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## Study on the Quality of Instant Noodles Made from Riau Local Corn Flour and Sago Starch

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**Abstract** Instant noodles are generally made from wheat flour. In order to reduce the import of flour, it is necessary to find alternative local flour such as corn starch and sago starch as the main raw material in the manufacture of instant noodles. The effect of the ratio of corn flour and sago starch on the moisture and protein contents, total acid number, intactness and rehydration time was investigated. The result showed that the ratio of corn flour and sago starch significantly affected moisture and protein contents, total acid number, and intactness, but did not significantly influence rehydration time of the instant noodle. The best treatment in this study was JS2 (55% corn flour, 35% sago starch, 10% tapioca) with moisture content before frying 10.73%, moisture content after frying 6.39%, protein content of 8.18%, total acid number 0.14%, intactness 95.36%, and rehydration time 10.33 min.

**Keywords:** instant noodles, corn flour, sago starch

### Introduction

Corn is the staple food of Indonesian people after rice. In some areas of Indonesia there are also using corn as a staple food (Budiman, 2013). Corn flour is one of the potential foodstuffs to be developed, one of which is used in making corn noodles. Local corn of Riau cultivated in Pelalawan area have starch content of 71.99%, fat 6.86% and protein 9.54% (Agustina, 2011). In the form of starch content contained in maize generally amylose 25-30%, amylopectin 70-75% (Suarni and Widowati, 2013). Sago is one of Indonesia's local foodstuffs that have a high enough potential to make high-calorie alternative food other than wheat and rice. The role of sago in this research is as adhesive in making instant noodle and also as source of resistant starch. Sago starch contains 27% amylose and 73% amylopectin (Raharjo, 2012). Sago is one of the local foods in Indonesia that has great potential to become one of the alternative foods with high calorie besides

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wheat and rice (Raharjo, 2012). In this study, sago starch served as the binding agent in the making of instant noodles. The sago starch contained 27% amylose and 73% amylopectin.

The substitution of wheat flour with locally produced flour such as corn flour and sago starch in the manufacture of instant noodles is expected to reduce the high dependence on imported wheat flour which tends to increase from year to year. The consumption of wheat flour in Indonesia in 2010 reached more than 17.1 kg per capita per year. Wheat flour is one of the staple foods that are widely used by the people of Indonesia to be made a variety of foods. The high consumption of Indonesian flour based foods is due to the shift in consumption from rice as the main source of carbohydrates to other alternative sources of wheat flour such as noodles, pasta, bread and pastries. This causes the consumption of wheat flour in Indonesia each year continues to increase. Based on the projection of the Indonesian Flour Producer Association (APTINDO), wheat flour consumption in 2011 reached 4.6 million tons, higher than in 2010 at 4.3 million tons (Mahatama and Afrianto, 2011).

In addition to reducing dependence on wheat imports, the use of local corn flour is also intended to produce instant noodle that is free of gluten content so it is safe for consumption for people with autism. The results of the previous study showed the use of 20% local corn flour yielded wet noodles which have met the Indonesian quality standard of wet noodle SNI 01-2987-1992 (Pato *et al.*, 2010) and substitution of wheat flour with 40% of local corn flour produced dry noodles that meet the Indonesian quality standard of dry noodle SII 0178-90 (Agustina, 2011). However, the results of research (Pato and Rifka, 2012) indicate that instant noodles made from local corn (without the use of wheat) have not met the quality standard of instant noodles (SNI 01-3551- 2000) because the intactness produced only 39.5% of which should be at least 90%.

The instant noodles that have been produced contain low fat and high carbohydrate as well as maximum intactness in accordance with acceptable standard. Therefore, it was considered necessary to carry out a study on the quality of instant noodles made from local Riau corn flour and sago starch. The study aimed to obtain the formulation of instant noodles added with sago extract and to produce instant noodles made from corn flour and and sago starch that fulfilled the quality standard of instant noodles (SNI 01-3551-2000).

## **Materials and methods**

### ***Materials and chemicals***

The materials used in this research were the corn from Pelalawan, sago starch, NaCl, baking powder, eggs, carboxyl methyl cellulose (CMC),

and cooking oil, while the chemical materials used for analysis were  $K_2SO_4$ ,  $H_2SO_4$ , NaOH,  $Na_2O_3$ , HgO,  $H_2BO_3$ , HCl, KOH and phenolphthalein indicator.

