

Preserve and Candy Development of Sweet Cherry (*Prunus avium* L.)

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Abstract: The research was conducted to develop preserve and candy from fresh cherry (*Prunus avium* L.) for studying their storage life. The preserve was made from 60%, 65% and 70% sugar concentration. The candies were made from 65%, 70% and 75% sugar concentration. Among them the best preserve and candy was identified on the basis of overall acceptability. The study showed that the color, flavor, texture and overall acceptability among the preserves and among the candies were different. The preserve (CP70) made from 70% and the candy (CC75) made from 75% sugar concentration was best among others of the similar product. Higher concentration of sugar and slower processing gives higher acceptability for preserve and candy. Among different changes, moisture concentration was prominent during preparation of preserve and candy. The moisture content was 42.0% and 37% for preserve and candy respectively which were nearly half of the initial concentration of fresh cherry. The storage stability of candy (90 days) was higher than storage stability of preserve (60 days).

Keywords: Cherry, Preserve, Candy, Acceptability, concentration

1. Introduction

Sweet cherry (*Prunus avium* L.) is among the most important foods of mankind as they are both nutritive and indispensable for maintenance of health. Being rich source of carbohydrates, minerals, vitamins and dietary fibres, these constitute an important part of our daily diet. Moreover, they add flavour and diversity to diet. In recent times, sweet cherries have received more attention on their beneficial role in human diet than any other food group. They hold an immense value in formulating a balanced diet. Due to their high nutritive value, sweet cherry make a significant nutritional contribution to human well being. They are cheaper and better sources of protective foods. If they can be supplied in fresh or preserved form throughout the year for human consumption, the national picture of its contribution to GDP will improve greatly.

Sweet Cherry (*Prunus avium* L.) belonging to family Rosaceae is one of the most important fruit crops of temperate region of the world. Cherries are considered native of Southeast Europe and Asia Minor. In India, Jammu and Kashmir is the main cherry growing state having 3106 hectares under this crop with the annual production in metric tones. Cherries have high calorific value than apple as they are rich in protein and sugars. Besides, carotene and folic acid contents are fairly high. The fruit is also rich source of minerals like potassium, calcium, magnesium, iron and zinc (Randhawa, 1991). Shelf life of cherry fruit is very less and large quantities get wasted. Also there is lack of efficient post-harvest management of cherries, which leads to the rapid quality deterioration and sudden glut in the market. This crop can be saved from wastage and at the same time, can be converted into more valuable and priced commodity by processing into various products (Maini and Anand, 1996). Various products prepared from cherries are juice, frozen cherries, dehydrated cherries, canned products, cherry jam, cherry juice concentrate, cherry juice powder, cherry bars and cherry candies. Candied products available these days are descended from the simplest confections first made

more than 4000 years ago. A candied fruit or vegetable is essentially a preserve from which sugar syrup is drained. It has sugar concentration higher than preserve and after drying beyond sticky condition can be stored without spoilage.

2. Materials and Methods

The fresh cherry and sugar was collected from the local market and was used in the study.

3. Preparation of Cherry

The cherry was washed thoroughly in several changes of water and Peels were removed by scrubbing. Then the cherry was sliced crosswise according to its shape to a thickness of 0.5 cm. The cherry was soaked in clean water to prevent browning. The pieces of cherry were boiled for about for three minutes and set aside the boiled water. And it was done several times until the desired spiciness obtained. Finally these pieces of cherry were ready to make preserve and candy.

4. Preparation of Preserve

The cubes were steeped in sugar syrup having 40% total soluble solids (TSS) for a day. Then the cubes were removed from the syrup and increased consistency of syrup to 60% TSS by boiling. The cubes were steeped in 60% TSS syrup for a day. Then the process was repeated to raise the strength of syrup from 60% to 65% and finally to 70% TSS. The cubes were steeped in 70% TSS for a week. At each level of TSS (60%, 65% and 70%) the syrup was drained and filled the container with fresh sugar syrup corresponding with the level of TSS from whom that was collected. The sugar was used as similarly described by Ponting *et al.* (1966).

