

Effect of Minimal Processing on Physicochemical Properties of Pineapple Variety Mauritius (*Ananas cosmosus*)

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Abstract

Pineapple is considered as one of the most wanted fruit crop grown in the tropical and subtropical areas. Many varieties of pineapple are cultivated in the world. Mauritius variety is one of the important fruit crops of pineapple. The Vazhakkulam area in Ernakulam district of Kerala state has more concentrated in pineapple cultivation. The present study aimed to determine the physical properties of Vazhakkulam pineapple (Mauritius grade) before and after minimal processing. The present study revealed that the fresh pineapple comprises of TSS (12.2° Brix), acidity (0.64%), firmness (12 Kg/cm²), sweetness index (19.06), ascorbic acid (48.48 mg), reducing sugar (4.014%), total sugar (26.26%), non-reducing sugar (21.13%) and the fresh fruit was acidic. The total weight of fruit was 702 g and the percentage recovery of edible fruit was 62.5%. Physio-chemical properties of the fruit were changed based on the minimal processing method used.

Keywords: Mauritius Variety, Minimal Processing, Physio-chemical Properties, Pineapple

1. Introduction

India is the sixth largest producer of pineapple in the world with a share of about 7.4% in production of pineapple. Pineapple is the third most important tropical fruit crop, after bananas and mangoes. Pineapple is widely grown in Asia (Thailand, Philippines, Malaysia, China and India), South Central America (Brazil, Costa Rica). The pineapple fruits are normally consumed fresh or as fresh pineapple juice and in processed forms like canned pineapple slices, pineapple jam, pineapple candy, pineapple beverages etc.

To increase the shelf life of fruits or any product they can be preserved through processing. Minimal processing is one of the short term preservation technique. It increases the shelf life of the product. Minimally processed products

are more convenient and these products also retain their nutritional quality. Minimally processed fruits and vegetables are prepared and handled to maintain their fresh nature while providing 'ready-to-eat' convenience to the user.

Gonzalez-Aguilar *et al.*, (2005)¹, states that, "minimal processing is becoming increasingly popular amongst consumers due to the retention of the nutritional quality and sensory characteristics namely appearance, texture and flavour, as a result of reduced dependence on chemicals and heat treatments. The minimal processing aims to make the food chemically as well as microbiologically safe. Minimally processed sample also maintain the nutritive value".

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Kerala produces four lakh tonnes of Vazhakkulam pineapple (Mauritius grade) in around 40,000 acres. Even though majority of the produce goes into the fresh fruit segment in the domestic market, it is also greatly needed for making processed and shelf-life extended products. Minimal processing is one of the short term preservation technique commonly used for extending the shelf life of fruits. The reduction of microbial load is expected in MP products.

Minimally processed fruit may have longer shelf life than whole fruit because different pre-treatment methods that are taking place. Therefore it is imperative to study whether the minimally processed products can maintain their physio-chemical properties. Therefore the present study was undertaken with the following objectives to determine the physical properties and edible portion size of fresh sample of Vazhakkulam pineapple (Mauritius grade), to analyse the physio-chemical properties and to ascertain the physio-chemical composition of pineapple variety Mauritius after minimal processing.

2. Materials and Methods

'Mauritius' variety of pineapple with yellowish orange coloration was chosen for this study. Pineapple is one of the leading commercial fruit of the tropical countries around the world. Vazhakulam pineapple locally known as 'kannara' is a Mauritius variety coming under the species *Ananas cosmosus*. It comes under the family Bromeliaceae and the order of Polales. It is one of the most commonly grown cultivars in Kerala.

2.1 Assessment of the Physical Properties of Pineapple

The quality of fruits varies to a large extent due to difference in their taste, flavour, colour, aroma and size. At the time of purchasing of fruits, the consumer consider the external appearance such as freedom from external damage along with good weight, colour and consistency (Ngereza and Pawelzik, 2016)². The fruit weight, overall length, circumference, shape and peel colour were the important physical characteristics in fresh pineapple. These characters were analyzed in the laboratory after procurement.

2.2 Determination of Edible Portion of Mauritius Pineapple

To determine the edible portion of pineapple, the whole fruit was weighed and then removed the crown, peel and inner core and weigh the edible portion was separated. Weighed the peel, crown and inner core separately to find the individual weight and also taken the weight of the edible portion. Percentage weight of the edible portion was also determined.

2.3 Minimal Processing of Pineapple

Minimal processing is one of the preservation techniques of fruits and vegetables. The minimal processing technology involves cleaning, washing, trimming, coring, slicing and shredding of fruits, sanitization, rinsing, chemical treatment, drying, packaging, refrigeration and package.

