

Study of Antioxidant Activity of Iwel from Brown Rice Flour and Seaweed Flour

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Abstract

This study aims to determine the effect of the proportion of brown rice flour and seaweed flour on the antioxidant activity of iwel, a traditional Lombok cake. This study used a completely randomized design (CRD) with one factor, namely the proportion of brown rice flour and seaweed flour with 6 treatments, namely K0 (100%: 0%), K1 (90%: 10%), K2 (80%: 20) , K3 (70%: 30%), K4 (60%: 40%) and K5 (50%: 50%). Each treatment was repeated 3 times in order to obtain 18 experimental units. The chemical parameters observed included chemical parameters (antioxidant activity, moisture content, ash content), and organoleptic parameters (texture, color, taste and odor) by hedonic and scoring. Observation data were analyzed using Analysis of Variance at the 5% real level using Co-stat software. If there is a significant difference, a further test is carried out using Orthogonal Polynomials for chemical parameters and Honest Significant Difference (BNJ) at the 5% level for organoleptic parameters. The results showed that the higher the addition of seaweed flour caused a decreased in antioxidant activity, moisture content, and preference of panelists but increased ash content of iwel. The proportion of brown rice flour and seaweed flour at K2 was the best treatment seen from the antioxidant activity of 58.80%; moisture content 17.13%; and the ash content of 3.94% and the panelists prefer a bit chewy texture, red color, taste of brown rice flour and had not smell of seaweed.

Keywords: brown rice flour, Iwel, seaweed flour

How to Cite: Amri, K., Nazaruddin, & Cicilia, S. (2020). Study of Antioxidant Activity of Iwel from Brown Rice Flour and Seaweed Flour. *International Journal of Advance Tropical Food*, 2(2),58-68. <http://dx.doi.org/10.26877/ijatf.v2i2.7908>.

INTRODUCTION

Traditional cakes are food that has been produced or consumed from generation to generation, using local ingredients, specially processed in an area in Indonesia. Traditional cakes have various types and nutritional content and have a distinctive taste. The potential of the cake traditional can be used as the basis for its development at present and in the future by still paying attention to and correcting the weaknesses of traditional quaternions, especially in terms of hygiene and personal hygiene who handle the food (Suter, 2014).

Iwel is one of the traditional Lombok cakes which is popular. Iwel has a sweet and sticky taste and is classified as a intermediate moisture food (IMF) similar to dodol, the difference is in the processing process. In iwel making, sticky rice which is still in the form of rice is roasted so that it gives off a burnt aroma before grinding it to produce glutinous rice flour, while the coconut, which is separated from the shell, is roasted until it is slightly charred, then shredded manually or using a machine. Brown sugar boiled with water until thick and then cooled. After the thick liquid sugar has cooled, it is mixed with roasted black sticky rice and grated coconut to form a dough. The resulting dough is then steamed until cooked. Mixing raw materials when cold is intended to facilitate mixing. After cooking, the steamed dough is drained on a board that absorbs enough water and the steam is allowed to escape without creating

moisture, the ideal board for draining is usually woven bamboo. The main raw material in the process of making iwel cakes is black sticky rice found in traditional markets.

Glutinous rice flour is flour made of rice cultivars containing large amounts of amylopectin (Imanningsih, 2012). In traditional Indonesian cakes, sticky rice flour is used to produce chewy and slightly sticky products, such as kelepon, mortar, bugis and lapis cake. Glutinous rice flour has a higher viscosity and has smaller starch granules compared to rice flour. The amylose content in glutinous rice flour tends to be less, namely 0.88%, while the amylopectin content of glutinous rice flour tends to be more, namely 99.11%. Lately, black sticky rice is difficult to obtain because it is limited and black sticky rice is a seasonal crop, so it is not planted every season like rice. The weakness of black glutinous rice if consumed has a side effect for sufferers of stomach acid, which causes reflux of stomach acid, so this condition will make the stomach and chest feel uncomfortable due to a burning and burning sensation, therefore it is necessary to look for an alternative to black sticky rice, one of which is brown rice.

