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Effect of Various Red Dragon Fruit Peel (*Hylocereus polyrhizus*) and Yellow Pumpkin (*Cucurbita moschata*) Combinations and Carrageenan Proportion on the Quality of the Jam

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ABSTRACT

Objective: the objective of this study was to analyze the thickening effect of different red dragon fruit peel, yellow pumkin, and carrageenan proportions on the jam quality whitch is rich in starch and antioxidans and liked by costumer.

Material and methods: A Descriptive and diagnostic analyzed of proportion and quality of the jam with different composition of red dragon fruit peel, yellow pumpkin, and carrageenan. The result material process is tested with physicochemical and organoleptic.

Result: The Formula E (50% RDFP and 50% YP with 0.60% carrageenan addition) is the best treatment, as evidenced by the water content of 24.46%, ash content of 2.47%, 32.75% reducing sugar content, crude fiber of 5.67%, antioxidant activity of 32,49 ppm, and organoleptic score of 4.29 (pink) and 4.05 (liked) for color and taste, respectively.

Conclusion: The quality of jam based on the physicochemical and organoleptic properties preferred by the panelists is formula E (50% red dragon fruit skin, 50% yellow pumpkin, and a carrageenan concentration of 0.60%).

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KEYWORDS

Red Dragon Fruit Peel, Pumpkin, Carrageenan, Antioxidants activity.

INTRODUCTION

Central Kalimantan Province has an area of 2.743.158 ha. with a depth of 0–2 m covering an area of 1.157.163 ha and a depth of more than 2 m covering an area of 1.585.995 ha based on the results of the analysis of the Peatland Distribution Map[1]. Dragon fruit is much loved by the public because, in addition to its sweet taste, dragon fruit also has an interesting color. Red dragon fruit is widely developed in Central Kalimantan with a land area of 97,061 ha and a total annual production of 22.736 quintals, specifically for Palangka Raya City, a land area of 29.020 ha and a total annual production of 2.591 quintals[2]. The rapid cultivation of dragon fruit and the high consumption of dragon fruit due to the increasing number of fruit consumers has caused a circulation of fruits in the community and has an impact on the high volume of waste from the rest of the fruits. The problem of waste from fruits until now has not been optimally solved due to the low level of public awareness and understanding of waste treatment. Therefore, the impact of separate waste causes many problems including disease, air, and water pollution to the environment, especially since most of this fruit waste contains a lot of water that is very easy to rot[3].

Dragon fruit (*Hylocereus polyrhizus*) flesh is generally eaten while the skin is removed. The skin of the fruit is considered a useless ingredient and tends to be discarded due to its unpleasant, bitter, sour, and tasteless properties. The skin of the fruit has nutritional value that is not inferior to the flesh of the fruit, for example, the skin of the dragon fruit. The macro content in the dragon fruit peel consists of 3.2% protein, 0.7% fat, 19.3% ash, and 72.1% carbohydrate. The skin of the dragon fruit also contains a total of 46.7% dietary fiber, 34.3% soluble dietary fiber, and 12.6% insoluble dietary fiber[3]. Some other advantages of dragon fruit peel are rich in anthocyanins, alkaloids, flavonoids, tannins, steroids, saponins, and polyphenols and are a source of antioxidants[3-4]. Red dragon fruit peel ethanol extract with a concentration of 1.0 g per 100 mL provides an inhibition percentage of antioxidant activity with an average of 20.867%. Red dragon fruit peel ethanol extract has antioxidant activity with an IC_{50} value of 3.14 grams per 100 mL[5].

Yellow pumpkin (*Cucurbita moschata*) has a fairly complete nutritional content and high dietary fiber. According to Dar et al.[6], yellow pumpkin is a vegetable food that has functional properties because it contains phenolic compounds, flavonoids, β-carotene, potassium, and high dietary fiber. According to Kristiani et al.[7], yellow pumpkin flour contains a moisture content of 14.96%, ash content of 5.79%, 15.69 g of protein, 1.62 g of fat, 4.22 g of carbohydrates, total dietary fiber content of 3.08%, and β-carotene of 4.86 mg.

As a local food, yellow pumpkin has long been known and used by Indonesian people. However, the use of yellow pumpkin is still limited to traditional food processing such as wajik, dodol, compote, wet cakes, or other traditional foods that have a short shelf life and their distribution is also still limited[8]. The low utilization of yellow squash can also be seen from the low consumption rate of yellow pumpkins, which is less than 5 kg per capita per year[9]. Processed food products from yellow squash are still not widely made, so it is necessary to have a variety of yellow pumpkin processing products. One of the processed products that can be made from the yellow pumpkin is the jam.

