

## QUALITY OF GOLDEN PAPAYA SOLD IN STREET MARKETS AND SUPERMARKETS IN JOÃO PESSOA - PB

### QUALIDADE DE MAMÃO GOLDEN COMERCIALIZADO EM FEIRAS LIVRES E SUPERMERCADOS DE JOÃO PESSOA – PB

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**Abstract.** Fruit production is a major sector of Brazilian agribusiness and papaya is one of the main fruits sold in the country. The papaya tree is believed to have originated in Central America. The physical characteristics of papaya vary according to the group and variety. There are several ways of selling the fruit, but the main ones are street markets and supermarkets, which follow the trend of modernization in commerce, with a more comfortable environment for customers and the fruit receiving greater care in packaging, handling, and the way it is presented. The aim of this study was to evaluate the quality characteristics of papayas marketed in two locations in the city of João Pessoa-PB, in order to identify possible differences in quality attributes. A completely randomized experimental design was used, with five treatments: fruit from two street markets and fruit from three supermarkets. The following variables were assessed: total fruit mass (g) and pulp weight (g); diameter (cm), length (cm), and color using the Colorimeter app and the phycochemical variable SS/TA ratio. The data on the variables was subjected to analysis of variance (ANOVA) using the F test up to a 5% probability of error level, and then the Scott-Knott test was carried out at a 5% significance level. With regard to the variables mass, pulp weight, and fruit diameter, the supermarkets had a higher average than the street markets. For the length variable, there was no statistical difference between the treatments. Golden papayas sold in supermarkets in João Pessoa - PB showed superior physical characteristics compared to street markets, especially in terms of fruit mass, pulp weight, and diameter.

**Keywords:** *Carica papaya*. Tropical fruit. Fruit production. Post-harvest.

**Resumo.** A fruticultura é um dos grandes setores do agronegócio brasileiro, sendo o mamão uma das principais frutas comercializadas no país. O mamoeiro tem sua possível origem na região da América Central. As características físicas do mamão variam de acordo com o grupo e a variedade. Existem vários meios de comercialização de frutos, porém os principais são as feiras livres e os supermercados, os quais seguem a tendência da modernização no comércio, com ambiente mais confortável aos clientes e os frutos recebem um maior cuidado com embalagem e manuseio e na forma como são apresentados. O objetivo deste trabalho foi avaliar as características de qualidade de mamões ofertados em dois locais de comercialização na cidade de João Pessoa-PB visando constatar possíveis diferenças nos atributos de qualidades. Foi utilizado o delineamento experimental inteiramente casualizado, com cinco tratamentos, sendo eles, frutos provenientes de duas feiras livres e frutos de três supermercados. Foram avaliadas as variáveis, massa total do fruto (g) e peso da polpa (g); diâmetro (cm), comprimento (cm), coloração pelo aplicativo Colorímetro e a variável físico-química Relação SS/AT. Os dados das variáveis foram submetidos à análise de variância (ANOVA) pelo teste F até o nível de 5% de probabilidade de erro, e posteriormente, foi realizado o teste de Scott-Knott com 5% de significância. Com relação às variáveis massa, peso da polpa e diâmetro dos frutos, os supermercados apresentaram uma média superior às observadas nas feiras livres. Para a variável comprimento não houve diferença estatística entre os tratamentos. Os mamões Golden vendidos em supermercados de João Pessoa-PB demonstraram características físicas superiores em relação às feiras livres, destacando-se na massa do fruto, peso da polpa e diâmetro.

**Palavras-Chave:** *Carica papaya*. Frutas tropicais. Fruticultura. Pós-colheita.

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## INTRODUCTION

Fruit production in Brazil plays a significant role in the agricultural sector, contributing approximately 16% of all jobs created by agribusiness. In this context, an increase in fruit exports could positively impact the country's economic and social development, especially by promoting income generation in less developed regions, such as the northeastern semi-arid region. It is important to note that Brazil has a good logistical infrastructure, making it possible to transport these products efficiently. In addition, the proper use of storage technologies throughout the production chain means that exported fruit reaches its final destination with preserved sensory quality, maintaining its nutritional properties and characteristic flavors<sup>1</sup>. However, these conditions are not seen for all crops and their production chains.

As a tropical plant, the papaya tree is believed to have originated in Central America, more precisely between southern Mexico and Nicaragua. The emergence of this commercial species is attributed to the hybridization of two species found in Mexico. The fruit quickly became widely distributed in different regions of the world, and some authors correlate this with the fact that it has a large number of long-lived seeds. Today, papaya is grown in many tropical countries and even some subtropical countries<sup>2</sup>.

