



DETERMINATION OF SHELF-LIFE OF JABOTICABA'S FRUITS CV. 'SABARÁ'

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ABSTRACT

The jaboticaba is a fruit tree with great potential, both for fresh consumption, as for industrialization. The objective of this study was to evaluate the shelf-life of jaboticabas's fruits cv. 'Sabará' stored under refrigeration and at room temperature. After harvest, the fruits were washed, screened, packed in plastic trays, in single layer, and stored under refrigeration (5 °C, and 49% UR), and at room temperature (27 °C, and 33% UR). The determinations performed in triplicate immediately after harvest and every other day, until the disposal of the fruit, were: pH, soluble solids (°Brix), total titratable acidity (% citric acid), total and reducer sugars (%), vitamin C (mg/100g) and phytopathological. The design adopted was entirely randomized, realized the analysis of variance (F test) and comparison of averages by Tukey test to 5% of significance. Under refrigeration, the storage was more than 9 days to 12 days, the fruits showed intense shriveling (loss of moisture), being unsuitable for marketing. The soluble solids remained stable during this period, but there was decrease of pH and the levels of total and reducer sugars, in addition to increased acidity, facts that indicate occurrence of fermentation process. The losses of vitamin C were of the order of 72,5, from 4,952mg/100g in zero time, and 3,593mg/100g at the end of this period. The stored fruits at room temperature were discarded at the beginning of storage, by shriveling, incidence of microorganisms and strange odor.

Keywords: *Myrciaria jaboticaba* (Vell.) Berg, storage, refrigeration, shelf-life, sanity.

DETERMINAÇÃO DA VIDA-DE-PRATELEIRA DE JABUTICABAS 'SABARÁ'

RESUMO

A jaboticabeira é uma fruteira com grande potencial, tanto para consumo *in natura*, quanto para a industrialização. O objetivo do estudo foi avaliar o tempo de conservação de jaboticabas 'Sabará' estocadas sob refrigeração e à temperatura ambiente. Após a colheita, os frutos foram lavados, selecionados, acondicionados em bandejas plásticas, em camada única, e armazenados sob refrigeração. As determinações realizadas em triplicata logo após a colheita e a cada dois dias, até o descarte dos frutos, foram pH, sólidos solúveis (°Brix), acidez total titulável (% ácido cítrico), açúcares totais e redutores (%), vitamina C (mg/100g) e fitopatológica. O delineamento adotado foi o inteiramente casualizado, realizando-se análise de variância (teste F) e comparação de médias pelo teste de Tukey a 5% de significância. Sob refrigeração, o armazenamento atingiu 12 dias, período no qual os frutos apresentavam

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intenso murchamento (perda de umidade), estando inapropriados para comercialização. O teor de sólidos solúveis manteve-se estável durante o armazenamento, porém houve diminuição do pH e dos teores de açúcares totais e redutores, indicando a ocorrência de processo fermentativo. As perdas de vitamina C foram da ordem de 72,5%, passando de 4,952 mg/100g no tempo 0 de estocagem, para 3,593mg/100g ao final deste período. Os frutos armazenados em temperatura ambiente foram descartados no início do armazenamento, por apresentarem murchamento, incidência de microorganismos e odor estranho.

Palavras-chave: *Myrciaria jaboticaba* (Vell.) Berg, ácido ascórbico, refrigeração, vida-de-prateleira, sanidade.

INTRODUCTION

The jaboticaba (*Myrciaria* spp.) is a fruit tree native to South-Central Brazil, being cultivated in the far south to the extreme north of the country (MANICA, 2000), having aroused great interest among the farmers and industries, due to its high productivity, hardiness and to the use of their fruits in the form of fresh fruit or industrialized.

The plants produce fruit with great potential, both for fresh consumption, as for the industry, being used in the manufacture of jelly, jam, brandy, liqueur, wine and vinegar (DONADIO, 2000). However, what is observed is that more than half of the production is lost, because the producers did not have at their disposal information on how to handle them at the peak of the harvest, in order to increase your marketing period as fresh fruit or keeping it for marketing in the offseason (BRUNINI & COELHO, 2004/2005).

