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OPTIMIZATION OF SORGHUM INSTANT NOODLES PRODUCTS: A STUDY OF THE CHARACTERISTICS OF RED SORGHUM (SORGHUM BICOLOR) AND WHITE SORGHUM (KD4)

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Abstract: Various potential alternative food sources can be developed to support diversification and food security program of the Indonesian, one of them is sorghum. It is the most important food source in the fifth rank after wheat, rice, corn and barley. Research is aimed at developing sorghum as an alternative food product of sorghum noodles. Research used Randomized Block Design (RBD): 2-factors RBD experiments with 3 replications. Factor I: Types of flour (T): T1: red sorghum flour (*Sorghum bicolor*) and T2: white sorghum flour (*KD 4*). Factor II: Concentration (K): K1:25%; K2:50%; K3:75%; and K4:100%. Observations: organoleptic parameters of taste, color, aroma, elasticity, moisture content, carbohydrate, protein, and fat. Data analysis: organoleptic test used Friedman test, chemical analysis used an analysis of variance followed by Duncan test 5%. Results of the study: 1) Rendement of grain was 6 tons/ha, rice 4,2 tons/ha, flour 4,2 tons/ha, bran 0,6 tons/ha, sorghum bran 1,2 tons/ha; 2) sorghum noodles as sorghum flour product diversification; 3) The best treatment for some combinations of sorghum noodles: T1K1 (K1=25%); 4) second best treatment for sorghum noodles: T2K2 (K2 = 50%); 5) The water content of the noodles = 2-3%; 6) carbohydrate noodles = 39-45%; 7) protein noodles = 8-9%; 8) fat noodles=2-4%; 8) organoleptic parameters of taste, color, and aroma were significantly different, while the appearance was not significantly different; 9) noodle products testing parameters = score of 3 (neutral)-5 (really liked), color = 3 (neutral)-5 (really liked); aroma = 3 (neutral)-5 (really liked); crispness = score of 4 (like) - 5 (really liked)

Keywords: *Sorghum flour, characteristics, alternative food, and noodles*

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1. Introduction

Sorghum as a potential alternative food sources which can be developed to support diversification and food security program of the Indonesian takes the fifth rank after wheat, rice, corn and barley. This research "Optimization of Sorghum Instant Noodles Product" is conducted in order to develop the potential of sorghum as an alternative food source to Support Food Security Program.

The research objective of the 1st year is to get a flour blend which has the formulation and initial design of sorghum flour as a substituent of wheat flour in producing the product of wet sorghum noodles that can be accepted by consumers. It includes the quality of sorghum flour and wet noodles viewed from three aspects, namely: Organoleptic aspects; by producing products with flavor, color, aroma, and flexibility that can be acceptable to consumers, the chemical aspects; by producing products with moisture content, protein content, and carbohydrate content in accordance with SNI, and by producing products that are safe for consumers. Diversification of food should be improved in the direction of food security of the Indonesian. One potential source of food and not fully utilized is sorghum (Sorghum sp), and the tendency of food crises in the future makes sorghum has a bright prospect to be developed. Development of sorghum-based food industry needs to be supported by a strong R & D base. Cooperation between R & D institutions both national and international and private partners needs to be improved to strengthen aspects of post-harvest and sorghum agro-industry development, especially sorghum-based food diversification towards food security.

Benefits of this research / urgency (virtue) study are: the diversification of sorghum-based products supports the diversification and food security program of the Indonesian, reducing dependence on imported wheat, obtaining sorghum-based flour blends, making sorghum wet noodles products and other sorghum products to be popular in community. Findings / Innovation targeted are: gaining Appropriate Technology for the process of making sorghum flour, obtaining sorghum-based flour blends, gaining Appropriate Technology for the process of making sorghum wet noodles, obtaining sorghum wet noodle products, and gaining technology for products of wet noodles and instant noodles with sorghum bran. Application of the research used for supporting construction and development of science and technology - socio-cultural are: increasing the economic value of sorghum, diversifying products processed based on sorghum, supporting the diversification of food, supporting the food security program of the Indonesian, reducing dependence on imported wheat so that sorghum products become popular in the community, and the research results can be implemented by a third party (industrial, private, or government).

