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The Effect of the Amount of Stevia Leaf Powder (*Stevia rebaudiana*) and Drying Time on the Quality of Snake Fruit Padang Sidempuan Dried Candied

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Abstract. This study aimed to determine the Effect of using stevia leaves as a natural sweetener on dried sweets of Padang Sidempuan's snake fruit. The method used in this study was the factorial Complete Randomized Design (CRD) method with two factors, namely the amount of stevia leaf powder (0.20%: 0.25%; 0.30%; 0.35%) and drying time (4, 6, 8 and 10 hours). The tests carried out were moisture content, ash content, total sugar, total dissolved solids, total microbes, acidity (pH), and organoleptic tests of colour, flavour, taste, and texture. This study's results showed a highly significant effect exerted by the amount of stevia leaf powder on moisture content, ash content, total dissolved solids, total sugar, total microbes, acidity (pH), and an organoleptic test of colour, flavour, and taste. Drying time significantly affected moisture content, ash content, total sugar, total microbes, total dissolved solids, and texture organoleptic test. The interaction between the amount of stevia leaf powder and the drying time had a highly significant effect on moisture content and a significantly different effect on total microbes and organoleptic colour. The amount of stevia leaf powder is 0.35%, and the drying time of 8 hours results in the best treatment on dried sweets of Padang Sidempuan's snake fruit.

Keywords: dried sweets, drying time, stevia leaf powder

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1. Introduction

Snake is a native fruit originating from Indonesia. The characteristics of snake fruit plants are fibrous roots, have no stems, have thorns, and can grow up to 1.5-5 meters. Snake has a Protein content of 0.4 g, Carbohydrates of 20.9 g, and Calcium of 28 mg, as well as phosphorus, vitamin C, B vitamins and iron. One of the characteristics produced by the snake Padang Sidempuan fruit is the presence of a chelate or astringent taste when consuming it. The astringent taste produced in snake fruit is obtained from the high content of tannin compounds [1].

A method that has long been used from the past until now that is useful for extending the shelf life of food products is drying. The advantage obtained from the drying process is that the material

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used has a longer shelf life and is durable. The water content of the material influences the shelf life; if the water content in the material is getting less, it will inhibit the growth of microorganisms, chemical reactions and enzyme activity so that the shelf life of the product will be longer [4]. Making dried sweets using Padang Sidempuan snake will increase their economic value, with the addition of stevia as a natural sugar that can provide a sweet taste that has an impact on health, with the best drying time in making sweets.

2. Materials and Methods

The material used in this study was Padang Sidempuan snake fruit with a harvest age of 6-7 months, which was produced on Jl. Sibolga 1 Huta Koje Hamlet, Parsnake Fruitan Village, West Angkola District, South Tapanuli. Stevia leaves are obtained from Cianjur, mica plastic made from PE (polyethylene) plastic, and sodium metabisulfite. The reagents used were aquades, filter cloth, 5% phenol solution, 80% alcohol, 0.225 N H_2SO_4 solution, 0.9% NaCl solution, and Plate Count Agar (PCA).

This study used a factorial completely randomized design (CRD) consisting of two factors, namely the amount of stevia leaf powder (S) as factor I with 4 treatment levels, namely S_1 = 0.20%, S_2 = 0.25%, S_3 = 0.30% and S_4 = 0.35%. Factor II, namely the addition of drying time (W) with 4 levels, namely W_1= 4 hours, W_2 = 6 hours, W_3 = 8 hours, and W_4 =10 hours). This research was conducted in 2 repetitions. If the results were significantly different and very significant, then continue to the LSR (Least Significant Range) test.

2.1. Preparation of Padang Sidempuan Snake Fruit Processing

Physiologically, ripe snake fruit is prepared, sorted, peeled fruit skin, washed until clean, cut into snake fruit with a 2 cm and 4 cm long thickness, and weighed until it reaches 250 g. Then, a 2% sodium metabisulfite solution is prepared to soak snake fruit, and the soaking process lasts 1 hour. After the soaking process, the snake fruit is washed using clean running water.

2.2. Preparation of Stevia Leaves

Separated stevia leaves in a dry state from the branches in a dry state and crushed stevia leaves using a blender. Then, the sieving process is carried out using a sieve with a large 60 mesh so that a homogeneous stevia leaf powder size is produced. The filtered stevia leaf powder was then weighed according to the treatment (S_1 = 0.20%, S_2 = 0.25%, S_3 = 0.30%, S_4 = 0.35%), after which it was brewed using 100 ml of 100°C hot water for 30 minutes to separate the stevia leaf extract, then filtered to obtain stevia extract results, then added water up to 200 ml/treatment.

