Global Scientific JOURNALS

GSJ: Volume 10, Issue 6, June 2022, Online: ISSN 2320-9186
www.globalscientificjournal.com

THE ADDITION OF SEAWEED FLOUR *(Eucheuma cottonii)* IN THE MAKING OF WHITE BREAD TO INCREASE FIBER CONTENT

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ABSTRACT
This research aimed to determine the effect of the addition of seaweed flour on white bread products favored by panelists and to increase the fiber content of white bread by the addition of seaweed flour *(Eucheuma cottonii)*. This research was conducted at the Laboratory of Fish Product Processing in Faculty of Fisheries and Marine Sciences at Universitas Padjadjaran in January 2019. Fiber content testing was carried out at the Ruminansia Animal Nutrition and Food Chemistry Laboratory of the Faculty of Animal Husbandry, Padjadjaran University. The research method used was experimental method, with 20 semi-trained panelists and 4 treatments. White bread was prepared with treatment of seaweed flour addition (0%, 20%, 30%, 40%). The observed parameters were hedonic tests with parameters of organoleptic characteristics including appearance, aroma, texture, and taste of white bread, as well as fiber content test. The results showed that the addition of 30% seaweed flour produced the most preferred white bread compared to other treatments, with an average value 7.3 of appearance criteria; 7.4 of aroma; taste was 8.1 and texture is 7.4; the weight of taste criteria was 0.51 and the alternative value was 8.02. Had the fiber content that was equal to 3.91% (1.37 gr) of 35 gr of white bread, meant the addition of seaweed flour had a very significant effect on the fiber content of the resulting bread. The higher the percentage of seaweed flour was added, the higher the content produced in white bread would be.

Keywords: *dietary fiber, bread, seaweed flour, hedonic test*

INTRODUCTION

Seaweed is one of the many superior products of marine nature in Indonesia that has not received an optimal touch of technology. According to Suryatna (2015) the iodine content in seaweed is about 2400 to 155000 times greater than that in vegetables. Iodine contained in seaweed is naturally bound as an organo-iodine compound, so that when seaweed is added to food, for example in bread and noodles, it will affect the taste and texture of the food. Utilization of seaweed to increase its added value is by making seaweed flour.

Seaweed is one type of aquaculture in the field of fisheries that has the opportunity to be developed. According to the Bureau of Statistics, seaweed production in 2006 to 2012 increased by an average of 25.82%, namely 39.60 tons for 2006; in 2007 as many as 100 tons, in 2008 as many as 193.96 tons; in 2009 as many as 586.45 tons; in 2010 as many as 1116.50 tons; in 2011 as many as 273.17 tons and in 2012 as many as 787.87 tons (Statistical Calculation Agency 2012).

Seaweed is a source of food that is rich in fiber. Fiber from seaweed contains carbohydrates in the form of galactose, mannose, agarose and so on which are not easily digested by human digestion (Hirao 1972). Seaweed also contains enzymes, nucleic acids, amino acids, vitamins (A, B, C, D, E and K) and macro minerals such as iron, magnesium and sodium. The content of minerals, vitamins and amino acids in seaweed reaches 10-20 times compared to land plants (Istini, 1991). Based on the Food Composition Table (1972) seaweed contains 2.7 grams of fiber in 100 grams of dried seaweed. One of the alternative uses of

Eucheuma cottonii seaweed to increase its added value was by making seaweed flour (*Eucheuma cottonii*). Seaweed flour could be used as an additive in making white bread.

Bread contains fiber and protein that can be consumed as a substitute for rice. Adding seaweed flour to the making of white bread can produce white bread that has a variety of delicious flavors and is good for health. Dietary fiber is very important in achieving optimal health levels. It is necessary to add fiber and protein to daily processed food products to meet the body's needs for dietary fiber.

White bread products are quite popular in Indonesia and have been widely distributed in various levels of society because Indonesian people consume large amounts of wheat flour. Wheat flour has a high level of demand, in 2014 the public's need for wheat flour reached 7.53 million tons, an increase of 5.4% from consumption in 2013 which reached 5.35 million tons. 30% of the total flour is used for wet noodle processing and small industries, 20% for instant noodles, 25% for breads, 18% for biscuits and the rest for fried food and households (Ministry of Industry 2014). Bread that is made using wheat flour contains little fiber. Therefore, the natural food fiber from seaweed (*Eucheuma cottonii*) flour was added to white bread products in order to increase the fiber content and could be liked by panelists. The research was conducted to determine the concentration of seaweed flour in white bread with the aim of finding the ideal concentration that could increase the taste and fiber content.