Jam is a product that is familiar to most people where the jam is a preserved product made from crushed fruit juice, then added with sugar and cooked until thickened or half solid. Jam is not eaten just like that, but as a spread on plain bread or as a filling for sweet bread. To obtain good quality jam, good quality raw materials, the right processing method, and the appropriate composition of raw materials and additives are needed. Additional ingredients used for making jam are sugar, carrageenan, jelly, gum arabic, Na-CMC, and yellow pumpkin puree. In addition, one of the problems that often arise in the process of making a jam is its plasticity. The addition of pectin from the skin of the red dragon fruit and yellow pumpkin alone is not enough to improve the plasticity properties of the jam, so the addition of hydrocolloids is required. Hydrocolloids can reduce the content of free water in foodstuffs. To improve the plasticity properties as well as maintain the stability of the jam, this study utilized carrageenan.

Carrageenan is a galactose polysaccharide compound resulting from seaweed extraction. Carrageenan is used because, in addition to being hydrophilic, carrageenan is more stable in immobilizing water at lower concentrations, stronger in forming gels, and more economical than gum arabic. The carrageenan used in this study is a type of kappa carrageenan extracted from *Eucheuma cottonii* seaweed since it can form a strong gel compared to iota and lambda types. The selection of kappa carrageenan as a hydrocolloid is also able to increase fiber levels in foodstuffs[9].

The purpose of this study was to determine the effect of various red dragon fruit peel and pumpkin combinations and carrageenan proportion on the quality of the red dragon fruit peel jam that is high in fiber and rich in antioxidants that consumers like.

RESEARCH METHOD

This research was carried out in the UPR Agricultural Industry Technology laboratory, the UPR Agricultural Cultivation laboratory, and the Health Laboratory of the Faculty of Medicine, Lambung Mangkurat University. This research was conducted from March to May 2022.

The tools used in the process of making red dragon fruit peel jam are ovens, spoons, knives, analytical scales (Shimadzu), basins, pots, plastic spatulas, scales, and blenders (Philips). Tools for analysis include porcelain crushes, cup tongs, baking sheets, stopwatches, electric stoves, desiccators, water baths, glasses, paper, ovens (Memmert), test tubes, Erlenmeyer flask, filter paper, funnels, measuring flasks, measuring cups, volume pipettes, spectrophotometers (Genesys 10S UV-Vis), and universal testing instruments (Zwick/Z0.5).

The materials used are red dragon fruit peels obtained from Kalampangan village, Palangka Raya, yellow pumpkin from Bajang village, kappa-type carrageenan obtained from CV Nurajaya Surabaya, and citric acid obtained from UD Fenny Denpasar, and other ingredients such as sugar, NaOH 0.313 N, H_2SO_4 0.255 N, methanol, 1.1- diphenyl-2-picrylhydrazyl solution (DPPH) 0.004%, distilled water, alcohol, I_2 solution, and amylum 1%.

The design used in this study was a randomized group design with various treatments based on the proportion of red dragon fruit peel (RDFP) and yellow pumpkin (YP) as well as carrageenan concentrations with 5 different levels, namely:

A = 90% RDFP and 10% YP without the addition of carrageenan;

B = 80% RDFP and 20% YP with 0.15% carrageenan addition;

C = 70% RDFP and 30% YP with 0.30% carrageenan addition;

D = 60% RDFP and 40% YP with 0.45% carrageenan addition;

E = 50% RDFP and 50% YP with 0.60% carrageenan addition.

The addition of carrageenan concentration is based on the weight of the skin of the dragon fruit and yellow pumpkin used. Each treatment was repeated 4 times so that 20 experimental units were obtained.

Fresh red dragon fruit skin and yellow pumpkin (not rotten and discolored) are chosen and thoroughly washed from adhering dirt. Then, all ingredients that have been weighed according to the formula (Table 1) are blended for 2 minutes and heated at a temperature of 70-80 ºC for 25 minutes in a pan with constant stirring so that the heat is evenly distributed. The jam is then stored in glass jars and cooled at room temperature for 60 minutes and then tightly closed.