5. Preparation of Candy

The cubes were steeped in sugar syrup having 40% total soluble solids (TSS) for a day. Then the cubes were removed from the syrup and increased consistency of syrup to 65% TSS by boiling. The cubes were steeped in 65%TSS syrup for a day. Then the process was repeated to raise the strength of syrup from 65% to 70% and finally to 75% TSS. The cubes were steeped in 75% TSS for a week. At each level of TSS (65%, 70% and 75%) the syrup was drained and finally dried under shade to make candy with different sugar content as Cruess (1958) describe that the candied fruit is usually coated with a thin transparent layer of heavy syrup and dried to a more or less firm texture. In the preparation of candy osmotic dehydration step prior to drying was used as described by Ramamurthy *et al.* (1970). The drying time requirement was similarly followed as described by Islam and Flink (1982).

6. Storage of Preserve and Candy

The prepared preserve was packed in glass bottle and the candy was packed in polyethylene (HDGP). Both the preserve and candy was stored in room temperature (30±30C). The packed preserve and candy was opened at a regular interval to analyze and observe its physical and chemical parameters and consequently to find the storage stability of the preserve and candy.

7. Chemical Analysis

The fresh cherry, processed preserves and candies were analyzed for moisture, ash, vitamin-C, protein and fat content as per the methods of AOAC (2005).

8. Subjective (Sensory) Evaluation of Preserve and Candy

For statistical analysis of sensory data different samples were evaluated for color, flavor, texture and overall acceptability by a panel of 10 testers. All the testers were briefed before evaluation. The samples were presented to 10 panelists and randomly coded sample. The test panelists were asked to rate the different composition presented to them on a 9 point hedonic scale with the ratings of: 9 = Like extremely; 8 = Like very much; 7 = Like moderately; 6 = Like slightly; 5 = Neither like nor dislike; 4 = Dislike slightly; 3 = Dislike moderately; 2 = Dislike very much; and 1 = Dislike extremely. The result was analyzed by statistical software (Mstatc).

9. Result and Discussion

9.1 Effect of preparation method on sensory parameter of preserve

The color, flavor, texture and overall acceptability of preserves made from different concentration of sugar were evaluated by 10 panel judge. Sample CP60 was made from 60% sugar syrup, CP65 was made from 65% and Sample CP70 was made from 70% sugar syrup. The analysis of variance (ANOVA) was Performed for color, flavor, texture and overall acceptability of sample GP60, GP65 and GP70.

Table 1: Analysis of variance for color, flavor, texture and overall acceptability of preserve

Sensorial Property	Statistical Parameter			Sensorial Property	Statistical Parameter		
	Sources of variance	Mean squares	Probability		Sources of variance	Mean squares	Probability
Color	Products	5.633	0.0000	Texture	Products	10.033	0.0000
	Judge	0.311	0.4496		Judge	0.311	0.3437
	Error	0.300			Error	0.256	
Flavor	Products	3.9	0.0046	Overall Acceptability	Products	9.033	0.0000
	Judge	0.385	0.6793		Judge	0.533	0.0880
	Error	0.530			Error	0.256	

Note: Degree of freedom (df) were 3, 9 and 27 for products, judge and error respectively

There was statistical significant difference in color, texture and overall acceptability among the samples as the P value was 0.0000<0.05. The P value (0.0046 <0.05) for flavor indicate that the samples were significantly different in flavor. These differences may be due to variation in their preparation, especially for sugar concentration and processing time as the GP70 takes higher sugar and time than GP65 and sequentially GP60.

9.2 Effect of preparation method on sensory parameter of candy

The color, flavor, texture and overall acceptability of preserve made from different concentration of sugar were evaluated by 10 panel judge. Sample CC65 was made from 65% sugar syrup. Sample CC70 was made from 70% sugar syrup. Sample CC75 was made from 75% sugar syrup. The analysis of variance (ANOVA) was Performed for color, flavor, texture and overall acceptability of sample CC65, CC70 and CC75.