2. Literature Review

1.3 Sorghum is known as' 'brother' of wheat or corn, grain crops (Cereal) are rich in calories, so it is considered as one of the staple food rice substitution, in addition to maize, cassava or sago. Sorghum besides shapes and tastes like rice, is also highly nutritious. If it is seen from the table of Nutrition Directorate of the Ministry of Health, it has higher nutritional content than other staple foods such as rice, flour (wheat), corn and cassava. He says that 332cal calories per 100g of sorghum is slightly lower than rice (360cal), wheat (365cal) and corn (361cal). And the carbohydrate content of 73g per 100g of sorghum is also much less than rice (78,9g) and wheat (77,3g). However, this grain has more high protein content (11g per 100g) than wheat (8,9g), rice (6,8g), corn (8,7g) or even cassava (1,2g). He says that sorghum has Calcium (28mg per 100 g), Iron (4,4mg), Phosphorus (287mg), and vitamin B1 (0,38mg). 1 g protein content of sorghum is 1.6 times higher than rice. Sorghum also has iron content of 5.5 times more than rice (2.05 times), the phosphorus, vitamin B1 3.1-fold, 4.7-fold and 4.6-fold fat calcium. Besides, sorghum also contains phenols and tannins with a high composition. Two of these compounds are able to fight cancer-causing free radicals.

1.4 Sorghum can be used as raw material for semi-finished products. It is directed to enrich the potential of sorghum, which will be used as raw material for advanced products. The product forms are generally dry, have more compact shape and can be retained as well as very flexible to be used. Semi-finished products are in the form of sorghum flour. Based on the physical properties, sorghum flour has characteristics that are not different from wheat flour. It includes the grain fineness of the flour, the smell and the nature of amilograf.

1.5 One form of the use is as substituent sorghum flour for wheat flour in noodle-making process. Noodles are food product made from wheat flour with or without the addition of other foodstuffs and food additives. The addition of other foodstuffs and food additives are permitted to have distinctive shapes of noodles. Noodles are food that is shaped wrench and have a diameter from 0.07 to 0.125 inches. It is made with the addition of eggs or egg yolks. Eggs are used to improve the nutritional quality and also to provide color to the resulting noodles (Meltz, 1970).

3. Research Method

The research method consists of four stages. Stage 1: research on the optimization of sorghum products. Stage 2: research on the optimization of sorghum flour blend products. Stage 3: research on the optimization of sorghum wet noodles products. Stages 2 and 3 use Randomized Block Design (RBD) with two factors and three replications. Factor I: Types of Sorghum Flour (T); T1 is red sorghum flour (Sorghum bicolor), T2 is white sorghum flour (KD4). Factor II: Percentage of Sorghum Flour (S); S1 is 25% sorghum flour; S2 is 50% sorghum flour; S3 is 75% sorghum flour; and S4 is 100% sorghum flour. Stage 4: research on the optimization of sorghum bran products, uses Randomized Block Design (RBD) with one factor and three replications. Factor I: Types of Sorghum Flour (T); T1 is red sorghum flour (Sorghum bicolor), T2 is white sorghum flour (KD4). Observations include Organoleptic parameters of taste, color, aroma, elasticity, water content, carbohydrates, protein, and fat. Data analysis uses Organoleptic test using Friedman test, whereas chemical analysis uses analysis of variance continued with Duncan test 5%.

4. Discussion

Results from Stage 1: research on the optimization of sorghum products is presented in Tables 1 and 2, and Figure 1.

Table 1. Test Results for Color of Sorghum Products

No.	Product	Red Sorgum /T_1 (Sorghum bicolor)	White Sorgum /T_2 (KD4)
1.	Grain	Red ++	White dark
2.	Rice	Red +	White
3.	Flour	Red	White
4.	Bran	Red	White
5.	Dust	Red	White

