).

Soybean flour is rich in isoflavone antioxidants (208.6 mg). Isoflavones in soybeans can reduce the risk of coronary heart disease, menopausal symptoms, prostate disease, and cancer. Soy isoflavones are classified as non-steroidal phytoestrogens and have potential properties to protect and prevent several degenerative diseases, such as cardiovascular, cancer, and osteoporosis. Soybeans contain protein, the only legume with all essential amino acids. The body cannot produce essential amino acids so that humans must consume foods that contain these amino acids. (Cahyadi, 2007). Sago (Metroxylon sp) is one of the local food resources that can be used as an alternative food ingredient to diversify food consumption. The carbohydrate content of sago is equivalent to that of rice flour, cassava,

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Volume 1, Number 1, June 2021
P-ISSN: 2797-7412

and potatoes. Moreover, the carbohydrate content of sago flour is relatively the highest compared to corn and wheat flour; sago flour contains 55.97% starch and 29.08% amylose (Hayati et al., 2014).

Cookies are one of the food products favored by people of various ages. Therefore, cookies are now quite popular and can be found easily. Cookies are categorized as biscuits whose raw materials are wheat flour, water, milk, eggs, sugar, and shortening. Moreover, they are made in several stages: mixing, shaping, and baking. Cookies are commonly small with a flat or slightly raised shape. Fat and sugar are two major characteristics of cookies (Suarni, 2009). Cookies made of soft dough and high-fat content are relatively crispy and less dense when their cross-sections of the pieces are broken (SNI 01-2973-1992). Cookies are usually made of flour (Nurbaya and Estiasih, 2013). However, cookies made of non-wheat flour are usually included in the short dough group (Turistyawati, 2011). Soft wheat flour containing 8-9% protein or not containing protein content due to the development is not needed in making cookies (Fajiarningsih, 2013). Low protein content makes the dough more easily blend**ed** with other ingredients. The characteristics of cookies are containing high amounts of sugar and fat but less than 5% water; thus, their texture is crispy (Brown, 2000). Substituting organic red bean, soybean, and sago flours for wheat flour to make cookies can increase the economic values of red beans, soybeans, and sago as agricultural products. Moreover, this substitution will increase levels of beneficial dietary fiber for health. This research focused on using composite flour as a substitute for wheat flour to make organic red bean, soybean, and sago composites-based flour. This substitution reduced the use of wheat flour but increased the level of the nutritional content of cookies. It is expected that the dependence on flour will reduce.

Methods

This research is an experimental study and employed a completely randomized design (CRD) with four formulas. The organoleptic test examined smells, tastes, textures, and colors of organic red bean, soybean, and sago composites-based flour. Meanwhile, the physical properties were examined by the swelling power test. The obtained data were then analyzed using the analysis of variance procedures (ANOVA) from a completely randomized design to determine statistically significant treatments. If a relationship was found, the test continued to the Duncan test.

Results

Organoleptic characteristics of cookies made of organic composite flours

The acceptability of cookies was assessed using the organoleptic test and a hedonic scale to examine the panelists' preference for colors, tastes, smells, and textures of organic red bean, soybean, and sago composites-based flour. The taste was assessed by tasting cookies made of composite flours. The color was judged by observing the cookies using the sense of sight. Meanwhile, the odor was assessed using the sense of smell, and the texture was examined by touching and chewing the samples served. This study revealed that organic red bean, soybean, and sago composites-based flour significantly affected the colors, tastes, textures, and smells of the cookies.

Colors

The organoleptic test discovered colors of organic red bean, soybean, and sago composites-based flour, as presented in Table 1.

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Tabel 1. Average Scores of the Organoleptic Test on Cookies' Colors

Formulas	Color Scores
F1	3.62[a]
F3	3.30[a]
F5	3.40[a]
Without composite flour adding	4.62[b]

Numbers followed by the same letters indicate no significant difference at the 0.05 level assessed by Duncan's test.