RESEARCH METHODOLOGY

Research Place and Time

The research was carried out in January 2019 at the Fishery Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University. Fiber content testing was carried out at the Laboratory of Ruminant Animal Nutrition and Food Chemistry, Faculty of Animal Husbandry, Padjadjaran University.

Tools and materials

The tools used include baking sheets, spatulas, ovens, scales, basins, clean rags, rolling pins, gas stoves, paper labels and small containers. The materials used in the research were seaweed flour (*Eucheuma cottonii*), wheat flour, yeast, water, chicken eggs, salt, sugar, powdered milk and margarine. The chemicals used for the analysis of dietary fiber content were distilled water, acetone, 1.25% NaOH, 1.25% sulfuric acid, n-Octanol and samples.

Research Method

The method used was an experimental method for organoleptic tests. Four treatments of adding seaweed flour (*Eucheuma cottonii*) based on the weight of wheat flour in white bread dough, namely:

1) Treatment A : Addition of 0% seaweed flour (control)
2) Treatment B: Addition of 20% seaweed flour
3) Treatment C : Addition of 30% seaweed flour
4) Treatment D : Addition of 40% seaweed flour

Organoleptic test is carried out to determine the level of preference or feasibility of a product so that it can be accepted by panelists or consumers by using hedonic tests. In the hedonic test, 20 semi-trained panelists were used as a test (Soekarto 1985). Panelists in this research were students of the Faculty of Fisheries and Marine Sciences, Padjadjaran University who had been given an explanation beforehand and were familiar with white bread products and had experiences in organoleptic assessment. The results of the organoleptic analysis would be tested statistically and the results of the fiber content analysis would be tested in a comparative descriptive manner.

Data analysis

Non-parametric analysis was carried out for organoleptic testing using the two-way analysis of variance Friedman test with Chi-square test according to Sudrajat (1999) and the fiber test data were analyzed descriptively. The statistics used in the Friedman test were defined by the following formula:

$$\chi^2 = [\frac{12}{bk\,(k+1)} \sum_{ii=1}^{t} (RRR)^2] - 3b\,(k+1)$$

Description :

X2 = Friedman Test Statistics

b = Deuteronomy

k = Treatment

Rj = Total rank of each treatment

If the research data showed the same number, the correction factor (FK) was calculated as follows:

$$FK = 1 - \frac{\sum Tii}{bk\,(k^2-1)}$$

$$H_c = \frac{x^2}{FK}$$

Description :

T = N (t^3 – t)

t = The number of the same observation value for a rank

N = The number of the same observation value for a rank with the same t value

The significant value of the observation price x_c^2 could be determined using chi squared with db = k-1; = 0.05.

Decision rules for hypothesis testing, namely:

H0 = treatment did not give a significant difference at level = 0.05

H1 = treatment gave a significant difference at level = 0.05

If the price of H_c < x_a^2 (k-1) then accept H0 and reject H1 and if H_c > x_a^2 (k-1) then reject H0 and H1 is accepted. If the results of Friedman's two-way analysis of variance were significant, then to find out the differences in each treatment, a multiple comparison further test was carried out. The multiple test formula was as follows:

$$|Ri - Rj| \geq ZZ\ \frac{\alpha}{k\,(k-1)}\ \sqrt{\frac{bk\,(k+1)}{6}}$$

Description:

| Ri - R j | = Difference in average ranking

Ri = Average rating from sample to i

Rj = Average rating from sample to j

= Experiment wise error rate (0.05)

b = Number of repetitions

k = Number of treatments

Z = /(k(k-1))

Pairwise comparisons were carried out in making panelist decisions on the preferred product criteria. Bayes method is one of the techniques that can be used to analyze the best decision making from a number of alternatives with the aim of producing results that consider various criteria (Marinim, 2004). The Bayes equation was as follows:

Total value $i = \sum_{i=1}^{n}$ Value ij (Krit j)

Information:

Total value I = Total value from alternative to – i

Value ij = Alternative value to – i on criteria – j

Crit j = The level of importance (weight) of the criteria – j

I = 1, 2, 3, ….. n; n = number of alternatives

J = 1, 2, 3, ….. m; m = number of criteria

RESULTS AND DISCUSSION

Appearance

The appearance of white bread that had been added with seaweed flour (*Eucheuma cottonii*) had a very important effect on color and shape. The appearance of food has major role because even though the food is delicious, but if the appearance is not attractive when served, it will result in the taste of people who will eat it being lost (Soeparno 2009). The following is the average appearance value of white bread that had been added with seaweed flour (*Eucheuma cottonii*) which can be seen in Table 1.

