

Jurnal Internasional FANRES.pdf

WORD COUNT

5752

TIME SUBMITTED

13-JAN-2022 11:58AM

PAPER ID

81328874

Original Paper

The Study of Physic Chemical Properties and Preference Level of Instant Porridge Made of Pumpkin and Brown Rice

Agus Slamet^{1*}, Bayu Kanetro¹, Agus Setiyoko¹

1) Faculty of Agroindustry, University of Mercu Buana Yogyakarta, Indonesia *)

Corresponding Author: agus@mercubuana-yogya.ac.id

Received: 28 May 2021; Revised: 14 August 2021; Accepted: 20 August 2021

DOI: <https://doi.org/10.46676/ij-fanres.v2i2.29>

Abstract— Pumpkin (*Cucurbita moschata* D.) is an annual plant from the Cucurbitaceae family. The availability of pumpkins in Indonesia is relatively high. Pumpkin production in Indonesia reaches an average of 21 tons per hectare. Pumpkin has high carotenoid content reaching 160 mg/100 g. Pumpkin comes from the family Cucurbitaceae and the genus *Cucurbita*. The cultivar (*Cucurbita moschata* D.), which is common for human consumption, is referred to as pumpkin. Rice is a 15 ingredient as a source of energy for humans. In addition, rice is also a source of protein, vitamins, and minerals beneficial for human health. Based on the color of rice, there are several types of rice in Indonesia, such as white rice, black rice, glutinous rice, and brown rice. Brown rice is generally consumed without going through the grinding process, but it is only ground into broken rice and the husk is still attached to the endosperm. Both of these materials have the potential to be processed into instant porridge. In order to produce an instant porridge that has physicochemical properties and meets consumers' preferences, it is necessary to optimize different mixtures and ensure the right drying temperature. The research investigated different mixtures of pumpkin and brown rice at different ratios of 25:75, 50:50, and 75:25. Variations of drying temperatures include 150°C, 160°C, and 170°C. The result 12 g instant porridge was tested for physical properties; color, water absorption capacity, oil absorption capacity, bulk density, and extraction yield. The instant porridge preference test was based on color, aroma, taste, consistency, and overall preference. The instant porridge mostly preferred by the panelists was analyzed for identifying the chemical properties. The data obtained were tested in a completely randomized 6 design. When the analysis marked a significant difference, the Duncan Multiple Range Test was run at a significance level of 5%. The results showed that instant porridge based on physical, chemical, and preference characteristics was influenced by different mixtures of brown rice and different drying temperatures. Concerning the physical properties, preference was obtained from the treatment of pumpkin and brown rice at a ratio of 50:50 at a temperature of 160°C. The chemical composition of the instant porridge included 5.62% water, 12.37% protein, 3.70% fat, 1.81% ash, 1.361.79 (mg GAE/g) phenolic, 164.36(µg/g) beta carotene and 41.5% RSA antioxidants.

Keywords— instant porridge, pumpkin, brown rice, physicochemical properties

I. INTRODUCTION

3 Carotenoids are yellow, red, and orange pigments in plants. Carotenoids can function as precursors of vitamin A and antioxidants. The high carotenoids can be removed by extraction. Beta carotene has several benefits, the first is as a precursor of vitamin A [21]. Research from the National Cancer Institute shows that, in addition to being good for the eyes, foods rich in carotene are also good for cancer prevention. Beta carotene has the ability as an antioxidant that can play an important role in stabilizing carbon-nucleated radicals, so it can be useful for reducing the risk of cancer.

Pumpkin is rich in dietary fiber, contains bioactive compounds, carotene, vitamin A and tocopherols [20, 22]. In addition to these vitamins, pumpkin also contains other vitamins, namely B6, K, C, thiamine, and riboflavin. The mineral content found in pumpkin includes K, P, Mg, Fe, and Se [11].

Pumpkin (*Cucurbita moschata* D.) is an annual plant from the Cucurbitaceae family. The availability of pumpkins in Indonesia is relatively high. Pumpkin production in Indonesia averages 21 tons per hectare. Pumpkin has a high carotenoid content reaching 160 mg/100 g. Pumpkin or pumpkin comes from the family Cucurbitaceae and the genus *Cucurbita*. The cultivar (*Cucurbita moschata* D.) which is common for human consumption is referred to as pumpkin. The name of the pumpkin varies between countries, among others, pumpkin is called Kabocha (Japan), buttercup (New Zealand). Pumpkin with yellow-orange color generally tastes sweet, and is sweeter than other pumpkin varieties [9]. Pumpkin can remain stable during storage about 3 to 4 months after harvest. However, once the skin is peeled off, it becomes susceptible to softening, microbes, discoloration, and spoilage. Pumpkin is rich in fiber (dietary fiber), bioactive compounds, carotene, vitamin A and tocopherols. In addition to these vitamins, pumpkin also contains other vitamins, namely B6, K, C, thiamine, and riboflavin. The mineral content found in pumpkins includes K, P, Mg, Fe, and Se [11].

