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Physico-chemical characterization of fresh pineapple (*Ananas comosus* L.) fruit

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Abstract

The present study aimed to evaluate the physico-chemical properties of fresh pineapple (*Ananas comosus* L.) fruit to assess its quality attributes for consumption and processing. Parameters including fruit weight, crown, peel, core, edible yield, moisture content, total soluble solids (TSS), pH, acidity, ascorbic acid content, and sugar composition were determined. The average fruit weight was 1.23 kg, with crown and core weighing 0.128 kg and 0.170 kg, respectively. The edible portion (fruit cubes) accounted for 0.528 kg. The fruit exhibited high moisture content (88.2%), TSS of 14.8 °Brix, and moderate acidity (1.02%) with a pH of 3.94. Ascorbic acid content was 35.56 mg/100g, and total sugars were 13.20%, consisting of 6.08% reducing and 7.12% non-reducing sugars. These findings indicate that fresh pineapple has desirable juiciness, sweetness, acidity, and nutritive value, making it suitable for both fresh consumption and processing into value-added products.

Keywords: Pineapple, physico-chemical characteristics, edible yield, TSS, ascorbic acid, sugar content

1. Introduction

Pineapple (*Ananas comosus* L.) is one of the most important tropical and subtropical fruits cultivated worldwide, valued not only for its unique flavor, juiciness, and aroma but also for its nutritional and health-promoting properties. Belonging to the family Bromeliaceae, pineapple is cultivated extensively in countries such as India, Thailand, the Philippines, Costa Rica, and Brazil. In India, major pineapple-growing states include West Bengal, Kerala, Assam, Tripura, and Karnataka, with Telangana emerging as a potential region for commercial cultivation due to its favorable agro-climatic conditions.

Pineapple is rich in carbohydrates, vitamins (especially vitamin C), minerals, dietary fiber, and bioactive compounds, including antioxidants and bromelain, a proteolytic enzyme with medicinal and industrial applications. Its balanced combination of sweetness and acidity makes it an ideal fruit for fresh consumption as well as processing into value-added products like juice, canned slices, jams, jellies, and fermented products. The economic significance of pineapple is therefore twofold: it contributes to income generation for farmers and serves as a raw material for the food processing industry.

Quality assessment of fresh pineapple fruits is crucial for determining their suitability for consumption and processing. Physico-chemical characteristics, such as fruit weight, peel and core proportions, edible yield, total soluble solids (TSS), pH, acidity, ascorbic acid content, and sugar composition, are important indicators of fruit quality. These parameters influence consumer preference, storage behavior, shelf life, and processing efficiency. For instance, TSS and sugar content are directly related to sweetness, while acidity and pH affect taste, flavor stability, and microbial safety. Similarly, ascorbic acid content not only contributes to nutritional value but also affects antioxidant properties, which are important for functional foods.

Despite the commercial importance of pineapple, quality evaluation studies are relatively limited in the Indian context, particularly for cultivars grown in emerging regions like Telangana. Detailed physico-chemical characterization of pineapple fruits is essential for standardizing post-harvest handling, determining edible yield, and guiding processing strategies for the food industry. Moreover, such studies provide critical data for breeding programs aimed at developing superior cultivars with higher nutritional value, better taste, and extended shelf life.

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Therefore, the present study was undertaken to evaluate the physico-chemical characteristics of fresh pineapple fruits, including fruit yield components, moisture content, TSS, pH, acidity, ascorbic acid content, and sugar composition. The results are expected to provide valuable information for growers, processors, and researchers involved in the production and utilization of pineapple.

2. Materials and Methods

The present research study entitled “Physico-chemical characterization of fresh pineapple (*Ananas comosus* L.) fruits” was carried out in the Post-Harvest Laboratory, Department of Fruit Science, College of Horticulture, Rajendranagar, Hyderabad, SKLTSHU during the year 2017-2018. The materials used and the methodologies adopted for the investigation are described below.

2.1 Handling of Experimental Material

2.1.1 Selection of Fruits

Mature, fully ripe pineapple fruits of cv. Queen, uniform in size, free from pest infestation, disease, mechanical damage, or physiological disorders were procured from Kothapet Fruit Market, Hyderabad. The fruits were carefully transported to the laboratory for analysis.

