PAPER 3:
EFFECT OF MATURITY, FRUIT AND PULP LOCATION AND PULP SIZE AND THICKNESS ON THE QUALITY OF VACUUM-FRIED JACKFRUIT (*ARTOCARPUS HETEROPHYLUS*) PULP FROM EVIARC SWEET VARIETY

Roberta D. Lauzon[1], Lorina A. Galvez[1], Jennlyn F. Vinculado[1], Felix J. Amestoso[1] & Yan Diczbalis[2]

[1]Visayas State University, Visca, Baybay City, Leyte, Philippines
[2]Queensland Department of Agriculture Fisheries and Forestry, Australia

ABSTRACT

The study was undertaken to evaluate the effect of fruit development and conditions of the quality and acceptability of fresh and vacuum-fried jackfruit pulps from EVIARC Sweet jackfruit variety. Four maturity periods; 85, 88, 91, and 94 days after bagging of fruits were considered in the study. The effects of fruit location on the tree and pulp location in the fruit, as well as size and thickness of the pulps were the conditions evaluated. Physico-chemical properties such as pH, TTA, TSS, thickness, and pectin of fresh ripe pulp were evaluated while sensory attributes of vacuum-fried jackfruit pulps were determined. Color, aroma, texture, oiliness, and general acceptability of vacuum-fried jackfruit pulps were the attributes evaluated by semi-trained panelists. Consumer acceptability was determined by subjecting the product to consumer evaluation employing students, faculty, staff, housewives, and guests of the Visayas State University. Fruit maturity significantly affected the quality of vacuum-fried jackfruit pulps. Eighty-eight days after bagging is the ideal maturity of jackfruit for vacuum-fried pulp production. Fruit location on the tree and pulp location in the fruit had significant influences on pH, TSS, and TA. Fruit location on the tree, location of pulp in the fruit, and pulp size and thickness had no significant effects on the sensory attributes of the vacuum-fried jackfruit pulps; the products were acceptable among consumers.

Keywords: EVIARC Sweet, vacuum-fried jackfruit

INTRODUCTION

Jackfruit (Artocarpus heterophyllus, Lam.) is one of the most widely grown fruit crops in the Philippines (Coronel, 1983) and one of the most famous in the world owing to the largest tree-borne edible fruit that may weigh as much as 50 kg. It is known for its large edible bulbs of yellow, very sweet smelling, pineapple and banana-flavored flesh that enclose a smooth, oval, light-brown seed. Jackfruit is nutritious owing to its vitamins and minerals (Morton, 1987) as cited by Lauzon et al. (2013).

Green jackfruit is usually used as vegetables while ripe jackfruit is usually consumed as fresh fruits. Other regions used the ripe jackfruit bulb as an ingredient in native delicacies like guinataan, the filling of banana turon or banana roll, and as flavorant for ice cream and other frozen desserts.

The Visayas State University (VSU) through the Department of Food Science and Technology developed vacuum-fried jackfruit pulps from ripe bulbs of jackfruit, specifically the EVIARC Sweet variety. The product was highly acceptable among consumers of all ages and even among foreign guests of the university. The high acceptability of vacuum-fried jackfruit encouraged the Department of Food Science and Technology to commercialize the product. The current vacuum frying technology for jackfruit operated at the Visayas State University has shown great potential for the conversion of jackfruit pulps into a commercial product. Diamante (2007) pointed out that commercialization of vacuum-fried jackfruit provides a way

of adding real value to the crop and reinforces its promotion as a viable crop for farmers. The popularity and high demand for vacuum-fried jackfruit encourages a number of processors to adapt the vacuum frying technology. However, the current vacuum frying technology has some constraints yet to be addressed.

Uneven color, occasional browning, bland taste, less aromatic, and a less crispy texture in some fried pulps are some identified problems in the current vacuum-fried jackfruit technology which is believed to be influenced by fruit maturity. Pale color, bland taste, and absence of jackfruit aroma are noted in vacuum-fried pulps from underripe jackfruits while brownish yellow color and a less crunchy texture are perceived in vacuum-fried pulps from overripe fruits.

Standardization of fruit maturity and pulp quality are necessary in order to achieve and maintain product quality. This study was conducted to determine the effects of fruit maturity, fruit location on tree, location of pulp in fruit, and pulp size and thickness on the quality and acceptability of vacuum-fried jackfruit pulps.

METHODOLOGY

Procurement of Materials

The fruits were procured from the farm of *Magsasakang Siyentista* or Farmer Scientist from Mahaplag, Leyte. Arrangements were made with the *Magsasakang Siyentista* to provide dedicated jackfruit trees as source of fruits for the study. The freshly harvested jackfruit with identified maturity was carefully harvested from the farm and brought to the Department of Food Science and Technology for evaluation.