Post-harvest losses of jaboticaba's fruits during the production and marketing have not received the attention that the magnitude of the problem justifies, mainly due to ignorance of their physico-chemical properties depending on the place of cultivation, which, according to VIEITES et al. (2011), may vary depending on the cultivar, the weather, the culture, and management of pesticide treatments.

The postharvest life of jaboticaba's fruits is too short, approximately four days, mainly due to the rapid loss of water, which causes changes in the texture of the fruit. In addition, the shell loses luster, besides change of taste dramatically. It is

believed that this change of taste can be caused by a process of fermentation on pulp, which begins as soon as the fruits are harvested (BARROS et al., 1996).

The use of refrigeration is one of the most effective tools in maintaining quality and extension of the period of marketing of horticultural products, slowing the metabolic processes, without cause physiological disorders, and prolonging the time to market (BRUNINI et al., 2004). In addition, consumers are increasingly demanding with regard to the quality of food and products, looking for those more nutritious, safe and to preserve health. This is a world trend that reflection in the production of quality food. During storage may occur changes in appearance, taste, texture and color, which are reflected in the nutritional quality of the product *in natura*, preprocessed and processed. However, today there is a great call by the nutritional qualities of foods as a way of preventing disease. This category includes antioxidants present in foods, such as vitamins C and e and phenolic compounds (DURIGAN, 2004).

NASCIMENTO et al. (2013) conducted a study on the shelf life of jaboticaba's fruits cv. 'Sabará' applying pre and post-harvest treatments, and observed average 8% of soluble solids (8°Brix) and acid levels between 1,26 and 1,77%, i.e., such results suggest that the raw materials were in another stage of ripeness that those of this experiment, soluble solids content after the harvest was 12,93°Brix and acidity of 0,687%. Already

AGOSTINI et al. (2009) in a study post-harvesting of jaboticaba's fruits cv. Paulista observed in time zero, different values of this experiment to the parameters of pH (2,6), acidity (2,40% citric acid), and reducer sugars (2,93%). OLIVEIRA et al. (2003), analyzing jaboticaba's fruits cv. 'Sabará' grown in different regions of São Paulo state, found that the pH ranged from 2,91 to 3,72; the acidity of 0,88 to 1,65%; and soluble solids of 11,50 to 17,90° Brix, what are bands of values that include the levels determined in the experiment in question. Already, MACHADO et al. (2007) determined in this study values similars for pH (3,58) and acidity (0,58%), however, the value found by the authors for soluble solids was higher (16,96%). All these differences can be derived from the cultivar, growing and maturing stage.

MATERIAL AND METHODS

The fruits used in the experiments were collected in the orchard of the Research and Development Unit of Tietê, SP, belonging to the Polo Centro Sul of the Agência Paulista de Tecnologia dos Agronegócios (APTA), located in Piracicaba-SP. Were selected two trees in the orchard of jaboticaba cv. 'Sabará', whose production was more abundant and homogeneous, being harvested all the branches in a range of about 1 meter tall each. After the harvest, the jaboticaba's fruits were conducted at the laboratory of post-harvest of Polo Centro Sul in Piracicaba-SP.

After washing and selection steps, the fruits were packed in white plastic trays, single layer, distributed and stored in refrigerator (5°C, and 49%UR), and at room temperature (27°C, and 33%UR), being then characterized at time 0 (the harvest) and every 3 days, to the point of disposal.

The fruits were discarded when unsuitable presented for consumption, that is, with significant losses in physical and chemical composition, and infected with microorganisms.

In addition to the changes listed above, changes, in final quality of the products, caused by diseases can also be observed, and may have its origin in the country, manifesting symptoms in post-harvest or post-harvest origin itself. According to AGRIOS (1997), only the postharvest diseases may compromise the overall production of crops in 10 to 30%, and could be larger still, these statistics over 30%, especially in developing countries where the technologies used in preservation of products are precarious (ECKERT & OGAWA, 1988).