Table 1 shows that the treatment without composite flour produced yellowish -white cookies. The addition of 30% and 60% composite flours created brownish-yellow cookies. Meanwhile, the addition of 90% composite flour created brown cookies. The color test discovered that the treatment without adding organic red bean, soybean, and sago composites-based flour (control) obtained an average value of 4.26 (liked by the panelists). Meanwhile, the addition of 30% organic red bean, soybean, and sago composites-based flour earned an average value of 3.62 (liked by the panelists). The addition of 60% organic red bean, soybean, and sago composites-based flour earned an average value of 3.30 (neutral). Finally, the addition of 90% organic red bean, soybean, and sago composites-based flour had an average value of 3.40 (slightly liked by the panelists). The treatment without any addition of the composite flour was mostly preferred by the panelists. The treatment with 30% composite flour was liked by the panelists. The treatment with 60% composite flour received a neutral response from the panelists. Finally, the treatment added with 90% composite flour was slightly liked by the panelists. This research concluded that the panelists did not like the color of cookies added with 90% organic red bean, soybean, and sago composites-based flour (F5). In contrast, the panelists gave a favorable response for the color of cookies made of composite flour. The ANOVA analysis showed that the addition of organic red bean, soybean, and sago composites-based flours affected the color of the cookies. The ANOVA analysis discovered that the F-value of organic red bean, soybean, and sago composites-based flour was 13.027 with a significant level (P-value) of 0.000 > from 0.05. These findings concluded that the alternative hypothesis (Ha), stating that composite flour significantly affected the color of cookies, was accepted.

Duncan's analysis showed that the treatments with the addition of 60%, 90%, and 30% composite flours, had equal results. Meanwhile, the treatment without composite flour showed a difference of 4.26. . These results concluded that the treatment without the addition of composite flour had a color preferred most by the panelists. In contrast, the addition of 60%, 90%, and 30% composite flours produced the same color and were slightly liked by the panelists.

Taste

The most favorable taste for the panelists was F1 (30% composite flour addition) because less composite flour added in the cookies created a more delicious taste. The organoleptic test denoted that the 4 treatments had different average scores of taste ranging from 2.96 to 3.67. This study discovered that the panelists disliked the cookies without the addition of composite flour (2.96). Meanwhile, they showed a neutral response for cookies with the addition of 90% composite flour (3.01). The panelists slightly liked the cookies with the addition of 60% composite flour (3.26). Finally, the cookies with the addition of 30% flour composite were preferred the most by the panelists (3.67). The analysis of variance on

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the taste of cookies revealed that the F-value was 5.321 with a significant level (P-value) of 0.002 < from 0.05. These findings interpreted that the alternative hypothesis (Ha), stating that the composite flour significantly affected the cookie flavor, was accepted.

Duncan's analysis discovered that cookies without the addition of composite flour as well as the addition of 90%, 60%, and 30% of composite flour showed differences with an average of 3.67. This difference occurred because they were liked by the panelists. These results concluded that the cookies with the addition of 30% composite flour had the most favorable taste for the panelists. Meanwhile, the cookies with the addition of 90%, 60%, and 0% of composite flour were somewhat preferred by the panelist with average scores of 3.26-2.96.

Table 2. Average Scores of the Organoleptic Test on the Cookies' Tastes

Formulas	Taste Scores
F1	3.67^b
F3	3.26^a
F5	3.01^a
Without the addition of composite flour	2.96^b

Numbers followed by the same letters indicate no significant difference at the 0.05 level assessed by Duncan's test.

Smells

The average value of the cookies' smells ranged from 2.99 to 3.51, indicating that the panelists somewhat liked and liked the cookies. Four treatments with three repetitions showed that the highest value was found in the treatment with the addition of 30% composite flour because the panelists gave a favorable response (3.51). Meanwhile, the treatment with the addition of 60% composite flour was somewhat favored by the panelists (3.25). The treatment with the addition of 90% composite flour received a neutral response from the panelists (3.07). Finally, the treatment without the addition of composite flour was slightly liked by the panelists (2.99). These findings concluded that the panelists did not like the smell of cookies without the addition of composite flour.

Table 3. Average Scores of the Organoleptic Test on the Composite Cookies' Smells

Formulas	Odor Scores
F1	3.51^b
F3	3.25^{ab}
F5	3.07^a
Without the addition of composite flour	2.99^a

Numbers followed by the same letters indicate no significant difference at the 0.05 level assessed by Duncan's test.

The results of the panelists' assessment showed that the average odor value ranged from 2.99 to 3.51 or from "somewhat liked" to "liked". Four treatments with three repetitions discovered that the highest value was earned by the treatment with the addition of 30% composite flour. The treatment with the addition of 30% composite flour was favored by the panelists (3.51). Meanwhile, the treatment with the addition of 60% composite flour was slightly preferred by

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the panelists (3.25). The treatment with the addition of 90% composite flour received a neutral response from the panelists (3.07). Finally, the treatment without the addition of composite flour was not liked by the panelists (2.99). These findings concluded that the panelists did not like the smell of cookies without the addition of composite flour.