Physico-Chemical Properties

Moisture content, pH, titratable acidity (TTA), total soluble solids (TSS), and pectin content of jackfruit pulps from 88-, 91-, and 94-days-old fruits were analyzed following the method set by AOAC (1980).

Moisture Content (MC). Five grams of jackfruit pulp from different fruit maturity was separately weighed and placed into previously tared crucibles The crucibles were dried for 24 hours or until the weight of the sample became constant for 3 consecutive readings. The moisture content of the samples was computed following the formula below:

$$\% \text{ MC} = \frac{W1 - W2}{W1} \times 100$$

Where: W1 = initial weight; W2 = final weight of sample; 100 – constant figure

pH. Ten grams of homogenized sample was weighed and added with 10 mL distilled water and mixed well. The mixture was centrifuged and the supernatant was collected and used in the determination of pH of the sample. The evaluation was conducted three times and the average of three readings was used in reporting the data.

TTA. The TTA of the sample was determined employing the methods set by AOAC (1980). Five grams of finely crushed sample was diluted with 25 mL disltilled water and mixed well. Three to four drops of phenolphthalein indicator was added into the mixture and properly mixed. The mixture was titrated with 0.1N NaOH until a pale pink color appeared. The percent age of TTA (% ascorbic acid) was computed using the given formula.

Total Soluble Solids (TSS). The TSS of the sample was determined using a laboratory hand refractometer. A drop of the sample was placed on the prism of the instrument. The lid was closed and the instrument was directed towards a light source to get a clear sight of the reading. The TSS was calculated and computed based on the following formula:

$$\text{TSS} = \text{diluted factor (DF)} \times °\text{B}$$

$$\text{DF} = 1 + \frac{\text{volume of hundred (10 added (mL))}}{\text{Weight of sample (g)}}$$

Assume: 1 mL water = 1 g water

Pectin. Jackfruit pulps from fruits of different maturity was separately collected and placed in separate containers. One hundred grams of fruit pulp was chopped and separately placed into sauce pots. An equal amount of water was added and the mixture was boiled for 3 minutes. Fifteen milliliters of the extract was collected in a clean flask. Denatured alcohol (50 mL) was added into the flask and the mixture was slowly stirred with a glass rod and allowed to stand undisturbed to allow for the formation of pectin lumps. Pectin was collected by allowing the mixture to pass through a pre-weighed filter paper. It was then allowed to dry on the filter paper and re-weighed. The weight of pectin was determined by subtracting the weight of the filter paper and recorded as gram pectin per 100 g pulp.

Fruit Preparation and Evaluation

Effect of Fruit Maturity. Fifteen fruits of the same age were harvested from the trees dedicated for the project. The fruit age was 85 days after bagging as identified by the *Magsasakang Siyentista*. The fruits were grouped into four with 5 fruits per group. Each group was considered a treatment; T1 – 85 days, T2 – 88 days, T3 – 91 days, and T4 – 94 days. The fruits were allowed to ripen at ambient conditions.

The fruits of different maturity; 85, 88, 91, and 94 days were washed with diluted dishwashing solution, rinsed with tap water, and dipped into 10 ppm chlorinated water. The fruits were split opened and separately depulped and deseeded. The pulps from different fruit maturity were separately blanched, drained, packed, and frozen. The frozen pulps were vacuum-fried employing the vacuum frying schedule set by Diamante (2007). The vacuum-fried pulps were spun-dried to remove the excess frying oil, packed, sealed, and kept in closed containers ready for evaluation. The process of producing vacuum-fried jackfruit is presented in Figure 1.

The identified fruit maturity suitable for vacuum frying was the maturity of fruits used in the succeeding fruit quality evaluation.

Effects of Fruit Location on Tree. Nine fruits of the same maturity (88 days) were used in the study. Fruit selection was based on their location on the tree. Three fruits from the upper part, three from the middle portion, and three fruits from the lower part of the tree were selected. The fruit location namely upper, middle, and bottom parts were considered as treatments of the study. Upon harvest, the fruits were brought to the laboratory to ripen at room conditions. The pulps of ripe jackfruits were separately collected and processed into vacuum-fried jackfruit following the method of Diamante (2006) with modifications.

Effect of Pulp Location on Fruits. Five fruits of same maturity (85 days) were harvested and allowed to ripen at laboratory conditions. After three days of storage, the fruits were separately washed with a mild detergent, washed with potable water, sanitized in 10 ppm chlorinated water, and split opened. Pulps were separately collected from three fruit locations; the upper,

middle, and bottom portions of the fruit. The pulps were separately deseeded, blanched, and frozen ready for vacuum frying. The pulp locations in the fruit were considered treatments of the study.