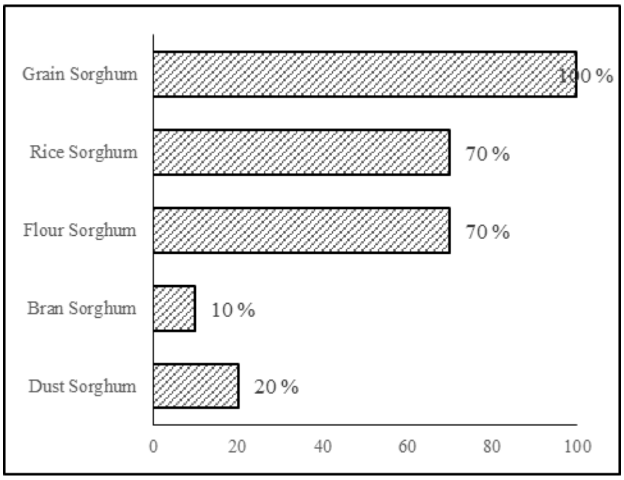

Figure 1. The yield of Processing Sorghum (Sorghum seed production is 6-7 tons per hectare)

Figure 1 showed that sorghum T1: red sorghum flour (Sorghum bicolor) and T2 : white sorghum flour (KD 4) had potential to be developed to support the food industry. The following was another advantage of red sorghum (T1) and white sorghum (T2).

Table 2. Observations of water levels

Raw material (T)	Grain Sorghum (kg)	Rice Sorghum (kg)	Sorghum Flour (kg)	Sorghum Bran (kg)	Sorghum Dust (kg)
T_1	12.3	12.3	11.9	12.1	12.4
T_2	11.5	11.5	12	12.2	12.3

Stage 2: Optimization of Sorghum Flour Blend Products is presented in Table 3.

Table 3. Color Test for Flour Blend

Treatment	Colour
T1S1	Reddish white
T1S2	Reddish white +
T1S3	Reddish white ++
T1S4	Reddish white +++
T1S1	White cloudy
T1S2	White cloudy +
T1S2	White cloudy ++
T1S2	White cloudy +++

The results of calculation of the percentage of Organoleptic were parameters of color, flavor, and appearance of sorghum flour blend with treatment for sorghum flour types (T); T1 : red flour / Sorghum bicolor (T1) and T2 : white flour / KD4 and treatment for concentration of sorghum flour (S); S1 = 25%, S2 = 50%, S3 = 75%, and S4 = 100%; the meaning of scores were, 1: dislike, 2: rather like, 3: neutral, 4: like, and 5: really liked. It showed that the highest score for color parameter was in treatment T1S4 (T1 = red flour / Sorghum bicolor (T1) and concentration of sorghum flour S4 = 100%) with a percentage of 50% and score 5 (really liked). The second was in treatment T2S3 (T2 = white flour / KD4 and sorghum flour concentration S3 = 75%) with a percentage of 50% and score 5 (really liked). The first highest score for flavor parameter was in treatment T1S3 (T1 = red flour / Sorghum bicolor and concentration of sorghum flour S3 = 75%) with a percentage of 50% and score 5 (really liked). The second highest score for flavor parameter was in treatment T2S2 (T2 = white flour / KD4 and S2 sorghum flour concentration = 50%) with a percentage of 53.4% and score 5 (really liked). The first highest score for appearance parameter was in treatment T1S3 (T1 = Flour red / Sorghum bicolor and concentration of sorghum flour S3 = 75%) with a percentage of 45% and score 5 (really liked). The second highest score for appearance parameter was in treatment T2S2 (T2 = White flour / KD4 and sorghum flour concentration S2 = 50%) with a percentage of 51.7% and score 5 (really liked). Friedman test results of the product showed the sorghum flour blend for color parameters (.846 Sig> 0.05), flavor parameter (.109 Sig> 0.05), and the appearance (Sig 0.343> 0.05). It means that these parameters were not significantly different for the parameters of color, flavor, and appearance of the sorghum flour blend produced by factors in the types and concentration of sorghum flour. It indicated