Observed Variables

The variables observed in this study were water content and ash content which was analyzed using the thermogravimetric method, reducing sugar content with the Nelson-Somogyo method, crude fiber content using gravimetric method, antioxidant activity tested with 2.2-diphenyl-l-picrylhydrazyl (DPPH) inhibition method[10], as well as sensory properties test using a hedonic score of color and taste[11].

Data Analysis Techniques

The data from the study were analyzed descriptively and inferentially. Descriptive data analysis was carried out to determine the tendency of jam quality due to the influence of the comparison of red dragon fruit skin and yellow pumpkin and carrageenan concentration. Data processing of physical, chemical, and organoleptic test results is presented in the form of tables and bar charts.

Inferential data analysis is carried out to test research hypotheses. The analysis technique used is the analysis of variance (ANOVA) method. Data processing is carried out using Statistical Package for Social Science (SPSS) software. If it has a real effect, then further tests are carried out using the 5% honest-real difference (Tukey's multiple comparisons) test to find out the level of treatment that is different.

RESULT

The statistical results of the study are presented below. For the presentation of statistical results, the following is the order of the tables. First, the value of physicochemical parameters (Table 2). Furthermore, the results show the Effect of Combination of Variations in Red Dragon Fruit Skin and Pumpkin and Carrageenan Proportion on Jam Quality seen from the average antioxidant activity (Table 3) red dragon fruit peel jam and taste with organoleptic results (Table 4).

Physicochemical Characteristics of The Jam

Based on the results of the variety analysis, different proportion of red dragon fruit peel jam and yellow pumpkin with the addition of carrageenan has a very noticeable effect on the physicochemical properties of the jam which can be seen in Table 2.

Antioxidant Activity

The results of the variety analysis showed that the proportion of red dragon fruit skin jam and yellow pumpkin with the

Table 1. The composition of the ingredients for making red dragon fruit peel jam

Treatment Groups and Carrageenan Concentration (g)					
Ingredients	**A**	**B**	**C**	**D**	**E**
RDFP	450 g	400 g	350 g	300 g	250 g
YP	50 g	100 g	150 g	200 g	250 g
Carrageenan	0 %	0.15 %	0.30 %	0.45 %	0.60 %
Pectin	5 g	5 g	5 g	5 g	5 g
Sugar	250 g	250 g	250 g	250 g	250 g
Water	100 mL	100 mL	100 mL	100 mL	100 mL
Citric Acid	2 g	2 g	2 g	2 g	2 g

Description: The total weight of the main ingredients (red dragon fruit skin and yellow gourd) is 500 g.

Table 2. Value of physicochemical parameters of red dragon fruit jams

Formula	Water Content (%)	Ash Content (%)	Reducing Sugar Content (%)	Crude Fiber Content (%)
A	29.47 ± 1.88[a]	1.69 ± 0.03	23.67 ± 4.34	2.87 ± 0.80
B	28.24 ± 2.75[bc]	1.78 ± 0.02	26.34 ± 0.69	3.65 ± 0.37
C	26.3 ± 4.13[cd]	1.98 ± 0.05	29.52 ± 0.59	4.58 ± 0.50
D	25.73 ± 1.25[d]	2.25 ± 0.06	31.08 ± 1.84	4.97 ± 0.17
E	24.46 ± 1.62[d]	2.47 ± 0.04	32.75 ± 2.09	5.67 ± 0.59
Average ± SD	26.84 ± 2.33	2.03 ± 0.04	28.67 ± 1.91	4.35 ± 0.49

Description: The same letter in the same column indicates no rea difference in the 5% Tukey's multiple comparisons test.

Table 3. Average antioxidant activity of red dragon fruit skin jam, yellow pumpkin, and carrageenan concentration (%)

Formula	Antioxidant Activity (ppm)
A	43.16 ± 1.26[c]
B	39.09 ± 1.03[bc]
C	36.32 ± 0.95[b]
D	34.84 ± 0.67[ab]
E	32.49± 0.28[a]
Average ± SD	37.18 ± 0.84

Description: The same letter in the same column indicates no real difference in the 5% Tukey's multiple comparisons test.

