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Effect of Various Natural Preservatives & Natural Colouring Materials on the Quality of Ber (*Ziziphus mauritiana*) Candy

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An experiment was carried out in the Post Harvest Technology laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (Uttar Pradesh) during the year 2022-2023. The experiment consisted of 10 treatments and 1 control. The investigation laid out in Completely Randomized Design with three replications. Ber candy was stored for 80 days at ambient temperature. From storage studies it was revealed that T3 (jaggery + ginger) performed best in terms of quality (taste, flavour, overall acceptibility) and

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storage. With a fairly high Benefit-cost ratio of 2.34.On the basis of results it is concluded that treatment T3 be used for commercialization. The results indicated that the quality observations and sensory evaluation are affected by various treatments.

Keywords: Ber candy; quality; commercialization.

1. INTRODUCTION

Ber /Indian jujube /Indian plum / Chinese date /Chinese apple /dunks

Scientific name: *Ziziphus mauritiana*

Family: Rhamnaceae

Promising varieties: Umran, Kathapal

After harvest, fruits are liable to accelerated physiological, chemical, and microbial processes that invariably lead to deterioration and loss of wholesomeness.

It is then necessary to institute some measure of processing such as reduction in moisture content, denaturation of endogenous enzymes and microorganisms, or packaging in order to curtail perishability.

Value addition to food products has assumed vital importance in our country due to diversity in socio-economic conditions, industrial growth, urbanization and globalization.

It is not merely to satisfy producers and processors by way of higher monitory return but also with better taste and nutrition.

Value is added by changing their form, colour and other such methods to increase the shelf life of perishables.

Importance of Post-harvest technology lies in the fact that it has the capability to meet food requirement of growing population by eliminating losses making more nutritive food items from raw commodities by proper processing and fortification.

India is the world's second largest producer of fruits.

It has potential to grow all types of temperate, sub - tropical and tropical fruits because of varied agro - climatic diversity.

The total production of fruits is over 45 million tones.

The losses are estimated to the extent of 20 -30 per cent due to lack of proper harvesting, processing and storage facilities, which is valued at Rs. 230 billion

This study aimed to evaluate the effects of different food additives on the quality of ber candy and to estimate the economics of various treatments [1].

2. MATERIALS AND METHODS

The present experiment was conducted with the objective of assessing the flavour, taste, texture, shelf life and economics for checking "Effect of various natural preservatives and natural colouring material on the quatity of ber candy". Different treatment combinations were used (Table 1). The details of the materials and methords used are given below.

2.1 Prequisites

Extraction of colour from beetroot, carrot and spinach: Add 2 cups of grated/cut vegetable to 2 cups of water. Mix it well, close and cook for 10 minutes.

Once done let it cool. Blend it into a smooth paste.

Filter the paste and your colour is ready.

Ginger extract: The ginger is grated and the pulp is squeezed to extract the juice [2].

Procedure for preparation of ber candy: The sound fruits are washed under tap water to remove dirt or any foreign particle on the skin. It is then put in salt water for about 15 minutes and washed again with clean water. The stem of ber fruits is removed manually by using a sharp stainless steel knife. The edible fruit portion is cut in two halves and the seed is removed. The cut fruit is boiled for 2-5 minutes or till slightly soft. The sugar/jaggery syrup (30 degree brix) as per treatment + lemon juice is then poured on the fruits which are kept submerged in it for 4 days. The density of the syrup is gradually raised to 75 degree brix in a course of 10-12 days.

5th day	50 °B
10th day	75 °B

The spinach extract, beetroot extract, ginger extract, carrot extract, cardamom are added according to the treatments on the 10th day and the fruit is kept in it for 24 hours. The syrup is drained. The fruits are dried in shade till the moisture content in the fruit is 20 %. Another test to check if the fruit is dry enough is that there should be no visible moisture when the candied fruit is cut open or you should not be able to squeeze any moisture from the fruit [3].

2.2 Statistical Analysis

The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance (ANOVA) for Completely Randomized Design (CRD) by Fisher and Yates (1963). The significance and non- significance of the treatment effect were judged with the help of 'f' value (variance ratio) that was compared with the Table 1 value at 0.05% level of significance.

Table 1. Treatment combinations

Treatments	Combinations			
T0	-	-	-	-
T1	ber	jaggery	lime juice	Spinach
T2	ber	jaggery	lime juice	Beetroot
T3	ber	jaggery	lime juice	Ginger
T4	ber	jaggery	lime juice	Carrot
T5	ber	jaggery	lime juice	cardamom
T6	ber	sugar	lime juice	Spinach
T7	ber	sugar	lime juice	Beetroot
T8	ber	sugar	lime juice	Ginger
T9	ber	sugar	lime juice	Carrot
T10	ber	sugar	lime juice	cardamom

2.3 Chemical Analysis Methods

(1) Total soluble solids (°B)

The percentage of total soluble solids was determined by using ERMA hand refractrometer by placing a drop of the filtered juice on the prism of the refractrometer and observing the coincidence of shadow of the sample with the reading on the scale and expressed as °B [4].