Brown rice is rice with red color because the aleurones contain genes that are thought to produce anthocyanin compounds that cause red or purple colors. Carbohydrate content remains the largest composition, protein and fat are the second and third largest compositions of brown rice. The main carbohydrates in rice are starch and only a small portion of pentosan, cellulose, hemicellulose and sugar. Starch ranges from 85-90% of the dry weight of rice. Rice protein consists of 5% albumin fraction, 10% globulin, 5% prolamin, and 80% gluten. Fat content ranges from 0.3-0.6% in milled dry rice and 2.4 - 3.9% in cracked rice (Indrasari and Adnyana, 2006).

Brown rice also contains antioxidants and phytonutrients that contain the immune system, reduce cholesterol levels, reduce the risk of heart disease, stroke, relieve asthma (Ahira, 2012). Starch is concentrated in the endosperm part of the rice seeds with an average content of 90.68% of the dry weight of milled rice (Yanai, 1979 in Arendt and Zannini, 2013). Starch is composed of a linear fraction, namely amylose, and a branched fraction, namely amylopectin. The problem that arises in making iwel is that it will affect the chewiness because the high amylose content in brown rice will produce a slightly hard texture, while the characteristics of iwel in general that are liked by consumers are sticky and sweet textured. Therefore, to improve the texture and elasticity it is necessary added chewy like seaweed.

Seaweed is a low-level plant that has high nutritional value. One of its ingredients that plays a role in the formation of texture is carrageenan. According to Winarno (2004), carrageenan is a polysaccharide contained in red seaweed which has a function as a thickening, gelling or emulsifying agent in the industrial sector. Carrageenan has the ability to stabilize the emulsion by reducing the surface tension through the formation of a protective layer covering the dispersed globules so that the insoluble compounds will be more dispersed and more stable in the emulsion. The research on making iwel cake from brown rice and seaweed has never been done.

According to Andriani, et al (2018), the use of brown rice in making snack bars can be added to brown rice flour up to 90% and the best results were in the formulation of 60% brown rice flour, while according to Devillya, et al (2016), the addition of brown rice flour in the best steamed sponge was in the 60% formulation because it was seen in terms of color, aroma and texture in this steamed sponge according to the taste of the panelists. The effect of variations in mixing brown rice flour on anthocyanin levels in steamed sponge cake with 60% formulation had the

highest anthocyanin content. According to Erilia (2012), the use of seaweed flour in making dodol can be added to seaweed flour up to 40%, while according to Lukito, et al (2017), the best addition of seaweed flour was 20% by producing dodol which is good and liked by the panelists. Dodol has similarities with iwel in terms of raw materials and the manufacturing process

RESEARCH METHOD

Materials and Equipment

The materials were used to making iwel are seaweed flour, brown rice flour, grated coconut, sugar, and salt. The materials used for the analysis are analytical grade.

Research Design

The design used in this study was an experimental which is carried out in the laboratory, a completely randomized design (CRD) with one factor, namely the proportion of brown rice flour and seaweed flour with 6 treatments, namely K0 (100%: 0%), K1 (90%: 10%), K2 (80%: 20) , K3 (70%: 30%), K4 (60%: 40%) and K5 (50%: 50%). Each treatment was repeated 3 times in order to obtain 18 experimental units.

Iwel Cake Making Process

The ingredients in making iwel were seaweed flour, brown rice flour, grated coconut, sugar, and salt. They are mixed and steamed for 30 minutes 95-97°C and followed by pounded. The mashing is done using a rock collision for 5 minutes so that the resulting iwel wich has a good texture.

Analysis Sample

The chemical parameters observed included chemical parameters (antioxidant activity, moisture content, ash content), and organoleptic parameters (texture, color, taste and odor) by hedonic and scoring.

Data Analysis

Data were analyzed using Analysis of Variance at the 5% real level using Co-stat software. If there is a significant difference, a further test is carried out using Orthogonal Polynomials for chemical parameters and Honest Significant Difference (BNJ) at the 5% level for organoleptic parameters.

RESULTS AND DISCUSSION

Observed data and analysis of the effect of the proportion of brown rice flour and seaweed flour on observed parameters of iwel can be seen in Table 1 to Table 4.