2.3.1 Preparation of the Pineapple Sample for Minimal Processing

Mauritius which is the most common grade and 60% ripe pineapples were chosen for this study. Fruit were selected according to size and skin colour (yellowish to orange coloration).

The fruits were washed with water and disinfected with a 2% sodium hypochlorite solution (2 ml of sodium hypochlorite 1 L of water). After sanitation followed by washing with soap water and twice in running tap water to remove chlorine content in fruit surface. Fruit were washed and disinfected.

The whole fruit was weighed then the crown was removed from the fruit apical region. Fruit was then manually peeled and sliced. It was then cut into pieces using sharp stainless steel knife under aseptic condition. The slices were cut at approximately 1 cm thickness and their cores were removed.

2.3.2 Minimal Processing Methods

The slices were separately dipped into treatment solution i.e., distilled water (T0 – control experiment) for 3 minutes, Hot water immersion treatment at 65°C for 3 minutes (T1), Hot water immersion treatment at 100°C for 1 minutes (T2), dipped in Citric acid 1% + Ascorbic

Table 1. Different minimal processing methods

Treatment code	Minimal processing methods
T0	Control sample - Dipped in water for 3 minutes
T1	Hot water immersion treatment - 65°C for 3 minutes
T2	Hot water immersion treatment - 100°C for 1 minutes
T3	Dip in Citric acid 1% + Ascorbic acid 1% for 3 minutes
T4	Dip in CaCl ₂ (<0.5%) for 3minutes
T5	Dip in 2.5% Calcium lactate for 3 minutes
T6	Microwave exposure for 1 minute
T7	Dip in Honey (60° Brix) for 4 hours

acid 1% for 3 minutes (T3), dipped in <0.5% CaCl₂ for 3 minutes (T4), 2.5% Calcium lactate for 3 minutes (T5), Microwave exposure for 1 minutes (T6) and dipped in Honey (60° Brix) for 4 hours (T7) (Table 1).

The treated samples were drained with muslin cloth and each treatment was packed in separate PET bottles. All packed bottles were placed on trays and stored in a cold room at 4°C. The packs from each treatment were selected and were evaluated for quality changes.

2.4 Physio-chemical Composition of Samples

All the main physio-chemical attributes that can indicate quality changes in minimally processed pineapple: Such as firmness, sweetness index, acidity, ascorbic acid, total soluble solids, pH, reducing sugar, non-reducing sugar and total sugar were determined. Chemical composition of the samples was analyzed using standard AOAC procedures. The TSS of a given fruit sample was determined with the help of the refractometer, acidity by pH meter and the firmness of the fruit was measured by penetrometer. The sweetness index was calculated as (SI) = Total soluble solid (TSS)/Acidity³.

2.5 Data Analysis and Interpretation

Collected data was tabulated and percentage analysis was applied for better understanding.

3. Results and Discussion

3.1 Physical Properties of Fresh Pineapple

Physical properties of fresh pineapple (Mauritius) assessed for are presented in Table 2

Table 2. Physical properties of fresh pineapple (Mauritius)

Physical properties	Values
Total fruit weight	702 g
Fruit weight (without crown)	609 g
Overall length	32 cm
Fruit length	13.5 cm
Crown length	17.8 cm
Circumference	29.7 cm
Shape	Conical
Peel colour	Yellowish orange

The fresh pineapple (Mauritius) fruit was tapering slightly from the near base and the total weight was 702 g. After removing the crown, the weight was 609 g. The overall length of fruit including crown was 32 cm. After removing the crown, the fruit length was 13.5 cm and the crown length was 17.8 cm. The circumference of the fruit before peeling was 29.7 cm. The fresh pineapple (Mauritius) fruit was conical in shape. And the peel was yellowish orange in colour.

3.2. Edible Portion Percentage of Fresh Pineapple (Mauritius)

Total weight of the fresh pineapple (Mauritius) was weighed and then removed the crown, peel and inner core. Weight of the edible portion was taken separately.

The percentage recovery of edible fruit portion is shown in Table 3.

The whole fruit weight was found to be 702 g (100%). The crown weight was 73 g (10.4%) and peels weight was 121 g (17.2%) and the inner core constituted 69 g (9.8%). The percentage recovery of edible fruit was calculated as 439 g (62.5%).

3.3 Physio-chemical Properties of Fresh Pineapple

Physio-chemical properties of pineapple (Mauritius) were analysed by quantitative method for determining the chemical characters and presented in Table 4. Sweetness index and firmness of the fruit was also determined in fresh and minimally processed samples.

