



Research Article

EFFECT OF DIFFERENT RECIPES ON STORAGE OF KARONDA CANDY

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Abstract: The studies were based on effect of different recipes on storage period of Karonda candy. The experiment comprised of two types of karonda i.e. green and pink with seed and without seed were stored at ambient temperature. From the findings it was observed that, there was a gradual increase in TSS, acidity, reducing sugars and total sugars content of candy irrespective of fruit color type and recipes used in experimentation. However, pH, non reducing sugars, ascorbic acid, moisture, iron content of candy were found to be decreased with the advancement of storage period. The Karonda candy prepared from different recipes of sugar concentration of 60°B, 65°B and 70°B can be stored up to 120 days without any microbial count. From the present findings it is concluded that Karonda candy with 65°Brix sugar is suitable sugar concentration for Karonda candy preparation.

Keywords: Karonda candy, Sugar concentrations, Green fruits, Pink fruits

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Introduction

Karonda (*Carissa carandas* Linn.) is well known as a protective hedge plant yielding berry like fruits are edible and attractive in color. It is indigenous fruit of India and belongs to family apocynaceae. Karonda is very hardy evergreen bush growing well even on marginal and inferior land when most other fruits either fail to grow or give poor performance. Almost every part of plant is used for one purpose or other. Karonda is usually valued for its important nutritional qualities and recognized as richest source of carbohydrates, protein, fat, iron. It is an important fruit of dry land horticulture. Now a day, it is being commercialized by the farmers because of low cost of cultivation and good returns. But, it has got great potential in processed forms. Preservation of fruits is the more important due to non-availability of fresh produce throughout the year. Considering the nutritional and medicinal importance of Karonda fruit crop, its candy can be prepared and preserved. The present investigation was carried out to find out best recipe for candy to obtain maximum consumer acceptability.

Materials and Methods

The experiment was conducted in Post Harvest Technology Laboratory, College of Agriculture, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, 444104, Maharashtra, India. Candy prepared from pink type fruit with or without seed. For the experimentation, matured pink color type fruits with uniform sized were procured from AICRP ON Citrus, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, 444104, Maharashtra, India. Approximately 20 kg matured Karonda fruits was brought to the laboratory and sorted out. Ripe, diseased, damaged and off type fruits were strictly discarded. The selected fruits were thoroughly washed with clean water to remove dirt. For candy with seed, whole fruits were used and candy without seed the fruits were cut into halves and seeds were removed.

Treatment Details:

T1 – Fruit pieces without seed impregnated with sugar having TSS 60°Brix.

T2 – Fruit pieces without seed impregnated with sugar having TSS 65°Brix.

T3 – Fruit pieces without seed impregnated with sugar having TSS 70°Brix.

T4- Whole fruit with seed impregnated with sugar having TSS 60°Brix.

T5- Whole fruit with seed impregnated with sugar having TSS 65°Brix.

T6 – Whole fruit with seed impregnated with sugar having TSS 70°Brix.

Preparation of Karonda candy

Healthy and good quality matured unripe fruits were selected for candy preparation. For experimentation pink with whole fruit with seed and fruit pieces without seed are used. Then whole fruit and pieces were impregnated with sharp stainless steel fork and then cut into equal sizes slices, seeds and hard cores were removed. The prepared slices as well as whole fruits of Karonda then blanched in 500 ppm potassium metabisulphite, 0.25% citric acid and 2% salt solution with hot water treatments to become the slices and whole fruit soft. Then these prepared slices and fruit were steeped in syrup of 60, 65 and 70°Brix with the addition of sugar at different concentrations.

The sugar syrup initially prepared at concentration of 40°Brix. After 24 hours of steeping in each treatment, the syrup concentration was increased by adding sugar proportionally. The syrup concentration was increased by 5°Brix every time until the concentration reached up to 60, 65 and 70°Brix according to the treatment for a period until the equilibrium was reached between slices and the syrup concentration. Finally, the pieces and whole fruit as per treatment impregnated in each treatment were drained free of syrup and rinse immediately with tap water and dried in shade for 24 hrs. After drying, the candy was packed in 250-gauge polythene packets and those kept in plastic boxes which stored under ambient condition. The chemical observations were recorded at every 30 days interval for 120 days.

Results and Discussion

Effect of different recipes on storage period of Karonda Candy is presented in [Table-1] and [Table-2].