The weight of different varieties of papaya can range from 200 g to over 10 kg. The pure line varieties most commonly sold in Brazil, such as "Golden" and "Sunrise Solo", weigh around 400 g to 500 g, while the hybrids are larger, weighing between 900 g and 1600 g. When immature, the peel is greenish in color, and as it matures, the colors vary from yellow to orange. The color of the pulp also varies according to the degree of ripeness of the fruit and the variety used, with shades of yellow, pink, red, and orange. The internal cavity of the fruit can be smooth circular or star-shaped with between 5 and 7 concavities<sup>3,4</sup>.

In the 2021 partial report by SECEX (Foreign Trade Secretariat), the data showed a 17% increase in the volume of papaya exported from January to November, compared to the same period in 2020. The total volume was 46,000 tons, the highest in the historical series, which began in 1997. The amount received also increased, 22% more than in 2020, reaching \$46 million. The COVID-19 pandemic and its impacts, such as the rise in the dollar, are considered to be factors responsible for these record exports. Producers opted to export most of their production due to the European Union's high demand for papaya, mainly to Portugal, Spain, and the Netherlands<sup>5</sup>.

Perishable foods, such as papaya, suffer biological, physical, or chemical deterioration making it impossible to sell them and resulting in losses. It is necessary to handle and store papaya properly to avoid economic losses. Some aspects of storage must be considered, such as the ideal temperature for the type of product, humidity, ventilation, lighting, average fruit shelf life, and physical factors such as adequate packaging, stacking, and handling, among others. Approximately 86% of losses in the produce section occur during the display of the product for sale, while another 9% occur during transportation and 5% during storage<sup>6</sup>.

Street markets (fairs) were among the world's first means of commercialization. Meanwhile, supermarkets reflect modernization, an environment where consumers enjoy greater comfort and the fruit receives greater care in the way it is presented. Therefore, this study aimed to evaluate the physical characteristics of papayas to find out whether there are any differences between the physical qualities of fruit from street markets and supermarkets in João Pessoa-PB.

## MATERIALS AND METHODS

This study was carried out at the Multidisciplinary Laboratory XI of the Nova Esperança Institutions, João Pessoa-PB. The Solo "Golden" group papayas were collected from five commercial establishments, two street markets, and three supermarket chains in the Metropolitan area of João Pessoa. The fruits were selected according to their external color, attempting to achieve uniformity in terms of their stage of ripeness, to obtain the most homogeneous sample possible.

Five commercialization places were evaluated: three different supermarket chains, where the fruit received greater care in terms of packaging, storage, and a controlled environment. The other sites evaluated were street markets 1 and 2, where the fruit was sold without any protective packaging at the respective market stalls. At each collection site, four fruits that met the ripeness criteria but were also free of pathogens and mechanical damage were selected. In the laboratory, the fruit was washed under running water and dried at room temperature. For the physical evaluations, each fruit was considered a repetition.

A completely randomized experimental design was used, with five treatments: fruit from two street markets and fruit from three supermarkets. The following variables were evaluated: total fruit mass (g) and pulp weight (g), determined on a semi-analytical scale; diameter (cm), and length (cm), measured with a pachymeter in the equatorial region. The SS/TA ratio was obtained from the ratio between the concentration of soluble solids (° Brix) and titratable acidity (% citric acid).

The HUE angle of the fruit epicarp was assessed objectively using the Colorimeter application (version 1.6.6.2, Research Lab Tools, São Paulo, Brazil) installed on an Android smartphone. The images (3468 x 4624 pixels) were captured with a Samsung Galaxy A32 smartphone camera (8 MP).

The data on the variables was subjected to analysis of variance (ANOVA) using the F-test up to a 5% probability level of error, followed by the Scott-Knott test carried out at 5% significance using the SISVAR software<sup>7</sup>.

## RESULTS AND DISCUSSION

The Golden papaya fruit sold in street markets and supermarkets in João Pessoa differed in quality in terms of the physical characteristics assessed in this study.

In terms of fruit mass, the supermarket fruits had a higher mass than the street markets. In street market 2, the average mass was 257.36 g, while in supermarket 3 the average mass was 481.93 g, in other words, there was a difference of approximately 65% between the mass of Golden papaya sold in street markets and supermarkets in João Pessoa-PB.

Ferreira et al.<sup>4</sup>, conducting a sample sizing for fruit from commercial papaya cultivars, found an average mass of 522.67 g for Golden papaya, a value similar to that found in fruit from supermarkets in João Pessoa - PB, while the papayas from street markets in João Pessoa are below this average.