2.1.2 Fruit Preparation

The selected fruits were weighed individually using a digital balance to record the average fruit weight. The fruits were washed thoroughly in clean water to remove dust and adhering dirt. Using a stainless steel knife, the crown, peel, and core were separated. The remaining edible portion of the fruit was cut into uniform cubes, and the weight of the cubes was recorded to determine edible yield. The proportion of crown, peel, core, and fruit cubes was expressed relative to the total fruit weight.

2.2 Determination of Physico-Chemical Parameters

2.2.1 Moisture Content

The moisture content of fresh pineapple cubes was determined using the oven-drying method. Approximately 10 g of sample was weighed and dried in a hot air oven at 105 °C until a constant weight was obtained. Moisture content was calculated as the percentage of weight loss during drying.

2.2.2 Total Soluble Solids (TSS)

TSS was measured using a hand-held refractometer and expressed in °Brix. A few drops of fresh pineapple juice were placed on the prism surface, and readings were taken in triplicate for accuracy.

2.2.3 pH and Acidity

The pH of fresh pineapple juice was measured using a digital pH meter. Titratable acidity was determined by titrating 10 ml of juice with 0.1 N NaOH using phenolphthalein as an indicator and expressed as % citric acid.

2.2.4 Ascorbic Acid Content

Ascorbic acid (vitamin C) content was estimated using the 2,6-dichlorophenolindophenol (DCPIP) titration method. Fresh juice (10 ml) was titrated against the standard dye until a faint pink endpoint persisted for 15 seconds. The

results were expressed as mg of ascorbic acid per 100 g of fresh weight.

2.2.5 Sugar Analysis

- **Total sugars:** Determined by the Lane and Eynon volumetric method.
- **Reducing sugars:** Estimated by Fehling's titration method.
- **Non-reducing sugars:** Calculated by subtracting reducing sugars from total sugars.

All measurements were carried out in triplicate to ensure accuracy and reliability of the results.

2.3 Statistical Analysis

The data obtained were analyzed for descriptive statistics, including mean, standard deviation, and range, to summarize the physico-chemical characteristics of fresh pineapple. Comparisons were made between different components of the fruit (crown, peel, core, edible cubes) to determine the proportions and yield of consumable portions.

3. Results and Discussion

Results are tabulated and discussed under following heads in the light of available literature (table 1 and Fig 1).

3.1 Fruit Weight and Component Yield

In the present study, the average fruit weight of fresh pineapple (*Ananas comosus* L.) was 1.23 kg. The crown weight accounted for 0.128 kg, while the core weighed 0.170 kg. The peel and other discarded parts summed up to 0.430 kg, and the edible portion comprised 0.528 kg of the total fruit mass. Accordingly, the edible yield was approximately 42.9% of the total fruit weight, which is comparable with earlier reports indicating variable edible proportions depending on cultivar and fruit size. Fruit component distribution is influenced by genotype and environmental factors, and such yield estimates are crucial for evaluating processing potential and economic value of fresh fruit supplies (e.g., Soler's quality indices, where pulp ratio relates directly to fruit utility).

High edible yield is economically important for processors, especially when producing fresh-cut cubes, juice or other value-added products. Variations in component weight across studies have been linked to genetic backgrounds and agronomic practices, suggesting that cultivar selection and field management can influence the ratio of edible to non-edible parts.

3.2 Moisture Content

The moisture content of fresh pineapple cubes was found to be 88.2%, demonstrating the high water content characteristic of succulent tropical fruits. High moisture levels are typical in pineapple and are directly responsible for juiciness and mouthfeel, which are important sensory attributes preferred by consumers. Comparable studies have reported high moisture proportions in pineapple and related fresh products, although the exact values may vary among genotypes and maturation stages. The high moisture also impacts post-harvest handling, as greater water content is associated with reduced shelf life and increased perishable nature of fresh fruit, necessitating careful cold storage and handling protocols to maintain quality.

3.3 Total Soluble Solids and Acidity

The Total Soluble Solids (TSS) value of pineapple juice was 14.8 °Brix, indicating a moderate level of soluble sugars, organic acids, and other soluble constituents. TSS is a primary indicator of sweetness and maturity in fruits; in fresh pineapples, TSS values typically range from about 12 to 18 °Brix depending on cultivar, growing region and harvest maturity. TSS influences consumer preference, with higher values generally indicating sweeter fruit that is more acceptable for fresh consumption and processing.