Acidity (%)

10 ml of homogenized sample was taken and made up to 100 ml volume in a volumetric flask. The contents were filtered through Whatman No.l filter paper. An aliquot of 10 ml was taken for titration against 0.1N NaOH using phenolphthalein as an indicator. The turn of aliquot to light pink colour which persists for 15 seconds was considered as an end point. The titratable acidity was estimated in terms of percent citric acid (Ranganna, 1986).

Factor for acidity=lml of 0.1N NaOH = 0.0064g of citric acid.

Total acidity % = (Titrate×normality×0.06404 Wt. Or volume of sample) × 100

(3) Moisture content

Moisture content was determined by using hot air oven drying method 10gm of sample was taken in pre-weighed empty Petri plate and dried hot air oven at 100 °C till constant weights were obtained. Plates were cooled in desiccator. The moisture content was calculated by using formula. (Ranganna 1986) [5].

$$\% \text{ Moisture} = \frac{\text{Initial weight-Final weight}}{\text{Weight of sample}} \times 100$$

(4) pH Value

The sample was soaked in distill water till it soften and ground along with the little amount of distilled water. Then the pH was noted with the help of an electronic pH meter.

(5) Organoleptic evaluation

The organoleptic evaluation for accessing the taste, color, flavor and texture of the samples were conducted by panel of 10 judges who scored on a 9 points hedonic **(Srilakshmi 2007)** scale as mentioned below [6].

3. RESULTS AND DISCUSSION

According to the results recorded in Tables 3 and 4.

3.1 Total Soluble Solids (°B) of ber Candy

Total soluble solids of Ber candy were observed to be increased gradually up till the end of experiment under ambient storage conditions. At

the beginning of storage there was significant difference amongst various treatments.At 80 days the minimum TSS was recorded in T0 (control) and maximum in T5 (jaggery + cardamom). Similar results was reported by Tandon et al., (2008).

3.2 Acidity (%) of ber Candy

The acidity(%) of Ber candy was observed to decrease upto the end of the experiment under ambient storage co re to be decreased gradually up to the end of the experiment under ambient storage conditions. At the begining of storage there was significant difference amongst various treatments. At 80 days after storage the minimum acidity was recorded in T4 (jaggery + carrot) and maximum in T0 (control). Similar results was reported by Neelesh (2014) in papaya candy [7].

3.3 Physiological Loss in Weight (%) of ber Candy

The moisture content (%) of ber candy was observed to gradually decrease up to the end of the experiment under ambient storage conditions. At 80 days the minimum physiological loss in weight was recorded in T0 (control) and maximum in T2 (jaggery + beetroot). Similar results was reported by Daisy and Gehlot (2006) in Aonla preserve [8].

3.4 pH of Ber Candy

The pH of ber candy was observed to decrease gradually up to th e end of the experiment under ambient storage conditions. At the beginning of storage there was significant difference amongst various treatments maximum pH 5.03 was observed in T3. At 80 days after storage. The minimum pH was recorded in T0 (control) and maximum in T4 (jaggery + carrot) and T9 (sugar + carrot). Similar results was reported by Jain et al. (2004) in papaya cubes.

3.5 Ascorbic Acid (mg/100 gms) of Ber Candy

Ascorbic acid of Ber candy were observed to be decreased gradually up till the end of experiment under ambient storage conditions. At the beginning of storage there was significant difference amongst various treatments. At 80 days after the minimum ascorbic acid was recorded in T9 (sugar + carrot) and maximum in T0 (control) [9].

3.6 Reducing Sugars (%) of ber Candy

Reducing sugars of Ber candy were observed to be increased gradually up till the end of experiment under ambient storage conditions. At the beginning of storage there was significant difference amongst various treatments. At 80 days after the minimum reducing sugars were recorded in T6 (control) and maximum in T2 (jaggery + beetroot).

3.7 Total Sugars (%) of ber Candy

Total sugars of Ber candy were observed to be increased gradually up till the end of experiment under ambient storage conditions. At the beginning of storage there was significant difference amongst various treatments. At 80 days after The minimum total sugars were recorded in T0 (control) and maximum in T4 (jaggery + carrot).

3.8 Non-reducing Sugars (%) of Ber Candy

Non-reducing sugars of Ber candy were observed to be decreased gradually up till the end of experiment under ambient storage conditions. At the beginning of storage there was significant difference amongst various treatments. At 80 days the minimum non-reducing sugars were recorded in T9 (control) and maximum in T1 (jaggery + spinach) and T6 (sugar + spinach) [10].

3.9 Colour (Sensory Score) of ber Candy

The data are showing significant difference at 80 days after storage organoleptic score for colour of the ber candy showed a gradual decrease in all the treatments up to the end of experiment. A minimum appealing colour was recorded in T0 (control) and maximum appealing colour was recorded in T7 (sugar + beetroot) at 80 days after storage and findings agreed with the Singh et al., (2012) in ber candy.