The objective of this study was to evaluate the shelf-life of jaboticaba's fruits cv. 'Sabará' stored under refrigeration and at room temperature.

The characterization of the fruits was performed through the analyses broken down below:

- pH: determined second method AOAC n.981.12 (1997);
- soluble solids (°Brix): determined by Refractometer, second method AOAC n.932.12 (1997);
- total titratable acidity (citric acid): determined by potentiometric titration, second method AOAC n.942.15 (1997);
- total and reducer sugars (%): by the method of Lane and Eynon described by CARVALHO et al. (1990).
- vitamin C: quantified second method n.43.065 of AOAC (1984), modified by BENASSI (1990), which replaces the solvent extractor metaphosphoric acid by oxalic acid. The results were expressed as mg of ascorbic acid/100g pulp.
- phytopathological analysis: the identification of post-harvest diseases of jaboticaba's fruits was initially performed by observation of characteristic symptoms and signs of the pathogens present in the lesions. Fruits with symptoms of readily identifiable illnesses were noted in the evaluation sheet, the other with early

symptoms of decay which prevented their immediate diagnosis underwent a humid chamber for 24 hours, being reevaluated after this period. The wet room consisted of placing a damp plastic bag over the fruits packed in plastic trays. Structures of the pathogens formed after the creation of humid chamber were identified through observation under stereoscopic microscope or by observing blades made with these in an optical microscope. When needed, isolation of fungi on culture media was performed.

RESULTS AND DISCUSSION

The loss of quality characteristics interferes with the acceptability of the product by the consumer, the postharvest storage temperature is one of the most important factors in the definition of these characteristics.

The design was entirely randomized, with 2 storage temperatures, and 5 evaluation times and 3 repetitions for each analysis, making a factorial scheme of 2x5, and the times have been split into trays and samples in triplicate. The laboratory tests were performed in triplicate. Data were subjected to analysis of variance (F test) and averages compared by Tukey test to the 5% level of significance, using the SAS software (2010).

The fruit viable for consumption won't pick up after three days of storage, featuring proliferation of diseases, as well as wilting and strange odor. In this way, were dropped at the beginning of the experiment, not being performed physico-chemical analyses.

Table 1. Averages of physico-chemical determinations (triplicate) of jaboticaba's fruits cv. 'Sabará' stored at room temperature.

Storage time	0 days
pH	3,19
Soluble Solids (°Brix)	12,63
Total Titratable (%)	0,704
Total sugars (%)	1,364
Reducer sugars (%)	0,838
Vitamin C (mg/100g)	5,342

The shelf time of ripe jaboticaba's fruits stored under refrigeration was between 9 and 12 days. After this period, the fruits were unsuitable for marketing and consumption, with excessive moisture loss, i.e., presented intense shriveling.

The results of the physicochemical analysis showed that throughout the store there was no significant difference between the samples regarding the determination of soluble solids (°Brix). However, for all other determinations the differences were well defined and consistent, reduction of pH, total and reducer sugars. This fact

clearly indicates the fermentation process of the fruit throughout the stocking. Microbial growth implies consumption of fruit sugars and organic acids production resulting in increased acidity and consequent decrease in pH. Despite this fact, the soluble solids content has not changed, as it mentioned earlier. MOTA et al. (2002) in postharvest conservation study of jaboticaba's fruits cv. 'Sabará' observed also along the storage stability of the soluble solids in 13,6 ° Brix and acidity increase of 3,11 to 4,29%.

Table 2. Averages of physico-chemical determinations (triplicate) of jaboticaba's fruits cv. 'Sabará' stored under refrigeration.