### ***Research methodology***

The research was carried out experimentally using Completely Randomized Design (CRD) with five treatments and four replications. The treatments to make instant noodles for 100 grams of flour were as follows:

JS1 = 60% corn flour, 30% sago starch, 10% tapioca

JS2 = 55% corn flour, 35% sago starch, 10% tapioca

JS3 = 50% corn flour, 40% sago starch, 10% tapioca

JS4 = 45% corn flour, 45% sago starch, 10% tapioca

JS5 = 40% corn flour, 50% sago starch, 10% tapioca

The parameters observed in this research were moisture and protein contents, total acid number, intactness and rehydration time. The formulation of making instant noodles from corn flour and sago is shown in Table 1.

**Table 1.** Formulation of making instant noodle of corn and sago starch

Composition	Treatments				
	JS1	JS2	JS3	JS4	JS5
Corn flour (g)	60	55	50	45	40
Sago starch (g)	30	35	40	45	50
Tapioca (g)	10	10	10	10	10
Water (ml)	40	40	40	40	40
Eggs (g)	30	30	30	30	30
NaCl (g)	1,3	1,3	1,3	1,3	1,3
CMC (g)	1	1	1	1	1
Baking Powder (g)	0,3	0,3	0,3	0,3	0,3

### ***Process of making corn flour***

The stages of making dry shelled corn flour were cleanly shelled corn which was ground using a corn grinding machine; the grinding was performed twice. The first grinding was to change the shelled corn to become stamped corn and the second grinding was to change the stamped corn to become the corn flour. The corn flour is dried in the sun to ensure the water content is less than 10%, then corn flour sieved using a sieve of 100 meshes.

### ***Process of making instant noodles***

Instant noodles were made according to Juniawati (2003). The first step of making instant noodles was preparing a batter that was made by using the main ingredients such as corn flour, sago starch, tapioca and water. The amount of corn flour, the sago starch and tapioca used was based on the formulation in Table 1. The additional materials used were CMC, salt, eggs, water and baking powder.

All the main ingredients and additives were mixed and stirred until batter was formed. Dough was made into small spheres, and then milled with size of 2 mm thickness to form the sheet, folded twice and then milled again. This process was done several times until the sheets were uniform. The dough sheets were left for about 10 minutes to optimize the gelatinization process. The dough sheets were then steamed in the steamer at 100 °C for 15 minutes. After steaming, the sheets are allowed to cool first and then cut to form noodle strands. The formed noodle strands were then dried by oven at 65-75 °C for 3 h until the noodle strands dry out. The dried noodles were then fried at 160 °C for 15 seconds and packed in plastic for analysis.

### ***Statistical analysis***

The data were analyzed with an analysis of variance (ANOVA) with significance defined as  $p \leq 0.05$ , and the means were separated with Duncan's multiple range tests using SPSS for Windows. Significance of differences among treated samples was evaluated using Duncan's multiple range tests at the 5 % level.

## **Results**

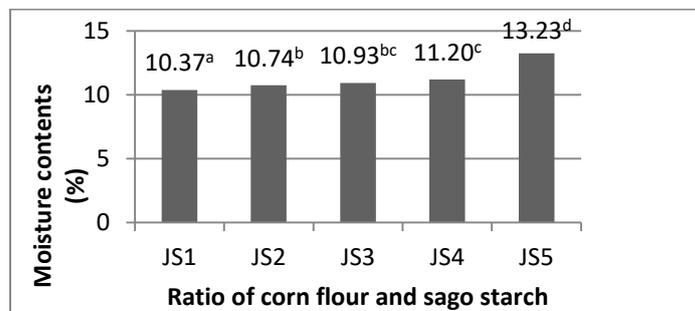
### ***Moisture content***

The result of analysis of variance showed that the ratio of corn starch and sago starch significantly influenced the instant noodle content before and after frying. Average moisture content of noodles can be seen in Figures 1 and 2. Data show the increasing use of sago starch, the moisture content of instant noodles before frying tend to increase (Figure 1), while the moisture content of instant noodles after frying tend to be lower (Figure 2).

### ***Protein content***

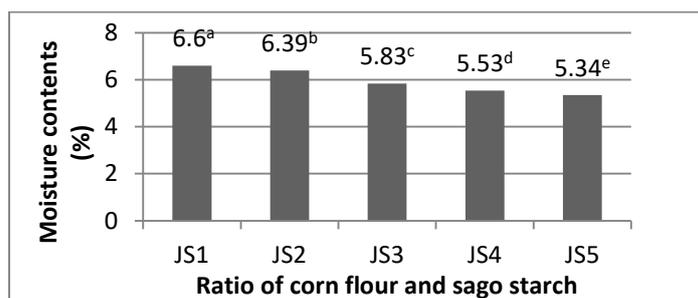
Protein content of instant noodles made with different corn flour and sago starch ratio had an average of 9.41-5.57%. The highest protein content was found in JS<sub>1</sub> treatment (corn flour 60 g: sago starch 30 g: tapioca 10 g).