Table 4. Average organoleptic results of red dragon fruit skin jam flavor, yellow pumpkin, and carrageenan concentration

Treatments	Mean of color parameters	Mean of taste parameters
A	3.79 ± 0.11[a]	3.97 ± 0.19[a]
B	3.89 ± 0.08[bc]	4.10 ± 0.30[ab]
C	4.02 ± 0.41[c]	4.15 ± 0.29[ab]
D	4.08 ± 0.49[c]	4.29 ± 0.10[b]
E	4.29 ± 0.52[c]	4.05 ± 0.26[ab]
Average ± SD	4.01 ± 0.32	4.11 ± 0.23

Description: The same letter in the same column indicates no real difference in the 5% Tukey's multiple comparisons test.

addition of carrageenan concentration had a significant effect on antioxidant activity. The average value of the antioxidant activity of the jam can be seen in Table 3.

Sensory Analysis of Color and Taste

Based on the results of the variety analysis, it shows that the proportion of red dragon fruit skin jam: yellow pumpkin with the addition of carrageenan concentration has a significant effect on the organoleptic test of jam flavor. The average value of the flavor of jam can be seen in Table 4.

DISCUSSION

Physicochemical Characteristics of The Jam

Table 2 showed that the average value of jam moisture content ranges from 24.46%–29.47%. The highest average water content value is found in formula A which is 29.47%, while the lowest average water content value is found in treatment E which is 24.46% with no significant difference from formulas D and C. This shows that the more carrageenan additions, the moisture content in the jam are decreasing. In this study, the addition of carrageenan functioned as a gelling agent. Gel formation is a phenomenon of merging or crosslinking polymer chains so that a continuous three-dimensional mesh is formed, then this mesh captures or mobilizes the water in it and forms a strong and rigid structure. Carrageenan easily binds to water because it has a negatively charged sulfate group along its polymer chain. The sulfate ester group and galactopyranose unit contained in carrageenan are hydrophilic, so free water will decrease and form a strong gel structure[12]. One of the properties of carrageenan is that it can mobilize water. The higher concentration of carrageenan added to the dragon fruit skin jam causes the amount of free water and adsorbed water present in the ingredients to decrease.

According to Arsyad and Riska[3], the maximum jam moisture content is 35%. From the research results of red dragon fruit skin jam, all treatments on this dragon fruit skin jam product have met the water content standards in jam.

The results of the analysis of the ash content of red dragon fruit peel jam in various treatments ranged from 1.69%–2.47%.

Table 2 showed that higher RDFP, YP, and carrageenan will result in higher ash content of the jam. Factors influencing the increase in ash content are pectins that can form gels and can bind water[13]. The amount of bound water affects the ash content which will increase because the skin of the red dragon fruit and yellow pumpkin contains many minerals such as sodium, potassium, and calcium. In addition, the more yellow pumpkin is added to the red dragon fruit skin jam, the more ash content of the jam is produced. Apart from being caused by the mineral content in yellow pumpkin, the high protein content also plays a role in increasing the ash content in the red dragon fruit skin jam. Where following the opinion of Priyono et al.[14], the mineral content in fruits is different due to various factors such as genetic variation, planting techniques (agricultural practices), soil conditions, fruit maturity, and environmental factors. The mineral content contained in the red dragon fruit is 8.8 mg of calcium, 3.61 mg of phosphorus, and 0.65 mg of iron.

Reducing sugars are a group of simple sugars (carbohydrates) that can oxidize to form a carboxyl group and have the ability to reduce other components, for example, glucose and fructose[15].

Based on Table 2, it can be deduced that the average value of reducing sugar content in the jam ranges from 23.67%–32.75%. The highest average value of reducing sugar content is found in formula E which is 32.75%, while the average value of the lowest reducing sugar content is found in formula A, which doesn't differ from treatments B and C but differs significantly from formula D and E. Higher concentration of red dragon fruit skin jam and yellow pumpkin increase the content of reducing sugar, while the concentration of carrageenan does not affect the reducing sugar content. This can be caused by the low reducing sugar content of red dragon fruit skin (12.35%) than the yellow pumpkin (15.82%). The reducing sugar content in jam becomes higher which can be caused by the sucrose hydrolysis process that affects the reducing sugar content. The process of inversion of sucrose into inverted sugars (glucose and fructose) affects the level of reducing sugars, where this inversion process can be influenced by reactions that occur from acids, heat, and mineral content[16].

The amount of sugar added to the dough in the jam-making process also affects the reducing sugar content. When the jam is cooked, the hydrolysis of sucrose produces glucose and fructose due to the presence of acids and heat at the time of ripening. At high temperatures, it can also increase the rate of inversion of sucrose into reducing sugar[15]. Sucrose is used in the process of making jam to produce a sweet taste and increase the shelf life of the product. According to Netramai et al.[17], positing that sucrose dissolved in heated water will partially decompose into glucose and fructose. Heating that is done slowly over a long time produces more inverted sugar compared to fast and short heating.