Effect of Pulp Size. Fruits were washed with a mild dishwashing solution, rinsed with tap water, and dipped into 10 ppm chlorinated water. The clean fruits were split opened, depulped, and the fruit pulps were arbitrarily grouped into small, medium, and large. Twenty five pieces of fresh bulbs were collected from each size categories and separately placed into clean containers. The pulps were deseeded, blanched, drained, and allowed to cool before being packed, and frozen. The frozen pulps of different sizes were separately vacuum-fried, spin-dried, packed, and kept ready for evaluation.

Pulp Thickness. Fruit pulps from fruits with identified maturity were collected and deseeded. The pulps were split opened and seeds were removed. The fruit pulps were sorted and arbitrarily grouped as thin, thick, and thicker. The thickness was determined using a vernier caliper. The pulp with different thickness were separately blanched, drained, allowed to cool, and frozen. The frozen jackfruit pulps with different pulp thickness were separately vacuum-fried, spin-dried, packed, and kept ready for evaluation.

SENSORY EVALUATION

Sensory evaluation of the different treatments was carried out employing a laboratory test panel composed of thirty two fourth-year students, faculty, and staff of the Department of Food Science and Technology of the Visayas State University, Visca, Baybay City, Leyte, Philippines. Sensory evaluation was carried out using the method set by Mabesa (1986). Samples were randomly coded with three digit numbers and presented to the panelists and they were asked to evaluate the vacuum-fried jackfruit according to their color, aroma, taste, texture, oiliness, and general acceptability using quality scoring in combination with the 9-Point Hedonic scale.

CONSUMER EVALUATION

The samples with the highest mean acceptability rating based on the result of sensory evaluation were subjected to consumer acceptability evaluation employing one hundred consumers consisting of students, faculty, staff, and guests of the university. Consumers were individually given samples of the most acceptable vacuum-fried jackfruit pulps together with the control samples. They were asked to rate the product based on their own judgement. Each consumer was given a scorecard for them to write their answers. The percentage of consumers who liked or preferred the product was determined by dividing the total "like" responses by the total number of consumers who evaluated the product and the answer was multiplied by one hundred.

$$\% \text{ acceptability} = \frac{\text{No. of like of prefer answers}}{\text{Total no. of consumers who evaluated the product}} \times 100$$

RESULTS AND DISCUSSIONS

Physico-Chemical Properties

The physico-chemical properties of EVIARC Sweet jackfruit as influenced by fruit maturity is presented in Table 1. Results revealed that fruit maturity significantly influenced the physico-chemical properties of fresh jackfruit pulps.

Table 1. Physico-chemical properties of fresh jackfruit pulps as influenced by fruit maturity.

Maturity (Days)	Moisture Content** (%)	Pectin* (g)	pH*	TTA** (% AA)	TSS** (°Bx)
85	5.89 d	3.63 a	4.4 c	0.0596 d	16.93 d
88	6.62 c	2.67 b	4.9 b	0.1357 c	33.88 a
91	8.60 d	2.66 b	5.0 b	0.1603 b	30.33 b
94	12.82 a	2.62 c	5.3 a	0.2334 a	27.35 c

* - significant; ** - highly significant

Moisture Content. Pulps from fruit harvested 85 days after bagging had significantly lower moisture content at 5.89%. Increasing the fruit maturity to 88, 91, and 94 days increased the moisture content to 6.62%, 8.60%, and 12.82% respectively which were significantly different from each other. The significantly higher moisture content of pulps from the 94-days-old fruit can be attributed to some enzymatic activities that result in the conversion of pectin to free D-galacturonic acid, a water soluble compound which makes the overripe fruit watery (Raymundo, 1989). This finding can be supported by the result in pectin determination as shown in Table 2 wherein pulps from the 94-days-old fruit had significantly lower pectin content and higher moisture content.

Pectin Content. Fruit maturity had a significant effect on pectin content of the pulps. Pectin content was significantly higher in fruit pulps from 85-days-old fruit. As the maturity period increased to 88, 91, and 94 days, there was a significant decrease in pectin content from 3.63 g, 2.67 g, and 2.66 g, respectively and a significantly lower pectin content of 2.62 g in fruit pulps from the 94-days-old fruit. Pectin content was indirectly proportional to the fruit maturity period and moisture content of the pulps. The significant decrease in pectin content of pulps from the 94-days-old fruit was due to the action of enzymes on pectin that resulted in The production of soluble pectic substances. As pointed out by Meyer (1971) soluble pectic substances in some fruits increases as it passes the ripening stage..

pH. The pH value of jackfruit pulps was significantly influenced by maturity. Our results have shown that as fruit maturity increased from 85 days to 88, 91, and 94 days; pH values of the pulps significantly increased from 4.6 to 4.9, 5.0, and 5.3, making the pulps slightly acidic.