Table 3. Edible portion percentage of fresh pineapple (Mauritius)

Portions	Weight	Percentage (%)
Total fruit weight	702 g	100
Crown weight	73 g	10.4
Peel weight	121 g	17.2
Core weight	69 g	9.8
Edible portion percentage	439 g	62.5

Table 4. Physio-chemical properties of fresh pineapple

Chemical characters	Values/100g
Acidity (%)	0.64
Sweetness index	19.06
Ascorbic acid (mg)	48.48
Total soluble solid (TSS) ($^{\circ}$ Brix)	12.2
Reducing sugar (%)	4.014
Total sugar (%)	26.26
Non- reducing sugar (%)	21.13
Firmness Kg/cm ²	12.0
pH	3.58

Table 5. Physio-chemical properties of the minimally processed pineapple

Particulars	T0	T1	T2	T3	T4	T5	T6	T7
Acidity (%)	0.23	0.32	0.23	0.38	0.24	0.33	0.29	0.32
Sweetness index	20.04	38.13	43.47	32.63	53.33	36.66	48.27	83.75
Total soluble solid (TSS) (^o Brix)	12.2	12.2	10.0	12.4	12.8	12.1	14	26.8
Ascorbic acid (mg)	44.4	18.18	42.42	46.4	45.9	38.2	42.36	38.38
Reducing sugar (%)	3.89	3.19	2.71	3.75	4.07	4.52	2.93	10.31
Total sugar (%)	17.60	17.21	15	16	16.6	19.53	18.68	28.62
Non-reducing sugar (%)	13.02	13.31	11.67	11.63	11.9	14.25	14.96	17.39
Firmness Kg/cm ²	9.73	9.45	6.36	12.35	11.31	7.56	11.41	7.5
pH	3.74	3.59	3.63	3.41	3.52	3.67	3.69	3.7

*T0 – Control = sample-Dipped in water for 3 minutes; T1 = Hot water immersion treatment - 65°C for 3 minutes; T2 = Hot water immersion treatment - 100°C for 1 minutes; T3 = Dip in citric acid 1% + ascorbic acid 1% - 3 minutes; T4 = Dip in CaCl₂ (<0.5%) for 3 minutes; T5 = Dip in 2.5% Calcium lactate for 3 minutes; T6 = Microwave for 1 minutes; T7 = Dip in honey (60° Brix) for 4 hours.

Fresh Mauritius variety pineapple sample had 0.64% acidity, 48.48 mg of ascorbic acid, 12.2° Brix of total soluble solids, 26.26% of total sugar, 21.13% of non-reducing sugar and 4.014% of reducing sugar. The fresh pineapple fruits were acidic in nature and pH was 3.58. Sweetness index of the sample was found to be 19.06. Firmness of the fruit was 12.0 Kg/cm².

Ali *et al.*, (2015)⁴ has reported that the sweetness index of pineapple varieties of Honey queen, Giant Kew (G.K), Asshini and Ghorashal pineapple was 28.2, 18.24, 18.29 and 31.50 respectively.

In minimally processed samples, the acidity has been found to be maximum in T3 sample (citric acid 1% + ascorbic acid 1% - 3minutes). Sweetness index varied in different treatments. Dip in honey (T7) had the maximum index (83.75). Increased level of Total Soluble solids was found in treatment T7. Ascorbic acid content of the minimally processed samples ranged from 18.18 mg to 46.4 mg. Ascorbic acid is the vitamin that usually degrades most rapidly.

The above result shows that the reducing sugar, total sugar and non-reducing sugar have been found to be high in T7 i.e. 10.3%, 28.62% and 17.39 respectively. A study

conducted by Eman *et al.*, (2015)⁵ recorded that, “the total soluble solids content was increased in fresh-cut guava treated with honey throughout cold storage”.

Firmness of the fruit found to vary according to the treatments given ranging from 7.5 to 12.35 Kg/cm² (Table 5).

There was not much variation found in the pH of minimally processed samples of different treatments.

4. Conclusion

Medium sized fresh pineapple (Mauritius) fruit weighed 702 g of which 439 g was edible (62.5%) and had 48.48 mg of ascorbic acid per 100 g. Sweetness index was moderate in Mauritius variety. It was clear from the study that, physio-chemical properties of pineapple were changed based on the minimal processing method applied. Minimally processed refrigerated fruits have attracted the interest of the food industry including food manufacturers, retail food stores, restaurants and carry-out establishments. Further studies may be conducted to develop new techniques that will retain the physio-chemical properties of the pineapple after minimal processing.

5. References

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