Table 2 stated that the average value of fiber content of red dragon fruit skin jam ranges from 2.87%–5.67%. The highest average fiber content value is found in formula E which doesn't differ from formula D while the average value of the lowest fiber content is found in formula A. This shows that the more carrageenan is used, the higher the crude fiber content in the jam. The increase in fiber levels in dragon fruit skin jam is caused by the concentration of added carrageenan because carrageenan is one of the fiber components of seaweed[18]. Crude fibers are fibers that are laboratory resistant to acids and bases and consist mostly of cellulose and are not easily soluble. Crude fiber is a type of polysaccharide often referred to as complex carbohydrates. This crude fiber has a long chemical chain making it difficult to digest by enzymes and the human digestive tract[19]. In addition, Nasution[20] stated that crude fibers such as cellulose, hemicellulose, and lignin are water-insoluble fibers because these fibers are not water soluble, hence their existence is still present in the final product.

Antioxidant Activity

Antioxidant activity can be measured using the DPPH radical method. This method is widely used because it is considered simple, easy to work with, and does not take much time. Testing antioxidant activity on a test sample usually uses the DPPH inhibition test method. The DPPH test is used to measure and estimate the working efficiency of substances that act as antioxidants. DPPH is used to evaluate the free radical soaking activity of a natural antioxidant and functions as a free radical compound. Purple DPPH can turn into a stable compound with a yellow color by reaction with antioxidants[21]. DPPH is a stable free radical with maximum absorbance at 515–517 nm.

The results of the 5% multiple comparisons test on antioxidant activity can state that the more proportion of red dragon fruit skin: yellow pumpkin and carrageenan concentrations added, the higher the antioxidant activity of jam. As shown in Table 3. showed that the skin of red dragon fruit 50% and yellow pumpkin 50% and carrageenan 0.60% showed antioxidant activity of 32,49 ppm, which is higher than the skin of red dragon fruit 90% and yellow pumpkin 10% and carrageenan concentration of 0% which is 43.16 ppm. This shows that the amount of antioxidant content is influenced by the content of antioxidant compounds from the raw materials of these food products.

In addition, antioxidant activity is also related to the results of the total anthocyanin analysis of the product. Where the higher the total anthocyanins, the higher the antioxidant levels. Noor et al.[22], argue that the skin of dragon fruit contains antioxidants in the form of anthocyanins, polyphenols, tannins, vitamin C and saponins based on FTIR testing. Anthocyanins are the most abundant flavonoid compounds on the skin of the red dragon fruit they can bind free radicals be-

cause they have a hydroxyl group to release protons in the form of hydrogen ions. Anthocyanins have a strong free radical counterpower due to a large number of hydrogen ions so that free radical hydrogen atoms bind to each other and free radicals are reduced as evidenced by DPPH testing. Likewise, it can be seen that the concentration of adding carrageenan to the antioxidant activity of jam has increased along with the increasing carrageenan added in jam making. This is possible because the carrageenan concentration of 0.60% has a higher and stronger gel matrix-forming stability so that the antioxidants in it are not lost due to the hydrolysis reaction of jam products[23]. According to Gunawan et al.[23], the magnitude of antioxidant activity may be influenced by the content of phenol compounds from plants. The group of polyphenol compounds can bind free radical ions so that they are not harmful to the body. In particular phenolic compounds are thought to contribute significantly to the antioxidant activity of a natural ingredient, mainly due to redox properties that allow phenol compounds to act as reducing agents or hydrogen donors. The presence of a hydroxyl group in phenolic compounds causes these phenolic compounds to be able to capture free radicals. Phenolics secure cells from the attack of reactive oxygen compounds such as singlet oxygen, superoxide, peroxyl radicals, hydroxyl radicals, and nitrite peroxy[24].