TSS. The total soluble solids of jackfruit pulps from 85 days of maturity had the lowest TSS value of 16.93°Bx. Increasing the fruit maturity to 88 days resulted in a significantly higher TSS of 33.88°Bx. Increasing it further to 91 and 94 days resulted in significantly lower TSS values of 30.3°Bx and 27.35°Bx, respectively. It is possible that upon maturity, sugar in the fruit pulp was converted into fruit acid as exhibited by the increasing value of titratable acidity (Table 1). Of the fruit maturity evaluated, pulps from the 88-days-old fruit had a significantly higher TSS value of 33.88°Bx, significantly higher than its counterpart.

TTA. The TTA of 85-days-old pulps was 0.0596%, significantly lower than its counterparts. Increasing the maturity period to 88 days significantly increased the TTA of fresh pulps to 0.1357%. A significant increase in TTA was noted as maturity periods increased to 91 and 94 days. TTA of pulps from 94-days-old fruit was 0.2334%, significantly higher than the TTA of all samples evaluated (Table 1).

Effect of Maturity on Sensory Attributes

Quality Description. The description of quality attributes of vacuum-fried jackfruit from EVIARC Sweet variety as influenced by fruit maturity is presented in Table 2. The color of

vacuum-fried pulps from 85- and 88-days-old fruits was described as "light yellow" to "dark yellow". Increasing the maturity period to 91 and 94 days resulted in a "golden yellow" to "brownish yellow" color. The darkening in color of vacuum-fried pulps from 91- and 94-days-old fruits can be attributed to the increase of sugar in the pulps as shown in Table 2; sugar caramelizes upon frying of the pulps. The more sugar caramelized, the darker the color of the product. As observed, sugar leached out from the fruit upon frying and the caramelized sugar adhered to the surface of the fried pulps, resulting in the browning of the product. The aroma of vacuum-fried pulps from 85-days-old fruit was described as "slightly perceptible jackfruit aroma", while a "very perceptible jackfruit aroma" was perceived in fruits processed from 88-, 91-, and 94-days-old fruits. For taste, a "slightly sweet taste" was noted in products from 85-days-old fruit. Increasing the fruit maturity to 88, 91, and 94 days resulted in a "moderately sweet" to "very sweet taste" of the vacuum-fried pulps. Ripening of fruits increased the sugar content which contributed to the sweetness of the fruit. The texture of vacuum-fried jackfruit was perceived as "very crispy" regardless of fruit maturity. The oiliness of vacuum-fried pulps was influenced by fruit maturity. Vacuum-fried pulps from 85-days-old fruit was perceived as "not oily". However, the oiliness description of vacuum-fried pulps from 88-, 91-, and 94-days-old fruits ranged from "not oily" to "slightly oily".

Table 2. Quality description of vacuum-fried pulps from AES1 variety as influenced by fruit maturity.

Treatment	Days	Color	Aroma	Taste	Texture	Oiliness
1	85	Light yellow to dark yellow	Slightly perceptible jackfruit aroma	Slightly sweet	Very crispy	Not oily
2	88	Light yellow to dark yellow	Very perceptible jackfruit aroma	Moderately sweet	Very crispy	Not oily to slightly oily
3	91	Golden yellow to brownish yellow	Very perceptible jackfruit aroma	Moderately sweet	Very crispy	Not oily to slightly oily
4	94	Golden yellow to brownish yellow	Very perceptible jackfruit aroma	Moderately sweet	Very crispy	Not oily to slightly oily

General Acceptability. The mean general acceptability ratings of vacuum-fried jackfruit pulps as influenced by fruit maturity are tabulated in Table 3.

Table 3. Mean[1] acceptability ratings[2] of the sensory attributes of vacuum-fried jackfruit from pulp of AES 1 variety as influenced by fruit maturity.

Treatment	Days	Color**	Aroma**	Taste**	Texture^{ns}	Oiliness**	Gen. Acc.**
1	85	8.08a	7.00c	6.39c	7.80	7.44a	7.27b
2	88	7.77b	8.05a	8.14a	7.85	7.06b	8.11a
3	91	5.94c	7.52b	7.83b	7.47	6.66c	7.21b
4	94	4.91d	6.71d	6.82c	7.38	6.14d	6.16c

[1]N = 24 * - significant ** - highly significant ns – not significant

[2]Range of scores:

9 – like extremely
8 – like very much
7 – like moderately
6 – like slightly
5 – neither like nor dislike
4 – dislike slightly
3 – dislike moderately
2 – dislike very much
1 – dislike extremely

Results showed that fruit maturity significantly influenced product acceptability. The color of vacuum-fried pulps from 85-days-old fruit had significantly higher mean acceptability rating of 8.05, equivalent to "like very much". This was significantly higher than vacuum-fried pulps from

the fruit that was left to mature for 88 days with a mean rating of 7.77 which corresponded to "like moderately" and significantly higher than the 91- and 94-days-old fruits with mean acceptability ratings of 5.94 and 4.91; leaning towards "like slightly" and "neither like nor dislike" category of the 9-point Hedonic scale.

