The effect of the comparison of fig leaves with stevia leaves and drying time on the quality of fig leaf teabags

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Abstract. Comparison of fig leaves with stevia leaves and drying time were evaluated for their effect on the quality of fig leaf teabags. The study was designed using a factorial completely randomized design with 2 factors: the ratio of fig leaves to stevia leaves (D) and drying time (P). The results of the analysis showed that the ratio of fig leaves and stevia leaves had a very significant effect on the water content, total sugar, and total phenol and had no significant effect on the crude fiber content. Drying time has a very significant effect on water content, total phenol, and crude fiber content, and has no significant effect on total sugar. The interaction between the 2 factors gave a very significant effect on the total phenol. The best fig leaf tea formulation is 95% fig leaf: 5% stevia leaf and 120 minutes drying time with antioxidant activity content of 23.81 g/mL.

1 Introduction

Tea drinks are beverages containing polyphenolic compounds and tannins. Tea is produced from the infusion of brewed leaves, shoots, and leaf stalks that have been dried first. In general, the process of making tea is by drying the parts of the plant that will be made into tea such as leaves or bark of the plant which aims to reduce the amount of water that will be made into tea. Commercial tea which is usually consumed by the public comes from tea leaves, but at this time there are many tea products derived from other herbal plants besides tea leaves.

Ficus carica L. is a plant called the fig plant, this plant is also widely used as medicine. Fig leaves have good nutritional content such as calcium, Mg, potassium, fiber, vitamin C, and vitamin A and are good for health. Fig leaves also contain flavonoid, phenolic and antioxidant compounds [1]. The side effects that result from consuming sugar are not as sweet as it tastes, the more consuming sugar will result in diabetes. One way to reduce the use and side effects of sugar is to make tea with a mixture of stevia as a substitute for sugar in tea. The sweetness of cane sugar is not comparable when compared to stevia, because stevia has a sweetness level of 200-300 times. Stevioside and rebaudioside compounds are

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the source of the sweet taste produced from stevia leaves. One of the processes of making tea is drying.

One of the processes of making tea is drying. Drying is done to extend the shelf life of the tea. The drying process can be influenced by 2 factors. The first factor is temperature, volume of air flow, and humidity. The second factor is the size of the material to be dried and the initial water content. The length of drying time can also affect the water content of the material, the water content will decrease with the length of the drying time, due to the higher heat energy causing the water in the material to evaporate into the free air [2]. This study aims to find a comparative formulation of fig leaves and stevia leaves to get the best teabags and determine the content of teabags and the antioxidant activity of teabags that can counteract free radicals.

2 Materials and methods

The fig leaves were obtained from Tin Seedling Farmers in Medan. Stevia leaves were obtained from Tanjung Morawa Stevia Seedling Cultivation. Ginger is obtained from supermarkets in Medan.

Making tea bags is done by sorting the fig leaves and stevia leaves first by washing them with running water so that no sap is left on the leaves. After that the leaves are dried. Then the withering process was carried out by allowing it to stand at room temperature for 18 hours. The fig leaves are chopped until they are separated from the leaf bones (leaves) to reduce the bitter taste of the leaves. Mixed fig leaves and stevia leaves as much as 100 g with a predetermined formulation on factor I, namely D1 (95: 5), D2 (90: 10), D3 (85: 15), D¬4 (80: 20). Drying is done in an oven at 50 °C using the drying time that has been determined in factor II, namely P1 (120 minutes), P2 (150 minutes), P3 (180 minutes).

Dried fig leaves and stevia leaves were added with dry ginger powder with a concentration of 5% in each treatment. The packaging process is carried out by using tea bags made of paper. The finished tea, then brewed with hot water at temperature 80°C for 2 minutes. Samples were stored for 3 days then analysis of quality parameters was carried out on tin tea powder, namely water content was carried out using the AOAC method [3]. An analysis of the quality parameters of fig tea drinks was carried out, namely the total sugar content is carried out by the total sugar method [4], total phenol content is carried out using the Indonesian National Standart method [5] and crude fiber content is carried out by the crude fiber method [4]. The results of the best treatment will be analyzed for quality parameters, namely testing the antioxidant content.