that all would be accepted by the panelists, though the color of sorghum flour was not different and the more flour used the more the color would darken. It was the advantage of both types of sorghum flour blend. The test results of water content, carbohydrates, protein, fat, ash, fiber, amylose, amylopectin, gel strength, gelatinization temperature, and water absorption showed the water content (10.81 to 12.43%), carbohydrates (71.87 -74.19%), protein (9.76 to 12.17%), fat (1.88 to 3.11%), ash content (1.45 to 2.37%), crude fiber (1.62 -2.02%), amylose (23.53 to 25.39%), amylopectin (40.66 to 42.52%), starch (65.21 to 66.76%), gel strength (0,25- 0.46%), gelatinization temperature (84.3 to 87%), and water absorption (6.89 to 8.69%). Results of analysis of variance showed the water content (Sig 0824> 0.05), carbohydrates (Sig 0540> 0.05), protein (Sig 0492> 0.05), fat (Sig 0.000 <0.05), ash (Sig 0998> 0.05), crude fiber (Sig 0567> 0.05), amylose (Sig 0.000 <0.05), amylopectin (Sig 0.000 <0.05), starch (Sig 0.000 <0.05), gel strength (Sig 0.000 <0.05), gelatinization temperature (Sig 0.000 <0.05), and water absorption (Sig 0.000 <0.05). It means that the water content, carbohydrates, protein, ash, and crude fiber were not different in reality. On the contrary fat, amylase, amyl pectin, starch, gel strength, gelatinization temperature, and water absorption showed that those parameters were significantly different. The water content of the sorghum flour blend <14%, in which this condition was required to safe water, so it was used to prevent the growth of microbes (Winarno, 1974). Protein of sorghum flour blend <14%, it means that this was in accordance with SNI for flour which has maximum protein 14%. When carbohydrate content of sorghum flour blend was compared with the products of rice, corn, and wheat (Table 4), then sorghum could be aligned. If it was compared with the vitamin and mineral content, so that sorghum was superior (Table 5). Another advantage of sorghum was the availability of red sorghum (T1) and white sorghum (T2). It made the color of the products produced also varies. Results of variance analysis showed that the carbohydrate content was significantly different, the more high concentration of sorghum, the more increasing of carbohydrate. Ash content <3% and crude fiber content <2% were appropriate with SNI 01-3751-1995, in which the maximum limitation of ash content on the flour was 3%. Gelatinization temperature was influenced by the concentration of starch, in which the more viscous solution, the temperature reached was slower, up to the viscosity of certain temperature was not increasing (Winarno 1995). Gel strength and water absorption of sorghum flour blend also showed that the sorghum flour blend had the ability to absorb water maximally due to the availability of balance amount of protein in the flour.