Table 2: ANOVA (Analysis of variance) for color, flavor, texture and overall acceptability of candy

<i>Sensorial</i>	<i>Statistical Parameter</i>			<i>Sensorial</i>	<i>Statistical Parameter</i>		
<i>Property</i>	<i>Sources</i>	<i>Mean</i>		<i>Property</i>	<i>Sources</i>	<i>Mean</i>	
	<i>Of</i>	<i>squares</i>	<i>Probability</i>		<i>of</i>	<i>squares</i>	<i>Probability</i>
	<i>variance</i>				<i>variance</i>		
<i>Color</i>	Products	3.9	0.0001	<i>Texture</i>	Products	8.133	0.0004
	Judge	0.478	0.0935		Judge	0.33	0.6474
	Error	0.233			Error	0.430	
<i>Flavor</i>	Products	1.433	0.0184	<i>Overall</i>	Products	6.40	0.0000
	Judge	0.33	0.3722	<i>Acceptability</i>	Judge	0.448	0.2695
	Error	0.285		Error	0.326		

Note: Degree of freedom (df) were 3, 9 and 27 for products, judge and error respectively

There was statistical significant difference in color, flavor, texture and overall acceptability among the samples as the P values for each parameter was less than 0.05(Table.2). The samples CC75, CC70 and CC65 were significantly different in color, flavor, texture and Overall acceptability. These differences may be due to variation in their preparation, especially for sugar concentration and processing time as the CC75 takes higher sugar and time than CC70 and sequentially CC65.

9.3 Effect of sugar concentration on sensory property of preserve

From table 3, among different sample (preserve) the highest score (7.3) for color and flavor was for sample CP70 and lowest score was for CP60 preceded by CP65. Similarly the highest score (7.5) for texture and overall acceptability was for sample CP70 and lowest score was

for CP60 preceded by CP65. For flavor there was no statistical significant difference between sample CP70 and CP65 as they were suffixed by same letter (b). On the basis of color, texture and overall acceptability, Sample CP70 was significantly different from CP60 and CP65 a suffixed by different letter (a) and ranked as “Like moderately” whereas the sample CP60 was ranked as “Neither Like nor Dislike” and CP65 was ranked as “Like slightly” as described by (Ranganna,1991). CP70 was identified as best sample (preserve) as its score for color, flavor, texture and most importantly overall acceptability was highest among the others. So it can be claimed that the high concentration of sugar and slower processing gives better quality preserve as the CP70 was made from 70% sugar syrup whereas CP60 and CP65 was made from low concentration (less than 70%) of sugar and their processing was quicker than CP70.

Table 3: Mean score of color, flavor, texture and overall acceptability of Preserve and candy

<i>Product</i>	<i>Sample</i>	<i>Sensory attributes</i>			<i>overall</i>
		<i>color</i>	<i>flavor</i>	<i>texture</i>	
<i>Preserve</i>	CP60	5.8 ^c	6.1 ^b	5.5 ^c	5.6 ^c
	CP65	6.5 ^b	7.0 ^a	6.6 ^b	6.5 ^b
	CP70	7.3 ^a	7.3 ^a	7.5 ^a	7.5 ^a
	LSD value	0.5146	0.6840	0.4754	0.4754
<i>Candy</i>	CC65	6.2 ^b	6.7 ^b	5.7 ^c	6.3 ^c
	CC70	6.5 ^b	6.8 ^b	6.7 ^b	7.1 ^b
	CC75	7.4 ^a	7.4 ^a	7.5 ^a	7.9 ^a
	LSD value	0.4535	0.285	0.430	0.326

9.4 Effect of sugar concentration on sensory property of candy

From table 3, among different sample (preserve) the highest score (7.4) for color and flavor was for sample CC75 and lowest score was for CC65 preceded by CC70. The highest score (7.5) for texture was for sample CC75 and lowest score was for CC65 preceded by CC70. For color and flavor there was no significant difference between samples CC70 and CC65 as suffixed by same letter (b). For overall acceptability and texture sample CC75, CC70 and CC65 was statistically different as suffixed by different letter. It was clear that, On the basis of color, flavor, texture and overall acceptability, Sample CC75 was significantly different from CC70 and CC65 as suffixed by different letter (a).