Table 1. Significance of the Effect of Proportion of Brown Rice Flour and Seaweed Flour on Antioxidant Activity, Moisture Content, and Ash Content

Parameters	F-statistic	F-table	Significance
Antioxidant Activity	939,817	0,332	S
Moisture Content	365,643	0,332	S
Ash Content	908,384	0,332	S

S : Significant

NS : Non-Significant

Table 2. Orthogonal Polynomial Advanced Test of Proportion of Brown Rice Flour and Seaweed Flour on Chemical Parameters of Iwel

Response	Antioxidant Activity	Moisture Content	Ash Content
Linier	S	S	S
Kuadratic	S	S	S
Kubic	S	NS	S
Kuartic	S	NS	NS
Kuintic	S	S	NS

S : Significant

NS : Non-Significant

Table 3. Significance of the Effect of Proportion of Brown Rice Flour and Seaweed Flour on Organoleptic Parameters of Iwel

Parameters	F-statistic	F-table	Significance	
			Hedonic	Scoring
Texture	14.728	2.294	S	S
Taste	17.991	2.294	S	S

S : Significant

NS : Non-Significant

Antioxidant Activity

Antioxidants are compounds that play a role in inhibiting oxygen-mediated oxidation. Antioxidant activity is the ability of antioxidant compounds to ward off free radicals. Antioxidant compounds play an important role in the body's defense against disease. This is because antioxidant compounds can prevent the bad effects caused by free radical compounds (Percival, 1998). The relationship between the proportions of brown rice flour and seaweed flour on the antioxidant activity of the iwel can be seen in Figure 1.

Based on Figure 1, it can be seen that the lower the proportion of brown rice flour and the higher the proportion of seaweed, the lower the antioxidant activity of the iwel cake with a linear regression pattern with equation $y = - 10,71x + 99,10$ and coefficient determinat $R^2 = 0,945$. The coefficient of determination of 0.945 is converted to % so that it becomes 94.5%, meaning that it is a decrease in antioxidant activity iwel is influenced by 94.5%, by the proportion of brown rice flour and seaweed flour. The antioxidant activity of brown rice flour is higher than that of seaweed flour. According to Fajar (2013) the antioxidant content in brown rice flour ranges from 92.28% - 92.97% because brown rice contains anthocyanin compounds, while according to Suryaningrum et al., (2006) the antioxidant content in seaweed flour is 40.60%. By decreasing the proportion of brown rice flour and increasing the proportion of seaweed flour, the antioxidant activity of the iwel cake will decrease. According to Awika, (2004), states that there is a good correlation between total anthocyanins and antioxidant activity. According to Sunarni et al., (2007), stated that antioxidant activity is influenced by the system used as the substrate and the conditions used to catalyze oxidation reactions.