Table 4. Nutrient Content of Rice, Corn, Wheat, and Sorghum

Nutrition	Rice	Corn	Wheat	Sorghum
Carbohydrate	78,9	72,4	77	73
Protein	6,8	8,7	8,9	11
Fat	0.7	4,5	1,3	3.3

Table 5. Vitamin and Mineral Content of Rice, Corn, Wheat and Sorghum

Nutrition	Rice	Corn	Wheat	Sorghum
Vitamin B1(mg)	0,12	0,27	tad	0,38
Calcium (mg)	6	9	16	28
Ferro (mg)	0,8	4,6	1,2	4,4
Phosphor (mg)	140	380	106	287

Stage 3: Optimization of Sorghum Wet Noodle Products. The results in physical observations of sorghum wet noodles is presented in Table 6.

Table 6. Wet Noodle Color Test Sorghum

Treatment	Colour
T1S1	Reddish white
T1S2	Reddish white +
T1S3	Reddish white ++
T1S4	Reddish white +++
T1S1	White cloudy

T1S2	White cloudy +
T1S2	White cloudy ++
T1S2	White cloudy +++

Calculation results for the Organoleptic parameters percentage of taste, color, flavor, and elasticity of sorghum wet noodles with treatment for sorghum flour types (T) were red flour / Sorghum bicolor (T1) and white flour / KD4 (T2); and treatment for concentration of sorghum flour (S): S1 = 25%, S2 = 50%, S3 = 75%, and S4 = 100%; the meaning of scores were 1: dislike, 2: rather like, 3: neutral 4: like, and 5: really liked. It showed that the highest score for taste parameter was in treatment T1S4 (T1) = red flour / Sorghum bicolor (T1) and the concentration of sorghum flour S4 = 100%) with a percentage of 43.7% and score 5 (really liked). The second was in treatment T2S1 (T2 = white flour / KD4 and concentration of sorghum flour S1 = 25%) with a percentage of 46.7% and score 5 (really liked). The highest score for color parameter was in treatment T1S4 (T1 = red flour / Sorghum bicolor (T1) and the concentration of sorghum flour S4 = 100%) with a percentage of 50% and score 5 (really liked). The second highest score for color parameter was in treatment T2S3 (T2 = white flour / KD4 and the concentration of sorghum flour S3 = 75%) with a percentage of 53.4% and score 5 (really liked). The highest score for flavor parameter was in treatment T1S2 (T1 = red flour / Sorghum bicolor and concentration of sorghum flour S2 = 50%) with a percentage of 53.4% and score 5 (really liked)). The second highest score for flavor parameter was in treatment T2S3 (T2 = white flour / KD4 and sorghum flour concentration S3 = 75%) with a percentage of 45% and score 5 (really liked). The highest score for elasticity parameter was in treatment T1S4 (T1 = red flour / Sorghum bicolor and concentration of sorghum flour S4 = 100%) with a percentage of 40% and score 5 (really liked). The second highest score for elasticity parameter was in treatment T2S1 (T2 = white flour / KD4 and concentration of sorghum flour S1 = 25%) with a percentage of 41.7% and score 5 (really liked). Friedman test results of sorghum wet noodles products showed taste parameters (Sig 0.977> 0.05), the color parameters (Sig 0.403> 0.05), flavor parameter (.456 Sig> 0.05) and elasticity (Sig 0,000 <0, 05). It meant that the parameters of taste, color, and aroma were not significantly different for those parameters resulted from factors in the type and concentration of sorghum flour. It indicated that all would be accepted by the panelists, though the color of sorghum flour was no different and the more flour used the more the color would get darker. It was the advantage of both types of flour produced by sorghum blend. On the contrary elasticity parameter was significantly different. It indicated that the factors of sorghum flour types and concentrations influenced the preferences of panel. The test results of water content, carbohydrates, protein, fat, ash, fiber, amylose, amylopectin, gel strength, gelatinization temperature, and elasticity showed the water content (28 to 32.87%), carbohydrates (45 to 63.55%) , protein (8.22 to 9.11%), fat (2.56 to 3.78%), ash content (1.29 to 2.27%), crude fiber (1.59 to 2.02%) , amylose (from 17.65 to 20.15%), amylopectin (42.27 to 43%), starch (from 61.27 to 63.68%), elasticity (17.45 to 36.67%). And conversely the breaking power of sorghum noodles (0.61 to 1.03%), and the results of analysis of variance showed the water content (Sig 0.005 <0.05), carbohydrates (Sig 0.000 <0.05), protein (Sig 0.000 <0.05), fat (Sig 0132> 0.05), ash content (sig 0.603> 0.05), crude fiber (sig 0.568> 0.05), amylose (sig 0360> 0.05), amylopectin (sig 0.110> 0.05), starch (sig 0845> 0.05), elasticity (sig 0.000 <0.05), and power breaking noodles (sig 0.000 <0.05). It indicated that the water content, carbohydrates, protein, elasticity, and power breaking of noodles were significantly different. While fat, amylase, amyl pectin, starch and crude fiber were not significantly different. The water content <33%, protein> 3%, and the ash content <3% of sorghum wet noodles, it means that it fulfilled the quality requirements of wet noodles (SNI 01-2987-1992). Elasticity of sorghum wet noodles was strongly influenced by the concentration of sorghum flour, in which the more increasing concentration the more decreasing noodle's elasticity. It was due to that sorghum flour did not contain gluten and finally it caused the more increasing of noodle breaking power. The content of gluten affected to the chemical reactions influencing to the formation of the S-S bond which greatly affected to the degree of solubility and rheological properties such as elongation (elastic) and elasticity (Suhardi, 1988). Another advantage of sorghum was the availability of red sorghum (T1) and white sorghum (T2). They made the color of the products produced also varies. Results of analysis of variance showed that the carbohydrate content was significantly different, in which the more increasing concentrations of sorghum flour, the more increasing the sorghum flour carbohydrates.