3 Results and discussion

3.1 Chemical analysis of fig leaf and stevia leaf raw materials

The results of the chemical analysis of fig leaves and stevia leaves can be seen in Table 1.

Table. 1 Chemical analysis of fig leaf and stevia leaf raw materials

Parameter	Fig leaves	Stevia leaves
Water content (%)	54.3583	42.5543
Crude fiber content (%)	18.5842	20.6376
Total phenol (µg GAE/g)	27.7995	24.6614

Antioxidant activity (µg/ml)	13.6667	17.5117

Table 1 shows significant results on fig leaves and stevia leaves. The result is that the water content of fresh fig leaves is higher than fresh stevia leaves, this is because fig leaves have a higher water content. The crude fiber content produced by fresh stevia leaves is higher than fresh fig leaves, stevia leaves have very high fiber content such as cellulose and hemicellulose. The total phenol of fresh fig leaves produced is higher than stevia leaves, fig leaves have a high phenolic content. The high phenolic compounds in fig leaves cause fig leaves to contain very active antioxidants. Stevia leaves besides being a source of sweet taste also contain high total phenols and are directly proportional to the antioxidant activity produced. The use of high stevia leaves will produce a bitter taste, this is due to the high content of tannins and flavonoids in stevia leaves.

3.2 Moisture content

The results of the analysis of the comparison of fig leaves with stevia leaves on water content of fig leaf teabags can be seen in Figure 1.

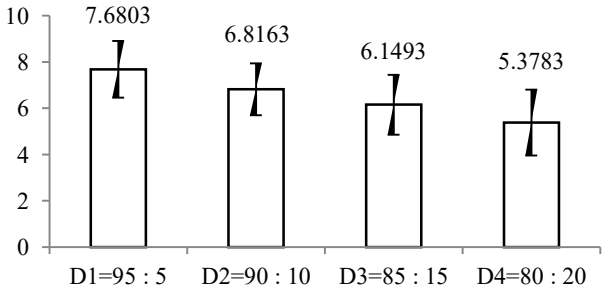

Fig. 1. Comparison of fig leaves and stevia leaves with water content of fig leaf teabags

The highest water content was produced by treatment D_1 which was 7.6803% and the lowest was D_4 which was 5.3783%. Fewer fig leaves will result in lower water content. The number of fig leaves that are less will experience faster evaporation than a high number of formulations when drying, the amount of water content in stevia leaves is lower than fig leaves, so that the results of low water content are obtained. The results of the analysis of the raw material of fig leaves have a moisture content of 54.3583% while stevia leaves have a water content of 42.5543%. The moisture content of dried fig leaves is 6.55% [6] and the water content of dry stevia leaves is 1.14% [7]. The evaporation process can be influenced by the level of humidity of the material and the temperature around the material [8].

The results of the analysis of drying time on the water content of fig leaf teabags can be seen in Figure 2.

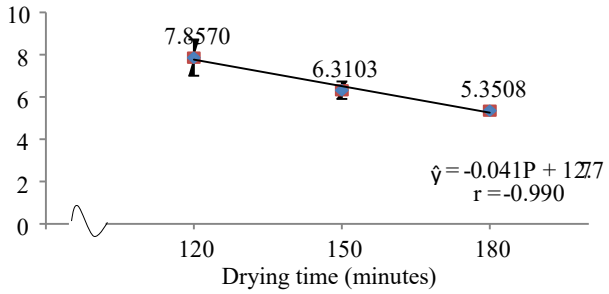

Fig. 2. The relationship between drying time and water content of fig leaf teabags

The highest water content was produced by P_1 which was 7.8570% and the lowest was by P_3 which was 5.3508%. The drying process with a long time can reduce the amount of water in the sample. The longer the drying time, the more the sample will receive heat so that more evaporation occurs in the material which causes the water content to decrease. Drying temperature and time can affect the process of evaporation of water that occurs during drying [9]. Drying temperature and time have a big effect on the drying process. Where the higher the given temperature will produce uneven results, the use of low temperatures will also take a long time for the drying process. Uneven drying will result in the dried material being damaged quickly so that the shelf life of the material will not last long [10].

