COMPARISON OF PROXIMATE ANALYSIS VALUE OF FRESH FRUITS AND VACUUM FRIED FRUIT CHIPS

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Abstract. Indigenous fruits such as bananas, jackfruit, and pineapple have sensory characteristics that many people like. However, these fresh fruits have a short shelf life. Processing Fruit chips using vacuum frying is one solution to extend the shelf life of fruit with good quality and nutrition content. This study aimed to obtain the proximate composition value of fresh fruit and vacuum fried fruit chips. The research method used proximate analysis based on water, carbohydrate, lipid, crude protein, crude fibre, and ash content. The results showed a significant difference in the water, carbohydrate, lipid, and ash content between fresh fruits and vacuum fried fruit chips. Meanwhile, in crude protein and crude fibre content, there was no significant difference. The water content of fresh fruits was higher than the vacuum-fried fruit chips. The carbohydrate, lipid, crude protein, and ash content of vacuum fried fruit chips were higher than the fresh fruits. The crude fibre of pineapple vacuum fried chips was higher than fresh pineapple. However, the crude fibre of fresh jackfruit and banana was higher than the vacuum fried fruit chips.

Keywords: Banana, Jackfruit, Pineapple, Proximate Composition, Vacuum Fried Fruit Chips

1 Introduction

Lampung is one of Indonesia's provinces with a variety of local fruits that have export potential. Lampung Province is ranked in the top five as a national production centre with average annual production for 22 types of the fruit of 1.4 tons. However, there are fundamental problems in agricultural products, including fruits. The selling value is not optimal and has low competitiveness, so it is necessary to optimize fruits to have competitiveness [1]. Dry food is one form of processed fruit product that has market opportunities. Fruit chips are one of the dry food products that can extend shelf life and

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increase the selling value of the fruit. Chips are defined as snacks in thin slices and processed through the frying process [2].

Process processing fruit into chips by vacuum frying will affect the content, appearance, and organoleptic properties of the fruit chips [3]. The composition of chemical components such as water, carbohydrates, protein, lipid, and minerals in fresh fruit will also be different from fruit chips. This difference is because the processing of fruit chips by frying uses palm oil at using temperature over 100^{o}C. During the frying process, palm oil acts as a heat transfer medium. It contributes to the quality of the resulting product [4]. When the fruit is fried, the water inside will evaporate. In addition, the color of the fruit will turn brown, and the oil will be absorbed into the fruit, creating a crunchy texture [5].

The vacuum frying method is a fryer pan with low temperature and pressure, which is used explicitly for high water content materials. Therefore, this process is suitable for processing fruit into chips. It is because vacuum frying can improve the physicochemical and organoleptic properties of the resulting product. So, the resulting product color, taste, and aroma does not change. In addition, the resulting product is also crispier and has an attractive appearance [6]. This study aimed to obtain the proximate composition value of fresh fruit and vacuum fried fruit chips.

2 Material and Method

2.1 Materials and Reagents

The main ingredients used in this study were samples of fruit and vacuum fried fruit chips, namely jackfruit, pineapple, and banana. Then the materials needed for testing are 0.255 N H2SO4 solution, NaOH (0.3 N, 0.1 N, 40%), anhydrous Na2SO4, CuSO4, aqueous, HCl (0.1 N), Phenolphthalein indicator, ethanol, solvent n-hexane, alcohol 95%, K2SO4 10%.

The tools needed in this research are oven, desiccator, hotplate, Kjeldahl flask, analytical balance, distillation, 250 mL fat flask, extract paper, fat-free cotton, Soxhlet apparatus, Erlenmeyer, return cooler, buncher funnel, 25 mL crucible cup, metal cup, 500 mL beaker, stir bar, litmus paper, filter apparatus, Furnace, crucibles, pestle and mortar, spatula, and extraction tool.

2.2 Sample Preparation

The raw material for fresh fruit is ripe, cleaned, peeled, and removed other than the flesh. After that, place it in a closed container. Then the fruit is sliced into uniform sizes and shapes. Next, the sliced fruit is washed and drained until it is completely dry. Furthermore, bananas and pineapples, soaked in the salt solution for 30 minutes, while for jackfruit, soaked in the lime solution for 30 minutes, then put in the freezer overnight before frying.