The mean score for overall acceptability of sample CC75 was (7.9) very near to 8.0 and can be ranked as “Like very much” as described by as described by (Rangana, 1991). Sample CC75 was identified as best sample (candy) as its score for color, flavor, texture and most importantly overall acceptability was highest among the others. So it can be claimed that the high concentration of sugar and slower processing gives better quality preserve as the CC75 was made from 70% sugar syrup whereas CC70 and CC65 was made from low concentration (less than 70%) of sugar and their processing was quicker than CC75. Comparing all the sample of preserve and candy, it was clear that highest acceptability score (7.9) was for CC75. From this it can be claimed that higher sugar concentration gives higher acceptability for preserve and candy (table.3)

as the taste is somewhat influenced by sweetness (Bhuiyan *et al.*, 2012).

Arrhenius type relationship with absolute temperature (Heldman, 1974; Augustin *et al.* 1979 and Islam, 1980).

10. Laboratory Attributes

Initially the moisture content of sweet cherry (*Prunus avium* L.) was 83.5%, protein 2.4%, fat 0.8% and vitamin-C 4mg/100 g, this composition are more or less in similarity with the determination of Sharma (2002). All the parameter i.e. moisture, protein, fat and vitamin of both the prepared preserve and candy were more or less different than the fresh ginger. But among different parameter moisture content was most prominently different than the fresh sweet cherry (*Prunus avium* L.). The moisture content of preserve was 42.0% and 37% for candy. It was clear that the moisture content was reduced to near about half of the initial (83.5%) concentration. This finding was similar to Pointing *et al.* (1966) as described that 50% of the water of fruit pieces could be removed by mixing with dry sucrose or by immersion in concentrated solution (65-75% solids) of sucrose or invert sugars. The vitamin C concentration was near about to one percent for preserve and candy respectively which were different from initial concentration. This difference may be due to processing method applied to prepare preserve and candy. Factors responsible for vitamin C losses are: temperature, oxidation, acidity, pH and metal trace (Villota and Hawkes, 1992). The vitamin-C content of develop products were low due to the fact that Siddiqui *et al* vitamin-C is readily oxidized. Moreover reduction of vitamin-C follows the first order kinetic reaction and the rate constant has and

11. Storage Stability

Observation of color, flavor and fungal growth of preserve and candy has been shown in Table.4. The color, flavor and fungal growth of preserve (CP70) were acceptable as there were no changes up to 60 days of storage. The remarkable change was noticed at 90 days of preservation and the preserve remarked as unacceptable to consume. The changes occurred possibly due to fermentation in presence of fungus (mold and yeast) as Frazier and Westheff (1978) describe that main spoilage organism for fruit products are mold and yeast. The color, flavor and fungal growth of candy were acceptable as there were no changes up to 90 days of storage. The remarkable change was noticed at 120 days of preservation and the candy remarked as unacceptable to consume. The changes occurred possibly due to fermentation in presence of fungus (table. 4). Comparing preserve and candy it was clear that the storage stability of candy (90 day) is higher than preserve (60 day) as the moisture content was lower in candy (37%) than preserve (42%). Both the preserve and candy were IMF (intermediate moisture foods) due to their moisture content and this type of food provide necessary plastic mouth feel to enable the food to be ready to eat and product can kept for long time without refrigeration or thermal processing in any hermetically sealed container.

Table 4: Effect of storage on the quality of preserves and candy

Storage period (day)	Preserve (GP70)				Candy (GC75)			
	Color	Flavor	Fungal growth	Remarks	Color	Flavor	Fungal growth	Remarks
0	Good	Pleasant	Not Visible	Acceptable	Good	Pleasant	Not Visible	Acceptable
15	Good	Pleasant	Not Visible					
30	Good	Pleasant	Not Visible					
45	Good	Pleasant	Not Visible					
60	Good	Pleasant	Not Visible					
90	Not good	Off flavor Spoiled			Fermentation occurred and Spoiled	Good	Pleasant	
120	Not good	Off flavor Spoiled		Not good		Off flavor Spoiled		Fermentation occurred and spoiled

12. Conclusion

The best preserve and candy of the Sweet cherry (*Prunus avium* L.) was identified based on the overall acceptability. Sugar concentration showed most prominent effect on overall acceptability. Color, flavor and texture were also influenced by sugar. Both the preserve and candy contains reduced amount of moisture and vitamin C than the fresh fruit.

The storage stability of candy was 90 days and is higher than storage stability of 60 days for preserve where moisture content was most important factor.

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