Table-1 Effect of Different recipes on storage period of Karonda Candy on pH, TSS and acidity

Treatments	pH (%)					TSS (°Brix)					Acidity (%)				
	Initial	30	60	90	120	Initial	30	60	90	120	Initial	30	60	90	120
T ₁	3.68	3.60	3.55	3.41	3.35	65.14	70.05	73.92	74.56	75.91	1.02	1.03	1.05	1.07	1.07
T ₂	3.70	3.66	3.61	3.50	3.25	64.39	69.68	74.05	75.08	76.59	1.06	1.08	1.10	1.12	1.12
T ₃	3.73	3.68	3.56	3.46	3.43	68.61	71.68	76.10	76.54	76.94	1.05	1.07	1.09	1.10	1.11
T ₄	3.66	3.61	3.61	3.51	3.43	68.20	69.53	71.71	72.83	74.88	1.19	1.20	1.23	1.23	1.24
T ₅	3.55	3.45	3.41	3.38	3.30	71.56	72.11	73.32	74.57	75.68	1.19	1.21	1.23	1.23	1.24
T ₆	3.53	3.46	3.46	3.40	3.31	72.26	73.34	75.18	75.43	76.25	1.23	1.25	1.27	1.27	1.28
F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m)±	0.031	0.029	0.020	0.023	0.020	0.136	0.253	0.063	0.198	0.031	0.014	0.015	0.009	0.007	0.005
CD at 5%	0.092	0.085	0.060	0.066	0.060	0.398	0.743	0.184	0.581	0.091	0.042	0.044	0.027	0.021	0.014

Table-2 Effect of Different recipes on storage period of Karonda Candy on TSS/acid ratio, Reducing sugar (%) and Non-reducing sugars (%)

Treatments	TSS/Acid ratio					Reducing sugar (%)					Non-reducing sugars (%)				
	Initial	30	60	90	120	Initial	30	60	90	120	Initial	30	60	90	120
T ₁	63.89	67.52	69.91	69.72	69.97	28.91	30.56	32.85	36.44	39.64	29.05	28.26	27.13	25.93	25.93
T ₂	60.50	64.40	67.24	67.30	68.63	29.25	31.32	33.25	36.97	40.17	28.91	29.71	27.08	26.00	25.94
T ₃	65.48	66.83	69.56	69.20	69.24	28.90	30.80	32.73	36.95	39.77	28.42	27.35	26.08	25.13	25.05
T ₄	57.12	57.80	58.32	58.97	60.46	27.39	28.50	31.84	35.66	37.69	27.04	26.21	25.52	24.75	22.99
T ₅	60.70	59.61	59.74	60.56	61.40	28.19	30.23	32.95	35.97	38.01	27.02	25.95	25.13	24.68	24.58
T ₆	58.39	58.70	59.10	58.94	59.41	28.99	31.05	33.26	37.06	38.88	27.64	26.87	26.22	25.38	25.05
F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	NS
SE (m)±	0.754	0.874	0.541	0.452	0.192	0.041	0.260	0.077	0.065	0.090	0.054	0.045	0.091	0.042	0.681
CD at 5%	2.214	2.567	1.589	1.327	0.563	0.121	0.763	0.227	0.192	0.263	0.158	0.132	0.269	0.124	-

Table-3 Effect of Different recipes on storage period of Karonda Candy on TSS/acid ratio, Reducing sugar (%) and Non-reducing sugars (%)

Treatments	Total sugars (%)					Ascorbic acid (mg/100g)					Iron (mg/100g)				
	Initial	30	60	90	120	Initial	30	60	90	120	Initial	30	60	90	120
T ₁	57.97	58.82	59.98	62.38	65.57	5.89	5.51	4.33	3.77	3.10	6.14	6.11	6.10	6.08	6.07
T ₂	58.16	61.03	60.34	62.97	66.11	6.02	5.69	4.48	3.96	3.32	6.16	6.13	6.12	6.10	6.08
T ₃	57.32	58.15	58.81	62.08	64.82	6.06	5.77	4.69	4.03	3.29	6.15	6.11	6.10	6.08	6.06
T ₄	54.43	55.27	57.37	60.42	60.68	6.58	6.11	5.01	4.38	3.56	6.14	6.11	6.10	6.08	6.06
T ₅	55.21	56.18	58.08	60.65	62.60	6.45	6.013	4.91	4.38	3.54	6.15	6.12	6.12	6.09	6.07
T ₆	56.64	57.92	59.48	62.44	63.93	6.05	5.70	4.56	4.12	3.48	6.15	6.11	6.10	6.07	6.06
F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	NS	Sig.	Sig.	Sig.	Sig.
SE (m)±	0.067	0.058	0.148	0.078	0.683	0.073	0.030	0.023	0.020	0.012	0.004	0.007	0.005	0.006	0.004
CD at 5%	0.198	0.169	0.434	0.229	2.005	0.213	0.087	0.067	0.060	0.034	0.012	-	0.014	0.018	0.012

pH (%)