The result of analysis of variance showed that the ratio of corn starch and sago starch significantly influenced protein content of instant noodle. The data in Figure 3 showed a decrease in protein content in instant noodles as the amount of sago starch was increased.



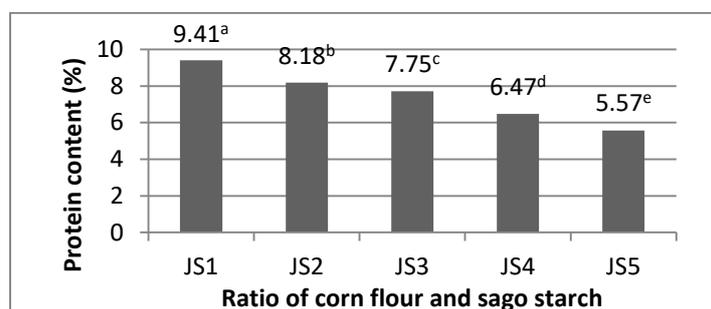
Different small letters were significantly different according to DNMRT test at 5% level

**Figure 1.** Moisture content of instant noodles made from corn flour and sago starch before frying process



Different small letters were significantly different according to DNMRT test at 5% level

**Figure 2.** Moisture content of instant noodles made from corn flour and sago starch after frying process

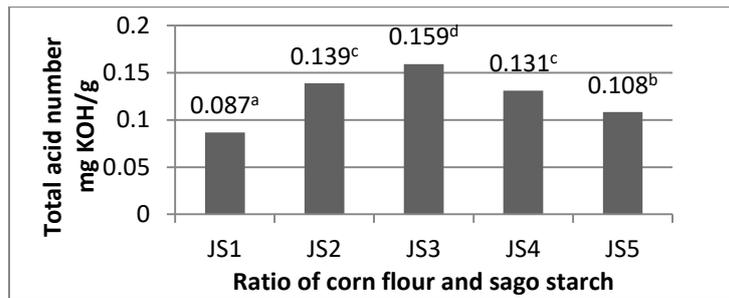


Different small letters were significantly different according to DNMRT test at 5% level

**Figure 3.** Protein content of instant noodles made from corn flour and sago starch

### **Total acid number**

The results of analysis of variance showed that the ratio of corn flour and sago starch significantly influenced total acid number of instant noodle produced. The data in Figure 4 show that acid numbers tend to increase with increasing sago starch.

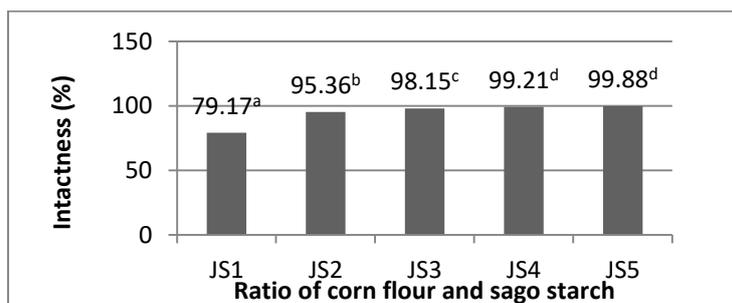


Different small letters were significantly different according to DNMRT test at 5% level

**Figure 4.** Total acid number of instant noodles made from corn flour and sago starch

### **Intactness**

The result of analysis of variance showed that the ratio between corn flour and sago starch significant affected intactness of instant noodles. Data in Figure 5 show that the average intactness of instant noodles ranged between 79.17-99.88%. The more use of sago starch, the level of intactness of instant noodles produced tend to increase.