For aroma, vacuum-fried pulps from 88-days-old fruit had an average mean of 8.05 equivalent to "like very much" , a significantly higher value than pulps from 85- and 91-days-old fruits with mean acceptability ratings of 7.00 and 7.52, respectively; under the "like moderately" category of the 9-point Hedonic scale. The same observation was noted in taste attributes wherein vacuum-fried pulps from 88-days-old fruit had a mean rating of 8.14 corresponding to "like very much" and significantly higher than vacuum-fried pulps from 91-days-old fruit whose mean rating was 7.83 equivalent to "like moderately" category of the scale. Of the treatments evaluated, vacuum-fried pulps from 88- and 94-days-old fruits had significantly low mean acceptability ratings of 6.39 and 6.82, which corresponded to "like slightly" category of the scale. Fruit maturity had no significant influence on textural quality of the vacuum-fried pulps. Regardless of fruit maturity, the product had a mean acceptability rating ranging from 7.38 to 7.80 and did not differ significantly from each other. Oiliness in vacuum-fried pulps was significantly affected by fruit maturity. Vacuum-fried pulps from 85-days-old fruit had the highest mean acceptability rating for oiliness which was at 7.44 and fell between "like moderately" to "like very much". This was significantly higher than vacuum-fried pulps from 88-, 91-, and 94-days-old fruits with mean acceptability ratings of 7.06, 6.66, and 6.14, respectively. For general acceptability, vacuum-fried pulps from 88-days-old fruit had the highest mean acceptability rating of 8.11 corresponding to "like very much" and considered the suitable maturity age of EVIARC Sweet jackfruit for vacuum-fried pulp production. The highest acceptability rating of vacuum-fried pulps from 88-days-old fruit can be attributed to the sweet taste and perceptible jackfruit aroma of the product which was influenced by the high TSS and TTA of the pulps (Table 4).

Table 4. Consumers* acceptability towards vacuum-fried pulp from 88-days-old fruit compared with the existing product.

Sample	Consumers Response			
	Like	Dislike	No Comment	Total
Sample A	99	-	1	100
Sample B	92	2	6	100

* Students, faculty and staff of VSU, guests of the university

Consumer Evaluation. The result on consumer evaluation is presented in Table 4. It was revealed that vacuum-fried pulps from 88-days-old fruit were acceptable among 99% of the consumers, higher than the existing vacuum-fried products with a consumer acceptability of 92%. The high consumer acceptability of vacuum-fried jackfruit from 88-days-old fruit pulps was due to its attractive uniform color, sweeter taste, distinct jackfruit aroma, and thicker pulps. Non-uniformity in color was observed in sample B.

Influence of Fruit Location on the Quality of Jackfruit Pulps

Physico-Chemical Properties. Location of fruit on the tree had significant effects on pH, TSS, and TA of jackfruit pulps but not on pulp thickness. Pulps from the fruit located at the lower part of the tree had a pH value of 4.80, significantly higher than the pulps from fruits located from the top and middle portion of the tree with pH values of 3.92 and 4.11, respectively. Fruit obtained from the top of the tree had a significantly higher TSS value of 31.0°Bx, higher than the TSS of pulps from fruits located at the middle and bottom portion of the tree with TSS values of 26.4 and 27.0, respectively; and the values were not significantly different. For TTA,

pulps from fruit taken from top part of the tree had a TTA value of 0.57% which was significantly higher than the TTA of pulps from the fruit located at the middle part of the tree with a TTA value of 0.44%. Pulps from fruit located at the lower part of the tree had significantly lower TTA of 0.26%. In terms of pulp thickness, the fruit's location on the tree had no significant effect on the thickness of the pulps. Regardless of the fruit's location, pulps from the top, middle, and bottom had a thickness of 3.12 mm, 3.02 mm, and 3.40 mm, respectively (Table 5).

Table 5. Physico-chemical properties of pulps as influenced by the fruit's location on the tree.