Data indicated in Table1 during the period of storage pH content of Karonda candy were gradually decreased in all recipes under study. The effect of different recipes on pH at initial days of storage condition was found significant. At initial days, maximum pH was found in treatment T₃ (3.73 %) and results were found significant at 30, 60, 90, 120 days of storage. At 30 days storage of maximum pH value was found in T₃ (3.68).

At 60 and 90 days of storage there was similar trend was found about minimum pH except 120 days where minimum pH was recorded in treatment T₂ (3.25). At 120 days of storage significantly maximum pH was recorded in T₃ (3.43) and minimum in treatment T₂ (3.25) but at par with treatment T₅ (3.30). The decrease in pH value of Karonda candy with an increase in storage period might be due to the overall increase in acidity of stored candy. Decrease in pH value during storage was also reported by Wani *et al.*, (2013) in Karonda jam and Zeeshan *et al.*, (2017) in dhakki dates candy

Total Soluble Solids (°Brix)

The total soluble solids of Karonda candy were the increased rapidly up to 30th days of storage and thereafter the gradual increase was observed in 60th to 90th and 120th days and in storage period as compare to earlier trend. The effect of all recipe treatments on TSS content at initial days of storage condition was found significant. At initial days of storage maximum TSS was found in treatment T₆ (72.26°Brix). At 30 days of storage maximum TSS was recorded in treatment T₆ (73.34°Brix). Similar trend was found in 60 and 90 days of storage where maximum TSS recorded in T₃ (76.10°Brix) and (76.54°Brix) respectively. At 120 days of storage minimum TSS recorded in T₄ (74.88°Brix) and maximum TSS in treatment T₃ (76.94°Brix). During storage increase in total soluble solids might be due to conversion of polysaccharides into sugars during hydrolysis process.

Acidity (%)

Data indicated in Table1 during storage of Karonda candy gradually increased acidity in all types of recipes. The effect of sugar concentration on percent acidity at initial to 120 days storage was found significant. At initial days of storage maximum acidity was recorded in treatment T₆ (1.23%) while, minimum acidity was recorded in T₁ (1.02%). Similar results were also recorded at 30, 60, 90 and 120 days of storage. At 120 days of storage maximum acidity was found in treatment T₆ (1.28%) while, minimum acidity was recorded by treatment T₁ (1.07%). Increase in acidity of Karonda candy might be due to conversion of sugars into acids during the 120 days of storage. An increase in acidity with storage period has also been observed by Manivasagan *et al.*, (2006) [1] and Patil *et al.*, (2014) [2] in Karonda candy.

TSS/Acid ratio

Data indicated in Table1 during storage of Karonda candy were the increased rapidly up to 30th days of storage and thereafter the gradual increase was observed in 60th to 90th and 120th days and in storage period as compare to earlier trend. At initial to 120 days of storage TSS/Acid ratio was increased due to increase in TSS in all recipes methods. The effect of sugar concentration on TSS/Acid ratio at initial to 120 days of storage was found significant. At initial days of storage maximum TSS/Acid ratio was recorded by T₃ (65.48) while, minimum TSS/Acid ratio was found in treatment T₄ (57.12). Similar trend was found in 30, 60, 90 days of storage. At 120 days of storage maximum TSS/Acid ratio was recorded by treatment T₁ (69.97) but at par with treatment T₃ (69.24) while, minimum in treatment T₆ (59.41). Increased TSS/Acid ratio might be due to increased sugar level in karonda candy during storage period. An increase in TSS/Acid ratio during storage period was also found by Sharma *et al.*, (1998) [3] in apple candy and Radhika *et al.*, (2016) [4] in ginger candy.