2.3. Soaking Snake Fruit Padang Sidempuan in Stevia Solution

Prepared stevia solution that has obtained and then put Snake fruit Padang Sidempuan then soaked according to the treatment (S_1 = 0.20%, S_2 = 0.25%, S_3 = 0.30%, S_4 =0.35%) the soaking process

lasts for 6 hours, after that drain, then dry using an oven with a temperature of 60°C and the duration of drying according to the treatment (W_1 = 4 Hours, W_2 = 6 Hours, W_3 = 8 Hours, W_4 = 10 Hours) after the drying process is complete, candied snake fruit is packed in mica plastic made of PE (*polyethylene*) plastic, storage is carried out for two days, and then analysis can be carried out.

2.4. Analysis

The analysis in this study was carried out on dried sweets of snake Padang Sidempuan by covering water content, ash content, total dissolved solids, acidity (pH), total microbes, total sugar, and hedonic organoleptic (flavour, taste, colour, and texture). The hedonic scale is converted into a scale number according to the degree of favorability on the number scale 1-7.

3. Results and Discussion

3.1. Effect of the Amount of Stevia Leaf Powder on the Observed Parameters

The results of the study showed that there was an influence exerted by stevia on the parameters of moisture content, ash content, total sugar, total dissolved solids, acidity (pH), total microbes, and organoleptic values consisting of color, taste, aroma, and texture as in Table 1.

Table 1. The Effect of the Amount of Stevia Leaf Powder on the Observed Parameters

Tested parameters	Amount of stevia leaf powder (S)			
	S_1	**S_2**	**S_3**	**S_4**
Water content (%)	24.657	24.277	23.678	23.117
Ash content (%)	0.640	0.753	0.833	0.893
Total sugar (%)	10.827	11.258	13.347	15.770
Total dissolved solids (°Brix)	8.500	8.550	8.900	9.000
Degree of acidity (pH)	3.753	3.788	3.845	3.905
Total microbes (10^2CFU/g)	3.705	3.646	3.548	3.466
Organoleptic value of colour	5.795	5.764	5.726	5.670
Organoleptic value of taste	5.574	5.651	5.748	5.797
Organoleptic value of aroma	5.813	5.754	5.688	5.600
Organoleptic value of texture	5.536	5.542	5.597	5.620

Description: S_1 = Amount of stevia leaf powder 0.20%; S_2 = Amount of stevia leaf powder 0.25%; S_3 = Amount of stevia leaf powder 0.30%; and S_4 = Amount of stevia leaf powder 0.35%

3.2. Effect of Drying Time on Observed Parameters

The results of the study showed that there was an influence exerted by drying time on the parameters of moisture content, ash content, total sugar, total dissolved solids, acidity (pH), total microbes, and organoleptic values consisting of color, taste, aroma, and texture as in Table 2.

Table 2. The Effect of Drying Time on the Observed Parameters

Tested parameters	Drying Time (W)			
	W_1	W_2	W_3	W_4
Water content (%)	26.357	24.909	22.905	21.417
Ash content (%)	0.679	0.756	0.802	0.883
Total sugar (%)	12.440	12.618	12.930	13.214
Total dissolved solids (°Brix)	8.200	8.450	8.900	9.400
Degree of acidity (pH)	3.792	3.807	3.838	3.851
Total microbes (10^2 CFU/g)	3.761	3.673	3.524	3.408
Organoleptic value of colour	5.848	5.7573	5.695	5.653
Organoleptic value of taste	5.565	5.676	5.726	5.802
Organoleptic value of aroma	5.727	5.719	5.712	5.696
Organoleptic value of texture	5.687	5.636	5.536	5.456

Description: W_1 = Drying time 4 hours; W_2 = Drying time 6 hours; W_3 = Drying time 8 hours; and W_4 = Drying time 10 hours

3.3. The Effect of the Interaction of the Amount of Stevia Leaf Powder and Drying Time on the Moisture Content of Dried Candied Snake Fruit

The interaction of the amount of stevia leaf powder and drying time has a very distinct effect ($P<0.01$) on the moisture content of dried candied snake fruit. The relationship between the interaction of the amount of stevia leaf powder and drying time on the moisture content of dried candied snake fruit can be seen in Figure 1.

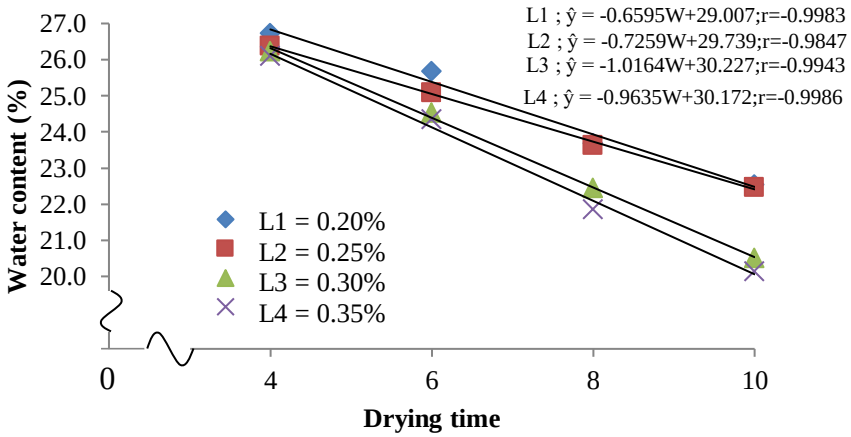

Figure 1. The Relationship of the Amount of Stevia Leaf Powder and Drying Time with the Moisture Content of Dried Candied Snake Fruit