Pulp Location	pH*	TSS* (°Bx)	TTA* (%)	Thickness^{ns} (mm)
Upper	3.92 b	31.0 a	0.57 a	3.12
Middle	4.11 b	26.4 b	0.44 b	3.02
Lower	4.80 a	27.0 b	0.26 c	3.40

Sensory Quality of Vacuum-Fried Pulps. Results from the sensory evaluation of vacuum-fried jackfruit pulps as influenced by the location of fruit on the tree are summarized in Table 6. The fruit's location on the tree did not significantly affect the sensory attributes of the vacuum-fried pulps. The mean acceptability ratings of the product ranged from 7.10–7.90 and fell within the "like moderately" category of the 9-point Hedonic scale. Results implied that regardless of the location of the fruit on the tree where the pulps were taken, the vacuum-fried pulps were acceptable.

Table 6. Mean[1] acceptability ratings[2] of vacuum-fried jackfruit pulp as influenced by the location of fruit on tree.

Fruit location	Sensory Attributes^{ns}						
	Days	Color**	Aroma**	Taste**	Texture^{ns}	Oiliness**	Gen. Acc.**
Top	7.20	7.13	7.90 a	7.10	7.50	7.8	7.27
Middle	7.18	7.10	7.67 b	7.13	7.54	7.7	8.11
Lower	7.10	7.11	7.60 b	7.09	7.50	7.7	7.21

[1]N = 24
[2]Range of scores:
9 – like extremely
8 – like very much
7 – like moderately
6 – like slightly
5 – neither like nor dislike
4 – dislike slightly
3 – dislike moderately
2 – dislike very much
1 – dislike extremely

Consumer Acceptability. Results from the consumer evaluation are presented in Table 7. Out of 100 consumers who evaluated the product, 97% liked sample A; 96% for sample B; 93% for sample C; and 90% for the control sample. These results implied that the vacuum-fried jackfruit, regardless of the location of the fruit on the tree was acceptable among consumers.

Table 7. Consumers[1] acceptability toward vacuum-fried pulp from fruit located at the top, middle and lower portion of the tree.

Sample	Consumers Response		
	Like	Dislike	No Comment
A (Top)	97	-	3
B (Middle)	96	-	4
C (Lower)	93	-	7
D (control)	90	-	10
[1]N = 100 consumers student, faculty, staff, and employee			

Effect of Pulp Location in Fruit. The location of the pulp in the fruit had significant influences on the pH, TSS, and pulp thickness but not on TSS of the pulp. The pH value of pulps located at the upper part of the fruit was 4.22 and significantly lower than the pH value of pulps located at the middle and bottom portion of the fruits which were 4.47 and 4.45 respectively, and were not significantly different. In terms of TSS, pulps from the bottom part of the fruit had the highest TSS value of 26.98°Bx which was significantly higher than the TSS value of pulps taken from the middle and upper parts of the fruit with TSS values of 24.63 and 24.41°Bx, respectively; significantly lower than the TSS values of pulps from the bottom of the fruit. For pulp thickness, pulps from the middle part of the fruit had an average thickness of 5.30 mm which was significantly higher than pulps from upper and lower parts of the tree with thickness values of 3.62 mm and 3.56 mm; and were not significantly different.

Table 8. pH, TSS, TTA and thickness of pulp as influenced by their locations in fruit.

Pulp Location	pH*	TSS* (°Bx)	TTA (%)	Thickness* (mm)
Upper	4.22 b	24.41 b	0.68	3.02 b
Middle	4.47 a	24.03 b	0.56	4.00 a
Lower	4.45 a	26.95 a	0.65	3.56 b

Sensory Evaluation. Results in sensory evaluation of vacuum-fried jackfruit pulps as influenced by location of pulps in the fruit are presented in Table 9. Results showed that pulp location in the fruit had no significant influence in all sensory attributes evaluated except on taste. In terms of taste, pulps from the upper part of the fruit had a mean acceptability rating of 7.81, closer to "like very much" and significantly higher than samples from middle and lower parts of the fruit with mean acceptability ratings of 7.35 and 7.0; which were not significantly different and fell under the "like moderately" category of the 9-point Hedonic scale. The high mean acceptability rating of pulps from the top portion of the fruit can be attributed to the high TSS value of the pulps which contributed to the sweetness of the product.