The IC_{50} value can be identified as the magnitude of the concentration that can inhibit free radical activity by as much as 50%. The smaller the IC_{50} value, the greater the antioxidant activity. On the other hand, the greater the concentration of the sample extract, the % value of its antioxidant activity will increase along with the lower IC_{50} value. This can be due to the higher concentration of the sample extract, the hydrogen donor in the sample extract will be given to more free radicals causing its antioxidant activity to increase. Table 3 showed the results of the IC_{50} values of the antioxidant activity test. Aminah et al.[25] stated that the value of IC_{50} represents the strength of the antioxidant in a sample (IC_{50} < 10 ppm is very strong; IC_{50} = 10–50 ppm is strong; IC_{50} = 50–100 ppm is moderate; IC_{50} = 100–250 ppm is weak). From the results of the IC_{50} value, it is known that in the treatment of 50% red dragon fruit skin, 50% yellow pumpkin, and the addition of carrageenan 0.60% have a strong antioxidant level where the smaller the IC_{50} value, the higher the level of antioxidant activity of a sample.

Sensory Analysis of Color and Taste

Color is a very important component to determine the quality or degree of acceptance of a food ingredient. The determination of the quality of a food ingredient generally depends on color, because color makes food more attractive. The results of organoleptic testing on color parameters are shown in Table 4.

Based on Table 4. The results of the organoleptic test of the color of the red dragon fruit skin jam showed that the color score ranged from 3.79–4.29. The highest score given by the panelists to the red dragon fruit skin jam was found in the E treatment (0.60% carrageenan addition) with a value of 4.29 (liked). This is alleged because the panelists preferred the color of the E treatment which showed red. The red color produced in the jam product comes from the anthocyanin color pigment and the caramel color of the heating of sugar (sucrose). In addition, the addition of carrageenan helps make the color in the jam even more visible. This is following the research of Fauziah et al.[12] stated that the higher the concentration of carrageenan, the darker the color will be, in organoleptic research the color produced the highest value of 2.93 (somewhat liked) with the addition of carrageenan 2.5%. Meanwhile, the lowest color score given by the panelists to the red dragon fruit skin jam was found in treatment A (control without the addition of carrageenan) with a value of 3.79 (somewhat liked) The color of the red dragon fruit skin jam in treatment A (control without the addition of carrageenan) was pink. This is thought to be due to the absence of carrageenan additions that do not help the color change in an attractive product. This is in line with the opinion of Gunawan et al.[26], who states that an ingredient that is considered nutritious and delicious will not be eaten if it has an unattractive color because it seems unpleasant.

The evaluation of odors and flavors depends largely on the flavor and flavor panels on the food during processing. Taste is a response to the presence of chemical stimuli that reach the taste buds of the tongue, especially the basic types of tastes that are sweet, salty, sour, and bitter[27]. According to Wittriansyah et al.[28], the taste is one of the determining factors in the level of acceptance or sales of a product.

Based on Table 4 about the results of organoleptic tests that have been carried out, the panelists assessed the red dragon fruit skin jam product. It was found that the addition of carrageenan to the red dragon fruit skin jam differed markedly from the taste parameters. The average taste obtained in all treatments can be categorized as liked (hedonic scale = 4). The average value of the taste parameters is A = 3.97, B = 4.10, C = 4.15, D = 4.29, and E = 4.05 but statistically, the results obtained differ markedly from the degree of taste liking. Table 4, shows that the more carrageenan concentration, the more preferred it is, but to some extent the higher the carrageenan the more disliked because with more carrageenan it will decrease the taste and improve the texture, the taste becomes more tasteless and the texture is hard, thus lowering the panelists' favorability level.

The taste of jam is not affected by the concentration of the addition of carrageenan. This is thought to be because carrageenan is a type of hydrocolloid that has a neutral or unsalted taste so the addition of carrageenan is significantly different to jam this is adhere to the research of Pratiwi et al.[29], the average value of each treatment ranges from 3.00–4.16 (somewhat liked to liked) where carrageenan is a type of hy-

drocolloid that has no taste so it has an unreal effect on the product. So in this case the taste of this jam is influenced by the added sugar content and the total sugar present in the yellow pumpkin and on the skin of the red dragon fruit.

CONCLUSION

Red dragon fruit peel jam can be modified with the addition of yellow squash to improve organoleptic characteristics, resulting in a more valuable product. The best red dragon fruit skin jam product based on the physicochemical and organoleptic properties preferred by the panelists is formula E with 50% red dragon fruit skin, 50% yellow pumpkin, and a carrageenan concentration of 0.60%.

RECOMMENDATIONS

Based on the results of this study, it is recommended that further research is needed on the shelf-life of red dragon fruit peel jam from the results of adding yellow pumpkin with carrageenan concentrations. One interesting thing is microbiological observations can be done to observe the microbiological profile of the jam which is linked to its shelf-life.

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