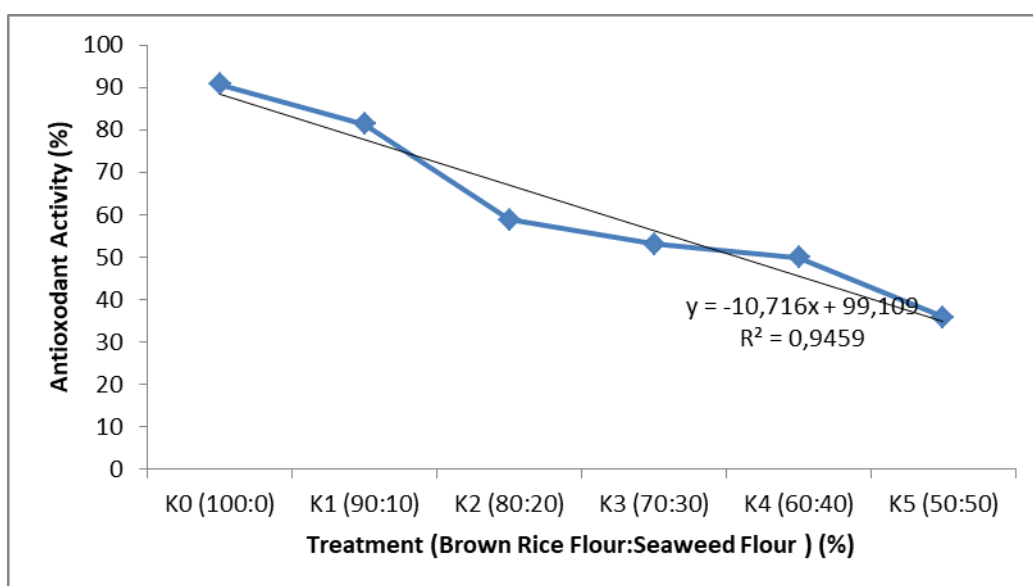


Figure 1. Graph of Effect of Proportion of Brown Rice Flour and Seaweed Flour on Antioxidant Activity of Iwel

Moisture Content

Moisture content is the amount of free water contained in food ingredients. It is a physical parameter that can determine the quality of food and processed products. Moisture content greatly affects the quality of food ingredients because it can affect the taste, texture, aroma and durability of these foodstuffs. This is one of the reasons why in food processing, water is often removed or reduced by evaporation and thickening or drying. Reducing the water content in food is intended to make food more durable and long lasting (Frahma, 2012). The relationship between the proportion of red rice flour and seaweed flour to the moisture content of the iwel can be seen in Figure 2.

Based on Figure 2, it can be seen that the lower the proportion of brown rice flour and the higher the proportion of seaweed flour, the water content of the iwel decreased with the regression pattern formed which is linear with the equation $y = -1,734x + 23,39$ and coefficient determinat $R^2 = 0,958$. The coefficient of determination of 0.958 is converted to % so that it becomes 95.8%, this means that the decrease in moisture content of iwel is influenced by 95.8% by the proportion of brown rice flour and seaweed flour. The lower the proportion of brown rice flour and the higher the proportion of seaweed flour, the lower the moisture content of the iwel cake. According to Indriyani et al., (2013) which states that the moisture content in brown rice flour ranges from 9.85% to 10.57%, while according to Agusman et al. (2014) states that the water content in seaweed flour is 6.88%. By decreasing the proportion of brown rice flour, the moisture content in the iwel cake will decrease. According to BSN (1996), the moisture content in intermediate moisture food ranges from 10% - 40% so that in this study the results for moisture content in all treatments meet the SNI requirements for intermediate moisture food.

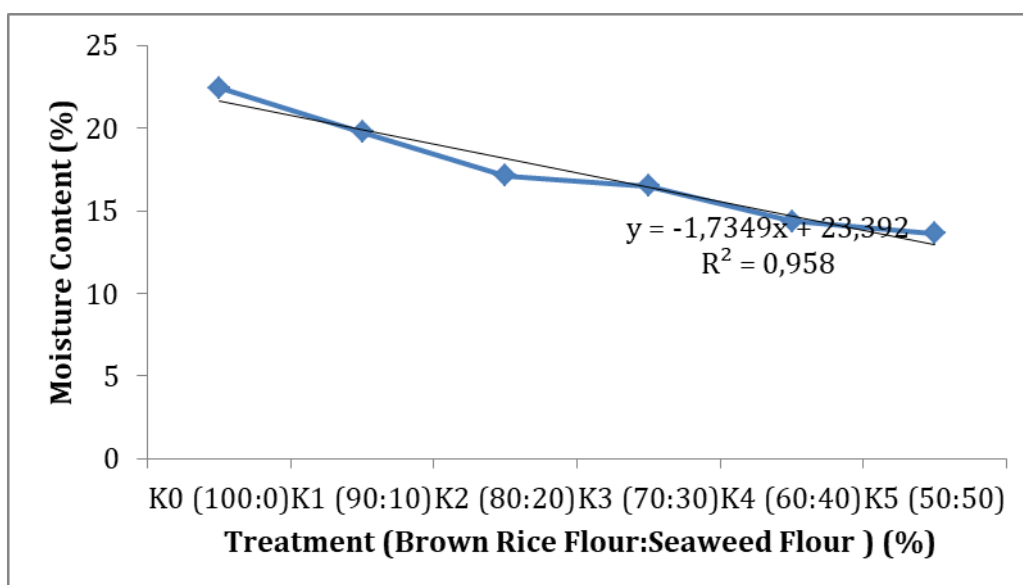


Figure 2. Graph of Effect of Proportion of Brown Rice Flour and Seaweed Flour on Moisture Content of Iwel