Table 9. Mean[1] acceptability ratings[2] of vacuum-fried pulp as influenced by the location of pulp in the fruit

Fruit location	Sensory Attributes[ns]					
	Color[ns]	Aroma[ns]	Taste*	Texture[ns]	Oiliness[ns]	Gen. Acceptability[ns]
Upper (top)	7.30	7.50	7.81 a	7.15	7.57	7.60
Middle	7.28	7.19	7.35 b	7.14	7.60	7.61
Bottom (lower)	7.25	7.17	7.00 c	7.10	7.55	7.61

[1]N = 24
[2]Range of scores:
9 – like extremely
8 – like very much
7 – like moderately
6 – like slightly
5 – neither like nor dislike
4 – dislike slightly
3 – dislike moderately
2 – dislike very much
1 – dislike extremely

Consumer Evaluation. Results from the consumer evaluation ratings revealed that the location of the pulp in the fruit had no influence on consumer acceptability towards the product. All samples evaluated regardless of their location in the fruit had high consumer acceptability ratings. Sample A received 97% consumer acceptability; sample B, 98%; sample C, 98%; and the control sample received 90%. These results implied that regardless of pulp location, the

product was acceptable among consumers.

Table 10. Consumer[1] acceptability towards vacuum-fried pulp taken from different locations in the fruit.

Sample	Consumers Response		
	Like	Dislike	No Comment
A (upper/top)	97	-	3
B (middle)	98	-	2
C (bottom/lower)	98	-	2
D control	96	-	4
[1]N = 100 consumer composed of students, staff, and faculty of VSU.			

Effect of Pulp Thickness

Quality Description. Quality description of the sensory attributes of vacuum-fried jackfruit as influenced by pulp thickness is presented in Table 11. In terms of color, "brownish yellow" color was perceived in vacuum-fried pulps from thin and thicker pulps, and "golden yellow to brownish yellow" color was noted in vacuum-fried products from thick pulps. For aroma, regardless of the thickness, the products were perceived to have "perceptible jackfruit aroma". For taste, a "sweet taste" was perceived in products from thin and thicker pulps while moderately sweet taste was described in products from the thick pulps. For texture, a "very crispy" texture was perceived in vacuum-fried products from thin and thick pulps, and "crispy texture" was perceived in thicker pulps. Thick pulps were described as "moderately oily" while thin and thicker pulps were perceived as slightly oily.

Table 11. Quality description of vacuum-fried jackfruit as influenced by the thickness of pulp used.

Pulp Thickness	Sensory Attributes				
	Color	Aroma	Taste	Texture	Oiliness
Thin	Brownish yellow	Perceptible jackfruit aroma	Sweet	Very crispy	Slightly oily
Thick	Golden yellow to brownish yellow	Perceptible jackfruit aroma	Moderately sweet	Crispy to very crispy	Moderately oily
Thicker	Brownish yellow	Perceptible jackfruit aroma	Sweet	Crispy	Slightly oily

General Acceptability. Table 12 summarizes the mean acceptability ratings of the sensory attributes of vacuum-fried jackfruit as affected by pulp thickness. Results revealed that pulp thickness did not significantly influence the mean acceptability ratings of the sensory attributes of the products. Regardless of the pulp thickness, the vacuum-fried products had a mean acceptability rating that corresponded to "like moderately". Although the mean acceptability rating for texture attributes of vacuum-fried products from thin pulps was significantly higher than thick and thicker pulps, their ratings did not significantly differ from each other.

Table 12. Mean[1] acceptability ratings[2] of the sensory attributes of vacuum-fried jackfruit as influenced by pulp thickness.

Thickness	Sensory Attributes[ns]					
	Color[ns]	Aroma[ns]	Taste[ns]	Texture[ns]	Oiliness[ns]	Gen. Acc.**
Thin	7.40	7.38	7.50	7.47	7.78	7.27 b
Thick	7.38	7.58	7.68	7.38	7.75	8.11 a
Thicker	7.63	7.63	7.63	7.45	7.35	7.21 b

[1]N = 32
[2]Range of scores:
9 – like extremely
8 – like very much
7 – like moderately
6 – like slightly
5 – neither like nor dislike
4 – dislike slightly
3 – dislike moderately
2 – dislike very much
1 – dislike extremely

Consumer Acceptability

Consumer acceptability towards vacuum-fried jackfruit as influenced by pulp thickness is presented in Table 13. Of the 100 consumers, 90% liked the vacuum-fried jackfruit from thin pulps, 93% liked the thick pulps, 96% liked the thicker pulps, and 92% liked the control products. The common comment on their likings preference toward the products is was the unique taste and crunchiness of the products. Those who did not give comment said that they cannot detect any differences between the sample and the rest of the samples evaluated.

Table 13. Consumer[1] acceptability towards vacuum-fried jackfruit as influenced by pulp thickness.

Samples	Consumer Response (%)		
	Like	Dislike	No Comment
Thin (A)	90	-	10
Thick (B)	93	-	7
Thicker (C)	96	-	4
Control (D)	92	-	8

[1]N = 100 respondents composed of students, faculty, staff and guests of VSU.

