Elongation, Cooking Loss and Acceptance of Wet Noodles Substituted with Fennel Leaves Flour

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Abstract: Fennel leaves are composed of various components that are beneficial to health and provide a distinctive flavor. The effort to increase fennel leaf consumption is through the processing of fennel leaf flour as an intermediate product which can be substituted in noodle product. The purpose of the study was to evaluate the elongation, cooking loss and acceptance of wet noodles substituted fennel leaf flour. The study used a complete randomized design, with 4 fennel leaf flour substitution treatments, were 0%, 2.5%, 5% and 7.5%. Wet noodles were analyzed for elongation, cooking loss and acceptance. The elongation and the cooking loss data were analyzed using One-Way ANOVA at a level of 0.05, while the acceptance data were analyzed using non-parametric Kruskal-Wallis followed by Duncan test. The results indicated that there was the influence of fennel leaves flour substitution on tensile strength, strain, cooking loss and acceptance of wet noodles. The highest tensile strength was shown by wet noodle substituted 2.5% fennel leaf flour, was 0.18N. The biggest strain was revealed by wet noodle substituted with 0% fennel leaf flour, was 58.65%. The lowest cooking loss of wet noodle was given by the substitution of 2.5%, was 0.66%. The lowest cooking loss of wet noodle was given by the substitution of 2.5%, was 0.66%. The highest acceptance was displayed by wet noodles substituted 0% fennel leaf flour, followed by 2.5% substitution.

Keywords: Acceptance, cooking loss, elongation, fennel leaves, noodles.

1 INTRODUCTION

Indonesia is facing a serious nutritional problem that is the multiple nutrients problem. The problem is related to non-communicable diseases such as micronutrient deficiencies and overnutrition intake (Depkes, 2011). One of the causes of multiple nutritional problems is the low intake of food sources of fiber and micronutrients (Siswanto et al., 2013) such as vitamins and minerals. These nutritional problems can be improved through the consumption of diverse foods by using vegetables. Fennel leaf is a type of vegetable that is developed because of the potential benefits of nutrients.

Fennel leaves are composed of 18.5% fiber and various micronutrients include iron, potassium, sodium, phosphorus, thiamine, riboflavin, niacin and vitamin C (Rather et al., 2012). Fennel leaves are also highly volatile components one of which is anethole (Chowdury et al., 2009) which contributes to the flavoring of food (Rahimmalek et al., 2014; Lasekan, 2014). Chlorophyll of 0.8 mg / g (Sarfaraz et al., 2011) in fennel leaves can also be a green color in foods such as noodles. In addition, the use of fennel leaves in the field of health, such as accelerate urine (diuretic) and spur production of sweat (Rusmin, 2007). Although it provides many benefits, the consumption of fennel leaves in

Indonesia is quite low because in addition to unpopular, also its taste is not liked by some people.

One effort to increase the consumption of vegetables, especially fennel leaves, is through product diversification. Fennel leaves can be processed into flour. Rauf and Sarbini (2015) revealed that in the form of flour can be used to extend the shelf life, as well as more practical in the distribution. In addition, fennel flour is an intermediate product that can be used in the processing of food products such as wet noodles. Wet noodle is a very popular product and became one of the staple foods for most countries in Asia, including in Indonesia. The high consumption of wet noodles can be used as a strategy to increase the consumption of fennel leaves, namely through substitution.

Quality of the noodles substituted with fennel flour such as elongation and cooking loss. A good quality of noodle has a high elongation value and low cooking loss (Muhandri, 2012). The elongation is based on the measurement of tensile strength and strain. Tensile strength is the maximum force given for deforming the material. While the strain is the amount of deformation due to the tensile force applied to the dough. The larger the strain of a material, the easier it will be to expand (Rauf and Sarbini, 2015). Meanwhile, low cooking loss proves that noodles are not easily broken and not brittle when cooked (Rosmeri and Bella, 2013). Fennel flour substitution in wet noodles may also have an effect on the sensory quality of noodles indicated from the panelist acceptance of color, flavor, taste, and texture. Borneo and Aguirre (2008) stated that the substitution of amaranth leaf and spinach leaves in the noodle production gives the influence on cooking quality, rheology and acceptance levels. The purpose of this study was to analyze the elongation, cooking loss, and the acceptance of wet noodles substituted with fennel flour.

2 RESEARCH METHOD

2.1 Materials

The main ingredients used in this study were wheat flour, fennel leaves, salt, and baking soda. The materials were obtained from supermarket in Surakarta.

