CONSUMERS'ACCEPTANCE OF FRESH AND COMBINED METHODS PROCESSED MELON, MANGO AND CASHEW APPLE[1]

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ABSTRACT - Fresh and combined methods processed Cantaloupe melons, mangoes and cashew apples were submitted to consumers' acceptance and scored on a nine-point hedonic scale. Fruits were osmotically treated in sucrose syrup with two different concentrations of SO_2. Overall acceptance, appearance, aroma, flavor and texture were evaluated. Fresh cashew apples received lower scores for acceptance than processed cashew apples while fresh mangoes were more acceptable than processed mangoes. Acceptance of fresh melons and processed melons was similar. Treatments of the tropical fruits with two different concentrations of SO_2 did not demonstrate significant differences between the fruits tested.

Index terms*:* sensory analysis, osmosis, *Cucumis melo* L., *Mangifera indica* L., *Anacardium occidentale* L.

ACEITAÇÃO DO CONSUMIDOR DE MELÃO, MANGA E CAJU *IN NATURA* E PROCESSADOS POR MÉTODOS COMBINADOS

RESUMO - Melões 'Cantaloupe', mangas e pedúnculos de caju *in natura* e processados por métodos combinados foram submetidos a testes de aceitação, utilizando-se de escala hedônica de nove pontos. As frutas sofreram tratamento osmótico em um xarope de sacarose com duas diferentes concentrações de SO_2. Foram avaliados aceitação global, aparência, aroma, sabor e textura. Pedúnculos de caju *in natura* obtiveram notas menores para aceitação se comparados aos processados, enquanto mangas *in natura* foram mais aceitas do que as processadas. A aceitação de melões *in natura* e processados foi similar. Tratamentos com diferentes concentrações de SO_2 não apresentaram diferenças significativas entre os frutos estudados.

Termos de indexação: análise sensorial, osmose, *Cucumis melo* L., *Mangifera indica* L., *Anacardium occidentale* L.

INTRODUCTION

Production of economically important tropical fruits is mostly distributed in tropical and subtropical zones of less developed countries. Lack of suitable techniques of handling, transportation and storage, and also high perishability lead to great losses, which could be reduced by processing by combined methods (Welti-Chanes et al., 1994).

Food preservation through processing by combined methods is a suitable combination of various hurdles, such as reduction of water activity, lowering pH , simple or combined use of antimicrobial agents and mild thermal treatment, which lead to room temperature stable and also low cost foods (Daza et al., 1997; Welti-Chanes, 1997).

Fruits processed by combined methods can be consumed as if they were fresh or used as components in food formulation such as ice creams, frozen desserts, and yogurts, with an advantage that this type of processing give to fruits a "fresh" and/or "healthy" appearance (Maltini et al., 1993).

One further advantage of processing by combined methods is that original organoleptic characteristics are largerly maintained (Alzamora et al., 1993). This work aimed to evaluate sensory acceptance of fresh and processed melons, mangoes and cashew apples.

MATERIAL AND METHODS

Cantaloupe melons 'Hi-Mark' (*Cucumis melo* L. var. *cantaloupensis* Naud.) and mangoes 'Coite' (*Mangifera indica* L.) obtained in local market and cashew apples clone CCP 76 (*Anacardium occidentale* L. var. *nanum*) from experimental sites of EMBRAPA (Pacajus, CE) were used.

Fruits were received and selected according to their quality attributes, washed in chlorinated water (50 ppm for 15 min), manually peeled and cut in cubes. After blanching at 100ºC for 2 min, fruits were submitted to osmotic treatment, in sucrose syrup at 25º Brix for 5 days, at 28-30ºC. A fruit:syrup proportion of 1:2 was used. Syrup was prepared according to Table 1, with different SO_2 concentrations. Fruits were packed in high density polyethylene bags at 90ºC and heat treatment was applied at 100ºC for one min. After heat treatment, bags were cooled in tap water during 15 minutes until approximately temperature of 28°C was reached and samples were taken for sensory analysis.

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Sensory evaluation was conducted with fresh and processed fruits. A nine-point hedonic scale, varying from "dislike extremely" (score 1) to "like extremely" (score 9) was used, according to Stone & Sidel (1992). Panelists were instructed to determine the acceptance of the single fruit presented. Each panelist evaluated all three fruits, fresh and processed, in randomized order of presentation, in different sessions for each fruit. Private booths and fluorescent lighting were used. Fruits at room temperature were presented to panelists. Thirty untrained panelists evaluated fruits in relation to appearance, aroma, flavor, texture and overall acceptance using the score sheet for acceptance testing presented in Figure 1. Results were analyzed by Analysis of Variance (ANOVA) and mean scores were compared by Tukey's (HSD) test.