Table 1. Average Appearance Value of Bread that had been Added with Seaweed Flour (*Eucheuma cottonii*)

Treatment	Median	Average Appearance
0% seaweed flour (control)	9	7,8b
20% seaweed flour	7	6,5b
30% seaweed flour	7	7,3b
40% seaweed flour	5	4,4a

Description: Numbers followed by letters that were not the same indicated significantly different according to the test multiple comparisons at the 5% test level.

The results of the average appearance of white bread that had been added with seaweed flour (*Eucheuma cottonii*) showed that the addition of seaweed flour (*Eucheuma cottonii*) to white bread affected the panelists' preference level based on the results of the 5% test level. The following was the average appearance value of white bread that has been added with seaweed flour (*Eucheuma cottonii*) which could be seen in Table 1.

Panelists' assessment of the appearance of white bread that had been added with seaweed flour (*Eucheuma cottonii*) showed the highest average value of 7,8b with the addition of 0% seaweed flour (control), while the addition of 40% seaweed flour had the lowest average value of the appearance of white bread, which is 4.4a.

The average appearance value in the control treatment was 7.8 with a median value of 9 (very like) with a very fluffy shape and dark brown color on the surface and yellowish white inside of white bread. The addition of 20% grass flour had an average appearance of 6.5 with a median value of 7 (likes) with the shape of white bread that expands and was brown on the surface and yellowish white inside. The addition of 30% seaweed flour had an average appearance of 7.3 with a median value of 7 (likes) meaning that the appearance of white bread with the addition of 30% seaweed flour was still favored by panelists with the shape of white bread that expanded and was light brown on the surface and bottom, brownish white inside of the white bread. The bread dough which was added with 40% seaweed flour had an average appearance value of 4.4 with a median value of 5 (neutral/ordinary) with the shape of white bread that does not expand and is colored brownish white on the outside and inside of white bread. The results of the Friedman statistical test showed that the treatment with the addition of 40% seaweed flour was significantly different from the treatment without the addition of seaweed flour (0%), the treatment with the addition of 20% or 30% of the seaweed flour. The treatment without the addition of seaweed flour (0%), with the addition of 20% and 30% of seaweed flour were not significantly different based on statistical results. The treatment without the addition of seaweed flour (0%) got the highest value based on the organoleptic results, so it was the best treatment based on the results of the appearance of white bread that had been added with seaweed flour.

In general, the formation of brown color in the manufacture of white bread after the dough baking process is a non-enzymatic browning reaction caused by the Maillard reaction and sugar caramelization. In the Maillard reaction, the hydroxymethylfurfural (HMF) compound which then becomes furfural and polymerizes, forming a brown melanoidin compound (Supriadi 2004). The color of white bread produced in this study was influenced by the amount of seaweed flour added, namely the more seaweed flour was added,

the color of the white bread produced would be paler or brownish white. Bread that had been added with seaweed flour had brownish yellow spots as well as brown spots on whole wheat bread. This is presumably due to the presence of phycocyanin pigment content in the added seaweed flour (Supriadi 2004) however, the appearance of the white bread was still accepted by the panelists.

Aroma

Aroma is related to the sense of smell, besides that aroma determines the delicacy of a food ingredient. According to Soekarno 1985 in Jaya 2016), the delicacy of a food is determined by the aroma factor. Aroma is a very subjective smell and difficult to measure, because each individual can detect it, but each individual has different preferences (Meilgaard et al. 2000). According to DeMan (1997) in Dewi (2017) the assessment of aroma is influenced by psychological and physiological factors that give rise to different opinions. In general, the aroma becomes the main attraction in determining the taste of good or bad in food. The results of observations on the aroma of white bread with the addition of seaweed flour could be seen in Table 2.