2.2 Fennel Flour Manufacture

The procedure of fennel flour production modified from Reddy (2012) was by selection of fresh fennel leaves, then washed. The fennel leaves then dried at room temperature (30˚C) for 5 days, followed by grinding and sieving to 80 meshes.

2.3 Wet Noodle Making

The preparation of wet noodles was modified from Li et al. (2014), Sirichokworrakit (2014) and Taneya et al. (2014). Wheat flour, fennel flour, water, salt, and baking soda were mixed into a dough. The next stage was pressed and slit the dough into a sheet and strips, followed by boiling for 2 minutes.

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2.4 Elongation Measurement

Measurement of dough elongation was performed in accordance with Nouri et al. (2015). The wet noodle was clamped to the probe of Universal Testing Machine Z0.5 from Zwick/Roell AG-Jerman, with a 30 mm probe spacing. The probe speed was set to 10 mm / min. The measurement was done until the noodles break. The result was displayed on the monitor screen.

2.5 Cooking Loss Measurement

The procedure of cooking loss measurement was in accordance with reported by Husniati, et al. (2015), Thomas, et al. (2014) and Muhandri, et al. (2011) with slight modification. The noodle about 15 grams was boiled in 100 ml distilled water for 2 minutes. The filtrate was taken 20 ml then dried in an oven at 105 ° C to a constant weight. The cooking loss is expressed as the ratio in percentage of the residual dry weight of the filtrate to the weight of the noodles before cooking.

2.6 Acceptance Measurement

The acceptance test of wet noodles was conducted by 30 panelists of Nutrition Science Department students, Universitas Muhammadiyah Surakarta. The noodles were measured for color, aroma, texture, taste and overall. The test was based on 7-point hedonic scale, namely 1 = dislike very much, 2 = dislike moderately, 3 = dislike slightly 4 = neither like nor dislike, 5 = like slightly, 6 = like moderately, and 7 = like very much. The panelists have been given an explanation of the samples to be measured and how to perform detailed testing.

2.7 Design and Data Analysis

Completely randomized design was used with 4 treatments including 0%, 2.5%, 5% and 7.5%. The elongation data (tensile strength and strain) and cooking loss were analyzed using one way ANOVA, while the acceptance data were using Kruskal-Wallis, followed by Duncan's test at 5% level.

3 RESULTS AND DISCUSSION

3.1 Elongation

The elongation is one of the parameters to determine the quality of the noodles. The parameter is based on the measurement of tensile strength and strain. Rauf and Sarbini (2015) reported that tensile strength indicates maximum force required to deform a material. Statistically, the result of wet noodle substituted with fennel flour showed an influence on tensile strength, with significance value $p = 0.006$. The tensile strength can be seen in Figure 1.

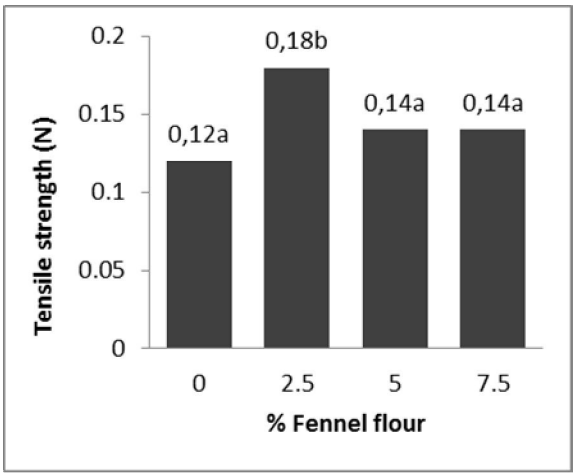

Figure 1. Tensile strength of wet noodles substituted with fennel flour.

In Figure 1, there is a difference in the value of tensile strength in wet noodles substituted 2.5% fennel flour, while fennel flour substitution 0%, 5%, and 7.5% are not significantly different. This is related to the decreasing proportion of gluten in wet noodles. Gluten is a protein in wheat flour which is used to form polymers that affect the quality of product (Rauf, 2015). Mirsaeedghazi et al. (2008) suggested that the tensile strength is associated with the presence of gluten proteins present in wheat flour. The protein matrix is formed from non-covalent crosslinks and the disulphide-bond then provides resistance to tensile forces.

The strain shows the magnitude of the deformation of a material due to the applied tensile force. The result showed

in Figure 2 indicates that there is an influence of fennel flour substitution on the strain of wet noodles, with significance value p = 0.008..