The interaction of the addition of stevia leaf powder and variations in drying time has a very noticeable influence on the moisture content of dried candied snake Padang Sidempuan. The highest water content was found in the S_1W_1 treatment, at 26.7232%, and the lowest was in the S_4W_4 treatment, at 20.1478%.

The results showed that the greater the amount of stevia leaf powder and the longer the time used, the lower the water content of sweets. This is because the water content in candied snake is related to the sugar content contained in sweets; sugar will affect the water balance, so the percentage of

water content will decrease. Drying using a low-temperature oven will result in more water bound in the material so that the resulting water content is lower [5].

3.4. Ash Content

3.4.1. The Effect of the Amount of Stevia Leaf Powder on the Ash Content of Dried Candied Snake Fruit

The amount of stevia leaf powder has a distinct effect (P<0.01) on the ash content of dried candied snake fruit. The relationship between the amount of stevia leaf powder and the ash content of dried candied snake fruit can be seen in Figure 2.

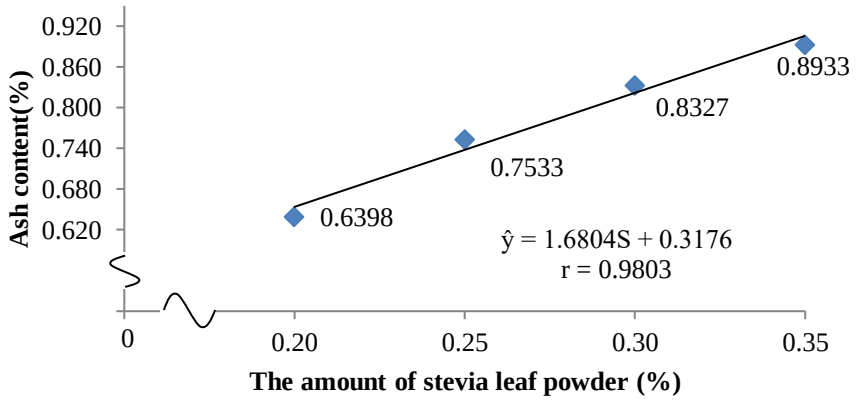

Figure 2. The Relationship of the Amount of Stevia Leaf Powder with the Ash Content of Candied Snake Fruit

The addition of stevia leaf powder has a very distinct effect on the ash content of sweets. The highest ash content was found in the S_4 (0.35%) treatment at 0.8933% and the lowest at S_1 (0.20%) at 0.6398%. The results showed that the higher the amount of stevia leaf powder used, the higher the ash content of dried candied snake produced. This is because the content of stevia leaf powder consists of various types of minerals, including phosphorus, iron, calcium, potassium, magnesium, and sodium [6].

3.4.2. The Effect of Drying Time on the Ash Content of Dried Candied Snake Fruit

Drying time has a very distinct effect (P<0.01) on the ash content of dried candied snake fruit. The relationship of drying time with the ash content of dried candied snake fruit can be seen in Figure 3.

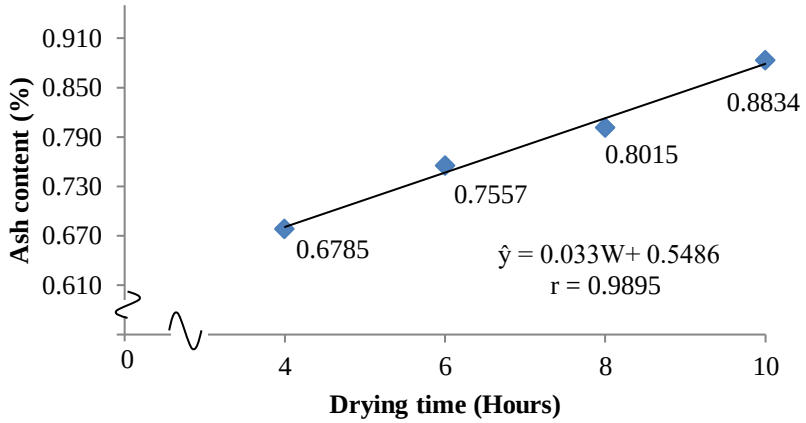

Figure 3. The Relationship of Drying Time with the Ash Content of Dried Candied Snake Fruit

The longer drying time exerts a very pronounced influence on the ash content of sweets. The highest ash content was found in the S_4 (0.35%) treatment at 0.8334% and the lowest at S_1 (0.20%) at 0.6785%. The results showed that the longer the drying time of the sweets used, the higher the ash content of the dried snake produced. This is because, during the drying process in dried candied snake fruit, there is a decomposition of water molecular bond components (H_2O) and an increase in sugar, fat, and mineral content—protein so that the ash content increases in dried candied snake fruit [7].