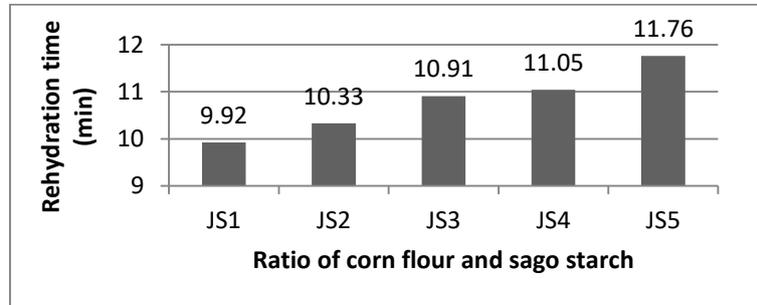
Different small letters were significantly different according to DNMRT test at 5% level

**Figure 5.** Intactness of instant noodles made from corn flour and sago starch

### **Rehydration Time**

The average rehydration time of instant noodles made from various ratios of corn flour and sago starch ranged from 9.92 to 11.75 minutes. The

result of analysis of variance showed that sago starch ratio did not significantly affect rehydration time of the instant noodle (Figure 6). The more use of sago starch the longer the rehydration time.



**Figure 6.** Rehydration time of instant noodles made from corn flour and sago starch

## Discussion

Water is an essential ingredient in food. Water can be intracellular and extracellular components, as a dispersing medium or solvent in various products. The moisture content is the amount of water contained in the material expressed in percent (%). Moisture content is one of the important characteristics of foodstuffs, because the moisture content in the foodstuffs also determines the acceptability, freshness, and shelf life of the food (Winarno, 1997). Figure 1 showed the increasing use of sago starch, the water content of noodles before frying tends to increase. This was due to the amount of amylopectin in sago starch that higher than corn flour. Therefore, in the making of noodles, the higher the sago starch content the higher the water absorption, which further caused the higher the water trapped in the starch granule. The results of this study were in accordance with the previous research conducted by Apsari (2006) where sago starch had moisture content which was higher (17.92% w/w) compared to the moisture content of corn (11.38% w/w). The more use of sago starch, the moisture content of instant noodles tend to be lower (Figure 2). In the process of frying noodles, the moisture contained in the starch evaporates in the frying process so that the starch undergoes gelatinization. Data from Figures 1 and 2 showed that the moisture content of instant noodles produced before frying process (10.37-13.23%) and after frying process (6.60-5.34%), which have fulfilled the standard of Indonesian instant noodle (SNI 01-3551-2000) i.e. no more than 14.50%.

Protein content of instant noodles made with different corn flour and sago starch ratio had an average of 9.41-5.57%. The highest protein content was found in JS<sub>1</sub> treatment (corn flour 60 g: sago starch 30 g: tapioca 10 g). This was due to corn flour had higher protein content than sago starch.

Agustina (2011) stated that the local maize of Riau has 9.54% protein content. Directorate of Nutrition for Ministry of Health of Indonesia (1990) stated that sago starch has very low protein content of 0.7 per 100 g. Sago is generally almost composed of starch alone and contains only very little other components. The levels of instant noodle protein produced in the treatment of JS<sub>1</sub>, JS<sub>2</sub>, JS<sub>3</sub>, JS<sub>4</sub> and JS<sub>5</sub> had met the quality standard of instant noodles (SNI 01-3551-2000) i.e. not less than 4.0%.

The acid number indicated the amount of free fatty acids in the oil and expressed by mg of base per 1 g of oil. Fatty acids contained in the food will undergo chemical changes that can affect the quality of food. The higher the free fatty acid content, the faster the food becomes rancid. The data in Figure 4 showed that acid number tend to increase with increasing sago starch. This is caused during frying; there was a process of exchange of cooking oil with water in the noodles. This statement is clarified by Rifka (2013); the water inside the noodle evaporates and leaves the pores that further pores filled with cooking oil. The total acid number in this study had fulfilled the Indonesian quality standard of instant noodle (SNI 01-3551-2000) that was not more than 2 mg KOH/g of oil. The average total acid number of instant noodle ranged from 0.087 to 0.159 mg KOH/g.

Intactness is one of the determinants of the quality of instant noodles. Instant noodles made from raw materials other than wheat flour, which gives the intactness of the noodles are amylose and amylopectin. The process of forming intactness occurs when the granules on starch and starch undergo gelatinization, resulting in enormous swelling of the granules and causing amylose and amylopectin to diffuse out of the granules to form gel trapped in the matrix. The dissolved amylose will bind to each other with a bonding matrix and retrograde so that the level of hardness in the noodles will increase, while the amylopectin can give sticky effect on the resulting noodles so that the noodles are not easily broken.