The frying process uses vacuum frying. The initial stage of the frying process is to set the temperature to 80^{o}C and the maximum vacuum pressure is 76 cmHg. The sliced fruit was placed into the vacuum frying baskets. Turn the vacuum fryer pump on for ± 30 minutes – 1.5 hours. The following process is frying. During the frying process, turn the handle up until the basket is submerged in oil. Do the frying until the bubbles and foam disappear for ± 90

minutes. After the process is complete, turn the stove, the thermal control, and the vacuum fryer pump off. The faucet, lock, and part of the cover above the cover are opened to normalize the pressure. The chips are removed and then placed into the spinner to drain the oil until no oil drips.

2.3 Sampling Method

Fresh fruit samples were Muli banana, honey pineapple, and jackfruit from Darsa Home Industry East Lampung. Likewise for the sample of fruit chips used consisted of Muli banana chips, honey pineapple chips, and jackfruit chips in 100-gram packages. Before testing, fresh fruit samples were separated from the skin and seeds, and only the flesh was taken. After that, the fruit is cut into pieces or chopped into tiny sizes and then placed in a clean container. Samples of fruit chips were prepared by taking and opening one package each, then transferred to a clean, dry plastic container, and sealed using a sealer.

2.4 Proximate Analysis

Proximate analysis was carried out according to the Association of Official Analytical Chemists (AOAC, 2005) for carbohydrate using by difference and crude fibre. Water, lipid, and ash content using SNI 01-2891-1992 method. The crude protein using Mehlenbacher (1960) method.

2.5 Statistical Analysis

The data obtained will be calculated on each parameter in water content, carbohydrates, lipid, protein, and ash in fresh fruit and vacuum fried fruit chips. Then the data is described using a table to facilitate data from the content found after testing. Then the proximate test data will be analyzed by T-test using Microsoft Excel.

3 Result and Discussion

In determining the proximate values of water, carbohydrate, lipid, crude protein, crude fibre, and ash, comparisons were made with previous studies. Based on the T-test results, there was a significant difference between the proximate values of fruit and vacuum fried fruit chips. The proximate value will interpret the physicochemical characteristics of the product. The processing process will undoubtedly affect the physicochemical properties of the processed material. Some foodstuffs are sensitive to high temperatures, thus allowing the loss of their nutritional value in large quantities [7]. However, with the vacuum frying method, the risk of loss of nutritional value and sensory properties will be reduced. Processing foodstuffs using the relationship between temperature, pressure, and frying time will produce a crunchy texture, distinctive taste, aroma, and evenly distributed color [8].

Table 1. Proximate Value of Jackfruit Fresh Fruit and Vacuum Fried Fruit Chips

Parameter	Fresh Fruits (%)	Vacuum Fried Fruit Chips (%)
Water	77.50 ± 0.56[a]	3.68 ± 0.24[b]
Carbohydrate	16.26 ± 0.36[a]	72.07 ± 2.40 [b]
Lipid	3.43 ± 0.09 [a]	15.06 ± 2.02 [b]
Crude Protein	1.82 ± 0.09 [a]	2.51 ± 0.26 [b]
Crude Fibre	5.65 ± 0.42 [a]	5.48 ± 0.12[b]
Ash	0.99 ± 0.21 [a]	2.80 ± 0.18 [b]

Table 2. Proximate Value of Pineapple Fresh Fruit and Vacuum Fried Fruit Chips

Parameter	Fresh Fruits (%)	Vacuum Fried Fruit Chips (%)
Water	83.41 ± 0.24 [a]	4.23 ± 0.03 [b]
Carbohydrate	11.89 ± 0.23 [a]	64.79 ± 1.38 [b]
Lipid	1.49 ± 0.04 [a]	22.20 ± 1.48 [b]
Crude Protein	2.70 ± 0.11 [a]	2.76 ± 0.13 [b]
Crude Fibre	4.90 ± 0.40 [a]	7.59 ± 0.89 [b]
Ash	0.51 ± 0.04 [a]	1.68 ± 0.11 [b]