RESULTS AND DISCUSSION

Mean scores obtained for acceptance of fresh and processed melons, mangoes and cashew apples are presented in Tables 2 to 4.

Sensory acceptance of processed melons treated with 300 ppm of SO_2 was equivalent to acceptance to fresh melons, according to Tukey's test ($p<0.05$) applied for appearance, flavor, texture and overall acceptance (Table 2). Aroma scores of processed melons were lower than those obtained for fresh melons, with scores significantly different ($p<0.05$).

Overall acceptance of the fresh and processed fruits was similar. Mean scores observed for overall acceptance of fruits treated with 300 or 900 ppm of SO_2 are characteristic of acceptable products. In hedonic scale, this range varies from "like slightly" to "like moderately". Figure 2 presents frequency percentage of hedonic scale scores of overall acceptance, obtained for the fresh and processed fruits. The frequency of responses are more concentrated between scores of 7 and 9, for fresh and processed fruits, meaning that processed fruit is acceptable as fresh fruit, confirming results of the mean comparison test for overall acceptance.

Fresh mangoes exhibited higher scores for all attributes than processed mangoes, except for flavor. Although significant different scores were observed for fresh and processed mangoes, overall acceptance scores were high for both treatments (Table 3). Figure 3 presents the frequency of hedonic scale scores for overall acceptance of fresh and processed mangoes treated with two different levels of SO_2. Fresh mangoes received 100% of responses between 6 and 9, while processed fruits received 80 and 90% of their responses between 6 and 9. This research demonstrated higher acceptance scores for mangoes than those reported by Daza et al. (1997) for processed mangoes, which varied from 4.2 to 7.0.

Fresh cashew apples exhibited lower scores for flavor, texture and overall acceptance when compared to processed fruits treated with 600 ppm and 900 ppm SO_2. Appearance and aroma scores were not significantly different between fresh and 900 ppm SO_2 treated cashew apples (Table 4). Fresh fruits received 45 % of their scores between 6 ("like slightly") and 9 ("like extremely"), while processed cashew apples received 90% of their scores between 6 and 9, indicating that processed fruits were better accepted (Figure 4). Differences may be due to a reduction of typical astringency caused by tannins in fresh fruit, when a complex with tannins and added sugar is formed and by

TABLE 1 - Composition of syrups used in osmotic treatment

	TREATMENT	
Sodium benzoate (ppm)	1000	1000
Citric acid	added up to syrup pH 2.5	Added up to syrup pH 2.5
Ascorbic acid (ppm)	600	600
Calcium chloride (ppm)	100	100
Sulfur dioxide – SO_2 (ppm)		
melon	300	900
mango	600	900
cashew apple	600	900

TABLE 2 - Mean scores for sensory acceptance for fresh and processed melons

	fresh	300 ppm SO_2	900 ppm SO_2
Appearance	7.93a	7.67ab	7.17b
Aroma	7.77a	6.80b	6.57b
Flavor	6.83a	6.80a	6.90a
Texture	7.43a	7.23a	7.03a
Overall acceptance	7.17a	6.93a	6.87a

In each row, samples followed by the same letters are not significantly different ($p<0.05$)

TABLE 3 - Mean scores for sensory acceptance for fresh and processed mangoes

	fresh	600 ppm SO_2	900 ppm SO_2
Appearance	7.80a	6.73b	6.83b
Aroma	7.73a	6.80b	7.03b
Flavor	7.67a	7.10a	7.20a
Texture	7.53a	6.27b	6.57b
Overall acceptance	7.77a	6.97b	6.73b

In each row, samples followed by the same letters are not significantly different ($p<0.05$)

TABLE 4. Mean scores for sensory acceptance for fresh and processed cashew apples

	fresh	600 ppm SO_2	900 ppm SO_2
Appearance	6.73a	6.20b	6.93a
Aroma	6.77a	6.77a	7.17a
Flavor	4.67b	6.87a	7.17a
Texture	6.00b	6.73a	6.93a
Overall acceptance	5.48b	6.73a	7.03a

In each row, samples followed by the same letters are not significantly different ($p<0.05$)

NAME: _____ DATE: _____

Please, evaluate the fruit sample and indicate how much you like or dislike it for appearance, aroma , taste, texture and overall acceptance.