3.5. Total Sugar

3.5.1. The Effect of the Amount of Stevia Leaf Powder on the Total Sugar of Dried Candied Snake Fruit

The amount of stevia leaf powder exerts a distinct effect ($P<0.01$) on the total sugar of dried candied snake fruit. The relationship between the amount of stevia leaf powder and the total sugar of dried candied snake fruit can be seen in Figure 4.

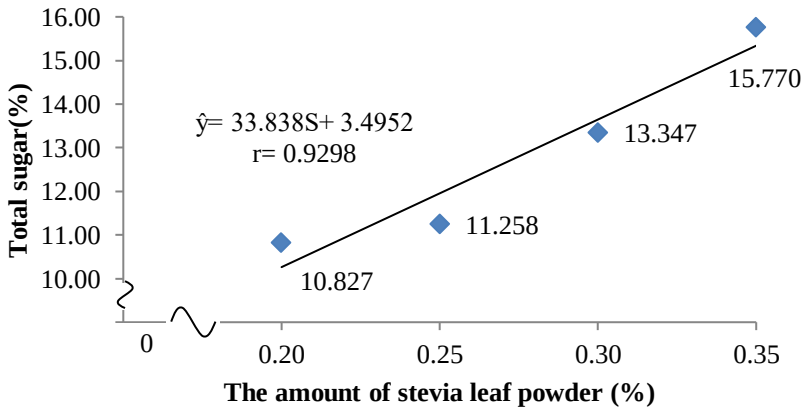

Figure 4. The Relationship of the Amount of Stevia Leaf Powder to Total Dry Candied Sugar

The highest total sugar was found in the S_4 (0.35%) at 15.770%, while the lowest real sugar was found in the S_1 treatment (0.20%) at 10.827%. The results showed that the higher the amount of

stevia leaf powder used, the higher the total sugar contained in a dried candied snake. The increase in real sugar is caused by the addition of sugar concentration, where sugar binds water so that sugar occupies the pores where water is placed in the flesh of a candied snake. Stevia leaves contain *stevioside* and *rebaudioside*, which function as producers of sweetness in stevia leaves; stevia can produce a sweet taste 300 times more than sucrose sugar [8].

3.5.2. The Effect of Drying Time on the Total Sugar of Dried Candied Snake Fruit

Drying time has a significantly different effect (P<0.05) on the total sugar of dried candied snake fruit. The relationship of drying time with the total dry candied sugar of snake fruit can be seen in Figure 5.

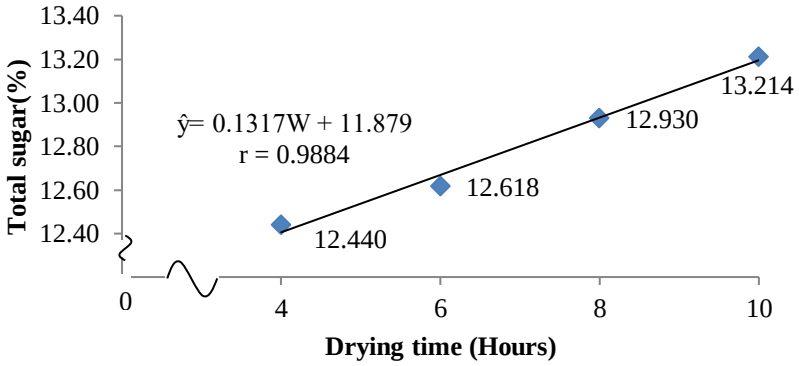

Figure 5. The Relationship of the Drying Time with Total Sugar of Dried Candied Snake Fruit

The highest total sugar was found in the W_4 (10 hours) at 13.214%, while the lowest real sugar was found in the W_1 treatment (4 hours) at 12.440%. The longer drying time in dried candied snake will affect the total sugar in sweets, an effect exerted by increasing the entire sugar content in sweets. This is because the concentration of sugar used affects the full value of sugar produced. A decrease in water content with increasing sugar content will have the effect of extending the shelf life and giving sweetness to sweets [7].

3.6. Total Soluble Solids

3.6.1. The Effect of the Amount of Stevia Leaf Powder on the Total Soluble Solids of Dried Candied Snake Fruit

The amount of stevia leaf powder exerts a distinct effect (P<0.01) on the total dissolved solids of dried candied snake fruit. The relationship between the amount of stevia leaf powder and the total dissolved solids of dried candied snake fruit can be seen in Figure 6.