Table 3. Proximate Value of Banana Fresh Fruit and Vacuum Fried Fruit Chips

Parameter	Fresh Fruits (%)	Vacuum Fried Fruit Chips (%)
Water	74.97 ± 0.47 [a]	5.33 ± 0.15 [b]
Carbohydrate	15.68 ± 0.44 [a]	70.67 ± 2.25 [b]
Lipid	5.30 ± 0.40 [a]	18.05 ± 2.20 [b]
Crude Protein	3.13 ± 0.51 [a]	3.16 ± 0.24 [a]
Crude Fibre	5.61 ± 0.61 [a]	5.60 ± 0.13 [a]
Ash	0.92 ± 0.02 [a]	3.52 ± 0.16 [b]

3.1 Water Content

Based on tables 1, 2, and 3, it can be seen that the water content of vacuum fried fruit chips after frying has decreased from the fresh ingredients. The water content decreased to 3.68% in jackfruit, 4.23% in pineapple, and 5.33% in banana. The results of the T-test ($P<0.05$) showed that there was a significant difference in the proximate value of fresh fruit and vacuum fried fruit chips. The results of this study are in line with previous studies, which stated that the water content of chips in fruit would decrease along with the higher the temperature used and the longer the frying time [7].

The water content in foodstuffs will significantly affect the productivity of the fruit in several ways, such as appearance, acceptance, and shelf life [8]**.** The water content affects the hardness. The lower the water content, the crispier the texture of the resulting product [9]. Low water content indicates that these foodstuffs have a longer shelf life compared to foods that have high water content [8]. Changes in water content are one of the factors that most influence the decline in product quality. Based on research that has been done on salak

chips, high water content can reduce the quality so that the product loses its crispness and can cause oxidative reactions that trigger rancidity [10].

3.2 Carbohydrate Content

Based on tables 1, 2, and 3, the carbohydrate content of jackfruit, pineapple, and banana chips was increased to 72.07% for jackfruit, 64.79% for pineapple, and 70.67% for banana. The results showed that vacuum frying significantly affected the carbohydrate value ($P<0.05$). Muchtadi and Ayustaningwarno (2010) state that as the water content decreased, compounds such as carbohydrates, proteins, and minerals would be present in high amounts in the food. But vitamins and dyes would generally be reduced or degraded [11].

In this study, carbohydrate content was calculated by the difference method, which is based on subtraction with other known components. Carbohydrates in food show the glucose content of a food. The frying with vacuum frying will cause a Maillard reaction between sugar and high temperatures. The Maillard reaction significantly reduced sugars that will react with the primary amine groups of proteins, forming pigment polymers that are insoluble in water, brown in color, called melanoidins. The Maillard reaction affects much of the spoilage in dried foods [12].

Carbohydrates in fried or dried ingredients will cause their concentration to increase. During the frying process, there is a breaking of the bonds of the water molecule components which causes the carbohydrate content to increase. This increase is caused by water molecules forming hydrates with other molecules containing carbohydrate atoms. Carbohydrates are the main source of calories and several groups of carbohydrates produce fibre that is useful in digestion, and has an important role in determining the characteristics of food products such as taste, color, and texture [13].

3.3 Lipid Content

Based on tables 1,2, and 3, it can be seen that the lipid content of fresh jackfruit, pineapple, and bananas was increased through the vacuum frying process. The value has increased to 15.06% for jackfruit chips, 22.20% for pineapple chips, and 18.05% for banana chips. These results indicated a significant difference ($P<0.05$) in the lipid content of fruit and fruit chips. The calculated lipid content indicates the amount of oil absorbed by the chips during frying [7]. The longer the frying time, the more oil will be absorbed by the ingredients, this is caused by the amount of air that evaporates so that the emptier space that can be filled with oil [13]. The increase in lipid content is due to the fact that during the frying process the material will absorb oil so that the lipid content in the material increases, the oil in addition to acting as a heat conductor, will also be absorbed by the food [14], [15]. Oil absorption is one of the most important quality parameters of frying products. Excess oil consumption causes significant health problems such as coronary heart disease, cancer, diabetes, and hypertension [16].

Another factor that can affect the lipid content is the thickness of the fruit slices. Based on the research that has been done on papaya chips, it is stated that the temperature and thickness of the slices have a significant effect. The higher the temperature and the thinner the fruit slices, the greater the lipid that can be absorbed by the material, so the material has a high lipid content [17]. High lipid content can also cause damage to chips in the form of rancidity. Rancidity occurs because the large oil content in the material causes the oxidation process to take place quickly [18].