The probability or chance was a person's level of confidence against an uncertain event. Probability analysis was performed to determine the probability of each ground state. The ground state of the quality included taste, color, flavor, elasticity, carbohydrates, protein, and fat of sorghum wet noodles. The probability value showed that the level of interest of the ground state, the more value of probability of the ground state, the more essential of the ground state. Regarding flake sorghum product, parameter of taste (17%) was considered as the most important parameter when it was compared with other parameters, i.e., carbohydrates (15%), color, elasticity, fat, protein (14%), and aroma (12%), respectively. The existing alternative process was compared to determine the optimal process. Alternative selection was conducted by calculating the expected value obtained from each of the alternative processes. The expected value of calculation results for each of the alternative processes is presented in Figure 2.

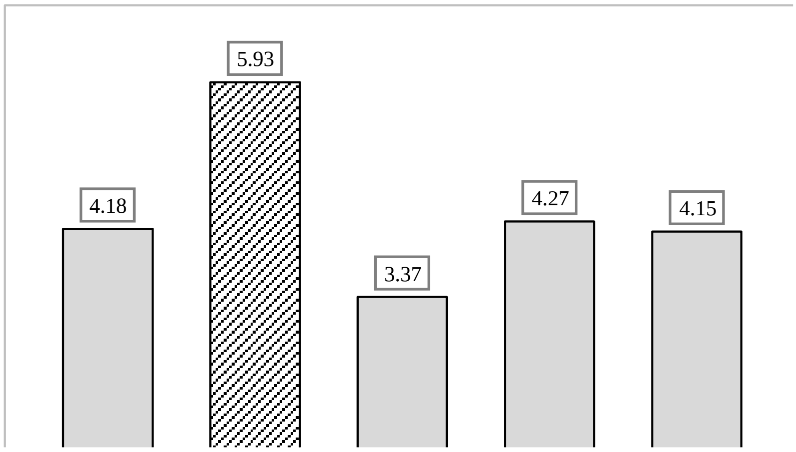

Figure 2. The results of the calculation of the expected value of sorghum wet noodle

Based on the results of the calculation of the expected value, the alternative treatment chosen was the treatment of T2S2 (T2 = white flour / KD4 and concentration of sorghum flour S2 = 50%) with the results of the calculation of the expectation value = 6.18. The second was the treatment T1K2 (T1 = flour red / sorghum bicolor and S2 sorghum flour concentration = 50%) with the results of the calculation of the expected value = 5.93. This means that the treatment was based on the best quality when it was compared with other treatments.

Stage 4: Optimization of Sorghum bran products. Sorghum bran of physical observation results is presented in Table7.

Table 7. Color Test of Sorghum bran

Treatment	Colour
T1	Reddish white
T2	White cloudy

Results of calculation for the percentage of organoleptic parameters of color, flavor, and appearance of sorghum bran with treatment for sorghum flour types (T): T1 = red flour / Sorghum bicolor and T2 = white flour / KD4; the meaning of scores were, 1: dislike, 2: rather like, 3: neutral, 4: like, and 5: really liked. It showed that the highest score for color parameters was in treatment T2 (T2 = white flour / KD4) with a percentage of 36.6% and score 5 (really liked). The highest score for flavor parameter was in treatment T1 (red flour / Sorghum bicolor) with a percentage of 38.4% and score 5 (really liked). The highest score for the appearance parameter was in treatment T1 (Flour red / Sorghum bicolor) with a percentage of 31.6% and score 5 (really liked). Table 7 showed that physically the color of bran was different. It gave an advantage of sorghum bran. Test results of Friedman of sorghum bran products showed that the color parameter (Sig 0.275> 0.05), flavor parameter (Sig 0, 683> 0, 05) and elasticity (Sig 1.000> 0.05). It means that the parameters of color, flavor, and appearance were not significantly different, for these parameters which were resulted from the factors of sorghum flour types. It indicated that all might be accepted by the panelists, though there was a difference for the color of sorghum flour. The color difference was red bran produced from red sorghum / Sorghum bicolor and white bran were produced from white sorghum / KD4. It became the advantages of both types of sorghum bran. Chemical test results showed that the water content (10.9 to 13.60%), carbohydrates (69.56 to 71.53%), protein (10 to 11.52%), fat (1.57 to 2.8 %), ash content (2.56 to 2.76%), crude fiber (11.21 to 12.01%), amylose (from 23.69 to 24.15%), amylopectin (from 42.02 to 42.15 %), starch (from 64.89 to 66.12%), gel strength (1.8 to 1.95%), gelatinization temperature (79,87-830C), and water absorption of sorghum bran (6.78 to 7 , 11%). Results of analysis of variance showed that the water content (Sig 0.847> 0.05), carbohydrates (Sig 0.424> 0.05), protein (Sig 0.653> 0.05), fat (Sig 0.626> 0.05), ash content (Sig 0.471> 0.05), crude fiber (sig 0.082> 0.05), amylose (sig 0.686> 0.05), amylopectin (sig 0.911> 0.05), starch (sig 0.826> 0.05), gel strength (sig 0.895 <0.05), gelatinization temperature (sig 0.352 <0.05), and water absorbing power of sorghum bran (Sig 0.438> 0.05). This means that the water content, carbohydrates, fat, ash and crude fiber, amylose, amylopectin, starch, fat, amylose, amylopectin, starch, gel strength, gelatinization temperature, and water absorbing power were not significantly different. The water content of the bran sorghum <14%, in which this condition was a prerequisite to safe water content, so it was used to prevent the growth of microbes (Winarno, 1974). High content of carbohydrate, protein, and fat became the benefits of sorghum bran, as well as the high fiber content.