Ash Content

Food consists mostly of organic matter and water. The rest consists of mineral elements, also known as ash content. Ash content is a parameter to indicate the value of organic matter (minerals) in a food ingredient or food product. The ash content and composition depend on the type of material and the method of ashes (Sudarmadji, 2007). The relationship between the proportion of red rice flour and seaweed flour to the ash content of the iwel can be seen in Figure 3.

Based on Figure 3, it can be seen that the lower the proportion of brown rice flour and the higher the proportion of seaweed flour, the higher the ash content with the regression pattern formed which is linear with the equation $y = 0,466x + 1,999$ and coefficient determinat $R^2 = 0,773$. The coefficient of determination of 0.773 is converted to% so that it becomes 77.3%, meaning that the increase in the ash content of iwel cakes is influenced by 77.3% by the proportion of brown rice flour and seaweed flour. According to the Ministry of Health of the Republic of Indonesia (2009) which states that the ash content in brown rice flour is 2%, while according to Agusman et al. (2014) states that the ash content in seaweed flour is 14.81%. Reducing the proportion of brown rice flour and increasing the proportion of seaweed flour, the ash content in the iwel cake will increase. According to SNI (1996), the ash content in semi-wet food is a maximum of 1.5% so that in this study the results for the ash content did not meet the SNI requirements for intermediate moisture food.

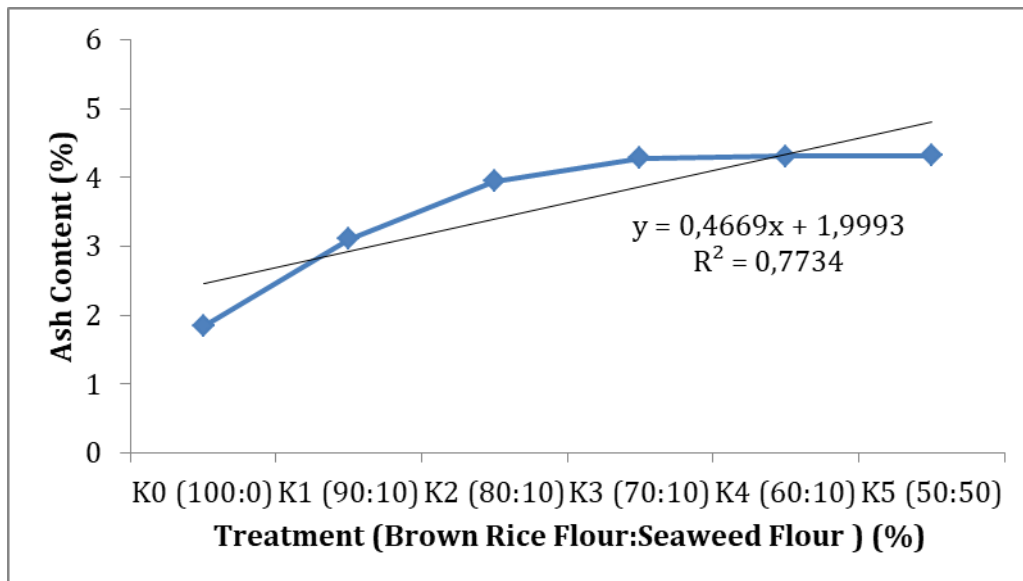


Figure 3. Graph of Effect of Proportion of Brown Rice Flour and Seaweed Flour on Ash Content of Iwel

Texture

Food texture plays an important role in determining consumer acceptance. This parameter can be determined by feeling the smoothness of the product when it is in the mouth (mouthfeel). According to deMan (1997) texture is an important parameter in soft foods. The relationship between the proportion of red rice flour and seaweed flour on the texture of the iwel cake can be seen in Figure 4.