Pumpkin flour consists of 13.0% water, 4.6% ash, 9.1% protein. The total fiber content is 78.4%, consisting of 46% cellulose and 62% total non-cellulose carbohydrates, and 10.1% uric acid [23, 24]. Production of fruit and vegetable flour

by various drying techniques has been widely common [7]. The production can also be done by freeze-drying [14], spray drying, vacuum drying [3], and microwave vacuum drying [15]. [5] stated that pumpkin flour produced by freeze-drying, either with or without pre-treatment with metabisulfite, produces orange flour, while metabisulfite causes loss of pumpkin orange color. Pumpkin flour processed by Freeze-drying produces pumpkin flour with functional properties, comprising of a high water absorption capacity of 92 ml/100 g, oil absorption capacity of 314 ml/100 g, both of which function as an emulsifier. [1] reported that cookies with the addition of pumpkin flour and carrot flour were substituted for two different types of flour at different compositions of 10%, 15%, 20%, and 25%. The use of pumpkin flour in pasta has been investigated by [10] in which it is used as the substitution of cornflour with pumpkin flour and durian flour. The addition of 25% pumpkin flour results in a paste with better color and favorable sensory reception.

Rice is a staple food for almost all people on the Asian continent. Rice accounts for more than 22% of global energy intake. Asia is the main rice producer, totaling about 92% of total world rice production [13]. For Asian countries, rice is a dominant staple food. Although it varies between countries, the contribution of rice to the fulfillment of calorie needs in the daily diet among Asian people is still relatively high. For example, Laos and Myanmar consume rice per capita per year, at around 179 and 190 kg, respectively, while Indonesian consume around 142 kg/year [17].

The fiber content in brown rice and white rice is commonly compared to find out essential fat content. The bran in rice contains important components, namely fiber, and essential fatty acids. Fiber can prevent gastrointestinal tract disease and heart disease, which often occur in developing countries. The National Cancer Institute recommends 25 grams of fiber per day when compared to white rice. That is equal to a cup of brown rice contains 3.5 grams of fiber, while white rice only has 1 gram. The content of essential oils in brown rice reveals that brown rice can reduce serum cholesterol which is a major risk factor for cardiovascular disease [12].

The optimal drying process using a drum drier that produces pumpkin powder with a good aroma uses a steam pressure of 313.54 kPa at a drum rotation of 1.27 rpm. Drum drier at a steam pressure of 313.54 kPa and a drum rotation of 1.27 rpm 7.5% in the noodle processing process with the highest fiber and carotene content [6].

To make instant porridge with a mixture of pumpkin and brown rice flour, it is necessary to optimize the right mixture and optimize the manufacturing process using a dryer. Two drying factors affect the results of instant porridge, namely the length of processing time and drying temperature. The drying temperature affects the physicochemical properties and the level of preference of the instant porridge produced. The research aims to determine the characteristics of pumpkin and brown rice instant porridge based on physicochemical properties and level of preference. Determine the formulation of pumpkin and brown rice and the drying temperature to produce instant porridge that has physicochemical properties that meet the requirements and are preferred by panelists.

II. RESEARCH METHOD

A. Materials and Equipment

The main ingredients used in this study were pumpkin (*Cucurbita moschata* D.) and brown rice. The pumpkin was obtained from Beringharjo market, Yogyakarta. The pumpkin selected had to be ripe for an optimal harvest age of 3 months, and the skin and flesh of the fruit were oranges. The pumpkin fruit used weighed between 8-10 kg/fruit. Brown rice was obtained from Mirota Godean shop, Yogyakarta. Chemical materials for chemical analysis were obtained from the Laboratory of Agricultural Product Processing, Faculty of Agroindustry Universitas Mercu Buana Yogyakarta.

The main equipment used in this research was a drum drier for making pumpkin and brown rice instant porridge. The other equipment included rapid viscosity analysis to test the amylograph properties of mixed flour and UV-Vis spectrophotometer for carotene analysis.

B. Research Design

a. The research began by making instant porridge with a mixture of pumpkin and brown rice with different ratios (25:75, 50:50, and 75:25). The drying temperatures were set at 150°C, 160°C, and 170°C. The research flow chart is presented in Figure 1.

b. The process of making pumpkin and brown rice instant porridge began by dividing and peeling the pumpkin to remove the skin, seeds, and tendrils on the inside of the pumpkin. The pumpkin flesh was then cut into pieces with a size of 2x2x2 cm³. The pumpkin fruit was then crushed using a blender with 50 ml water added to aid the crushing. The pumpkin pulp was then mixed with floured brown rice with ratios of 25:75, 50:50, and 75:25. The mixture of pumpkin and brown rice flour was then processed using a drying oven at temperatures of 150°C, 160°C, and 170°C [25].

c. The instant porridge produced was tested for physical properties, which included color, bulk density, rehydration, water absorption capacity, and oil absorption capacity. The level of preference test was operative in the tests. The instant porridge produced was tested for its level of preference concerning such properties as color, aroma, taste, thickness, and overall preference. The preference scale used was: 1 = strong dispreference, 2 = dispreference, 3 = neutral, 4 = preference, 5 = strong preference.

d. The most preferred instant porridge was analyzed for its moisture using the oven heating method [2], ash content [2], fat content using the Soxhlet method [2], carotene content, soluble dietary fiber and insoluble, the antioxidant activity of DPPH method, and phenol.