SAMPLE Nº: _____

APPEARANCE	AROMA	TASTE
( ) like extremely	( ) like extremely	( ) like extremely
( ) like very much	( ) like very much	( ) like very much
( ) like moderately	( ) like moderately	( ) like moderately
( ) like slightly	( ) like slightly	( ) like slightly
( ) neither like nor dislike	( ) neither like nor dislike	( ) neither like nor dislike
( ) dislike slightly	( ) dislike slightly	( ) dislike slightly
( ) dislike moderately	( ) dislike moderately	( ) dislike moderately
( ) dislike very much	( ) dislike very much	( ) dislike very much
( ) dislike extremely	( ) dislike extremely	( ) dislike extremely

TEXTURE	OVERALL ACCEPTANCE
( ) like extremely	( ) like extremely
( ) like very much	( ) like very much
( ) like moderately	( ) like moderately
( ) like slightly	( ) like slightly
( ) neither like nor dislike	( ) neither like nor dislike
( ) dislike slightly	( ) dislike slightly
( ) dislike moderately	( ) dislike moderately
( ) dislike very much	( ) dislike very much
( ) dislike extremely	( ) dislike extremely

Comments: _____

FIGURE 1. Score sheet for acceptance test

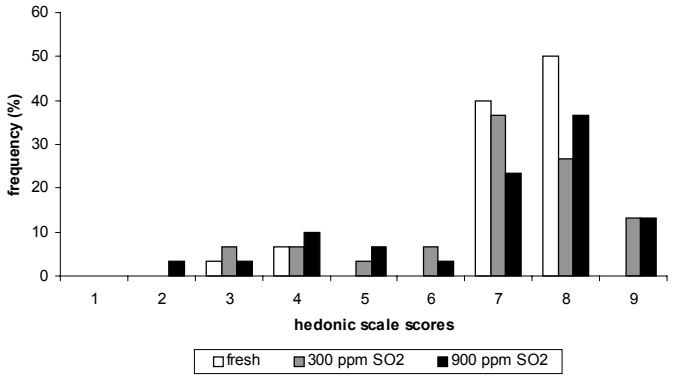

FIGURE 2. Frequency of hedonic scale scores of processed and fresh melons for overall acceptance of products (1=dislike extremely; 9=like extremely)

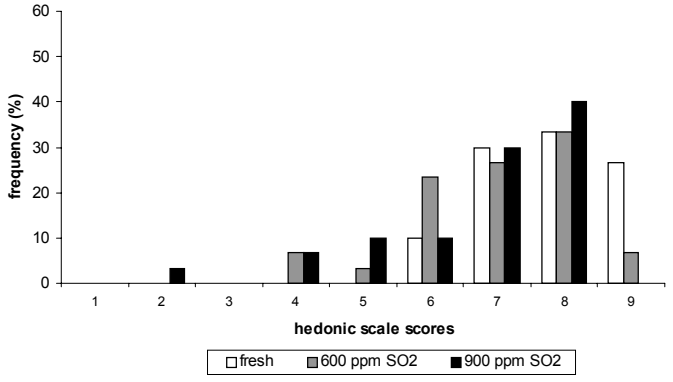

FIGURE 3 - Frequency of hedonic scale scores of processed and fresh mangoes for overall acceptance of products (1=dislike extremely; 9=like extremely)

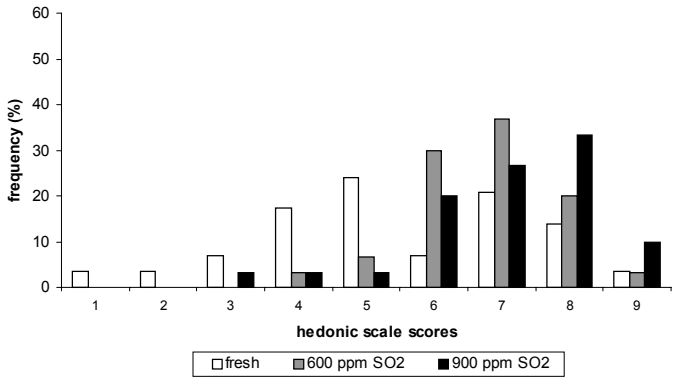

FIGURE 4 - Frequency of hedonic scale scores of processed and fresh cashew apples for overall acceptance of products (1=dislike extremely; 9=like extremely)

degradation of tannins caused during heat treatment.

CONCLUSIONS

Sensory acceptance results indicated that consumers' acceptance to fresh and processed fruits varied depending on the fruit. While fresh and processed melons received similar acceptance scores, fresh mangoes received higher acceptance scores than processed mangoes and fresh cashew apples received lower acceptance scores than processed cashew apples. Although acceptance scores were different for each processed fruit, combined methods applied resulted in products with good acceptance, which can be used immediately or as ingredient in food formulations.

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