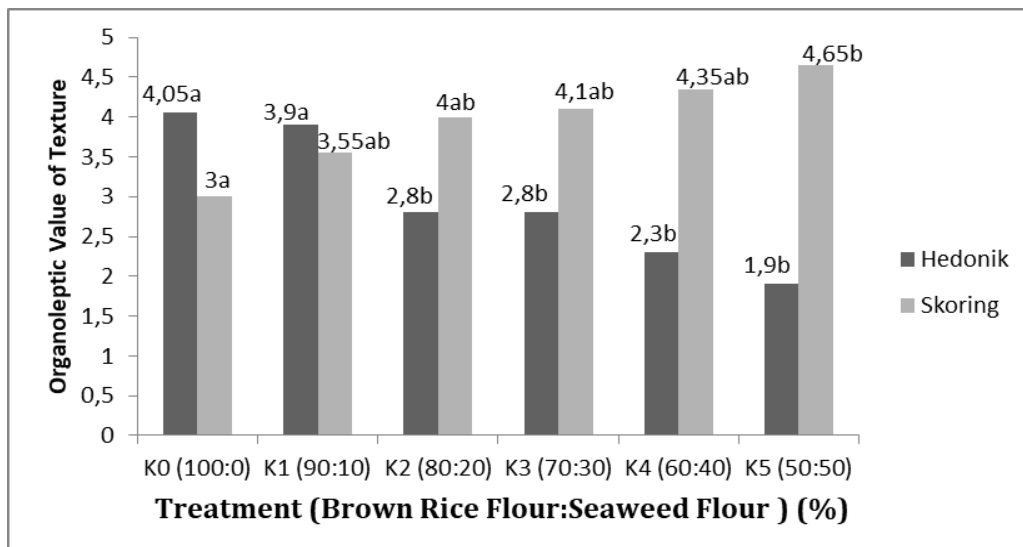


Figure 4. Graph of Effect of Proportion of Brown Rice Flour and Seaweed Flour on Organoleptic Value of Iwel's Texture. Hedonic score 1 (very dislike) – 6 (very like). Scoring 1 (not chewy)- 6 (chewy).

Figure 4 showed that the higher the seaweed flour is added along with the decrease in brown rice, the lower the hedonic value of the texture, which indicates

that the texture of the iwel was getting more disliked. This was because seaweed contains carrageenan which acts as a stabilizer which affects the texture to be too chewy so that the resulting iwel cake tends to be disliked by the panelists, while the highest value is in the K0 treatment (100% brown rice: 0% seaweed flour) of 4.05 (rather like). This was because brown rice flour contains amylose which affects the texture so that the texture of the iwel cake is getting tougher, not easy to crack but easy to bite, so it is preferred by panelists.

Based on the scoring test it was known that the texture of the iwel produced ranges from 3 - 4.65 (slightly chewy to slightly non-chewy), with the highest value being the K5 treatment (50% brown rice flour: 50% seaweed flour) with a value of 4.65 (a bit chewy). This was because seaweed contains carrageenan which functions as a gel formation where a phenomenon of joining or cross-linking polymer chains then forms a continuous three-dimensional mesh so that it produces a texture that is so strong and elastic that it is increasingly difficult to break down, because the function of carrageenan is a stabilizer. According to Hardian (1994) quoted by Sembiring (2002), seaweed produces carrageenan which forms a gel so that it can react and function well with sugar, starch, gum, etc., while the lowest value is in the K0 treatment with a value of 3 (rather not chewy). This is because brown rice contains 29.4% amylose so that the resulting texture becomes hard on iwel cake products.

Taste

Taste has an important role in determining the acceptance of a food. Taste sensing is divided into four flavors, namely sweet, salty, bitter and sour. Panelists' acceptance of taste is influenced by chemical compounds, temperature, concentration and interactions with other taste components (Winarno, 2004). The relationship between the proportion of red rice flour and seaweed flour to the color of the iwel cake can be seen in Figure 5.