C. Research Procedure

The research design consisted of 2 factors, namely the ratio of pumpkin: brown rice (25:75, 50:50, and 75:25%) and temperatures 150°C, 160°C, and 170°C. The data obtained were analyzed using Univariate analysis with the aid of SPSS.

Once a significant difference was identified, the analysis would proceed to the Duncan multiple range test (DMRT) at a significance level of 5%.

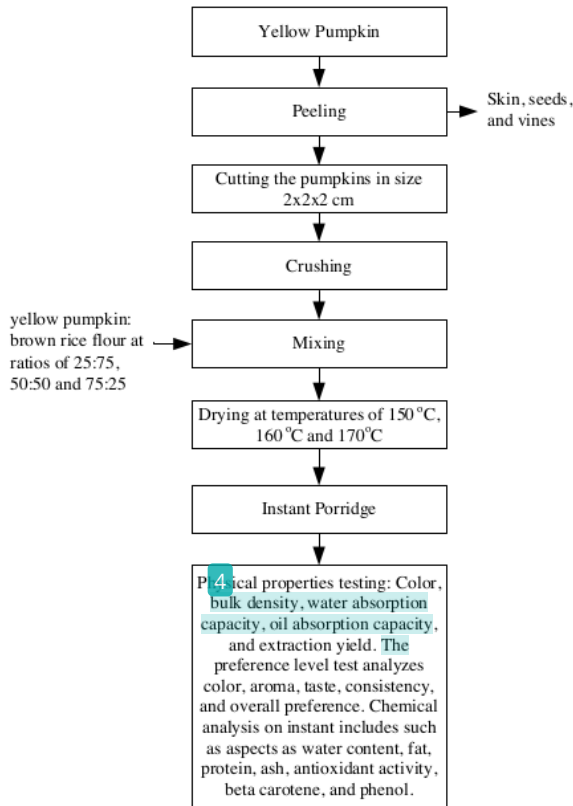


Figure 1. Research Procedure

III. RESULTS AND DISCUSSION

A. Physical Properties of Instant Porridge

Physical properties of instant porridge consisting of pumpkin and brown rice with various ratios of mixture and drying temperature consist of are analyzed by considering the following parameters.

Color

The color of instant porridge made of pumpkin and brown rice under different drying temperatures are analyzed concerning distinctive parameters as follows.

a. Brightness (L).

The brightness of instant porridge made of pumpkin and brown rice under different drying temperatures is shown in Table 1.

Table 1. Brightness (L) of Instant Porridge Made of Pumpkin and Brown Rice

Ratios of Pumpkin and Brown Rice	Drying Temperatures (°C)		
	150	160	170
25:75	48,02 ^{bcd}	48,02 ^{cd}	57,58 ^e
50:50	49,04 ^{cd}	49,40 ^d	56,67 ^e
75:25	39,06 ^a	44,55 ^b	44,55 ^{bc}

Numbers followed by the same letter correspond to insignificant difference at the level of significance (α 5%)

Based on statistical tests, the mixture involving brown rice ratio and drying temperature affected the color (L)/brightness of the mixture of pumpkin and brown rice porridge. Table 1 shows that the brightness level of instant porridge with pumpkin and brown rice with different ratios of pumpkin and brown rice at 25:75 and 50:50 does not lead to any significant difference. Likewise, no significant difference is identified at drying temperatures of 150°C and 160°C. The other ratio of pumpkin and brown rice at a temperature of 170°C produced generates a brighter color than that under different temperatures. This was due to the drying temperature of 170°C. The resultant instant porridge was drier so that the color became brighter. The brightness of the instant porridge produced is found at its utmost in the mixture of pumpkin and brown rice at ratios of 25:75 and 50:50 at a drying temperature of 170°C. The mixture of pumpkin and brown rice at a ratio of 75:25 produces instant porridge with a fairly bright color. This was because the greater the proportion of pumpkin, the higher the sugar content. According to [9] pumpkin (*Cucurbita moschata* D.) contains more glucose than other varieties. Sugars in foodstuffs produced with heat treatment will experience a Maillard reaction [4]. [6] reports that the higher drying temperature and longer drying time decrease beta carotene, making it sink at 56%. [11, 27] state that the temperature and processing duration in a drum drier affect the resulting product.

b. Redness (a)

Redness (a) of different compositions of instant porridge from the mixture of pumpkin and brown rice under different drying temperatures is shown in Table 2.