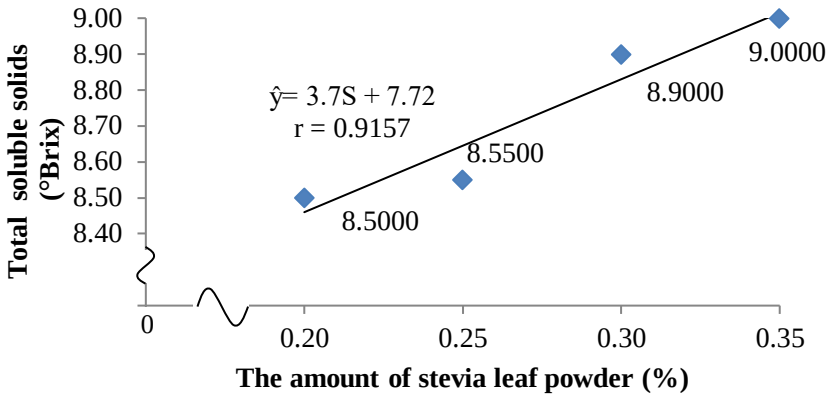

Figure 6. The Relationship of the Amount of Stevia Leaf Powder to the Total Soluble Solids of Dried Candied Snake Fruit

The highest dissolved solids were found in the S_4 (0.35%) of 9.0000°Brix, while the lowest total dissolved solids were found in the S_1 treatment (0.20%) of 8.5000°Brix. The higher the number of stevia leaves used, the higher the total amount of dissolved solids contained in a candied snake.

The carbohydrate content in stevia ranges from 35.2-61.9 g /100g stevia; the addition of stevia extract will increase dissolved solids due to the increase in carbohydrates that break down. The more the concentration of the material rises or the more material is used, the more particles bound by the stabilizer, and the total dissolved solids will increase [9].

3.6.2. The Effect of Drying Time on Total Soluble of Dried Candied Snake Fruit

Drying time exerts a distinct effect ($P<0.01$) on the total soluble solids of dried candied snake fruit. The relationship of drying time with the total dissolved solids of dried candied snake fruit can be seen in Figure 7.

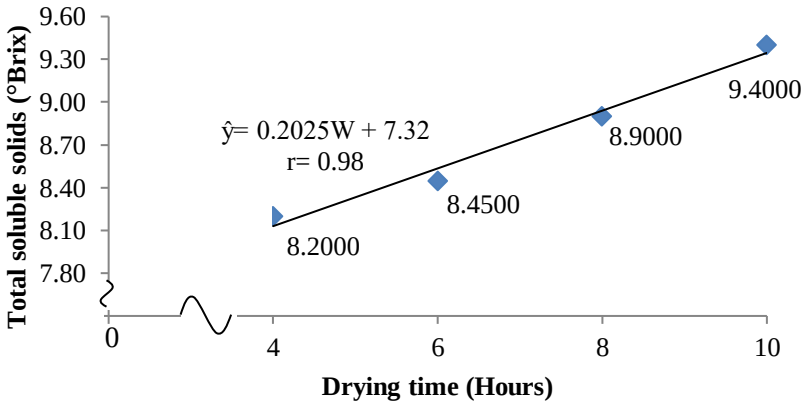

Figure 7. The Relationship of Drying Time to Total Dissolved Solids of Dried Candied Snake Fruit

The highest total dissolved solids were found in the W_4 (10 hours) of 9.4000°Brix, while the lowest total dissolved solids were found in the W_1 treatment (4 hours) of 8.2000°Brix. The longer the drying time carried out on dried candied snake, the more the total dissolved solids increase.

This can be caused by the components that dominate the total dissolved solids in the fruit, which are sugar and acid content, so the longer the heating, the more sugar will dissolve in the juice so that the total dissolved solids increase. Sugar can dissolve in water large enough; the more solid sugar produced, the more it grows [7].

3.7. The Effect of Interaction of Amount of Stevia Leaf Powder and Drying Time on Total Microbes of Dried Candied Snake Fruit

The interaction of the amount of stevia leaf powder and drying time exerts a significantly different effect ($P<0.05$) on the total microbes of dried candied snake fruit. The relationship between the amount of stevia leaf powder and drying time on the total microbes of dried candied snake fruit can be seen in Figure 8.