Pulp Size

Quality Description. The quality description of the sensory attributes of vacuum-fried jackfruit as influenced by pulp size is presented in Table 14. In terms of color, "golden yellow" to "brownish yellow" was discerned in vacuum-fried pulps from small bulbs, "brownish yellow" was noted in medium pulps, while "golden yellow" was used to describe the color of vacuum-fried pulps from large bulbs. For aroma, a "perceptible jackfruit aroma" was perceived in vacuum-fried pulps regardless of the size of pulp used. The same observation was noted in terms of taste and oiliness wherein "sweet taste" and "slightly oily" was perceived in the product regardless of the pulp size used. For texture, a "crispy" description was given to products from small bulbs while "very crispy texture" was perceived in medium and large jackfruit pulps. For oiliness, results showed that regardless of pulp size, the products were perceived as "slightly oily".

Table 14. Quality description of the sensory attributes of vacuum-fried pulp as influenced by fruit pulp size.

Pulp Size	Sensory Attributes				
	Color	Aroma	Taste	Texture	Gen. Acc.
Small	Brownish yellow to brownish	Perceptible jackfruit aroma	Sweet	Crispy	Slightly oily
Medium	Brownish yellow	Perceptible jackfruit aroma	Sweet	Very crispy	Slightly oily
Large	Golden yellow	Perceptible jackfruit aroma	Bland	Crispy	Slightly oily

General Acceptability. Table 15 summarizes the sensory attributes evaluated; only taste was significantly affected by pulp size. Of the sizes evaluated, small- and medium-sized pulps had mean acceptability ratings of 7.67 and 7.50, respectively corresponding to "like moderately" and did not significantly differ from each other. Large-sized pulps had a mean acceptability rating of 6.60, equivalent to "like moderately" and was significantly lower than small- and medium-sized pulps. The mean acceptability ratings of other attributes like color, aroma, texture, and general acceptability were not significantly influenced by the pulp size used.

Table 15. Mean[1] acceptability ratings[2] of the sensory attributes of vacuum-fried jackfruit as influenced by pulp size.

Pulp Size	Sensory Attributes^{ns}					
	Color^{ns}	Aroma^{ns}	Taste**	Texture^{ns}	Oiliness^{ns}	Gen. Acc^{ns}
Small	7.40	7.73	7.67 a	7.77	7.57	7.57
Medium	7.28	7.68	7.50 a	7.87	7.67	7.55
Large	7.78	7.58	6.60 b	7.80	7.65	7.17

[1]N = 32 ns – not significant ** - highly significant at p<0.005.

[2]Range of scores:

9 – like extremely
8 – like very much
7 – like moderately
6 – like slightly
5 – neither like nor dislike
4 – dislike slightly
3 – dislike moderately
2 – dislike very much
1 – dislike extremely

Consumer Acceptability

Table 16 present the results in consumer evaluation of vacuum-fried jackfruit as influenced by pulp size. Of the 100 consumer panelists, 98% signified a preference on vacuum-fried products from small fruit pulps, 95% preferred the medium-sized pulps, and 92% preferred the large-sized pulps, while 89% preferred the control. Comments of their preference towards the vacuum-fried products from 88-days-old pulp were the attractive color and dominant jackfruit taste.

Table 16. Consumers[1] acceptability towards vacuum-fried jackfruit pulp as influenced by pulp size.

Samples	Consumer Response (%)		
	Like	Dislike	No Comment
Small	98	-	2
Medium	95	-	5
Large	92	-	8
Control	89	-	11

[1]N = 100 respondents composed of students, faculty, staff and guests of VSU.

CONCLUSION

Fruit maturity has significant influences on the sensory qualities of vacuum-fried jackfruit pulps. Vacuum-fried pulps from 91-days-old fruit has a golden yellow color, perceptible jackfruit aroma, moderately sweet taste, and moderately oily. Maturity is critical in the production of vacuum-fried jackfruit. A period of 88 days after fruit bagging is the ideal fruit maturity period and the product was acceptable among 98% of consumers, higher than its counterpart.

Fruit location influenced the values of pH, TSS, and TTA but not on pulp thickness. It had no significant effect on the mean acceptability ratings of the vacuum-fried pulps as all the samples were highly acceptable among consumers. Fruit location had significant effects on pH, TSS, and thickness of the pulp but not on the percentage of TTA of the pulp. Fruit location had no significant influence on the mean acceptability ratings of the sensory attributes of the vacuum-fried pulps. Regardless of the pulp's location, the vacuum-fried pulps were acceptable among consumers. Pulp size and thickness had no significance influences on the sensory attributes of the product. Regardless of size and thickness of the pulps, the product was acceptable. Vacuum-fried jackfruit was acceptable among consumers regardless of size and thickness of the pulps used.

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