Table 2. Redness (a) of Instant Porridge Made of Pumpkin and Brown Rice

Ratios of Pumpkin and Brown Rice	Drying Temperatures (°C)		
	150	160	170
25:75	9,50 ^{bc}	9,24 ^{abc}	7,46 ^a
50:50	12,12 ^d	9,67 ^{bc}	8,22 ^{ab}
75:25	11,02 ^{cd}	12,19 ^d	11,82 ^d

Numbers followed by the same letter correspond to insignificant difference at the level of significance (α 5%)

Based on statistical tests, different compositions of pumpkin and brown rice under different drying temperatures pose an impact on the redness (a) of the porridge. The redness of instant porridge indicates that the mixture of pumpkin and brown rice at 75:25 ratio results in a more reddish tone than the

other mixtures of pumpkin and brown rice. The higher proportion of pumpkin is included, the redder the porridge becomes. This is because the pumpkin has a red/orange color. Pumpkin (*Cucurbita moschata* D.) has yellow-orange skin and flesh, fibrous property, and sweeter taste than other varieties of pumpkin, namely *Cucurbita pepo* and *Cucurbita maxima* [11, Neelamma et al., 2016).

c. Yellowness (b)

The extent of yellowish color (b) of instant porridge consisting of pumpkin and brown rice at varied drying temperatures is presented in Table 3. The statistical tests show that the mixture of brown rice and different drying temperatures is related to yellowness (b) of the mixture combining yellow pumpkin and brown rice.

Table 3. Yellowness (b) of Instant Porridge Combining pumpkin and Brown rice

Ratios of Pumpkin and Brown Rice	Drying Temperatures (°C)		
	150	160	170
25:75	16,21 ^a	15,30 ^a	15,85 ^a
50:50	20,72 ^{bc}	17,97 ^{ab}	17,87 ^{ab}
75:25	19,84 ^{bc}	22,78 ^c	22,07 ^c

Numbers followed by the same letter correspond to insignificant difference at the level of significance (α 5%)

The yellowness (b) of the instant porridge made of pumpkin and brown rice indicates that the higher the proportion of pumpkin, the more yellowish the color of the instant porridge will be [26]. In contrast, the drying temperature did not show any effect on the yellowness of the instant porridge. The yellowness of instant porridge is influenced by the increasing proportion of pumpkin. Pumpkin has an orange color pigment derived from carotenoids. The more proportion of pumpkin is, the yellowish instant porridge will be.

Water Absorption Capacity

The water absorption capacity of instant porridge made of pumpkin and brown rice is shown in Table 4.

Ratios of Pumpkin and Brown Rice	Drying Temperatures (°C)		
	150	160	170
25:75	152,40 ^d	153,83, ^d	160,00 ^c
50:50	117,00 ^c	100,00 ^b	133,00 ^c
75:25	85,00 ^a	83,00 ^a	86,00 ^a

Table 4. Water Absorption Capacity (%) of Instant Porridge Made of Pumpkin and Brown rice

Numbers followed by the same letter correspond to insignificant difference at the level of significance (α 5%)

Based on statistical tests, different ratios of pumpkin and brown rice coupled with different drying temperatures affect the water absorption capacity of the pumpkin. The water absorption capacity of the instant porridge made of pumpkin

and brown rice was found the highest at a ratio of 25:75 at a drying temperature of 170°C. The ratio of pumpkin and brown rice at 25:75 also demonstrates the highest water absorption capacity. This is because brown rice has higher starch content than pumpkin. As a result, the higher proportion of brown rice is, the higher the proportion of starch content than the smaller proportion of brown rice will be. [18] report that the starch content of brown rice is 85.5%. Under the temperature treatment of 170°C, the mixture of pumpkin and brown rice at a ratio of 25:75 results in the highest water absorption capacity compared to other temperature variations. The higher the drying temperature is, the drier instant porridge will be, so it has a higher absorption capacity. This is congruent with the results of research by [19], which demonstrates that instant porridge produced in 1.5 bar drum drier pressure treatment has more water absorption capacity than that produced under 1-bar treatment. In the 1.5 bar treatment, the drying temperature is higher than that of 1 bar.

Oil Absorption Capacity (%)

The oil absorption capacity of the instant porridge made of pumpkin and brown rice is presented in Table 5.