The results of the analysis of variance showed that the interaction of the ratio of fig leaves with stevia leaves and drying time resulted in no significant difference in water content.

3.3 Total sugar

The results of the analysis of the comparison of fig leaves with stevia leaves on total sugar of fig leaf teabags can be seen in Figure 3.

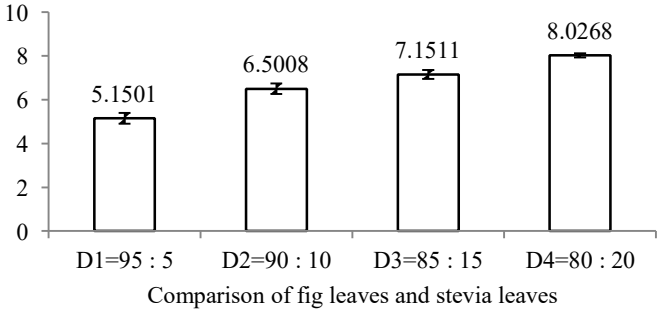

Fig. 3. The relationship between the ratio of fig leaves and stevia leaves to the total sugar of fig leaf teabags

The highest total sugar was produced by D4 which was 8.0268% and the lowest was by D1 which was 5.1501%. The high amount of stevia used will result in a high total sugar. Stevia leaves contain stevioside and rebaudioside compounds as a sweetener source. The higher concentration of stevia leaves also causes a bitter taste in fig leaf teabags. This is due to the content of tannins and flavonoids in stevia leaves [11]. The results of the analysis of variance showed that the comparison of fig leaves with stevia leaves resulted in no

significant difference in total sugar. The results of the analysis of variance showed that the interaction of the ratio of fig leaves with stevia leaves and drying time resulted in no significant difference in total sugar.

3.4 Total phenol

The results of the analysis of the comparison of fig leaves with stevia leaves on total phenol of fig leaf teabags can be seen in Figure 4.

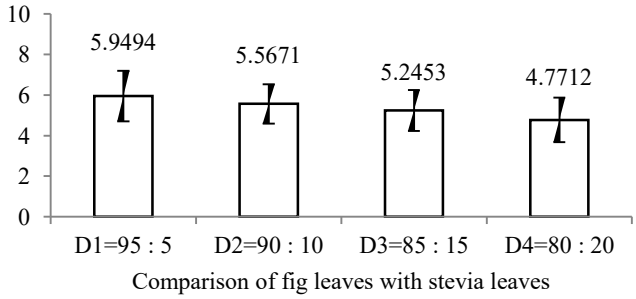

Fig. 4. The relationship between the ratio of fig leaves and stevia leaves to the total phenol of fig leaf teabags

The highest total phenol was produced by D_1 which was 5.9494 g GAE/g and the lowest was by D_4 which was 4.7712 g GAE/g. The highest total phenol was produced from the highest fig leaf formulation. Fig leaves are high in phenolic compounds, indicating that the total phenol in fig leaves is high. The yield of phenolic content of fig leaf extract with 70% ethanol solvent was higher than fig fruit [12]. Based on the results of the raw material analysis, the total phenol in fig leaves is 27.7995 g GAE/g, total phenol in stevia leaves is 24.6614 g GAE/g. The total phenol in dried fig leaves was 5.46 g GAE/g [6] and according to the total phenol content in dried stevia leaves it was 4.50 g GAE/g [13].

The results of the analysis of drying time on the total phenol of fig leaf teabags can be seen in Figure 5.