Reducing sugars (%)

The effect of recipe methods on reducing sugars content of Karonda candy was found to be significant at all stages at initial to 120 days of storage. There was trend of gradual increase in reducing sugars of all recipes during storage of 120 days. At initial days of storage maximum reducing sugars was found in treatment T2 (29.25%) which was significantly higher than all other treatments. At 30 days of storage maximum storage was recorded in treatment T2 (31.32%). At 60 and 90 days of storage maximum reducing sugars % was recorded by treatment T6. At 120 days of storage maximum reducing sugars was found in treatment T2 (40.17%) but at par with treatment T3 (39.77%). The increase in reducing sugars with advancement of storage might be due to increased degree of inversion of sugars. These findings are in conformity with the results reported by Rani and Bhatia (1985) in pear candy, Mehta *et al.*, (2005) [5] in galgal candy and Verma *et al.*, (2006) [6] in citrus peel candy.

Non reducing sugars (%)

The data presented in Table 1 there was gradual decreased in non reducing sugars of Karonda candy at initial to 120 days of storage period. At initial days of storage maximum non reducing sugar was recorded by treatment T1 (29.05%) and was significantly higher than all other treatments. At 30 days storage maximum non reducing sugar was found in treatment T2 (29.71%). At 60 days storage maximum non reducing sugars was recorded in treatment T1 (27.13%). At 90 days of storage maximum non reducing sugars found in treatment T2 (26.00%). At 120 days of storage non significant difference was recorded. The minimum non reducing sugars was recorded in treatment T4 (22.99%) and maximum in treatment T2 (25.94%). The non reducing sugars was found to be decreased with the advancement of storage period. These results were confirmed by Nayak *et al.*, (2012) [7] in aonla candy and Patil *et al.*, (2014) in Karonda candy.

Total sugars (%)

In general there was an increase in total sugars during storage. At initial days of storage maximum total sugar was recorded by treatment T2 (58.16%) but at par with treatment T1 (57.97%) and similar trend was found at 30,60,90 and 120 days of storage where T2 recorded significantly maximum total sugars than all other treatments. At 120 days of storage maximum total sugar was shown by treatment T2 (66.11%) while, minimum in treatment T4 (60.68%). Increase in total sugars throughout the storage might be because of increased degree of inversion of sugars. These results are in conformity with the results reported by Rani and Bhatia (1985) in pear candy, Patil *et al.*, (2014) in Karonda candy.

Ascorbic acid (mg/100g)

The data revealed that, all the treatments exhibited significant variation with respect to ascorbic acid content of karonda candy and the results were found statistically significant during entire storage period. In general, there was decrease in ascorbic acid content during storage. Maximum ascorbic acid at initial days of storage was found in T4 (6.58) and found significantly superior over all other treatments, but at par with treatment T5 (6.45) and similar trend was found at 30 to 120 days of storage. At 120 days of storage maximum acid was found in treatment T4 (3.56) which was significantly superior to all other treatments. The ascorbic acid content decreases with advancement of storage of product. Loss of ascorbic acid content was also reported by Manivasagan *et al.* (2006) in karonda candy.

Iron (mg/100g)

The iron content was found to be decreased gradually with increase in storage period. The data revealed that iron content at initial 120 days of storage was statistically significant. At initial days of storage maximum iron was found in treatment T2 (6.16). similar trends were found in 30,60,90 and 120 days at 120 days of storage maximum iron content was found in treatment T2 (6.08) followed by treatment T5 (6.07) but at par with treatment T6 and T4 (6.06). There is decrease in iron content of fruit product with advancement of storage period which was also confirmed by Wani *et al.*, (2013) in Karonda jam.

Conclusion

Chemical parameters like TSS, acidity, TSS/acid ratio, reducing sugars, total sugars were increased with the advancement of storage period. pH, ascorbic acid, non-reducing sugars, iron content and moisture content were decreased continuously with the increase in storage period of karonda candy. The Karonda candy prepared from different recipes of sugar concentration of 60°B, 65°B, 70°B can be stored up to 120 days without any microbial count.

Application of research: From the present findings it is concluded that Karonda candy with 65°Brix sugar is suitable sugar concentration for Karonda candy preparation.

Research Category: Horticulture

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Study area / Sample Collection: Post Harvest Technology Laboratory, College of Agriculture, Akola, 444104

Cultivar / Variety / Breed name: Karonda (*Carissa carandas* Linn.)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

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