Table 2. Average Value of Bread Fragrance that had been Added with Seaweed Flour (*Eucheuma cottonii*)

Treatment	Median	Average Appearance
0% seaweed flour (control)	7	6,5ab
20% seaweed flour	7	6,5ab
30% seaweed flour	7	7,4b
40% seaweed flour	5	5,2a

Description: Numbers followed by letters that were not the same indicated significantly different according to the test multiple comparisons at the 5% test level.

Panelists' assessment of white bread showed that the average aroma with the highest average value on the aroma of white bread was with the addition of 30% seaweed flour with an average value of 7.4 while the lowest average value for white bread was the addition of 40 % seaweed flour with an average value of 5.2 of aroma. The average value of aroma in the control treatment (0% of seaweed flour) was 6.5 with a median value of 7 (likes) the specific aroma of white bread. The addition of 20% seaweed flour had an average value of 6.5 with the median value of 7 (likes) had a specific aroma of white bread. The addition of 30% seaweed flour had an average value of 7.4 with a median value of 7 (likes) still had a specific fragrance specific to white bread, while for the treatment the addition of 40% seaweed flour had an average value of 5.2 with a median value of 5 (neutral/ordinary) still had a specific aroma of white bread but had a slightly fishy smell. The addition of this seaweed flour had a significant effect on the aroma of white bread produced, such as the presence of a fishy smell or other aromas as an innate character of seaweed flour. Overall all the treatments were still favored by the panelists.

Friedman statistical test results showed that the treatment with the addition of 40% seaweed flour was not significantly different from the treatment without the addition of seaweed flour (0%) and the treatment with the addition of 20% seaweed flour but significantly different from the treatment with the addition of 30% seaweed flour. The treatment without the addition of seaweed flour (0%) was not significantly different from the treatment with the addition of 20%, 30% and 40% seaweed flour. The best treatment based on the results of the aroma of white bread that had been added with seaweed flour was the addition of 30% seaweed flour.

Flavor

Taste is an important factor in determining a decision for consumers to accept or reject a food. Even though the other parameters have good values, if the taste is not good or the panelists don't like it, the product will be rejected (Soekarto 1985 in Jaya 2016). The following was the average value from observations on the taste of white bread with the addition of seaweed flour which could be seen in Table 3.

Table 3. Average Value of Bread Flavor that had been Added with Seaweed Flour (*Eucheuma cottonii*)

Treatment	Median	Average Appearance
0% seaweed flour (control)	5	6a
20% seaweed flour	7	6,3b
30% seaweed flour	9	8,1c
40% seaweed flour	5	4,5a

Description: Numbers followed by letters that were not the same showed significantly different according to the testmultiple comparisons at the 5% test level.

The results of the Friedman statistical test showed that the treatment with the addition of 40% seaweed flour was not significantly different from the treatment without the addition of seaweed flour (0%) but was significantly different from the treatment with the addition of 20% and 30% seaweed flour. The treatment with the addition of 20% seaweed flour was significantly different from the treatment without the addition of seaweed flour (0%), the treatment with the addition of 30% and 40% of seaweed flour. The best treatment based on the taste of white bread that has been added with seaweed flour is the addition of 30% seaweed flour.

Panelists' assessment of the taste of white bread that had been added with seaweed showed the highest average value of white bread taste was in the treatment of adding 30% seaweed flour, which is 8.1, while the lowest average value was in the treatment of adding 40% seaweed flour that is equal to 4.5. Taste is assessed by the presence of chemical stimulus responses by the taste buds (tongue), where in the end the overall interaction between the properties of aroma, taste and texture is the overall taste of the food being assessed. The average value of taste in the treatment without the addition of seaweed flour (control) was 6 with a median value of 5 (neutral/ordinary) with a neutral taste like white bread in general. The treatment with the addition of 20% seaweed flour had an average value which is 6.3 with a median value of 7 (likes) with a neutral taste. The treatment with the addition of 30% seaweed flour had an average value of 8.1 with a median value of 9 (very like) with savory bread, while for the treatment the addition of 40% seaweed flour had an average value of 4.5 with a median value of 5 (somewhat like) with a salty taste.

Amino acids in seaweed consist of mono-amino acids of 70% of total nitrogen and di-amino acids of 3% - 20% of total nitrogen. Amino acids that are commonly found in seaweed and in larger amounts are glutamic acid, alanine, glycine, proline and aspartic acid (Anggadiredja et al. 2008). Seaweed gives a savory taste (tasty) due to the presence of high enough glutamic acid (Wong et al. 2000), so that the addition of seaweed flour will give a savory taste to white bread.

