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Chayote candy: a value added confectionary product from chayote (*Sechium edule*)

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Abstract

Chayote (*Sechium edule*) fruit was utilized for preparation of value added chayote candy. The candy was prepared using slow and fast cook methods. The prepared products were stored for six month after packaging in the polythene bags. The products were evaluated fresh and after two, four and six months of storage for various chemical and sensory attributes. The results of the study suggested utilization of under utilized valuable nutrient resource which invariably goes waste.

Keywords: Chayote, *Sechium edule*, candy, confectionary products.

Introduction

The chayote plant, a climbing shrub bears roughly pear shaped fruits, somewhat flattened with coarse wrinkles, ranging from 10 to 20 cm in length. It has a thin green skin fused with the white flesh, and a single large flattened pip. The flesh has a fairly bland taste, and a texture described as a cross between a potato and a cucumber (Rafael, 1996).

In India, chayote (*Sechium edule*) has been reported to grow successfully in several parts of India (Nath, 1971). In Himachal Pradesh, Chayote is found in lower areas in the months of September and November where it is locally known as '*Lonku*'. It is consumed as a vegetable but not relished much due to its bland taste. This crop has considerable potential for further exploitation (Aung *et al.* 1990). However, it has remained neglected, underutilized and has hardly received any attention from post-harvest technology view point. The local villagers asked to suggest some methods of utilization of chayote as most of it goes waste. This prompted to explore the product development potential of chayote in the form of value added candy.

Material and Methods

Preparation of candy

The mature and tender fruits of chayote (*Sechium edule*) were procured from the local villagers, sorted, washed, peeled and cut into uniform cubic pieces (1.5cm approx). To retain the intactness of pieces during candying process, the pieces were soaked in 2 percent solution of lime water overnight followed by washing in water. Lime water treated pieces were further treated in 2 per cent boiling alum solution for 2 minutes to clean and give glossy appearance to the candy followed by washing in water. The pretreated pieces were candied in sucrose by slow and rapid cook methods as under:

Slow cook method

Pretreated pieces (1 kg) and cane sugar (500g) were arranged in a cooking container in alternate layers and allowed to stand for 24 hours. During this period fruit gave out excess of water due to osmosis and sugar went in to fruit pieces. At this stage another 250 g sugar was added, mixed thoroughly and allowed to rest for another day. Citric acid, one percent on sugar weight basis was added to invert a portion of cane sugar. The whole mass was then boiled for 4-5 minutes and rested for another 24 hours. Next day the strength of the syrup was raised to about 65^0Brix by adding more sugar (250g) followed by boiling for 5 minutes. The fruit was then left in syrup for another three days. Finally the strength was raised to 70^0Brix by cooking and the finished preserve was allowed to rest for two days, followed by draining the syrup and sponging the pieces with the help of a wet muslin cloth. The pieces were then dried in tray drier at 55 ^{O}C for 2.5 hours and packed in polyethylene bags for further analysis.

Rapid cook method

Pretreated fruit pieces (1 kg) and sugar (1 kg) were taken in a container and mixed thoroughly. To this 500 ml water and citric acid (1 per cent on sugar weight basis were added, mixed and rested for 4 hours. The pieces were allowed to stay in the syrup for 4 days followed by draining, sponging with the help of a wet muslin cloth and drying in the tray drier at 55^{O}C for 2.5 hr. The candy so obtained (Plate-1) was packed in polyethylene bags for further evaluation.

Chemical analysis

The prepared candy samples were evaluated fresh and after storage period of two, four and six months for total soluble solids (TSS), titrable acidity and sugars (reducing, non-reducing and total sugars) according to Ranganna, (1991). The sensory evaluation was carried on a nine point hedonic scale according to Larmond (1977). The data were statistically analyzed with the help of computer software using completely randomized design.

Results and Discussion

The data pertaining to TSS of candies prepared by slow and rapid cook methods, as affected by storage are presented in Table 1.

Table 1. Effect of method of preparation and storage on the TSS (°B) of chayote candy

Method of preparation	Storage (days)				
	0	160	120	180	Mean
Slow cook method	71.1	71.4	72.0	72.5	71.75
Fast cook method	74.1	74.4	74.9	75.3	74.67
Mean	72.6	72.9	73.4	73.9	73.20

CD (P≤ 0.05) Method of preparation = 0.95;
Storage duration = NS

The mean initial values of TSS for candies varied from 71.1^{0}B to 74.1^{0}B. After 180 days of storage, TSS of fresh candies prepared by slow and fast methods increased slightly. Data reveals significant differences in TSS of the chayote candies with respect to method of preparation. Higher values of TSS were found in candy prepared by fast cook method. During storage of 6 months, the increase in the TSS of candies may be due to surface evaporation and drying of candy samples (Sharma *et al.*, 1998).

The titrable acidity did not differ significantly with respect to the method of preparation (Table 2).