Ratios of Pumpkin and Brown Rice	Drying Temperatures (°C)		
	150	160	170
25:75	22,47 ^{bc}	21,53 ^a	22,58 ^c
50:50	22,98 ^c	21,47 ^a	26,74 ^d
75:25	25,58 ^d	26,27 ^d	25,73 ^d

Table 5. Oil Absorption Capacity (%) of Pumpkin and Brown rice

Numbers followed by the same letter correspond to insignificant difference at the level of significance (α 5%)

Based on statistical tests showed that different ratios of pumpkin and brown rice at various drying temperatures there was an interaction with the oil absorption capacity of the mixed pumpkin and brown rice porridge. The highest oil absorption capacity was obtained from pumpkin instant porridge and arrowroot starch at a ratio of 75:25 at temperatures of 150°C, 160°C, and 170°C. This is because the greater the proportion of pumpkin, the higher the beta carotene content. Beta carotene is a nonpolar compound so it will have the ability to absorb oil. The greater proportion of pumpkin in the instant porridge mixture of pumpkin and arrowroot starch, which is at a ratio of 5:1, has a greater oil absorption capacity than the smaller proportion of pumpkin [19].

16 Bulk Density

The bulk density of the instant porridge made of pumpkin and brown rice at various drying temperatures is presented in Table 6.

Table 6. Bulk Density (g/ml) of The Instant Porridge Made of Pumpkin and Brown Rice

Ratios of Pumpkin and Brown Rice	Drying Temperatures (°C)		
	150	160	170
25:75	0,58 ^c	0,72 ^d	0,78 ^c
50:50	0,52 ^b	0,57 ^c	0,59 ^c
75:25	0,41 ^a	0,49 ^b	0,50 ^b

Numbers followed by the same letter correspond to insignificant difference at the level of significance (α 5%)

Based on statistical tests, the ratio mixture of pumpkin and brown rice at various drying temperatures show a correlation with the bulk density of porridge made of pumpkin and brown rice. The density of instant porridge made of pumpkin and brown rice at a ratio of 25:75 is greater than that of other ratios. The bulk density is determined by the starch content in the instant porridge. Starchy materials are more porous than materials with low starch content. Pumpkin has a higher sugar content so it is easier to clump, making the bulk density become lower. This is in congruence with the results of the study of instant porridge made of pumpkin and brown rice at a ratio of 5:1 which leads to lower bulk density [19]. Bulk density is related to the texture and rehydration properties of the powder. Bulk density affects packaging and particle density regulation [10].

Extraction Yield

The extraction yield of instant porridge made of pumpkin and brown rice at various drying temperatures is presented in Table 7. Based on statistical tests showed that the ratios of pumpkin and brown rice and various drying temperatures generate a correlation with the bulk density of the porridge mixture of pumpkin and brown rice.

Table 7. Extraction Yield (%) of Instant Porridge Made of Pumpkin and Brown Rice

Ratios of Pumpkin and Brown Rice	Drying Temperatures (°C)		
	150	160	170
25:75	67,40 ^g	70,04 ^h	66,11 ^f
50:50	43,05 ^b	47,55 ^c	43,80 ^c
75:25	44,68 ^d	40,70 ^a	40,56 ^a

Numbers followed by the same letter correspond to insignificant difference at the level of significance (α 5%)

Table 7. shows that the biggest extraction yield of instant porridge made of pumpkin and brown rice is found at the ratio of 25:75. In this ratio, the highest yield results from the greater the proportion of brown rice, which generates higher starch content. As a result, the yield is also large, compared to the other mixtures with more pumpkins. Starch content in brown rice is 85.5% [18]. In pumpkin, the most abundant compound is water, which is 91.2% [8]. [19] report that more arrowroot starch compared to pumpkin resulted in a large yield of instant porridge mixture of pumpkin and arrowroot starch produced.

B. The Preference Level of Instant Porridge Made of Yellow Pumpkin and Brown rice

Table 7. shows that the yield of instant porridge mixed with pumpkin and brown rice is large at the ratio of 25:75. In this ratio, the highest yield of instant porridge is produced because the greater the proportion of brown rice, the higher the starch content, so that the yield is also large compared to those with more pumpkin. Starch content in brown rice is 85.5% [18]. In pumpkin, the most abundant compound is water, which is 91.2% [8]. [19] reported that more arrowroot starch compared to pumpkin resulted in a large yield of instant porridge mixture of pumpkin and arrowroot starch produced.

Temperatur e (°C)	Pumpki n and Brown Rice	Parameter				
		Color	Aroma	Taste	Density	Overall Preference
150	25:75	3,20 ^{abc}	3,33 ^{abc}	2,60 ^{ab}	2,60 ^a	2,73 ^{ab}
150	50:50	3,60 ^c	3,73 ^c	2,93 ^c	2,93 ^{ab}	3,27 ^b
150	75:25	2,53 ^a	2,67 ^a	2,00 ^a	3,00 ^{ab}	2,27 ^a
160	25:75	3,53 ^c	2,67 ^a	3,07 ^c	2,87 ^{ab}	3,20 ^b
160	50:50	3,27 ^{abc}	3,27 ^{abc}	3,13 ^c	3,53 ^c	3,73 ^c
160	75:25	3,60 ^c	2,93 ^{ab}	2,07 ^{ab}	3,07 ^{ab}	2,20 ^a
170	25:75	3,40 ^{bc}	3,40 ^{bc}	2,80 ^c	2,60 ^a	2,93 ^{ab}
170	50:50	3,33 ^{abc}	3,87 ^c	3,20 ^c	3,40 ^{ab}	3,33 ^b
170	75:25	2,87 ^{abc}	3,47 ^{bc}	2,73 ^{bc}	2,67 ^a	2,93 ^{ab}