Texture

Texture is one of the factors that can determine the level of panelists' preference for a food product. Texture is more important than aroma, taste and appearance because it affects the image of the food (Soekarto 1985 in Jaya 2016). According to US Wheat Associates (1983) in Supriadi (2004) bread texture is influenced by production factors and dough retention during the fermentation process. The influencing factors include: the ability of yeast to produce gas, the quality and quantity of gluten and the size of the flour particles to support the formation of a strong and elastic dough. In addition to the fermentation process, the baking process also determines the formation of the texture of the bread. The texture of a good bread is one that is smooth and quite elastic, which is supported by a smooth or uniform crumb texture. The results of observations on the texture of white bread with the addition of seaweed flour could be seen in Table 4.

Table 4. Average Texture Value of Bread that had been Added with Seaweed Flour (*Eucheuma cottonii*)

Treatment	Median	Average Appearance
0% seaweed flour (control)	7	6,6bc
20% seaweed flour	7	5,6a
30% seaweed flour	7	7,4c
40% seaweed flour	3	3,7a

Description: Numbers followed by letters that were not the same showed significantly different according to the testmultiple comparisons at the 5% test level.

The results of the Friedman statistical test showed that the treatment with the addition of 40% seaweed flour was not significantly different from the treatment with the addition of 20% but significantly different from the treatment without the addition of seaweed flour (0%) and the treatment with the addition of 30% seaweed flour. The treatment without the addition of seaweed flour (0%) was not significantly different from the treatment with the addition of 30% seaweed flour but significantly different from the treatment with the addition of 20% seaweed flour and the treatment with the addition of 40% seaweed flour. The best treatment based on the results of the texture of white bread that had been added with seaweed flour was the addition of 30% seaweed flour. Assessment of texture could be in the form of hardness, elasticity or crispness. The addition of seaweed flour had a significant effect on the texture of the resulting product. This was presumably due to the relatively large particle size of seaweed flour with high fiber content.

Panelists' assessment of the texture of white bread that had been added with seaweed flour is known that the highest average value of white bread texture was in the treatment of adding 30% seaweed flour with an average value of 7.4 while the lowest average value was in the treatment the addition of 40% seaweed flour that was equal to 3.7. The average value of texture in the treatment without the addition of seaweed flour (control) was 6.6 with a median value of 7 (likes) with a hollow texture, soft like bread in general. The treatment with the addition of 20% seaweed flour had an average value – average was 5.6 with a median value of 7 (likes) with a slightly hollow and soft texture. The treatment with the addition of 30% seaweed flour had an average value of 7.4 with a median value of 7 (likes) with a slightly hollow texture and soft, while the addition of 40% seaweed flour had an average value of 3.7 with a median value of 3 (did not like it) with a very little hollow texture, dense and less soft. The addition of seaweed flour had a very significant effect on the texture of the bread, which with the higher the percentage of seaweed flour added, the texture of the resulting bread would be lower in quality. The resulting bread became denser with smaller cavities and the texture became less tender. This was due to the coarser particle size of the flour added and the high fiber content in seaweed flour, causing the crumb structure to crumble easily.

Decision Making with Bayes Method

Decision making with the Bayes method is a technique used to carry out an analysis in making the best decision from a number of alternatives or treatments by considering the weight of the criteria and the median value (Marinim 2004). The weight of the criteria was obtained from the manipulation of the matrix of the test results for determining the comparison of criteria. The criteria being compared were appearance, aroma, taste and texture. The results of the calculation of the criteria weights could be seen in Table 5.

Table 5. Decision Matrix for Bread Assessment with Added Seaweed Flour (Eucheuma cottonii)

Treatment	Criteria				Alternative Value	Priority Value
	Appearance	Aroma	Texture	Flavor		
0%	9	7	7	5	6.32	0.24

20%	7	7	7	7	7.00	0.27
30%	7	7	7	9	8.02	0.31
40%	5	5	3	5	4.65	0.18
Criteria Value	0.17	0.15	0.18	0.51	25.98	1.00

Calculations with the Bayes method showed that the treatment that obtained the highest alternative value was 8.02 and had a priority value of 0.31 with the addition of 30% seaweed flour treatment. The treatment without the addition of seaweed flour (control) obtained an alternative value of 6.32 and had a priority value of 0.24. The treatment with the addition of 20% seaweed flour obtained an alternative value of 7.0 and had a priority value of 0.27. The addition of 40% seaweed flour treatment obtained an alternative value of 4.65 and had a priority value of 0.18. The highest alternative value by considering the criteria can be used to analyze in making the best decision (Marinim 2004). Overall, both the treatment without the addition of seaweed flour (control) or the treatment of adding 20%, 30% and 40% of seaweed flour were still favored by the panelists, except for the texture criteria in the treatment of adding 40% seaweed flour which the panelists did not like.