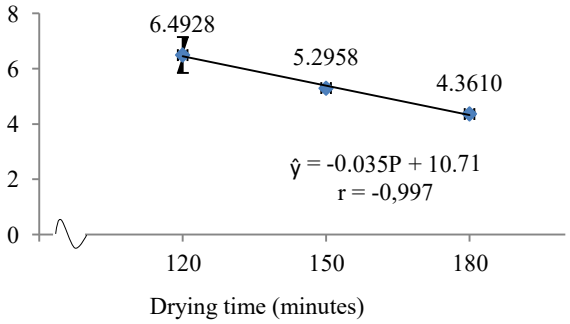

Fig. 5. The relationship between drying time and total phenol of fig leaf teabags

The highest total phenol was produced by P_1 which was 6.4928 g GAE/g and the lowest was by P_3 which was 4.3610 g GAE/g. The lowest total phenol was produced from the longest drying time. This is because the longer drying time can damage the phenol

compounds, so the longer the drying time the total phenol decreases. Drying results in an oxidation process that occurs in phenol compounds as a result of excessive heat treatment so that it can damage phenol compounds [6].

The results of the interaction analysis of the comparison of fig leaves with stevia leaves and drying time on the water content of fig leaf teabags can be seen in Figure 6.

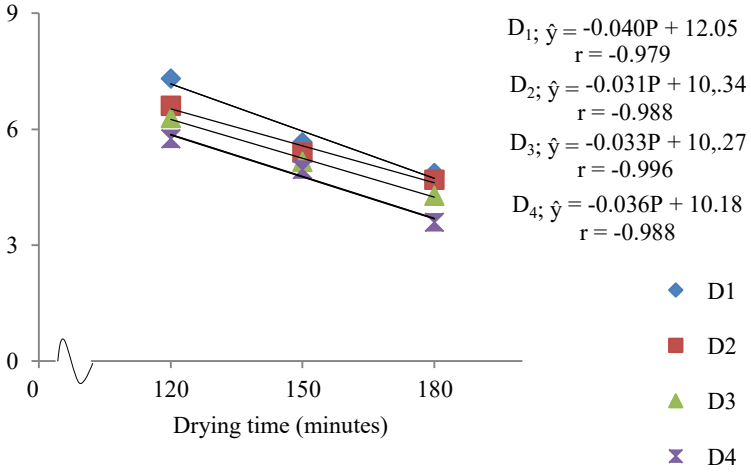

Fig. 6. The interaction relationship between the ratio of fig leaves and stevia leaves and drying time to the total phenol of fig leaf teabags

The highest total phenol was produced by D_1P_1 at 7.3136µg GAE/g and the lowest by D_4P_3 at 3.5929µg GAE/g. There is an interaction between the ratio of fig leaves and stevia leaves with drying time. Fewer fig leaves and longer drying time will result in lower total phenol content. The total phenol of fig leaves is higher than that of stevia leaves and phenolic compounds are compounds that are susceptible to heat, so drying time will result in a decrease in the total phenol content. Based on the results of the raw material analysis, the total phenol in fig leaves is 27.7995 g GAE/g, total phenol in stevia leaves is 24.6614 g GAE/g.

Total phenol in dried fig leaves was 5.46 g GAE/g [6] and total phenol in dried stevia leaves was 4.50 g GAE/g [13]. Giving too high and too long heat during the drying process will result in a decrease in the total phenol content, because phenolic compounds are easily oxidized due to excessive heat [14]. The total phenol content will decrease during drying, this is greatly influenced by temperature and drying time [15]. In fact, the antioxidant activity is directly proportional to the total phenol, where the lower the total phenol of a material, the lower the antioxidant activity.

3.5 Crude fiber content

The results of the analysis of variance showed that the comparison of fig leaves with stevia leaves resulted in insignificant differences in crude fiber content. The results of the analysis of drying time on the crude fiber content of fig leaf teabags can be seen in Figure 7.