Table 8. The Preference Level of Instant Porridge Made of Pumpkin and Brown rice

Numbers followed by the same letter correspond to insignificant difference at the level of significance (α 5%)

Preferred Color

Table 8 shows that the panelists confirm the preference for the color of the instant porridge made of pumpkin and brown rice at different ratios and temperatures, except for the mixture made at 150°C and a ratio of 75:25, which is marked by the average score of 2,53. This is because the drying temperature is insufficient, the instant porridge is not fairly dry and the color is less favorable. In the 75:25 ratio of pumpkin and brown rice, the instant porridge has the highest water content. This follows what is reported by [8], who mentions that the most abundant compound in pumpkin is water, which is 91.2%.

Preferred Aroma

Based on Table 8, the panelists prefer the aroma of instant porridge made of pumpkin and brown rice involving pumpkin and brown rice at 25:75, 50:50, and 75:25 at a drying temperature of 170°C. The panelists generally preferred the aroma because at that temperature instant porridge produces a favorable aroma as a result of high drying temperatures. High temperatures produce a stronger aroma than lower temperatures. [19] report that instant porridge made of pumpkin and arrowroot starch processed with a drum drier at a pressure

of 1.5 bar has a more favorable aroma than that produced at a pressure of 1 bar.

The Flavor of Instant Porridge

Table 8 shows that the level of preference for the taste of instant porridge made of pumpkin and brown rice at various amounts and temperatures. The panelists report positive feedback on all combinations, except for the porridge made at a ratio of 75:25 at a temperature of 150°C and 160°C. The two variants receive lower preference because the taste is different from the others. This is because the instant porridge does not have a high drying temperature so it is not quite dry. In the 75:25 mixture, the proportion of pumpkin is greater than that of brown rice, which means greater water content, so it requires a higher drying temperature.

The Viscosity of Instant Porridge

Table 8 shows that the most preferred viscosity is found at a ratio of 50:50 at a temperature of 160°C. The 50:50 mixture is thought to be the most appropriate mixture, especially concerning the starch content. Instant porridge viscosity is influenced by starch content, especially in the gelatinization process [4]. The drying temperature of 160°C is thought to be the right temperature for the starch gelatinization process in the instant porridge mixture of pumpkin and brown rice.

Overall Preference of Instant Porridge

Overall preference of instant porridge mixture of pumpkin and brown rice at 50:50 ratio at 160°C drying temperature was the most preferred instant porridge. The overall preference of instant porridge was assessed by the panelists based on the parameters of color, aroma, taste, and viscosity. The panelists give low preference scores to the other mixtures under different temperatures. This is because the existing parameters do not meet the panelists' preferences.

C. The Chemical Properties of Preferred Instant Porridge

The instant porridge produced was analyzed for chemical composition based on the level of preference. The preferred instant porridge is the mixture of pumpkin and brown rice at a ratio of 50:50 at a drying temperature of 160°C. The chemical properties of the instant porridge made of pumpkin and brown rice are presented in Table 9.

Table 9. The Chemical Properties of Preferred Instant Porridge Made of Pumpkin and Brown Rice

Components	Amount
Water (%)	5,62
Protein (%)	12,37
Fat (%)	3,70
Ash (%)	1,81
Phenolic (mg GAE/g)	1.361,79
Beta carotene (µg/g)	164,36
Antioxidants (% RSA)	41,5

Based on Table 9, the percentage of water, protein, fat, and ash content in the preferred instant porridge are 5.62, 12.37, 3.70, and 1.81%, respectively. These properties determine the minimum quality of instant porridge [16]. While the levels of phenolic, beta carotene, and antioxidants are quite high, which is essential for food ingredients in functional food. The antioxidant content produced is lower than the instant porridge made of pumpkin and arrowroot starch at a ratio of 5:1 at 1.5 bar drum drier pressure, which is 46.42% [19]. This is because the instant porridge processed with a drum drier can be controlled at a temperature compared to the drying treatment using an oven.

IV. CONCLUSION

- Instant porridge can have diverse physical and chemical properties, as well as distinctive preferences as a result of different combinations of brown rice and drying temperature.
- The most preferred instant porridge based on the analysis of physical properties and preference is identified in the mixture involving pumpkin and brown rice at a ratio of 50:50 at a temperature of 160°C. The chemical composition of the instant porridge involves 5.62% water, 12.37% protein, 3.70% fat, 1.81% ash, 1.361.79 (mg GAE/g) phenolic, 164.36(µg/g) beta carotene, and 41.5% RSA antioxidants.

