Journal of Bio & Geo Material and Energy (BiGME)
Volume 6 No. 1, February 2026
P-ISSN: 2808-1560 E-ISSN: 2808-1404

Identification of the Process and Characteristics of Jackfruit Chips in Tambang District

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Article info:

Submitted: September 2025
Revised: January 2026
Accepted: January 2026
Published: February 2026

Abstract:
Jackfruit chips are a promising product choice because they have a relatively simple production process, low raw material costs, and can be marketed at affordable prices. However, a major challenge faced by micro, small, and medium enterprises (MSMEs) is maintaining consistent product quality to meet consumer expectations and remain competitive in an increasingly competitive market. This research was conducted in Tambang District, Kampar Regency, Riau Province. Samples were collected from three jackfruit chip MSMEs in Tambang District, Kampar Regency. Evaluation of jackfruit chip quality was carried out based on SNI 01-4269-1996 including moisture content, ash content, fat content, texture (hardness), and sensory attributes. The results showed that Restu MSME produced jackfruit chips with superior processing and quality characteristics. These chips were processed using vacuum frying at a temperature of 97 °C and a vacuum pressure of 75 cmHg for 3 hours, resulting in a moisture content of 5.32%, ash content of 2.13%, fat content of 11.14%, a hardness value of 114.70 N/cm², and a descriptive sensory score of 4.65.

Keywords: Jackfruit chips, quality, SNI, Tambang District

1. Introduction

Jackfruit chips (*Artocarpus heterophyllus* Lamk.) are one of the processed tropical fruit products that have high economic potential, especially for MSMEs in areas such as Tambang District, Kampar Regency, Riau. Basically, MSMEs play a very important role in the Indonesian economy, contributing to more than 60% of the country's Gross Domestic Product (GDP) (Ministry of Cooperatives and SMEs, 2021). SMEs serve as the main drivers of job creation and the local economy. In the culinary sector in particular, SMEs have the potential to increase their income through processed products based on abundant local raw materials, such as jackfruit.

Jackfruit is available for around 8-12 months a year, providing an opportunity for local businesses to process this fruit into value-added products such as chips. Jackfruit chips not only offer a distinct flavor profile savory taste and crunchy texture, but also contain nutrients such as vitamins A and C, fiber, and antioxidant compounds that are very beneficial to consumer health (Irjayanti *et al*., 2022). Jackfruit chips are a promising product choice because, in addition to their relatively easy production process and low raw material costs, they can also be sold at affordable prices. However, the biggest challenge for MSMEs is maintaining consistent product quality to meet consumer expectations and maintaining competitiveness in an increasingly competitive market (Prasetyo & Suyanto, 2021).

Production among SMEs is often still simple and does not always pay attention to quality standards. A study by Rahayu (2021), which conducted a case study on the jackfruit chip agroindustry in Kualu Nenas Village, Tambang District, showed that the use of approximately 150 kg of local jackfruit produced 10 kg of

chips per production process, but without laboratory measurement of the physical and chemical characteristics of the product. On the other hand, through a sharia economics approach, Betmawati (2017) found that although the jackfruit chip business had increased family income by 92.9%, there were still challenges related to consistent product quality standards. The scarcity of quality characteristic data made it difficult to formulate quality standards for local jackfruit chips.

Fitria and Hidayati (2020), in the context of processed food production, found that quality is greatly influenced by several main factors: raw materials and fruit ripeness, processing methods (especially frying), as well as the type of packaging and storage conditions. Suryanto (2018) concluded that jackfruit harvested one day after reaching optimal ripeness produced a yield of around 23.96%, close to the maximum value (25.55%), and the highest sensory values for color (3.71), taste (4.32), and texture (3.91). These results emphasize the importance of selecting the right raw materials to obtain a quality end product.

In addition, the frying method plays an important role in determining the physical, chemical, and sensory characteristics. Hariono *et al*. (2018) tested the use of vacuum frying technology with a spray cooling system for jackfruit chips. This method allows frying at low temperatures (~80 °C) under vacuum pressure conditions so that the product has a natural color, crispy texture, and minimal oxidation risk. Conversely, conventional atmospheric frying tends to result in excessive browning and loss of crispiness of the product due to insufficient water release. Physical quality parameters such as moisture content, texture/hardness, and others are key indicators that need to be measured in quality evaluation.