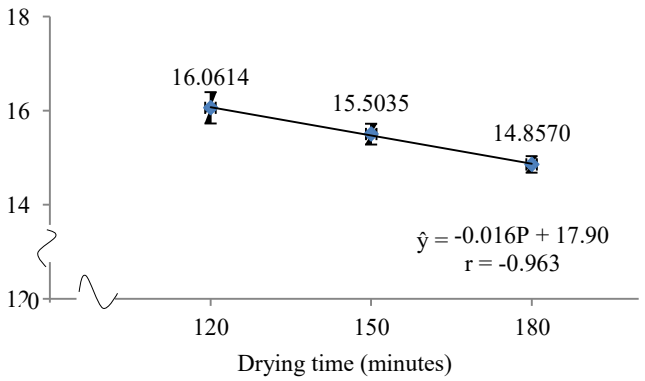

Fig. 7. The relationship between drying time and crude fiber content in fig leaf teabags

The highest crude fiber content was produced by P_1 which was 16.1614% and the lowest was by P_3 which was 14.8570%. Crude fiber content is lower with longer drying. The fiber content in fig leaves is included in the insoluble fiber in water. The fiber content contained in stevia leaves such as cellulose and hemicellulose will decrease due to the heating process during drying, because hemicellulose in crude fiber is the first component that is damaged when exposed to heat, this is because hemicellulose has low heat stability [16]. The best quality tea has low crude fiber [17]. Drying time and low fiber content have a positive effect on tea quality and product storage time [18].

The results of the analysis of variance showed that the interaction of the ratio of fig leaves with stevia leaves and drying time resulted in no significant difference in crude fiber content.

3.6 Antioxidant activity

Determination of the best product is done by making a tabulation table of all analyzed quality parameters. Where sorted from the highest value in each parameter analysis with the highest value generated by D_1P_1. The D_1P_1 treatment had the highest total phenol value compared to other treatments, this was because fig leaves contain high levels of antioxidants. Total phenol has a value that is directly proportional to antioxidant activity, it can be seen from the results of research proving that the lower the total phenol, the antioxidant activity will decrease and vice versa [15]. The results of the analysis of the antioxidant activity of the best products are presented in Table 2.

Table. 2. The results of the analysis of antioxidant activity on the best quality products

Ingredients	Antioxidant activity analysis results (IC_{50}) (µg/ml)	Commercial product antioxidant activity (IC_{50}) (µg/ml)
Fig leaves	20,97	18,47[19]
Stevia leaves	24,35	29,32[20]
D_1P_1 (95 : 5)	23,81	22,02[19]

Information : Comparison of fig leaves with stevia leaves = 95: 5 and old drying 120 minutes.

The test was carried out 3 times
D_1P_1 = comparison of fig leaves with stevia leaves

Based on the results of the analysis, it was found that the content of antioxidant activity in the best fig leaf teabags (D_1P_1) IC_{50} value was 23.81 g/ml, this value was included in the group of very active antioxidant activity. Based on the results of the analysis of the raw material of fig leaves, the antioxidant activity was 13.66 g/ml and stevia leaf was 17.51 g/ml.

Antioxidant activity produced from fig leaf teabags is influenced by fig leaves and stevia which are high in antioxidant activity. The results of fig leaf extract extracted using several solvents have very strong antioxidant activity with an IC_{50} value of <50 g/ml [21]. With the addition of stevia leaves in the manufacture of fig leaf teabags, it causes an increase in antioxidant activity. The high antioxidant activity is also caused by the high content of antioxidant activity in stevia leaves. Free radicals such as metal ions (Fe, Cu) will be bound by flavonoid compounds which are included in the antioxidant group which will produce free radicals by catalyzing the reaction [22]. Antioxidant activity can be seen from the phenol content, the higher the phenol content, the higher the antioxidant activity in the material [23].

4 Conclusions

Comparison of fig leaves with stevia leaves and drying time have an effect on water content, total sugar, total phenol, and crude fiber content. The best fig leaf tea formulation is 95% fig leaf: 5% stevia leaf and 120 minutes drying time with antioxidant activity content of 23.81 g/mL. The author hopes that further researchers will examine how to eliminate the bitter taste in fig leaf teabags and examine the storage method and shelf life of fig leaf teabags.

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