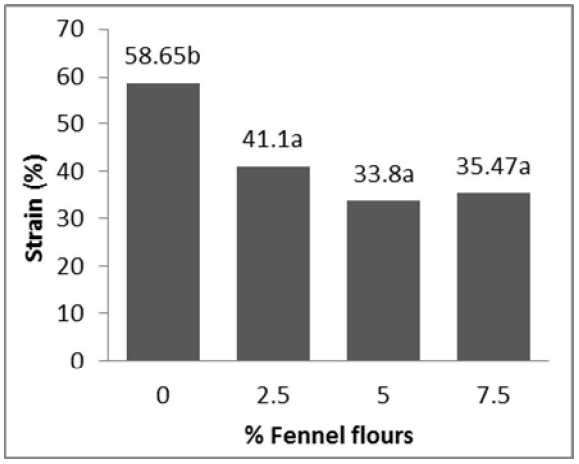

Figure 2. The strain of wet noodles substituted with fennel flours.

The wet noodles substituted 0% fennel star gives the highest strain value. Strain in wet noodles is strongly associated with the protein content of flour and fennel flour. Uthayakumaran et al. (2000) mentioned that strain is affected by protein level. The higher the protein content, the higher the strain value. Humphris et al. (2000) reported that the branched structure causes the magnitude of deformation, it formed by gluten polymers. Low level of gluten may cause the nipples to become easily broken or less elastic. Billina, et al. (2014) stated that elasticity of noodles is produced from the amount of gluten content in wheat flour used in the making wet noodles.

3.2 Cooking Loss

The cooking loss is one of the parameters to determine the quality of the noodles after cooking. Statistically, there is the influence of fennel flour substitution to the cooking loss of wet noodles, with significance value p = 0.001. The cooking loss of wet noodles can be seen in Figure 3.

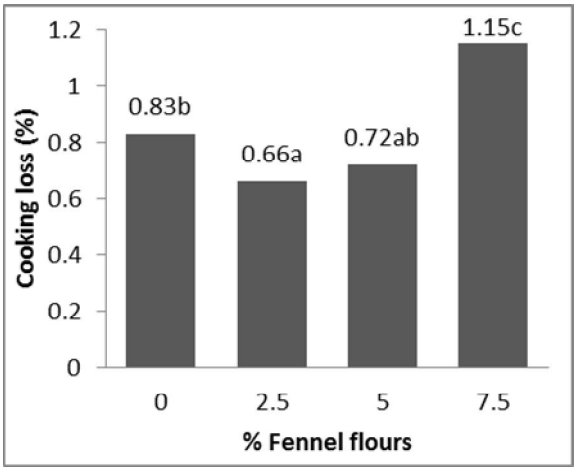

Figure 3. the cooking loss of wet noodles substituted with fennel flours.

Figure 3 shows the difference of cooking loss value in wet noodle substituted with fennel flour. Setyani et al. (2017) stated that the difference in cooking loss can be caused by the amylose content of the raw materials used. The higher the amylose level, the stronger the gel structure is formed, the lower the cooking loss of noodles. Therefore, cooking loss in wet noodles increases with the decrease of wheat flour used. The loss of solids due to heating indicates a large number of solids emitted from noodles during the cooking process. Chen et al. (2003) reported that cooking loss occurs due to the release of a small portion of starch from noodles. The released starch is suspended with boiling water, causing turbidity during cooking.

3.3 Acceptance

Statistically, there is the influence of fennel flour substitution on all sensory indicators of wet noodles such as color, aroma, taste, texture, and overall. Wet

noodle acceptance data is shown in Table 1.

Table 1. The acceptability of wet noodles substituted with fennel flours

Indicators	Acceptability Scores				*p*
	0%	2.5%	5%	7.5 %	
Color	5.8 □	5.4□	4.2□	3.2 □	0.00 1
Aroma	4.8 □	4.4□	4.1□	3.7 □	0.02 0
Taste	4.5 □	4.5□	4.0□	3.5 □	0.03 5
Texture	5.5 □	5.1□	4.8□	4.2 □	0.00 1
Overall	5.4 □	5.0□	4.37	3.7 □	0.00 1

In general, the highest the substitution levels of fennel flours, the lower the acceptability score of wet noodles. Substitution of 0% gives the highest acceptance, although the 0% substitution displays the highest acceptance score, while did not significantly different with 2.5% substitution. The acceptance score of both is the "like slightly" category. The difference with 0% substitution was indicated by the acceptance scores at the 5% and 7% substitution levels, both of which revealed the category "neither like nor dislike"

4 CONCLUSION

Fennel flour substitution affects the elongation, cooking loss and acceptability of wet noodles. The highest acceptability is given by 0% substitution which is not significantly different with 2.5% substitution.

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