Based on the calculation of the weight of the criteria starting from the appearance, aroma, texture and taste of white bread, it was found that taste assessment was an important criterion, then followed by texture, aroma and appearance which determines the final decision of the panelists in the selection of white bread products with the weight value of the criteria for taste, namely 0.51. This showed that although the assessment was good, if the taste of white bread was not liked by the panelists, then the product would be rejected by the panelists. This proved that the taste criterion was the most important criterion that determines the final decision of the panelists. According to Winarto (1997) in Iffa (2018), taste is the most important criterion whether or not a product is. Although other criteria were better, if the taste of white bread was not liked by the panelists, the product would be rejected. The taste criterion is the most important thing in the main consideration in choosing a product.

Fiber Level Test

Fiber content test is one of the tests carried out organoleptically, the aim is to determine the level of fiber content in a product. Dietary fiber is an ingredient in food of plant origin that is resistant to breakdown by enzymes in the digestive tract and therefore cannot be absorbed. This substance consists of cellulose with a small amount of lignin and a small amount of hemicellulose (Herminingsih 2010). The results of observations on the fiber content test of white bread could be seen in Table 6.

Table 6. Food Fiber Content of Bread that had been Added with Seaweed Flour (*Eucheuma cottonii*)

Sample	Fiber Content (%)
0%(control)	1,57
20%	2,38
30%	3,92
40%	4,32

Based on Table 6., the results of the analysis of dietary fiber content from samples of white bread with control treatment obtained 1.57%, for samples of white bread with the addition of 20% seaweed flour the results were 2.38%, for samples of white bread was treated with the addition of 30% seaweed flour, the results were 3.92% and for the sample of white bread with the addition of 40% seaweed flour the highest yield was 4.32%. With the addition of seaweed flour, it had an effect on the fiber content of the white bread produced, with the higher the percentage of seaweed flour added, the fiber content in the resulting white bread would be higher.

According to the Department of Nutrition, Ministry of Health and Institute of Health Sigapore (1999) in Supriadi (2004) that a product can be claimed as a source or contain dietary fiber if it contains more than or equal to three grams of dietary fiber per 100 grams of product (in the form of solid) or per 100

ml (in liquid form). Based on this, the white bread in this study could be claimed as a product that was high in dietary fiber content. According to Winarno (1997) in Supriadi (2004) by consuming high fiber, more bile acids, cholesterol and fat will be excreted with feces, besides that fiber can prevent the re-absorption of bile acids, cholesterol and fat.

Consuming fiber is beneficial in overcoming constipation and preventing diabetes, hypercholesterolemia and other degenerative diseases, preventing malignancies of the digestive tract and can be used to control body weight (Schmidl and Theodore 2002).

CONCLUSION AND SUGGESTION

Conclusion

Based on the results of the research on white bread with the addition of seaweed flour, it can be concluded that the treatment with the addition of 30% seaweed flour was the most preferred treatment with an average value of criteria and appearance of 7.3; aroma ie 7.4; taste was 8.1 and texture was 7.4; the weight of the taste criteria was 0.51 and the alternative value was 8,02. The results of the analysis of the fiber content of white bread that had been added with 30% seaweed flour was 3.92% and the water content was 32.09% with the addition of seaweed flour with the higher the percentage of seaweed flour added, the fiber content in white bread output would be higher.

Suggestion

Based on the results obtained from this study, several things can be suggested, including;

1) To produce bread that is preferred and has sufficient fiber content, it is advisable to add 30% seaweed flour.
2) Further research on other proximate tests such as water content, protein content, fat content, ash content, carbohydrate content and iodine content in white bread with the addition of seaweed flour is expected to be carried out.