Budiarti (2022) found that the frying of jackfruit chips affects the shelf life or durability of the jackfruit chips. Jackfruit chips that are easily damaged or have a short shelf life will be a problem for MSMEs that want to develop their products to a wider market. Durability evaluation can be done by testing product durability under certain storage conditions, which may involve testing the temperature, humidity, and packaging used. This assessment is important to determine whether jackfruit chips can last long on the market without spoiling (Sari & Arifin, 2021).

In the context of the local economy in Tambang District, there is a strong need to improve product quality. Rahayu (2021) reported that jackfruit chip businesses generate added value of up to IDR 2,674/kg with business efficiency reaching 1.25 and a marketing margin of up to IDR 20,000/kg, but without scientific estimates of product quality parameters. This indicates that the product still relies solely on economies of scale, rather than scientific quality data that can be used as capital for certification, halal standards, or market expansion.

Jackfruit chips have various characteristics that need to be evaluated to ensure that the products produced meet good quality standards. Some characteristics that need to be evaluated are taste, texture, color, nutritional content, and product shelf life (Budiarti & Prasetyo, 2021). Taste evaluation is important because the distinctive and distinctive flavor of jackfruit chips will attract consumers. A taste that does not meet consumer expectations can reduce the product's appeal in the market (Sari & Arifin, 2021). Likewise, the texture must be crispy, because an inappropriate texture, such as hard or soft, can reduce the overall quality of the product. Texture assessment can be done through sensory testing, which involves trained panellist to assess the organoleptic quality of the product (Daryanto, 2020).

The evaluation of the characteristics of jackfruit chips aims to improve the quality of products produced by MSMEs so that they can compete in an increasingly competitive market. In addition, by improving product quality, MSMEs can increase consumer satisfaction and expand their markets, both locally and internationally. Therefore, this evaluation aims not only to identify the weaknesses and strengths of the products produced, but also to improve the competitiveness of MSMEs in facing global competition. The aim of this research is to to determine the optimal processing parameters (temperature, vacuum pressure, duration) and evaluate moisture content, ash content, fat content, texture, and sensory attributes of locally produced jackfruit chips in Tambang sub-district.

2. Materials and Methods

This research was conducted in Tambang District, Kampar Regency, Riau Province. Samples will be taken from three jackfruit chip MSMEs in Tambang Subdistrict, Kampar Regency, namely Usaha Baru Ibu, Sinar Hidayah, and Restu. Sample testing was carried out at the Agricultural Product Analysis Laboratory, Riau University, the Instrumentation Laboratory, Andalas University, and at the Pekanbaru Technical

Implementation Unit of Goods Quality Testing and Certification. The observation of jackfruit chip quality based on SNI 01-4269-1996 was conducted at Sinar Hidayah MSME, Usaha Baru Ibu MSME, and Restu MSME.

Chemical content
Moisture, ash and fat content were analysed using SNI 01-2891-1992

Hardness
The hardness test of jackfruit chips was conducted using a Brookfield Texture Analyzer. The sample was placed on a metal plate positioned under a needle with a radius (r) of 2 mm. The test was conducted by pressing the start button so that the needle would move from top to bottom to break the jackfruit chips. Next, record the results obtained from the hardness profile to determine the hardness value of the jackfruit chips. The hardness test was repeated three times. The following are the steps for calculating the hardness test.

A = (texture value (g))/1000
B=A x 9.8
C=πr^2

Explanation:
A = Texture value (kg)
B = Force acting on the object (N)
C = Needle area (cm2)

T=B/C

Explanation:
T = Hardness test result (N/cm²)

Sensory properties
The descriptive test was conducted to determine the characteristics of jackfruit chips (texture) in each jackfruit chip agroindustry in Tambang District. Twenty semi-trained students who had passed the sensory evaluation course were used as panellists. Samples weighing ± 5 g were placed in plastic clips that had been given 3 random codes. In addition, the presenter provided mineral water and descriptive test questionnaires. Panellists were asked to provide descriptive assessments of the texture of jackfruit chips.