Based on Figure 11 showed that the panelists' assessment of the iwel produced ranged from 1.85 to 4.1. The higher the proportion of brown rice flour in the iwel, the higher the preference level of the panelists. This was because brown rice flour has a distinctive brown rice taste in iwel cakes so that the panelists tend to like it a bit. According to Thoif (2014), the more brown rice flour is added, the more distinctive taste of brown rice flour is felt. The higher the proportion of seaweed flour, the panelists' preference tended to decrease. This is because in seaweed there is a protein composed of amino acids which causes a bitter taste so that the panelists tend to dislike it. This is supported by Supriadi (2004), who states that the character of bread emphasizes taste, so that the addition of seaweed flour which is claimed to contain lots of protein produces a bitter taste in bread products with a taste that is not acceptable to the panelists.

Based on the scoring test, it showed that the value of iwel flavor produced ranges from 1.4 to 4.05 with the highest value in the K0 treatment (100% brown rice flour: 0% seaweed flour) with the criteria of having a very good taste of brown rice. This is because brown rice flour has a distinctive taste so that the iwel has a distinctive taste from brown rice. The higher the proportion of seaweed flour it affects the taste of the iwel cake. This is because in seaweed there is protein which, when degraded into simpler essential amino acids, causes a bitter taste, because protein is one component of flavor and taste. The level of seaweed flour added to the proportion of the product will have a strong effect on taste (Suwandi et al., 2002).

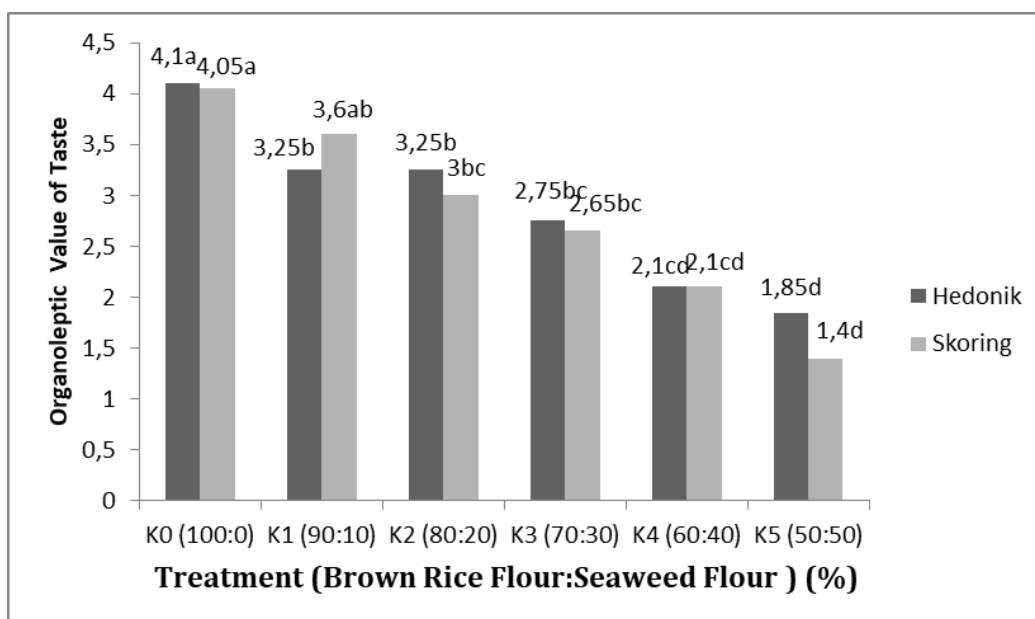


Figure 5. Graph of Effect of Proportion of Brown Rice Flour and Seaweed Flour on Organoleptic Value of Iwel's Taste. Hedonic score 1 (very dislike) – 6 (very like). Scoring 1 (not acceptable)- 6 (acceptable).

CONCLUSION

Treatment of the proportion of brown rice flour and seaweed flour had a significant effect on all iwel parameters. The higher the proportion of seaweed flour and the lower the proportion of brown rice flour caused a decrease in antioxidant activity and moisture content in iwel cake making but increased ash content. The proportion of brown rice flour and seaweed flour at K2 (80%: 20%) was the best result seen from the antioxidant activity of 58.80%, moisture content of 17.13% and ash content of 3.94% and was accepted by the panelists.

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