Refences

[1] Anggadiredja, J., A. Zatrika, W. Sujatmiko, S. Ismail dan Z. Noor. 1993. Teknologi Produksi Perikanan dalam Industri Farmasi; Potensi dan Pemanfaatan Makro Alga Laut. *Makalah Stadium Generale Teknologi dan Alternatif Produk Perikanan dalam Industri Farmasi Fakultas Perikanan*. Institut Pertanian Bogor, Bogor.

[2] Anggadiredja, J.T., Achmad, Z., Heri, P., dan Sri, I. 2011. *Rumput Laut*. Penebar Swadaya. Hal. 6,20, 63,77-80. Jakarta.

[3] Badan Perhitugan Statistik. 2012. *Jumlah Tenaga Kerja Berdasarkan Industri Usaha di Indonesia*. Diakses pada 22 Mei 2013 dari www.bps.go.id

[4] Badan Standardisasi Nasional. 1992. SNI No.01-2973-1992. *Standar Mutu Biskuit*. Badan Standardisasi Nasional. Jakarta.

[5] Departemen Kesehatan R.I. 1998. *Survei Nasional Pemetaan Gangguan Akibat Kekurangan Yodium (GAKY). Kerjasama P3G dan Direktorat Bina Gizi Masyarakat,* Departemen Kesehatan Republik Indonesia.

[6] Departemen Kesehatan RI. 2008. *Profil Kesehatan Indonesia 2008*. Diunduh dari http://www.aidsindonesia.or.id/index.php?option=com_content&task=view&id=1611&Itemid=124. Diakses : 17 November 2009.

[7] Dewan Standarisasi Nasional (DSN). 1995. SNI 01-3840-1995. *Persyaratan Mutu Roti*. Standar Nasional Indonesia. Jakarta.

[8] Direktorat Bina Gizi Masyarakat. 1996. *Panduan 13 Pesan Dasar Gizi Seimbang*. Departemen Kesehatan Republik Indonesia, Jakarta.

[9] Handayani, Ratih dan Siti Aminah. 2011. Variasi Substitusi Tepung Rumput Laut terhadap Kadar Serat dan Mutu Organoleptik *Cake* Rumput Laut (*Eucheuma cottonii*). *Jurnal Pangan dan Gizi*, 2(3):69-72. Universitas Muhammadiyah, Semarang.

[10] Hermaningsih, Anik. 2010. Manfaat Serat dalam Menu Makanan. http://www.daneprairie.com. Diakses 02 Desember 2014. Universitas Mercu Buana. Jakarta.

[11] Hirao, S. 1972. *Seaweed di dalam Utilization of Marine Products. Text Book for Marine Fisheries Research Course*. Ovearseas Technical, Coorperation Agency, Goverment of Japan.

[12] Istini, S., A. Zatnika, Suhaimi., dan J. Anggadiredja. 1986. Manfaat dan Pengolahan Rumput Laut. *Jurnal Penelitian Badan Pengkajian dan Penerapan Teknologi*, 2(2) : 101-115. Jakarta.

[13] Istini, S., Zatnika, A., dan Suhaimi. 1991. *Manfaat dan Pengolahan Rumput Laut Seafarming Workshop Report November Part II*, Bandar Lampung.

[14] Jaya 2016. Penambahan tepung karagenan terhadap tingkat kesukaan bakso udang. *Skripsi.* Fakultas perikanan dan ilmu kelautan, Universitas Padjajaran.Diakses pada tanggal 8 juni 2018 pukul 12.05.

[15] Kartiwan, Zulianatul Hidayah dan Bachtarudin Badewi. 2015. Suplementasi Tepung Rumput Laut pada Roti Manis Berbasis Tepung Komposit. *Jurnal Pangan dan Gizi*, 2:137-146. Kupang.

[16] Koswara, S. 2009. *Teknologi Pengolahan Telur (Teori dan Praktek)*. Diunduh dari eBookPangan.com. Diakses pada tanggal 15 September 2013.

[17] Marimin, 2004. *Teknik dan Aplikasi Pengambilan Keputusan Kriteria Majemuk*. Grasindo. Jakarta.

[18] Meilgaard, M., Civille G.V., Carr B.T. 2000. *Sensory Evaluation Techniques.* Boca Raton, CRC Press: Florida.

[19] Muchtadi, D. 2001. Sayuran sebagai sumber serat pangan untuk mencegah timbulnya penyakit degeneratif. *Teknologi dan Industri Pangan*,12:1-2.