ACKNOWLEDGMENT

The author would like to thank Universitas Mercu Buana Yogyakarta for providing funding for this research with reference 183/LPPM/UMBY/V/2020.

REFERENCES

- Adams, G.G., Imran, S., Wang, S., Mohammad, A., Kok, S., Gray, D.A., Channell, G.A., Morris, G.A., and Harding, S.E., 2011. The hypoglycaemic effect of pumpkin as antidiabetic and functional medicines. *Food Research International* 44, 862–867.
- AOAC, 2007. *Official Methods of Analysis*, 18th edn., 2005. AOAC International, Gaithersburg, MD.
- Arévalo-Pinedo, A., and Murr, F.E.X., 2006. Kinetics of vacuum drying of pumpkin (*Cucurbita maxima*): modelling with shrinkage. *Journal of Food Engineering* 76, 562–567.
- Astawan, M. 2012. Beras Merah Tangkal Kanker dan Diabetes. http://library.monx007.com/health/beras_merah_tangkal_kanker_dan_diabetes/1. Diakses pada tanggal 4 Maret 2012.
- Aydin, E. and G°Cmen, D., 2015. The influences of drying method and metabisulfite pre-treatment on the color, functional properties and phenolic acids contents and bioaccessibility of pumpkin flour. *LWT-Food Science and Technology*, 60(1), pp.385-392.
- Đào, V.T.T., 2015. Optimization of drum drying process parameters for pumpkin powder production and its substitution in rice noodles.
- Dirim, S.N. and Çaliskan, G., 2012. Determination of the effect of freeze drying process on the production of pumpkin (*Cucurbita moschata*) puree powder and the powder properties. *J. Food*, 37, pp.203-210.
- Jacobo VN, de Jesus ZMJ, Gallegos IJA, Aguilar GF, Camacho HIL, R°Cha GNE, and Gonzalez LRF. 2011. Chemical and physicochemical characterization of winter squash (*Cucurbita moschata* D.). *Notulae Botanicae Horti Agrobotanici Cluj-Nap°Ca*, 39(1), pp.34-40.
- Loy, J.B., 2004. Morpho-physiological aspects of productivity and quality in squash and pumpkins (*Cucurbita* spp.). *Critical reviews in plant sciences*, 23(4), pp.357-363.
- Mirhosseini H, and Amid BT. 2013. Effect of different drying techniques on flowability characteristics and chemical properties of natural carbohydrate-protein Gum from durian fruit seed. *Chemistry Central Journal*, 7(1), 1.
- Nawirska, A., Figiel, A., Kucharska, A.Z., Sokół-Lętowska, A. and Biesiada, A., 2009. Drying kinetics and quality parameters of pumpkin slices dehydrated using different methods. *Journal of Food Engineering*, 94(1), pp.14-20.