Days of storage	pH	Soluble Solids (°Brix)	Total Titratable Acidity (%)	Total sugars (%)	Reducer sugars (%)	Vitamin C (mg/100g)
0	3,16 ^b ± 0,02	12,93 ^a ± 0,06	0,687 ^{ab} ± 0,016	1,357 ^{bc} ± 0,231	0,904 ^{bc} ± 0,166	4,952 ^a ± 0,330
3	3,32 ^a ± 0,06	12,60 ^a ± 0,10	0,581 ^{bc} ± 0,053	2,756 ^a ± 0,041	1,675 ^a ± 0,457	4,571 ^{ab} ± 0,000
6	3,19 ^b ± 0,01	12,63 ^a ± 0,06	0,563 ^c ± 0,053	1,799 ^b ± 0,040	1,109 ^b ± 0,143	4,391 ^{abc} ± 0,345
9	3,15 ^{bc} ± 0,02	12,43 ^a ± 0,45	0,743 ^a ± 0,022	1,408 ^{bc} ± 0,094	0,604 ^{cd} ± 0,061	3,992 ^{bc} ± 0,691
12	3,06 ^c ± 0,04	12,50 ^a ± 0,10	0,737 ^a ± 0,029	0,744 ^c ± 0,217	0,372 ^d ± 0,225	3,593 ^c ± 0,599
Average	3,17	12,62	0,662	1,613	0,933	4,299
CV (%)	1,08	1,76	5,846	14,821	18,942	7,393

* Averages followed by the same letter in the columns, do not differ to 5% of significance ($p \leq 5$).

It is observed that over storage, there was statistically significant decrease of vitamin C. The values of this constituent went from 4,952 mg/100g at time 0 storage for 3,593mg/100g at the end of the 12 days of refrigerated storage, representing a loss of about 72,5% (table 2). This behavior is consistent when observed by BRUNINI et al. (2004) in the jaboticaba's fruits cv. 'Sabará', whose fruits, at the end of the storage period, showed a reduction in levels of vitamin C. The refrigeration inhibit the oxidative reactions and slow the physiological processes that reduce the loss of aroma, flavor and texture, among other attributes, but does not prevent the decrease in the content of this constituent, considered normal in most fruits during the post-harvest according to NEVES et al. (2008).

VIEITES et al. (2011) in postharvest study of jaboticaba's fruits cv. 'Sabará' stored at different temperatures and packaging, also found decreases in levels of ascorbic acid, as well as DAIUTO et al. (2010) in postharvest study of jaboticaba's fruits cv. 'Sabará' subjected to pre-treatment by hidrothermal. The authors determined soon after harvest, average of 25,92mg of ascorbic acid per 100 g of pulp, in jaboticaba's fruits by the witness

treatment, and after 10 days of refrigerated storage this value passed to 17,85mg/100g, amounting to a loss of 70% of vitamin C. The values found by the authors were larger than those found in this work, however, the percentages of loss occurred in the two studies were similar.

These results are considered important because the ascorbic acid, in addition to the pro-functional tabs already known, can also act as antioxidant agent in own fruit, contributing positively to the preservation of quality during storage. Those losses may have occurred because the organic acids, among which the consumption in ascorbic oxidative reactions, during the ripening and senescence of fruits.

The jaboticaba's fruits stored at room temperature in the first evaluation, carried out to 3 days, were already in disposition, point showing a high incidence of fungi of the genus *Colletotrichum*, *Penicillium*, *Aspergillus* and *Cladosporium*, in descending order (Figures 1 and 2), and loss of firmness checked visually (Figure 2). Fruit held under-cooled remained completely healthy until the penultimate evaluation, held to 9 days. In the last evaluation, held 3 days

later (12 days) the fruits did not present marketing conditions, being discarded.

The results of this study indicate the need for immediate consumption of jaboticaba's fruits stored at room

temperature, as the 3 days are totally ruined, while fruits under-cooled lasted until more than 9 days. Further studies are needed to determine needs of life of chilled jaboticaba's fruits.



Figure 1. Jaboticaba's fruits cv. 'Sabará' two days after storage under refrigeration (above) and under room temperature (below).



Figure 2. Jaboticaba's fruits cv. 'Sabará' stored under room temperature (2 days of storage), infected by fungi of the genus *Colletotrichum* and *Penicillium* (left) and *Penicillium* (right).

CONCLUSIONS

In the present work, the life of jaboticaba's fruits cv. 'Sabará' stored under refrigeration stood between 9 to 12

days, while under room temperature storage is not an appropriate practice, and recommended the immediate consumption.

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