[20] Mudjajanto, S dan Yulianti, N. 2010. *Membuat Aneka Roti*. Penebar Swadaya: Jakarta.

[21] Phillips, R.D., dan J.W Finley. 1989. *Protein Quality and the Effects of Procesing*. Marcel Dekker, Inc., United State of America, 219-246.

[22] Pomeranz, Y. dan Shellenberger. 1971. *Bread Science and Technology*. The AVI Publishing Company, Inc. Westport, Connecticut.

[23] Prihastuti, E., K Komariah dan S Purwanti. 2008. *Restoran Jilid I.* Direktorat Pembinaan Sekolah Menengah Kejuruan.

[24] Prosky, L. & De Vries, J. W. 1992. *Controlling Dietary Fiber in Food Products*. Van Nostrand Reinhold. New York.

[25] Rachmaniar, R., J. Anggadireja., A. Zatnika., S. Istini dan Suhaimi. 1986. *Seaweed a Raw Material for Industry, Di dalam* Workshop o*n Marine Algae Biotechnology*. Nasional Academy Press, Washington.

[26] Safitri, Lisa. 2017. Cara membuat roti tawar yang mudah dan sederhana. Diunduh dari https://medium.com/@safitrilisa240/cara-membuat-roti-tawar-yang-mudah-dan-sederhana-f6f7914918d2. Di akses tanggal 30 Januari 2022, pukul 14.00.

[27] Soegiarto, A.W. Sulistijo, dan H. Mubarak. 1978. *Rumput Laut (Algae), Manfaat, Potensi dan Budidayanya*. Lembaga Oceanologi Nasional. LIPI. Jakarta.

[28] Soekarto, T Soewarno. 1985. *Penilaian Organoleptik untuk Industri Pangan dan Hasil Pertanian*. Bharata Karya Aksara. Jakarta.

[29] Soeparno. 2009. *Ilmu dan Teknologi Daging*. Cetakan V. Gadjah Mada University Perss. Yogyakarta.

[30] Standar Nasional Indonesia (SNI).01-3840-1995. *Syarat Mutu Roti Tawar.* Dewan Standar Nasional. Jakarta.

[31] Stévant, P., C. Rebours, A. Chapman. 2017. Seaweed aquaculture in Norway*:* recent industrial developments and future perspectives. *Aquaculture International,* 25(4):1373-1390.

[32] Subarna. 1992. *Baking Technology*. *Pelatihan Singkat Prinsip-Prinsip Teknologi Pangan Bagi Food Inspektur.* PAU Pangan dan Gizi. Institut Pertanian Bogor, Bogor.

[33] Sudradjat, M. 1999. *Statistik Non Parametrik*. Fakultas Pertanian, Universitas Padjadjaran. Jatinangor.

[34] Supriadi, Cahyana. 2004. Suplementasi Rumput Laut pada Pembuatan Roti Tawar dan Cookies. *Skripsi*. Fakultas Teknologi Pertanian. Institut Pertanian Bogor. Bogor.

[35] Supriadi, I.H. 2004*.* Dinamika Estuari Tropik. *Jurnal* Oseana, 26(1):1-11.

[36] Suryatna, Bambang Sugeng. 2015. Peningkatan Kelembutan Tekstur Roti Melalui Fortifikasi Tepung Rumput Laut *(Eucheuma cottoni)*. *Jurnal Teknobuga,* 2(2):22-24.

[37] Surjana, W. 2001. Pengawetan Bakso Daging Sapi dengan Bahan Additif Kimia pada Penyimpanan Suhu Kamar. *Skripsi*. Fakultas Teknologi Pertanian. Institut Pertanian Bogor. Bogor.

[38] Wahyudi. 2003. *Memproduksi Roti*. Direktorat Pendidikan Menengah Kejuruan Direktorat Jenderal Pendidikan Dasar dan Menengah Departemen Pendidikan Nasional. Jakarta.

[39] Winarno, F.G. 1990. *Teknologi Pengolahan Rumput Laut*. Sinar Pustaka Harapan, Jakarta.

[40] Winarno, F.G. 1997. *Kimia Pangan dan Gizi*. PT Gramedia Pustaka Utama. Jakarta.

[41] Wong, Peter C.K. Cheung. 2000. Nutrional evaluation os some subtropical red and green seaweeds. Part I-Proximate composition, amino acid profiles and some physic-chemical properties. *Jurnal Food Chemistry* 71:475 - 482.