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Short communication

Microbial analysis of different *karonda* processed products during storage

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Karonda (*Carissa carandus*) is an indigenous fruit of India and belongs to the family Apocynaceae. It is very hardy and evergreen bush growing well even on marginal and inferior soils where most of the fruits either fail to grow or give poor performance (Singh *et al.*, 6). *Karonda* fruit is a rich source of minerals especially iron and calcium. It is also rich in pectin. The fruit has an immense potential for processing, *i.e.* jelly, pickle and preserve (Singh, 5). The ripe fruit having anti-oxidant properties is reported to be cooling, acidic and useful in bilious (Watt, 7).

The investigation was carried out at the Post-harvest Technology Laboratory, Department of Horticulture, Allahabad Agricultural Institute (Deemed University), Allahabad during September-December 2003 to 2005. Different processed products were prepared by standardized recipes (Table 1) Studies were performed on two *karonda* genotypes, *viz*. white with pink blush and green with purple blush. Four products were made from *karonda viz.*, jelly, jam, candy and squash. The fruits used for the experiment were taken from Mundera Mandi (Farm). Microbial analysis of the products was done in Biotechnology Laboratory of Department of Biotechnology. Glass bottles were used as packaging material and for storage of jelly, jam, candy and squash for different periods. The data of the experiment was statistically analyzed using complete randomized block design with three replications. Organoleptic quality of *karonda* products were evaluated by a panel of ten judges who scored on a 9 point hedonic scale. *Karonda* products were stored for four months at ambient temperature and microbial analysis was done at each storage period. Both bacterial as well as fungal counts were done at each storage periods (Ranganna, 4). Serial dilutions of the processed products were made using sterilized buffer medium. Products (jam, jelly, candy and squash) were made into four dilutions 10^1,10^2,10^3 and 10^4 for bacterial and three dilutions 10^1, 10^2 and 10^3 for fungal counts. A sample of 0.10 ml from each dilution was transferred into sterilized petriplates containing 20 ml. solidified media and spread uniformly over the entire surface with the help of sterilized bent glass rod. The petriplates were allowed to dry at least for 15 min. prior to inversion of petriplates in BOD for incubation at 30°C for 24 h. After 24 h of incubation, the population of bacteria, yeasts and moulds were counted and it was expressed as colony forming unit (cfu) per gram as per following formula.

$$\text{Organism cfu/g of sample} = \frac{\text{No. of colonies (Avg. of 3 replicates)}}{\text{Amount plated} \times \text{Dilution}}$$

Mean score of microbial analysis of the *karonda* products prepared is given in Table 1. The maximum bacterial population of 6.21×10^5 cfu/g of sample in jelly and minimum of 1.88×10^5 cfu/g of sample in candy (prepared by whole fruit with protein coating). Maximum mean score of 7.46×10^5 cfu/g of sample was obtained at 120 days of storage which was 1.68×10^5 cfu/g for fresh products. An increasing trend for microbial load was recorded upto 120 days of storage for all the products. The highest bacterial count was registered in jelly (6.21×10^5 cfu/g of sample) followed by jam (5.66×10^5 cfu/g of sample), squash (1.88×10^5 cfu/g of sample) and candy (1.88×10^5 cfu/g of sample). Data showed that the maximum count was obtained in jelly stored for 120 days and minimum by candy in the fresh products. The mean data for fungal count in the various products indicated maximum value (7.44×10^5 cfu/g of sample) in jam and the minimum (2.54×10^5 cfu/g of sample) in candy (whole fruit with pectin coating). The highest fungal count was obtained in jam followed by jelly, squash and candy. Maximum mean fungal count of 9.68×10^4 cfu/g was obtained at 120 days of storage in different samples and minimum mean fungal count was obtained in 1.84×10^4 cfu/g of sample in fresh products. An increasing trend was recorded up to 120 days of storage as compared to scoring of fresh products. Statistical analysis indicated that the difference in *karonda* products, storage periods and interaction between product and storage period was also significant. It is obvious from the Table 2, that the data on the mean score of microbial fungal count in different products stored for a period of five months. Data revealed that maximum fungal count was obtained by jam stored for 120 days and minimum in candy in fresh products, which was at par with that the jelly.

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Table 1. Changes in bacterial count (per ml/g of sample) during storage of *karonda* products.

Product (A)		Storage period (B) (days)					Mean
		0	30	60	90	120	
Jelly		3.20×10^5	3.50×10^5	5.03×10^5	8.00×10^5	11.30×10^5	6.21×10^5
Jam		2.40×10^5	2.50×10^5	6.20×10^5	7.90×10^5	9.30×10^5	5.66×10^5
Candy		0.80×10^5	1.10×10^5	1.30×10^5	2.50×10^5	3.70×10^5	1.88×10^5
Squash		1.00×10^5	1.80×10^5	2.60×10^5	4.70×10^5	5.20×10^5	3.06×10^5
Mean		1.68×10^5	2.04×10^5	3.63×10^5	5.80×10^5	7.46×10^5	
Comparison							CD at 5%
Product	=	A					0.12
Storage period	=	B					0.13
Interaction	=	AB					-

Table 2. Changes in fungal count (per ml/g of sample) during storage of *karonda* products.

Product (A)		Storage period (B) (days)					Mean
		0	30	60	90	120	
Jelly		1.80×10^4	2.40×10^4	6.01×10^4	9.80×10^4	14.00×10^4	6.80×10^4
Jam		3.31×10^4	4.00×10^4	7.90×10^4	9.00×10^4	13.00×10^4	7.44×10^4
Candy		1.10×10^4	1.30×10^4	2.30×10^4	3.89×10^4	4.60×10^4	2.64×10^4
Squash		2.00×10^4	3.80×10^4	4.70×10^4	6.00×10^4	7.40×10^4	4.78×10^4
Mean		1.84×10^4	2.50×10^4	5.06×10^4	7.10×10^4	9.6×10^4	-
Comparison							CD at 5%
Products	=	A					0.11
Storage period	=	B					0.11
Interaction	=	AB					-

In the present studies, microbial growth in jelly, candy and squash increased gradually with the storage duration. The maximum microbial growth was observed in jelly and jam, while it was minimum in candy. Microbial growth was always below the critical level, *i.e.* 3×10^5 cfu/g of sample. Spoilage was observed in the form of surface microbial growth and fermentation and odour. It was also observed that incidence of *Micrococcus aureus* was highest (100%) followed by *Bacillus coagulans* (50%) and *Aspergillus niger* (35%). In the present finding, *Aspergillus* spp. was observed in jelly and squash, while the *Pencillium* spp. and *Cuvularia* spp. in jam and candy. Bacterial count was in general, higher as compared to fungal count in different products of *karonda*. The sugar used in different products is known to have bactericidal and fungicidal properties. Similar findings was reported by Ingram (2). Microbial growth was observed due to improper sanitation practices during product oreparation. Similar findings was reported by Goldriech and Bordner (1), and Khan *et al.* (3).

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