3. Results and Discussion

Jackfruit chip processing
a) Sinar Hidayah

The jackfruit chip processing at Sinar Hidayah MSME begins with the receipt of raw materials in the form of jackfruit. The jackfruit was cut and peeled, and the flesh wa separated from the seeds. Next, the fruit flesh was washed with clean water and *soaked in a solution containing 15 g of baking soda per 10 kg of jackfruit flesh for 10–15 minutes*. The soaking process took approximately 10-15 minutes, after which the fruit was drained and washed again until the baking soda residue was removed, then drained again. The next stage was the frying process of the jackfruit flesh using vacuum frying at a temperature of 90˚C with a pressure of 70 cmHg for 2 hours and stirring. Next, the resulting jackfruit chips were drained of oil using a spinner for ± 15 minutes. The jackfruit chips were then cooled and packaged using PP packaging with a weight of 100 g of jackfruit chips/package.

Figure 1. Sinar Hidayah Jackfruit chips

b) Usaha Baru Ibu

The first stage was to prepare ripe jackfruit from suppliers. The second stage was to cut and clean the jackfruit to separate the flesh from the skin and seeds. The next stage was to wash the jackfruit flesh using running water until clean and drain it. The clean fruit flesh was fried using vacuum frying at a set temperature of 100˚C and a pressure of 75 cmHg. The frying process lasted for 2 hours and was stirred periodically. After frying, the oil from the jackfruit chips was drained using an oil drainer in the form of a spinner for approximately 5 minutes. The jackfruit chips were then cooled and packaged in polypropylene (PP) bags, 50 g per package.

Figure 2. Usaha Baru Ibu Jackfruit chips

c) Restu

The jackfruit used in the jackfruit chip processing is ripe and of good quality. Next, the jackfruit was cut and peeled. The peeled jackfruit was separated from the seeds. Then the fruit flesh was washed with water and drained. The process of frying the jackfruit flesh into chips used vacuum frying at a temperature of 97˚C and a pressure of 75 cmHg for 3 hours. Next, the oil was drained for ± 10 minutes and the jackfruit chips were cooled. The jackfruit chips were packaged in aluminum foil and a continuous sealer with a weight of 100 g of jackfruit chips per package.

Figure 3. Restu Jackfruit chips

All three MSMEs used the *vacuum frying* technique, but there were important differences in temperature, pressure, time, and packaging that affected product quality. Sinar Hidayah MSME fried at a lower temperature of 90˚C with a pressure of 70 cmHg for 2 hours, producing a darker color because the jackfruit used was riper compared to the jackfruit in the other MSMEs, but it was only packaged in PP plastic, which was less resistant to oxidation. Usaha Baru Ibu MSME used a temperature of 100˚C with a pressure of 75 cmHg for 2 hours and also used smaller PP packaging, so the process dried the chips faster but the shelf life was limited. Meanwhile, Restu MSME fried at 97˚C with a pressure of 75 cmHg for 3 hours and packaged the product using sealed aluminum foil, which reduced more moisture so that the crispness lasted longer and provided better protection against light and oxidation, making the product's shelf life relatively longer.

Moisture content

One of the quality characteristics of jackfruit chips is determined by their moisture content. Moisture content is related to the texture and shelf life of jackfruit chips. The moisture content of jackfruit chips is influenced by the moisture content of the raw materials, the soaking time using baking soda, the frying time, and other factors. Moisture content reduction can be achieved through several processing methods such as frying, drying, and baking. Jackfruit chips are fried using a vacuum frying machine and the moisture content testing is conducted using the gravimetric method. The results of moisture content observations on jackfruit chips from each jackfruit chip agroindustry in Tambang District are presented in Table 1.

Table 1. Average water content of jackfruit chips

Sample	SNI 01-4269-1996	Moisture content (%) ± SD
Sinar Hidayah	Max 5	6.43 ± 1.16
Usaha Baru Ibu	Max 5	6.04 ± 1.33
Restu	Max 5	5.32 ± 1.05

Based on Table 1, it can be seen that the lowest water content of jackfruit chips is found in MSME Restu at 5.32% with a standard deviation of 1.05. MSME Usaha Baru Ibu has a water content of 6.04% and a standard deviation of 1.33, while MSME Sinar Hidayah has a water content of 6.43% and a standard deviation of 1.16.

The difference in moisture content is due to the different times and temperatures during vacuum frying. MSME Restu uses a frying temperature of 97˚C for 3 hours, while MSME Usaha Baru Ibu fries jackfruit at a temperature of 100˚C for 2 hours. Sinar Hidayah MSME deep-fried the jackfruit at a temperature of 90˚C for 2 hours. According to Soto (2021), moisture content dropped rapidly in the first minutes, then approached equilibrium; for the same time, higher oil temperature always gave lower moisture .