Whereas, storage duration had significant effect (P≤0.05) on the titrable acidity that decreased with increase in storage duration. The acidity values of samples prepared by slow cook method and fast cook method varied from 1.60 to 1.65 initially and after 180 days of storage, the values decreased and varied from 1.38 to 1.41 percent, respectively. Data revealed that storage duration has decreasing effect on the acidity values of candies. Similar observations regarding acidity are also reported earlier by Sharma *et al.* (1998) and Sethi and Anand (1982).

As is evident from the Table 3 that the total sugars and reducing sugars were affected significantly (P≤0.05) by the method of preparation, whereas, storage duration had non-significant effect. Total and reducing sugars were higher in candy sample processed by fast cook method as compared to candies processed by slow cook method.

In candy processed by slow cook method, the initial values for total, reducing and non-reducing sugars were recorded as 70.76, 36.56 and 32.49 percent and after 180 days of storage the values were recorded as 72.40, 38.35 and 32.35 percent. Whereas, in case of candy processed by fast cook method the initial values for these sugars were recorded as 72.79, 37.74 and 35.67 and after 180 days of storage the values were recorded as 73.90, 39.15 and 33.01 per cent, respectively.

Table 2. Effect of method of preparation and storage on the titrable acidity of chayote candy

Method of preparation	Storage (days)				
	0	60	120	180	Mean
Slow cook method	1.65	1.59	1.51	1.41	1.54
Fast cook method	1.60	1.54	1.44	1.38	1.49
Mean	1.63	1.57	1.48	1.40	1.52

CD (P≤ 0.05) Method of preparation = NS; Storage duration=0 .07

The values of total and reducing sugars indicate an increasing trend whereas the values for non-reducing sugars show a decreasing trend during storage. Increase in reducing sugars might be due to conversion of sucrose to reducing sugars. However, increase in total sugars might be due to decrease in moisture content during storage.

Results of storage of candies were in accordance with the results reported by Kumar (1989); Sethi and Anand (1982); Sharma *et al.* (1998) and Siddique *et al.* (1990).

Table 3. Effect of method of preparation and storage on the total, reducing and non reducing sugars of chayote candy

Method of preparation	Storage (days)				
	0	160	120	180	Mean
a) Total Sugars					
Slow cook method	70.76	71.15	71.60	72.40	71.48
Fast cook method	72.79	73.04	73.40	73.90	73.28
Mean	71.77	72.09	72.50	73.15	72.38
b) Reducing Sugars					
Slow cook method	36.56	37.35	37.61	38.35	37.47
Fast cook method	37.74	38.38	38.55	39.15	38.45
Mean	37.15	37.86	38.08	38.75	37.96
c) Non Reducing Sugars					
Slow cook method	32.49	32.11	32.29	32.35	32.31
Fast cook method	35.67	32.92	33.11	33.01	33.68
Mean	34.08	32.51	32.70	32.68	32.99

CD ($P \leq 0.05$)

Total sugars:	Method of preparation = 1.0;	Storage = NS
Reducing Sugars:	Method of preparation = 0.79;	Storage = NS
Non Reducing Sugars:	Method of preparation = NS;	Storage = NS

Sensory evaluation

The overall acceptability scores of the fresh and stored candies prepared by different methods are presented in table 4 and physical appearance of candy samples are shown in Plate-1. The overall acceptability of the candies prepared by slow and fast cook methods were found to be significantly ($P \leq 0.05$) different. A perusal of data indicates that the scores of candies improved up to 4 months of storage and then decrease slightly. The overall acceptability scores for slow cook stored and fresh candy varied from 7.88 to 9.00 and that of fast cook stored and fresh candy varied from 6.18 to 6.90 on a nine point hedonic scale. As is evident from the data, the overall acceptability of candy prepared by slow cook method was relatively higher than the candy prepared by fast cook method on a nine point hedonic scale. Slow cooking resulted in soft and smooth candy whereas fast cooking resulted in hard and little shrunk candy. The candy prepared by slow cook method was liked more due to its juicy and soft texture than the candy prepared by rapid cook method on a nine point hedonic scale. Candies prepared from both treatments become slightly hard during storage but more hardening occurred in candy prepared by rapid cook method probably due to shrinkage and crystallization of sugar on the surface.

Chayote a prolific bearer of fruit has remained neglected from post harvest technological view point because of its poorer acceptability as a food. Study concluded with the findings that the chayote being a neglected fruit can be used in the development of candy which can enhance its post harvest utilization on household and commercial levels. This will encourage its production, generate income to the growers and provide ways to the consumers to harvest and harness the benefits of this underutilized valuable food and nutrient resource.

Table 4. Effect of method of preparation and storage on the overall acceptability of chayote candy

Method of preparation	Storage (days)				
	0	160	120	180	Mean
Slow cook method	9.00	8.45	8.16	7.88	8.37
Fast cook method	6.90	6.65	6.48	6.18	6.55
Mean	7.95	7.55	7.32	7.03	7.46

CD ($P \leq 0.05$) Method of preparation = 0.45; Storage duration = NS

Plate 1. Candy prepared by
a) slow cook method
b) Fast cook method



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