For the "pulp weight" variable, Golden papayas from supermarkets showed higher results than those found in street markets (Table 1). This difference was expected, since the fruit from supermarkets showed greater mass, and there is a positive correlation between fruit mass and pulp weight.

**TABLE 1** – Fruit mass, pulp weight, length, and diameter of Golden Solo papayas sold in different locations in João Pessoa-PB, 2022.

Venues	Fruit mass (g)	Pulp weight (g)	Length (cm)	Diameter (cm)
Street market 1	240.30 b	212.02 b	13.0 a	6.7 b
Street market 2	257.36 b	232.10 b	12.0 a	6.7 b
Supermarket 1	452.65 a	372.55 a	14.1 a	8.3 a
Supermarket 2	459.34 a	394.24 a	13.8 a	8.5 a
Supermarket 3	481.93 a	399.50 a	14.1 a	8.7 a

Averages followed by the same letter in the columns do not differ statistically from each other using the Scott-Knott test at the 5% probability level.

Fruit length showed no statistical difference between the treatments. The supermarket samples were approximately 1 to 2 cm longer than the street market ones. Dias et al.<sup>8</sup> found an average of 12.53 cm for the length of Golden papaya, a value compatible with that found in this study.

Supermarket papayas had a larger diameter than Golden papaya fruit from street markets. Dias et al.<sup>8</sup>, found an average of 7.86 cm for the diameter of Golden papaya, which corroborates the diameter values found in this study, which were a minimum average of 6.72 cm in street market 1, and a maximum of 8.7 cm in supermarket 3.

The Golden papayas found in both supermarkets and street markets showed no significant differences in terms of length. However, the papayas from the supermarkets had a larger diameter, resulting in a rounder shape compared to the papayas from the street markets, which had a more cylindrical shape (Figure 1).



**FIGURE 1** – Photos of Solo group Golden papayas sold at two street markets and three supermarkets, from left to right, in João Pessoa-PB, 2022.

A portion of Brazil's papaya production is destined for export, totaling 46,000 tons in 2020. The international market shows a preference for pear-shaped papayas, which can be seen in the fruit sold in supermarkets in João Pessoa, Paraíba. On the other hand, in the domestic market, there is a preference for more elongated-shaped papayas (Figure 1)<sup>5,9</sup>.

Table 2 shows the results of the analysis of the quality of Golden papaya at street markets and supermarkets in João Pessoa, PB. The street markets showed consistent results, with SS/TA and HUE values indicating relatively good quality, characterized by adequate levels of soluble sugars with acidity and a yellowish color, suggesting adequate ripeness. In the supermarkets, there were significant variations, with some locations showing riper papayas with higher soluble sugar content and more

intensely yellow color, indicating a sweeter taste and a more attractive appearance. On the other hand, other supermarkets had less ripe papayas, with a lower soluble sugar content and a slightly lower quality.

**TABLE 2** – Values for Soluble solids and titratable acidity ratio (SS/TA) with hue (HUE) for Solo group Golden papayas sold in different locations in João Pessoa-PB, 2022.

Venues	SS/AT	HUE
Street market 1	39.97331 c	41.64 b
Street market 2	41.1826 c	41.66 b
Supermarket 1	48.65024 b	45.67 b
Supermarket 2	36.27806 c	41.995 b
Supermarket 3	70.51753 a	54.275 a

Averages followed by the same letter in the columns do not differ statistically by the Scott-Knott test at the 5% probability level.

These results highlight the importance of considering where Golden papaya is sold, enabling consumers to choose the place of purchase according to their taste and ripeness preferences. Furthermore, there are social and environmental issues. Purchasing from street markets may be more sustainable, as it directly supports local farmers, reducing the carbon footprint associated with transporting products over long distances. Buying local products strengthens the community's economy, contributing to economic and social sustainability. In supermarkets there is greater control over the standard of the papayas for sale, and greater care is taken with hygiene.

## FINAL REMARKS

Golden papayas sold in João Pessoa - PB showed better physical quality characteristics in supermarkets when compared to street markets, for the variables fruit mass, pulp weight, and diameter.

Quality attributes are important to be considered in the production chain of fruit and vegetables. However, differences among physical characteristics are related to factors like lack of information about postharvest handling and good practices to preserve appearance and fruit quality. So, for 'Golden' papayas evaluated herein, the differences can be related to those factors that play a crucial role in postharvest conservation.

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