Jackfruit chips with low water content can increase the shelf life of the chips. If the chips contain high water content, they will become moist, resulting in jackfruit chips that are not crispy. De Souza (2025), low

water content is strongly linked to crispness, because drying and crust formation increase porosity and hardness in fried snacks. Products that are not crispy will reduce consumer acceptance of jackfruit chips. Consumer acceptance is influenced by the appearance of the chips, the texture of the chips, and the shelf life of the chips (Utami *et al*., 2022).

Ash content

Ash content testing was conducted on jackfruit chips to determine the amount of essential minerals contained in the product. Ash is an inorganic residue produced from the combustion of organic compounds or through the oxidation process in foodstuffs (Rahmadi *et al*., 2021). In addition, the ash content is also influenced by the processing of jackfruit chips, contamination from the production environment, and other factors (Saputri et al., 2022). Based on the results of the ash content research of jackfruit chips in each agroindustry, the results can be seen in Table 2.

Table 2. Average Ash Content of Jackfruit Chips

Sample	SNI 01-4269-1996	Ash content (%) ± SD
Sinar Hidayah	Max 3	2.59 ± 0.93
Usaha Baru Ibu	Max 3	2.71 ± 1.17
Restu	Max 3	2.13 ± 0.46

Table 2 shows that all agroindustry have jackfruit chips with ash content that meets SNI 01-4269-1996. The highest ash content was obtained by MSME Usaha Baru Ibu at 2.71 ± 1.17% and the lowest ash content was obtained by MSME Restu at 2.13 ± 0.46%. The higher the ash content in jackfruit chips, the higher the mineral content. This is due to the level of cleanliness of the jackfruit chips. According to Rahmadi *et al*. (2021), high ash content is caused by impurities in the fruit raw materials during the peeling and washing processes, which are not yet optimal. Saputri et al (2022) argue higher frying temperatures cause more water evaporation and are reported to raise measured ash content in fruit chip.

Fat content

Fat content testing refers to the amount or percentage of fat contained in jackfruit chips. The fat content is influenced by the duration of oil drainage, the frying temperature used, the number of rpm on the spinner, and the cooking oil used. The fat content in jackfruit chips can improve the texture and flavor of the chips. The results of fat content testing on jackfruit chips from each agroindustry can be seen in Table 3.

Table 3. Average Fat Content of Jackfruit Chips

Sample	SNI 01-4269-1996	Fat content (%) ± SD
Sinar Hidayah	Max 25	7.22 ± 0.97
Usaha Baru Ibu	Max 25	22.32 ± 0.51
Restu	Max 25	11.14 ± 0.32

Table 3 shows that the jackfruit chips produced by agroindustry in Tambang District meet the SNI 01-4269-1996 standard of a maximum fat content of 25%. The percentage of fat content in jackfruit chips varies because the fat content in each jackfruit chip produced undergoes different processing treatments. MSME Sinar Hidayah drains jackfruit chips using a spinner for ±15 minutes, MSME Usaha Baru Ibu drains the oil for ±5 minutes, and MSME Restu for ±10 minutes. The duration of oil drainage affects the fat content of jackfruit chips. The fat present in jackfruit and cooking oil used as a fat source in jackfruit chip production. The longer the oil drainage time, the lower the resulting fat content, and vice versa. According to the research results of Wijayanti *et al*. (2022), the spinner treatment affects the fat content in the chips. This condition occurs because most of the oil absorbed during frying is discarded during oil draining. Chips after being spun for 3 minutes produced a fat content of 23.56%, and a spinner time of 1 minute had a fat content of 27.39%.