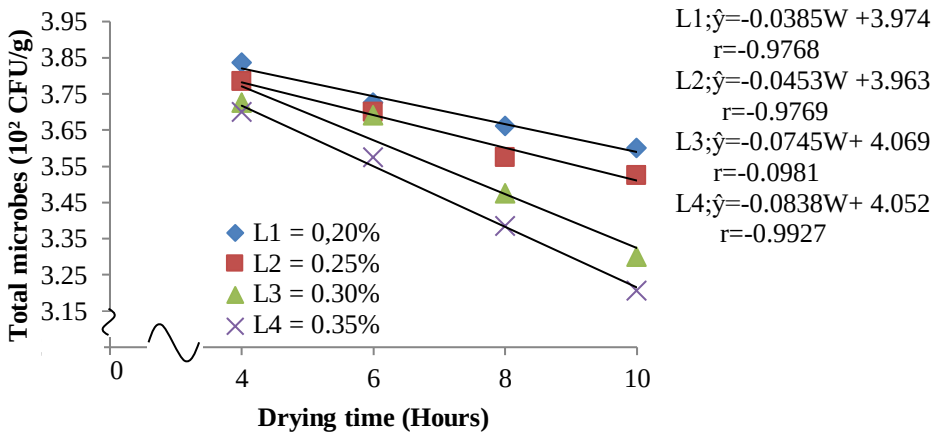

Figure 8. The Relationship of the Amount of Stevia Leaf Powder and Drying Time with Total Microbes of Dried Candied Snake Fruit

The highest microbial total was found in the S_1W_1 treatment of 3.885 10^2 CFU/g, while the treatment with the lowest value was found in the S_4W_4 treatment of 3.205 10^2 CFU/g. There is a decrease in total microbes along with the longer drying time and increasing the amount of stevia leaf powder. This is because sugar or stevia has hygroscopic properties, causing bacterial cells to be dehydrated and unable to grow, so die [10]. In addition, the lower the water content contained in candied snake, the more difficult microorganisms can multiply [7].

3.8. The Effect of the Amount of Stevia Leaf Powder on the Acidity (pH) of Dried Candied Snake Fruit

The amount of stevia leaf powder has a very distinct effect ($P<0.01$) on the degree of acidity (pH) of dried candied snake fruit. The relationship between the amount of stevia leaf powder and pH can be seen in Figure 9.

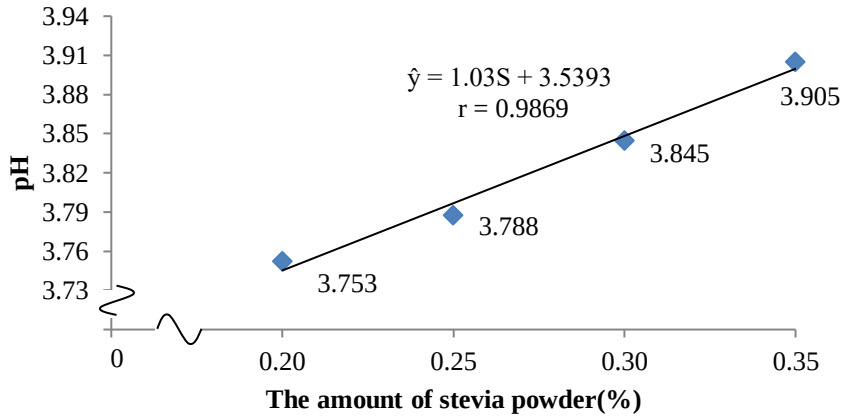

Figure 9. The Relationship of the Amount of Stevia Leaf Powder to the Degree of Acidity (pH) of Dried Candied Snake Fruit

The higher the amount of stevia leaf powder given, the higher the pH value produced in the S_4 treatment (0.35%) 3.905, while the less the amount of stevia leaf powder used, the lower the pH value in the S_1 treatment (0.20%) 3.753. This is because the addition of sugar H+ ions consisting of organic acids will affect the dilution process, which will produce H+ ions that form acids, increasing pH [11].

3.9. The Effect of the Interaction of the Amount of Stevia Leaf Powder and Drying Time on the Organoleptic Value of the Color of Dried Candied Snake Fruit

The exchange of the amount of stevia leaf powder and drying time exerts a significantly different influence ($P<0.05$) on the organoleptic value of the color of dried candied snake fruit. The relationship between the amount of stevia leaf powder and drying time to the organoleptic test value of the color of dried candied snake fruit can be seen in Figure 10.