Furthermore, the analysis of variance found that the organic red bean, soybean, and sago composite-based flour significantly affected the smell of cookies with the F-count was 2.574 with a significant level (P-value) of 0.057 > 0.05. The findings concluded that the hypothesis (Ho), stating that the addition of composite flour significantly affected the cookies' smell. Duncan's analysis showed that the cookies without the addition of composite flour as well as with the addition of 90% and 60% composite flours did not have significantly different smells. Meanwhile, cookies with the addition of 30% composite flour and 60% composite flour (F3) did not have a significantly different smell. However, cookies with the addition of 30% composite flour had a significantly different smell from those with 90% composite flour (F5) and without addition.

Texture

This study discovered that the four treatments did not have significantly different mean values of the texture variable. The average values ranged from 3.06 to 3.59. The panelists responded to the four treatments from "slightly liked" to "really liked". The treatment without the addition (control) of composite flour received a neutral response from the panelists (3.20). Meanwhile, the treatment with the addition of 90% composite seed flour (F5) and 60% composite flour (F3) were somewhat favored by the respondents with the scores of 3.06 and 3.35, respectively. The treatment with the addition of 30% composite flour (F1) was preferred by the panelists (3.59). These findings concluded that the panelists liked the texture of cookies made of organic red bean, soy, and sago composites.

Furthermore, the analysis of variance showed that the cookies made of organic red bean, soybean, and sago composites-based flour significantly affected the texture with the F-value of 3.078 and a significant level (P-value) of 0.030 < from 0.05. These findings concluded that the hypothesis (Ha), stating that the addition of organic red bean, soybean, and sago flour significantly affected the cookies, was accepted.

Table 4. Average Scores of the Organoleptic Test on the Composite Cookies' Textures

Formulas	Texture Scores
F1	3.51[b]
F3	3.25[ab]
F5	3.07[a]
Without the addition of composite flour	2.99[a]

Numbers followed by the same letters indicate no significant difference at the 0.05 level assessed by Duncan's test.

Duncan's analysis discovered that the treatment without the addition of composite flour as well as the treatments with the addition of 90% and 60% composite flours were liked by the panelists with the average socres of 3.06–3.35. Meanwhile, the treatments with the addition of 60% and 30% composite flours showed differences with the average scores of 3.35-3.51, indicating that they were liked by the panelists. These findings concluded that the addition of 30% composite flour had the most preferable texture for the panelists.

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Discussion

The results of this research are in line with the results by Astuti et al. (2014), who discovered that substitution of organic composite flour for flour had a significant effect with the 95% confidence level on the attribute color and p-value < 0.05 (0.032). These results were obtained because the higher substitution of organic composite flour changed color and increased the intensity of colors from light yellow to brownish-yellow. Red bean flour had a brownish pigment, and soybean flour had dull yellow color. Meanwhile, sago flour had a light brown pigment. So when the composite flours were mixed, their colors were evenly mixed and producing a brown color. In other words, adding more composite flour produced browner cookies. In contrast, cookies without the addition of composite flour produced a yellowish-white color. The panelists preferred the yellowish-white color this color made the cookies more attractive. Moreover, the panelists considered that the color of cookies with the addition of composite flour deviatedfrom the color of cookies in general.

The cookies showed different tastes due to the addition of organic red bean, soybean, and sago composites-based flour. The panelists assessed the taste of composite cookies because the addition of organic red bean, soybean, and sago composites-based flour was not more than 20% of the total flour weight. The results of the preliminary research denoted that the high percentage of composite flour made the color of the noodles not favorable, the taste a bit bitter, the smell increasingly unpleasant, and the texture easily destroyed (Sutomo, 2008).

The organoleptic tests of these four treatments showed average values. The organic red bean, soy, and sago had different tastes, but the panelists' preference levels for the different flavors were still acceptable. Organic peanut substituting for red, soybean, and sago produced cookies with a different taste. This research is in line with the research by Astuti et al. (2014) discovering that the proportion of substitution organic composite flour for wheat flour significantly affected the taste of cookies at the 95% confidence level with a p-value < 0.05 (0.064). This occurred because less substitution of organic composite flour increased the cookies' favorable taste preferred by the panelists. The proportion of substituting organic composite flour for wheat flour significantly affected the cookies' texture at the 95% confidence level and p-value < 0.05 (0.086). This occurred because more organic composite produced the cookies with brittle texture preferred by the panelists (Astuti, et al, 2014).

Conclusion

Formula 1 with the addition of 30% composite flour had the best taste, smell, and texture. However, its colorwas not better than the color of the formula without the addition of composite flour. This study suggests that further research should combine the resulted colors or use natural dyes to improve the assessment of cookies' colors.

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