High fat content in jackfruit chips can make them more prone to spoilage. The higher the fat content, the more likely the chips are to become rancid. This is because the fat contained in the chips undergoes hydrolysis and oxidation. According to Pounovic Intermittent frying studies show that not only contact with

food but also continued heating of oil without food raises FFA, especially at higher temperature and longer holding times. Rancidity in chips occurs because the high-water content reacts with the fat content, which breaks down into fatty acids. This occurs because the hydrolysis reaction in oil can be accelerated by heat, water, acidity, and enzyme catalysts. Hydrolysis is a reaction that separates fatty acids in glycerol in lipid molecules due to the presence of water molecules. In addition, repeated use of cooking oil can cause high levels of free fatty acids to form in the product. Valle et al. (2024) stated that hydrolyzed / degraded frying oil has lower smoke point, higher polarity and viscosity, which increase oil absorption and promote darker color in fried ingredients. The research by Deo (2025) found that the fat content of 15-16% in jackfruit chips aligns closely with that of vacuum-fried jackfruit chips, which is approximately 15.06%. Moisture loss and aw decrease faster, often increasing oil uptake because more empty pores and channels are created for oil to fill (Soto et al., 2021)

Hardness

The crispy texture of jackfruit chips determines the quality of the food and consumer acceptance. The crispiness of jackfruit chips is measured as the force required to break the chips on a texture analyser. The hardness test is influenced by the water content of the jackfruit chips, the frying method, the additives used, and the packaging. The results of the hardness test on jackfruit chips are shown in Table 4.

Table 4. Results of the Jackfruit Chip Hardness Test

Sample	*Texture* (N/cm²) ± SD
Sinar Hidayah	109,61 ± 4,20
Usaha Baru Ibu	278,33 ± 2,28
Restu	114,70 ± 9,11

The highest hardness value produced in this study was MSME Usaha Baru Ibu, which was 278.33 N/cm2. This indicates that the jackfruit chips produced have a slightly hard texture but are still crispy. MSME Restu had a lower hardness value of 114.70, indicating that the product was crispy due to the low water content in the chips. MSME Sinar Hidayah produced jackfruit chips with a hardness value of 109.61 and a texture that was mostly not crispy. According to research by Praveena *et al*. (2023), the hardness value of small-cut jackfruit chips fried using vacuum frying ranges from 1.01 N to 2.37 N at different frying temperatures, pressures, and times. The value of 1.01 N was obtained at a temperature of 100˚C, 9 kPa for 18 minutes, and the value of 2.37 N was obtained at a temperature of 110˚C, 12 kPa for 20 minutes. According to Chowdhury et al. (2025), for vacuum-fried jackfruit chips, crispiness is instrumentally measured as breaking force: the lower the breaking force, the crisper the chip. Usaha Baru Ibu MSME chips are thicker and denser, which affects the hardness test results. Gouyo et al. (2021) argue that high pore density with predominantly small pores tends to produce more fracture events and acoustic peaks, which are key to crispness perception.

e) Descriptive test

This test was conducted to determine the level of crispness of the samples, which was assessed directly by the panellists. The descriptive test was conducted on 20 panellists with one crispness parameter. The samples presented to the panellists were jackfruit chips from several jackfruit chip agroindustry in Tambang District, Kampar Regency. The results of the descriptive test of jackfruit chips on the texture parameter are shown in Table 5.

Table 5. Results of the Descriptive Test of Jackfruit Chips

Sample	Results of the Descriptive Test
Sinar Hidayah	1.65
Usaha Baru Ibu	4.25
Restu	4.65

Note: descriptive scores: 1. Very not crispy, 2. Not crispy, 3. Fairly crispy, 4. Crispy, 5. Very crispy

Based on the table, it can be seen that the jackfruit chips produced have different levels of crispiness. The chips produced by MSME Usaha Baru Ibu are in the crispy category, while those from MSME Restu are in the very crispy category. The non-crispy jackfruit chips were obtained from the Sinar Hidayah SME. This is related to the moisture content in the jackfruit chips. One of the processes that affects texture is frying. This process is carried out to remove moisture from the jackfruit.

4. Conclusion

The results of identifying the processing and quality characteristics of better jackfruit chips were obtained by Restu MSME. The raw material used is ripe, high-quality jackfruit. Next, the jackfruit is cut and peeled. Then, the flesh is washed with water and drained. The jackfruit flesh is fried using a vacuum fryer at a temperature of 97˚C and a pressure of 75 cmHg for 3 hours. The oil is drained for ± 10 minutes and cooled. Jackfruit chips are packaged in aluminum foil and a continuous sealer with a weight of 100 g of jackfruit chips per package. The jackfruit chips in a moisture content of 5.32%, ash content of 2.13%, fat content of 11.14%, hardness test of 114.70 N/cm2, and a descriptive test of 4.65.

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