The vacuum frying technique is a frying process in oil, which is carried out in a closed system, under atmospheric pressure, so that the boiling point of water in the ingredients will be reduced and the frying temperature can be lowered. Low frying temperatures and closed conditions minimize the entry of oxygen related to product quality such as preservation of nutrients, protection of oil quality, and reduction of formation of toxic compounds [98].

3.4 Crude Protein Content

Based on the tables above, there was a significant difference ($P<0.05$) between the crude protein content of fresh jackfruit and pineapple and vacuum fried fruit chips. Meanwhile, there was no significant difference ($P>0.05$) in the protein content of fresh banana fruit and vacuum fried fruit chips. The results that are not in line with previous studies are thought to be due to fruit's characteristics and differences in the testing and treatment methods of fruit. In this study, the fruit was first soaked in salt. At the same time, in the previous research, there was no pretreatment, and the testing method used was micro Kjeldahl. In contrast, this research used the Mehlenbacher method. However, the result showed that the vacuum frying method could maintain the crude protein content of banana vacuum fried fruit chips.

Protein is one of the crucial nutrients for the human body because it acts as a building block and body regulator. Protein is a source of amino acids that contain carbon, hydrogen, oxygen, and nitrogen. In the human body, protein will be absorbed in the form of amino acids. The processing of food material will affect the proximate value of the material [15]. As the heating process progresses, there will be a decrease in the protein content in the food. Proteins that are heated will experience the Maillard reaction, which will increase the solubility of protein levels, and protein structures will be denatured [6], [19].

3.5 Crude Fibre Content

Based on tables 1,2, and 3, the crude fibre content in jackfruit and bananas was decreased to 5.48% and 5.60%, respectively, due to the vacuum frying process. Another thing for pineapples, the crude fibre content increased from 4.90% to 7.59%. The results showed no significant difference ($P>0.05$) in the proximate value of fresh banana vacuum fried fruit chips. But there was a significant difference ($P<0.05$) between fresh jackfruit and pineapple and vacuum fried fruit chips. The decrease in crude fibre content can be caused by the breakdown of cell walls during processing and drying [20]. The breakdown of the cell wall due to the severance of polysaccharide bonds and the breakdown of glycosidic bonds which causes the formation of monosaccharides and disaccharides [21].

According to Dian Sundari (2015), the heating treatment did not provide a significant difference between fresh fruit and fruit chips due to the nature of the fibre, which is difficult to decompose and is resistant to high temperatures [15]. Cellulose and hemicellulose are more difficult to decompose, because they have the following properties, namely giving shape or structure to plants, not soluble in cold and hot air, cannot be digested by digestive juices so that they cannot act as energy producers. Fibre can aid in the digestion of food and can be broken down into glucose by certain enzymes and microbes [3]. Fibre has a function that is able to bind water so that it contributes to the formation of digestive waste to be more regular in the digestive tract. Fibre also has the ability to dilute the mass of feces which causes the movement of feces in the drain faster. This will cause the fibre to have the ability to absorb carcinogenic and toxic substances [22].

3.6 Ash Content

Based on Tables 1,2 and 3, the ash content increased compared to fresh fruit. The increase in jackfruit chips is 0.99% to 2.80%, pineapple chips are 0.51% to 1.68%, and pineapple chips are 0.92% to 3.52%. These results indicate a significant difference ($P<0.05$) in fresh fruit and vacuum fried fruit chips. The vacuum frying process will cause an increase in the ash content. According to Dian Sundari (2015), high and low ash content is influenced by high temperatures. A lot of water content is lost [15].

Ash content in foodstuffs indicates the presence of inorganic minerals in these foodstuffs. High ash content suggests material contamination by the tool due to friction during the process [23]. The higher the temperature used, the greater the water that evaporates and causes the resulting ash content to be even greater [24].

4 Conclusion

Frying with vacuum frying is a suitable method for producing high-quality chips that can maintain fruit chips' crude fibre and crude protein content. However, frying will affect the proximate value of fruit chips. In jackfruit and bananas, the water and fibre content decreased. At the same time, the levels of carbohydrates, lipid, crude protein, and ash increased. The water and carbohydrate content decreased in pineapple, while the lipid, crude protein, crude fibre, and ash content increased. Based on result above, there are factors that affect the difference in proximate value of the three types of fruit chips such as the type and characteristics of fruit used, the level of fruit maturity, the treatment of the fruit before frying, and the temperature and length of frying time.

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