- [12] Oktaviani, D.N. 2009. Hubungan Lamanya Pemanasan Dengan Kerusakan Minyak Goreng Curah Ditinjau dari Bilangan Peroksida. *Jurnal Biomedika*. 1;1.
- [13] Prihantini, S. 2003. Karakterisasi Kimia dan Uji Aktivitas Antioksidan Produk Minuman Fungsional Tradisional Sari Jahe (*Zingiber officinale* R.), Sari Sereh (*Cymbopogon flexuosus*), dan Campurannya. Institut Pertanian Bogor. Bogor.
- [14] Que, F., Mao, L., Fang, X. and Wu, T., 2008. Comparison of hot air-drying and freeze-drying on the physicochemical properties and antioxidant activities of pumpkin (*Cucurbita moschata* Duch.) flours. *International journal of food science and technology*, 43(7), pp.1195-1201.
- [15] Rakcejeva, T., Galoburda, R., Cude, L. and Strautniece, E., 2011. Use of dried pumpkins in wheat bread production. *Procedia Food Science*, 1, pp.441-447.
- [16] SNI, 2009. Standar Nasional Indonesia. Badan Standarisasi Nasional Indonesia. Jakarta.
- [17] Sukandar, Elin Y. Joseph I. Sigit, dan Rina D. 2010. Antihyperlipidemic and Antidiabetic Effect of Combination of Garlic and Turmeric Extract in Rats. *Jurnal Medika Planta*. 1; 1-8.
- [18] Sumartini, Hasnelly dan Sarah, 2018. Kajian Peningkatan Kualitas Beras Merah (*Oryza nivara*) Instan Dengan Cara Fisik. *Pasundan Food Technology Journal*, Volume 5, No.1, Tahun 2018.
- [19] Slamet, A., Praseptianga, D., Hartanto, R. and Samanhudi. 2019. Physicochemical and Sensory Properties of Pumpkin (*Cucurbita moschata* D) and Arrowroot (*Marantha arundinacea* L) Starch-based Instant Porridge. *International Journal on Advanced Science, Engineering and Information Technology*, 9(2), 412-421.
- [20] Wang, J., Wang, J. S., and Yu, Y. 2007. Microwave drying characteristics and dried vitamin A value of an Argentinian squash (*Cucurbita moschata*). *Archivos Latinoamericanos de Nutrición* 51, 395-399.
- [21] Flowerika., Thakur, Neha., and Tiwari, Siddharth. 2021. Correlation of carotenoid accumulation and expression pattern of carotenoid biosynthetic pathway genes in Indian wheat varieties. *Journal of Cereal Science*. <https://doi.org/10.1016/j.jcs.2021.103303>
- [22] Umavathi, S., M. Keerthika, K. Gopinath, C. Kavitha, M. Romij Uddin, S. Alagumanian, dan C. Balalakshmi. 2021. Optimization of aqueous-assisted extraction of polysaccharides from pumpkin (*cucurbita moschata* duch) and their biological activities. *Saudi Journal of Biological Sciences*.
- [23] Gutiérrez, Tomy J. 2021. In vitro and in vivo digestibility from bio nanocomposite edible films based on native pumpkin flour/plum flour. *Food Hydrocolloids*. <https://doi.org/10.1016/j.foodhyd.2020.106272>
- [24] Gutiérrez, T. J. 2018. Are modified pumpkin flour/plum flour nanocomposite films biodegradable and compostable? *Food Hydrocolloids*, 83(January):397-410. <https://doi.org/10.1016/j.foodhyd.2018.05.035>
- [25] Aydin, E. dan D. Gocmen. 2015. The influences of drying method and metabisulfite pre-treatment on the color, functional properties and phenolic acids contents and bioaccessibility of pumpkin flour. *Lwt*. 60(1): 385-392. doi: 10.1016/j.lwt.2014.08.025
- [26] Amilia, W., A. E. Wiyono, D. Ferzia, A. S. Rusdianto, I. B. Suryaningrat, N. S. Mahardika, dan B. Suryadarma. 2021. Physical, chemical, and sensory characteristics of frozen salted edamame during storage at room temperature. *International Journal on Food, Agriculture and Natural Resources*. 2(1):9-18.
- [27] Rusdianto, A. S., A. E. Wiyono, dan F. H. Fiana. 2020. AROMATHERAPY oil massage formulation from essential oil: tuberose flower (*polianthes tuberosa*) and lime oil (*citrus aurantifolia*). *International Journal on Food, Agriculture and Natural Resources*. 1(2):21-27.

5%

SIMILARITY INDEX

PRIMARY SOURCES

1	garuda.ristekdikti.go.id Internet	26 words — 1%
2	I Roza, Evawati, R A Fadri, Gusmalini, Yulismawati. " Analysis of Instant Fruitghurt Quality Based on Mangosteen () Skin with Various Concentrations of Maltodextrin and Dry Temperature Level ", IOP Conference Series: Earth and Environmental Science, 2020 Crossref	21 words — < 1%
3	insightsociety.org Internet	19 words — < 1%
4	repository.futminna.edu.ng:8080 Internet	19 words — < 1%
5	beconscious.in Internet	18 words — < 1%
6	etd.repository.ugm.ac.id Internet	13 words — < 1%
7	smujo.id Internet	12 words — < 1%
8	www.revistas.unitru.edu.pe Internet	12 words — < 1%

9	www.losingweight.com Internet	11 words — < 1%
10	Agung Wahyono, A Z Tifania, E Kurniawati, Kasutjaningati, W W Kang, S K Chung. "Physical properties and cellular structure of bread enriched with pumpkin flour", IOP Conference Series: Earth and Environmental Science, 2018 Crossref	10 words — < 1%
11	www.intechopen.com Internet	10 words — < 1%
12	1library.net Internet	9 words — < 1%
13	riceplusmagazine.blogspot.com Internet	9 words — < 1%
14	www2.llu.lv Internet	9 words — < 1%
15	Saleh Al-Ghamdi, Yoon-Ki Hong, Zhi Qu, Shyam S. Sablani. "State diagram, water sorption isotherms and color stability of pumpkin (<i>Cucurbita pepo</i> L.)", Journal of Food Engineering, 2020 Crossref	8 words — < 1%
16	William Dzusuo Tedom, Edith Nig Fombang, Wilfred Damndja Ngaha, Richard Aba Ejoh. "Optimal Conditions for Production of Fermented Flour from Pumpkin (<i>Cucurbita pepo</i> L.) for Infant Foods", European Journal of Nutrition & Food Safety, 2019 Crossref	8 words — < 1%
17	docplayer.es Internet	8 words — < 1%

18

"Polymers for Agri-Food Applications", Springer
Science and Business Media LLC, 2019

Crossref

6 words — < 1%

EXCLUDE QUOTES OFF

EXCLUDE MATCHES OFF

EXCLUDE BIBLIOGRAPHY ON