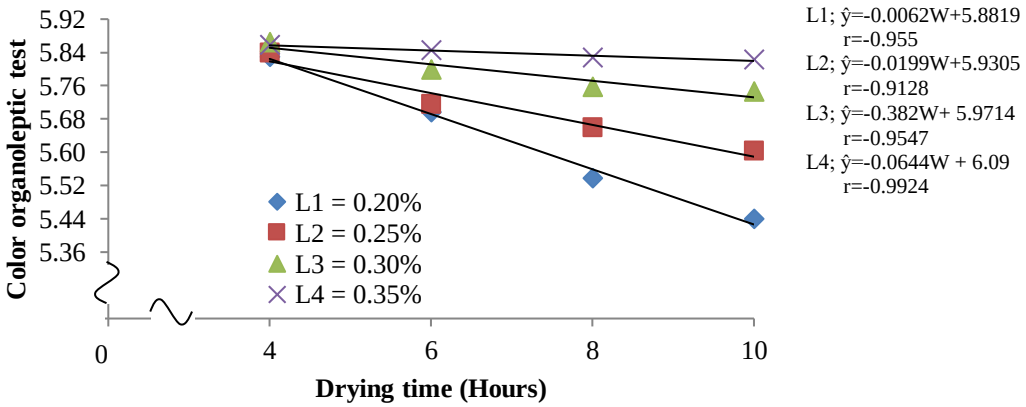

Figure 10. Interaction Relationship of the Amount of Stevia Leaf Powder and Drying Time with the Organoleptic Test of the Color of Dried Candied Snake Fruit

The lowest colour organoleptic test was found in the S_4W_4 treatment at 5.4392, while the treatment with the highest colour organoleptic test value was found in S_3W_1 at 5.8645. The high value of the colour organoleptic test in S_3W_1 treatment is influenced by the amount of stevia leaf

powder and shorter drying time. Stevia extract has a brownish colour, and the colour increases to dark brown along with the addition of stevia extract [9].

The drying process, which takes a long time and uses a high temperature, can cause damage to carbohydrates where non-enzymatic browning reactions (Maillard reactions) and caramelization occur. The occurrence of the Maillard reaction is due to a reaction between the amino group of the protein and the carboxyl group of the reducing sugar, which produces a brown colour, At the same time the caramelization process occurs due to heating the sugar above its melting point [9].

3.10. The Effect of the Amount of Stevia Leaf Powder on the Taste of Dried Candied Snake Fruit

The amount of stevia leaf powder exerts a distinct effect ($P<0.01$) on the taste of dried candied snake fruit. The relationship of the amount of stevia leaf powder with the color organoleptic test can be seen in Figure 11.

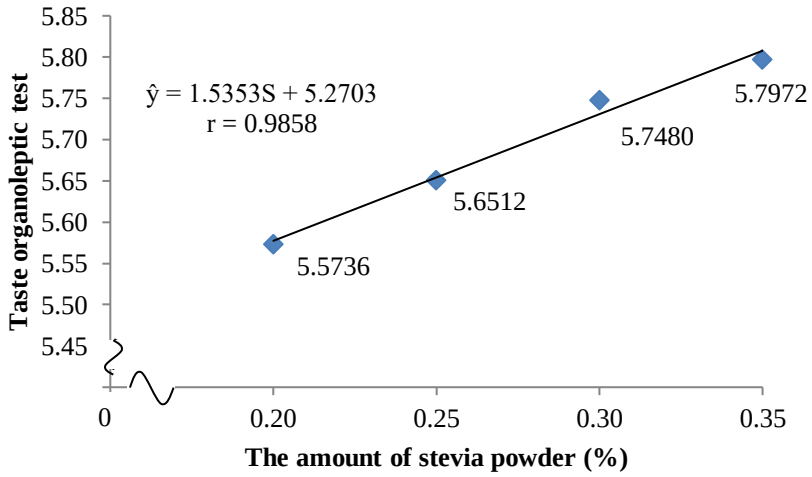

Figure 11. The Relationship of the Amount of Stevia Leaf Powder with the Organoleptic Value of the Taste of Dried Candied Snake Fruit

The higher the amount of stevia leaf powder given, the higher the taste value produced in the S_4 treatment (0.35%) of 5.7972, while the less the amount of stevia leaf powder used, the smaller the taste value created in the S_1 treatment (0.20%) of 5.5736. The high sweetness results from a dried candied snake, along with the increasing amount of stevia leaf powder used. Stevia contains 5-10% *stevioside*, 2-4% *rebaudioside* and other chemical compounds. The level of sweetness possessed by stevia is 200-300 times that of sucrose sugar. Increasing the addition of stevia does not have a harmful effect on the body because it does not contain carcinogenic substances. In addition, stevia can be used as a food additive, such as food flavoring and sweeteners in nutritional supplements [12].

3.11. The Effect of the Amount of Stevia Leaf Powder on the Flavour of Dried Candied Snake Fruit

The amount of stevia leaf powder exerts a distinct effect (P<0.01) on the smell of dried candied snake fruit. The relationship of the amount of stevia leaf powder with the aroma organoleptic test can be seen in Figure 12.