The titratable acidity in the present study was 1.02%, and the pH was 3.94, reflecting the characteristic tangy taste of pineapple. The balance between TSS and acidity (often expressed as the TSS/TA ratio) is a sensitive measure of taste quality and consumer acceptability — higher TSS with moderate acidity often correlates with favorable sensory perception. Studies of pineapple fruit quality have found pH values within the range of approximately 3.6-4.2 in fresh fruit, confirming that the present measurements align well with literature values and typical acid-sugar balance in ripe pineapples.

A balanced sweetness and acidity also influences processing outcomes: juices and canned products with higher TSS and appropriate acidity are preferred for flavour, stability and shelf life, especially under minimal processing conditions.

3.4 Ascorbic Acid Content

The ascorbic acid (vitamin C) content in fresh pineapple was 35.56 mg per 100 g of fresh weight. Pineapple is widely recognized for its nutritive value, and vitamin C is a principal antioxidant nutrient in the fruit, contributing to its health-promoting properties. Although ascorbic acid content may vary widely among different cultivars and growing conditions, earlier studies have reported ranges from about 5 to over 30 mg/100 g in various pineapple genotypes, with cultivar MD-2 noted for high vitamin C content (up to approximately 33.6 mg/100 g).

Vitamin C plays a key role in nutritional quality, and higher levels contribute not only to dietary antioxidant intake but also to better retention of colour, flavour and overall quality during handling and minimal processing. Thus, the relatively high ascorbic acid found in the present study underscores the potential of the pineapple fruit under evaluation as a good source of dietary vitamin C.

3.5 Sugar Composition

Total sugar content in the edible portion of fresh pineapple was 13.20% of fresh weight, with reducing sugars at 6.08% and non-reducing sugars at 7.12%. The sugar profile — including the proportions of reducing (e.g., glucose, fructose) and non-reducing (e.g., sucrose) sugars — significantly affects the perceived sweetness and flavor of the fruit. In many pineapple genotypes, sucrose is often the dominant sugar, followed by glucose and fructose, though the exact proportions can vary among cultivars and maturity stages. The relatively balanced distribution between reducing and non-reducing sugars observed here supports the moderate sweetness indicated by the TSS measurement. This balance of sugars is also advantageous for juice processing and fermentation because reducing sugar fractions are more readily metabolized by yeast and microbes during fermentation processes. Consequently, fruits with balanced sugar profiles can be suitable not only for fresh consumption but also for diversified processing

applications such as beverages and fermented products.

Overall, the measured sugar composition and other physico-chemical parameters of fresh pineapple fruits in this study align with values reported in literature and reaffirm the fruit's quality characteristics for both fresh consumption and processing purposes. The combination of moderate sweetness, balanced acidity, high moisture content, and significant ascorbic acid content positions this fruit well within the quality expectations for tropical pineapples.

Table 1: Physico-chemical parameters of fresh pineapple fruit

S. No	Parameter	Result
1	Average weight of fruit	1.23 kg
2	Crown weight	0.128 kg
3	Peel with discarded portions	0.430 kg
4	Core weight	0.170 kg
5	Yield of fruit cubes	0.528 kg
6	Moisture content	88.2 %
7	Total soluble solids (TSS)	14.8 °Brix
8	Ascorbic acid	35.56 mg/100g
9	Acidity	1.02 %
10	Total sugars	13.20 %
11	Reducing sugars	6.08 %
12	Non-reducing sugars	7.12 %
13	pH	3.94

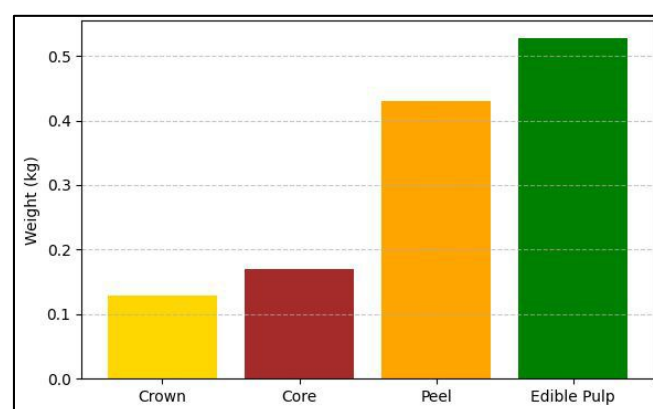


Fig 1: Comparison of fruit component proportions (crown, core, peel, edible pulp).

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