3.10 Taste of ber Candy

By the result of sensory score for texture the minimum taste was recorded in T0 (control) and maximum in T3 (jaggery + ginger), T5 (jaggery + cardamom). The decreasing trend was observed for taste with increase storage period. This might be due to degradations of volatile substance and flavour constituent.Similar results

Table 2. Economics of different tretments of ber candy

Treatments	Gross return(Rs/kg)	Net profit(Rs/kg)	Benefit Cost ratio
T0	900	160.63	2.65
T1	1130	160.26	2.31
T2	1190	171.75	2.34
T3	1170	171	2.34
T4	1150	166.56	2.33
T5	1200	154.7	2.20
T6	1000	141.37	2.18
T7	1100	152.85	2.31
T8	1070	152.11	2.29
T9	1050	147.67	2.27
T10	1120	135.81	2.18

Table 3. Means of redings taken at initial, 20 days, 40 days, 60 days and 80 days of the following parameters during storage at ambient conditions

Treatments	TSS °B	Acidity %	Physiological loss in weight %	pH	Ascorbic acid mg/100gms	Reducing sugars %	Total sugars %	Non-reducing sugars %
T0	25.56	1.34	17.16	3.62	64.2	16.02	21.92	5.9
T1	70.21	0.82	21.11	4.75	19.78	37.82	83.58	45.76
T2	70.55	0.69	21.15	4.95	19.36	38.46	83.92	45.46
T3	69.5	1.12	21.13	4.09	19.64	37.98	83.52	45.54
T4	70.36	0.57	20.97	4.96	19.38	38.14	83.4	45.26
T5	71.18	0.84	20.99	4.41	19.46	38.1	83.68	45.58
T6	70.48	0.81	20.26	4.74	19.74	33.42	79.18	45.76
T7	69.22	0.68	20.31	4.95	19.3	34.06	79.52	45.46
T8	69.01	1.06	20.28	4.10	19.4	33.58	79.12	45.54
T9	69.81	0.59	20.36	4.96	19	33.74	79	45.26
T10	70.89	0.82	20.40	4.40	19.34	33.7	79.22	45.52

Table 4. Means of redings taken at initial, 20 days, 40 days, 60 days and 80 days of the following parameters during storage at ambient conditions

Treatments	Colour	Taste	Flavour	Overall acceptibility
T0	6.2	5.6	5.6	4.6
T1	8.2	7.6	7.6	7.6
T2	8.2	7.6	7.6	7.6
T3	7.2	8.6	8.8	8.8
T4	8.2	7.6	7.6	7.6
T5	7.2	8.6	8.6	8.6
T6	8.2	6.6	7.6	6.6
T7	8.6	6.6	7.6	6.8
T8	7.2	7.6	8.6	7.6
T9	8.2	6.6	7.6	6.6
T10	7.2	6.6	8.6	6.6

were found by Kannan and Susbeela (2002) in ber candy.

3.11 Flavour of ber Candy

By the result of sensory score for taste, the minimum flavour was recorded in T0 (control) and maximum in T3 (jaggery + ginger). The decreasing trend was observed for flavour with increase storage period. This might be due to degradation of volatile substance and flavour constituents. Score of flavour of candy was observed to be decreased continuouslyup to the end of experiment under ambient storage conditions. Similar results reported by Hasanuzzaman in tomato candy [11].

3.12 Overall Acceptibility of ber Candy

The result of sensory score for overall acceptibility of ber candy, The minimum overall acceptibility was recorded in T0 (control) and maximum in T3 (jaggery + ginger). There was significant ditrerences between the treatments for taste, colour, and texture. Similar results observed by **Hiremanth and Rokhade (2006)** in sapota candy. The overall acceptability of mixed fruit leather is dependent on colour, texture, favour and taste rating ofthe product. The decrease in overall acceptability score may be due to absorption of atmospheric moisture, dilution of sugars and changes in acidity, oxidation of ascorbic acid as well as changes in biochemical constituents of candy. The similar observations were recorded by **Sharma** in apple candy [12].

3.13 Economics of Preparation of Different Treatments

It is evident from the treatment details that the highest benefit cost ratio was recorded in T0 (control). Finding detail (benefit cost ratio in descending order) T0(2.65) > T2 & T3(2.34) > T4(2.33) > T1 & T7(2.31) > T8(2.29) > T9(2.27) > T5(2.20) > T6 & T10(2.18) as shown in Table 2.

4. CONCLUSION

From the present investigation, it has been concluded that T3 (jaggery + ginger) performed best in terms of quality with a TSS of 69.5, the highest overall acceptibility of 8.8 and a shelf life of more than 6 months. The highest Benefit-cost ratio was found in T0 (control) i.e. 2.65.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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