Data in Figure 5 showed that the averaged intactness of instant noodles of corn flour and sago starch ranged from 79.17 to 99.88%. The more use of sago starch, the level of intactness of instant noodles produced tend to increase. It was due to sago starch had properties as adhesive because sago starch contains amylopectin 72.6% and amylose 27.0%. The more amylopectin content the starch become wetter, stickier and tends to absorb less water. Boediono (2012) stated that amylopectin could provide sticky properties on the noodles, so the noodles were not easily broken. This is because amylopectin can form sticky properties when mixed with water. The intactness of instant noodles produced in the treatment of JS<sub>2</sub>, JS<sub>3</sub>, JS<sub>4</sub>, JS<sub>5</sub> (95.35-99.87%) had met the quality standard of instant noodles (SNI 01-3551-2000) i.e. not less than 90% w/w.

Other important parameter of the instant noodle is rehydration time. Rehydration time is the time it takes of noodle to absorb water so that its texture becomes elastic resembling the texture before it is dried.

Determination of optimum rehydration time is done by cooking noodles in boiling water, then calculated the time required until the noodles are completely cooked and ready for consumption. Determination of optimum rehydration time is important to produce the desired texture of cooking. If the noodles are cooked too overcooked, then the noodles can become sticky and easily crumble. Conversely if the instant noodles are not cooked perfectly then the middle of the noodles still feel hard when chewed. The average rehydration time of instant noodles made from various ratios of corn flour and sago starch ranged from 9.92 to 11.75 minutes (Figure 6). The more use of sago starch the longer the rehydration time. According to Ramadhan (2009) which stated that the increasing density between starch molecules in the dough, so the longer the time it takes for water to enter the starch. The higher the amylopectin content gave the longer its absorption time. And conversely, the more use of corn flour was used the faster the rehydration time. This may due to the free hydroxyl group content increasing as a result of the high amylose content in corn flour.

## Conclusion

It can be concluded that the ratio of corn starch and sago starch significantly influenced moisture content before and after frying, protein content, total acid number and intactness, but did not significantly affect rehydration time. The best treatment that meet the Indonesian quality standard of instant noodle (SNI 01-3551-2000) was JS<sub>2</sub> (ratio of 55% corn flour and 35% sago starch) with average moisture content before frying 10.73%, moisture content after frying 6.39%, protein content 8.18%, total acid number 0.14%, intactness 95.36% and rehydration time 10.33 min.

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## References

- Agustina, R. (2011). Evaluation of quality of dry noodles made from wheat flour substituted with corn flour. (Thesis). Riau University. Pekanbaru. Indonesia.
- Apsari, K. W. (2006). Effect of sago starch substitution on physico-chemical properties of corn based extraction product. (Thesis). Bogor Agricultural University, Bogor, Indonesia.
- Budiman, S. P. H. (2013). Success in Corn Planting. Yogyakarta. Indonesia: Pustaka Baru Press.
- Boediono, M. P. A. D. R. (2012). Separation and identification of amylose and amylopectin from corn starch and potato starch at various temperatures. (Thesis). Bogor Agricultural University, Bogor, Indonesia.

- Juniawati (2003). Process optimization of instant corn noodle based on consumer preference study. (Thesis). Bogor Agricultural University. Bogor. Indonesia.
- Mahatama, E. and Afrianto (2011). Review of the Wheat Flour Market. <http://kemendag.go.id/flour> consumption information 2011. Commodity Team of Flour Flour Specialist, Ministry of Trade, Republic of Indonesia. Retrieved on September 13, 2011.
- Pato, U., Fitriani, S. and Efendi, R. (2010). Processing corn flour to maize noodle in Riau Province. Research Report. Research Institute, Universitas Riau, Pekanbaru Indonesia.
- Pato, U. and Rifka, F. I. (2012). Evaluation of the quality of instant noodles made from local corn flour. Research Report. Research Institute, Universitas Riau, Pekanbaru Indonesia.
- Suarni and Widowati, S. (2013). The structure, composition, and nutrition of corn flour. Publication manuscript. Downloaded on February 2, 2017.
- Ramadhan, K. (2009). Utilization of modified sago starch of *Heat-Moisture Treatment* for making instant rice noodle. (Thesis). Bogor Agricultural University. Bogor. Indonesia.
- Raharjo, R. (2012). Influence of *Rami* fibre fraction to bending strength of biocomposite sago starch. *Journal of Mechanical Engineering* 1:16-20.
- Rifka, F. I. (2013). Evaluation of the quality of instant noodles made from local corn flour. Thesis. Universitas Riau, Pekanbaru. Indonesia.
- Winarno, F. G. (1997). *Food Chemicals and Nutrition*. Gramedia. Jakarta.

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