Gelatinization temperature was influenced by the concentration of starch, in which the more viscous solution, the temperature reached was slower, up to the viscosity of certain temperature was not increasing (Winarno 1995), either Gel strength or water absorption of sorghum brand showed that sorghum bran had the ability to absorb water maximally. It was caused by the balance amount of protein in the bran. The carbohydrate and protein of sorghum bran when they were compared with the products of rice bran and corn (Table 8), so sorghum could be aligned. While, the low fat content would be the advantage of sorghum bran as well as the high crude fiber content.

Table 8. Comparison of the nutritional content of rice bran, corn, and sorghum

Nutritions	Rice Bran	Corn Bran	Red Sorghum Bran	White Sorghum Bran
Carbohydrate	54,6 g	64,5 g	70,3 g	71 g
Protein	12,6 g	9 g	10,8 g	11,1 g
Fat	14,8 g	8,5 g	1,9 g	2,1 g

5. Conclusion

Conclusions: 1) Rendement of grain was 6 tons / ha, rice was 4.2 tons / ha, flour was 4.2 tons / ha, bran was 0.6 tons / ha, sorghum bran was 1.2 tons / ha; 2) sorghum flour blend consisted of: water content was 10.3 to 13.5%, carbohydrates was 68.9 to 72.1%, protein was 10.6 to 11.7%, fat was 2-3%; 3) The best combination of treatments for wet noodles was: T1K1 (T1 was red flour / Sorghum bicolor (T1) and the concentration K1 was 25%) and T2K2 (white flour / KD4 (T2) and the concentration of K2 was 50%), water content was 2- 3%, carbohydrates was 39-45%, protein was 8-9%, fat was 2-4%, organoleptic parameters of taste, color and elasticity were significantly different while the scent was not significantly different, the parameters of taste, color, aroma, and suppleness had score 3 (neutral) - 5 (really liked); 4) sorghum bran of water content was 10.9 to 13.6%, carbohydrates was 55-62%, protein was 10 to 11.52%, fat was 2-3%.

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Further research: in the second year the reseach will be continued on the optimization of sorghum instant noodles. The aim is to obtain the product of sorghum instant noodles. This research will use Randomized Block Design (RBD) with 2 factors and 3 replications. Factor 1: Flour type (T): sorghum red flour ((*Sorgum bicolor*) and T_2: sorghum white flour (KD4). Factor II: Concentration (K) K_1:10%; K_2:20%; K_3:30%; K_4:40%; K_4:50%. The storage will be for three months. Observation will include noodles quality which is viewed from the physical aspects, chemical aspects, microbiological aspects, organoleptic aspects, and also the certainty of expiry dates. In the end, this research is targeted to be diversification of processed sorghum-based products, to support the program of diversification and food security in Indonesia, and to open up opportunities for sorghum industry.