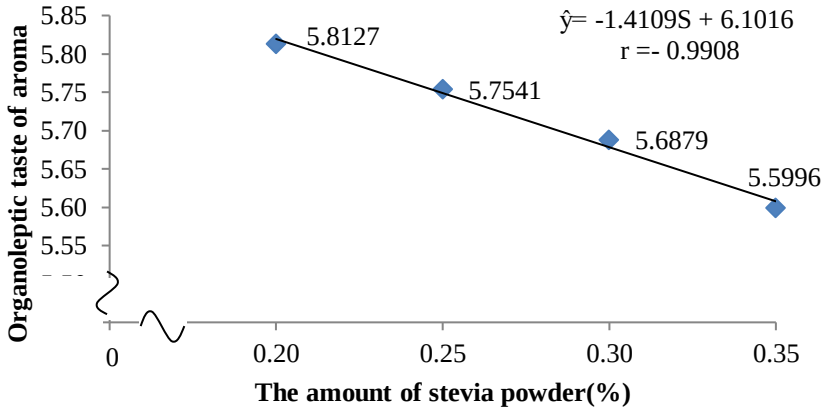

Figure 12. The Relationship of the Amount of Stevia Leaf Powder with the Organoleptic Flavour of Dried Candied Snake Fruit

The less the amount of stevia leaf powder given, the higher the flavour produced in the S_1 (0.20%) 5.8127, while the higher the amount of stevia leaf powder used, the lower the flavour made in the S_4 treatment (0.35%) 5.5996. This is because stevia has an unfavourable flavour caused by the flavour of language built from the aliphatic group of aldehyde compounds consisting of *3-methyl-butanal* compounds. The flavour obtained is based on the results of the sense of smell, which is influenced by psychological and physiological factors so it can cause differences of opinion [12].

3.12. The Effect of Drying Time on the Organoleptic Value of the Texture of Dried Candied Snake Fruit

Drying time exerts a distinct effect (P<0.01) on the organoleptic test values of dried candied snake fruit texture. The relationship of drying time with the texture organoleptic test can be seen in Figure 13.

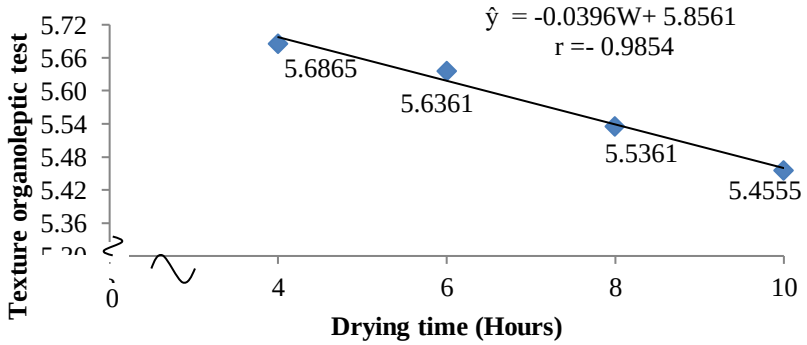

Figure 13. The Relationship of Drying Time with the Organoleptic Value of Texture of Dried Candied Snake Fruit

The longer the drying time given, the lower the texture value produced in the W_4 (10 hours) of 5.4555, while the faster the drying time passed, the higher the texture value created in the W_1 treatment (4 hours) of 5.6865. This is because the longer the drying time and the texture produced by the sweets, the harder the length of drying time causes more water evaporation so that the moisture content in the material is smaller.

The heating process causes the decomposition of water molecules, resulting in shrinkage of the material and increasing the concentration of pectin, cellulose, and other cell wall constituent materials. In addition, the gel formed from pectin is influenced by the amount of sugar used, so the greater the concentration of pectin and the amount of sugar used, the harder the texture produced [7].

3.13. Best Treatments

The results of tests that have been carried out on dried sweets snake Padang Sidempuan using several research parameters to produce the best treatment, using the de Garmo effectiveness test by determining the effectiveness value (Ne) and yield value (Nh) of each parameter performed. Therefore, it produces the best treatment on S_4W_3 with the addition of 0,35% stevia leaf powder with a drying time of 8 hours.

4. Conclusion and Recommendation

The addition of stevia leaf powder has a very distinct effect ($P<0.01$) on moisture content, ash content, total sugar, total dissolved solids, total microbes, acidity degree, and an organoleptic test of colour, taste and flavour. Also, it exerts a markedly different effect ($P<0.05$) on the organoleptic test of texture. Drying time exerts a very distinct impact ($P<0.01$) on moisture content, ash content, total sugar, total dissolved solids, total microbes, colour organoleptic test, and texture. The interaction between stevia leaf powder and drying time had a very distinct effect ($P<0.01$) on moisture content, as well as a markedly different effect ($P<0,05$) on total microbial and organoleptic colour. Based on the results of the study, the best treatment was obtained S_4W_3 with the amount of addition of stevia leaf powder as much as 0,35% and drying time of candied salak for 8 hours.

Further research is recommended to determine how long the shelf life of candied snake is and determine the selection of the right packaging to support the quality of dried candied snake.

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