

Original Research Article

Standardization of flavoured pineapple candy (*Ananas comosus* L.)

Comment [EP1]: Title of manuscript does not correspond with the article content.

Maybe more suitable title is:
Selected parameters of flavoured pineapple candy (*Ananas comosus* L.)

ABSTRACT

An experiment was carried out at the Post Harvest Technology, Department of Horticulture, SHUATS, Prayagraj (Uttar Pradesh) during the year 2021 - 2022. Pineapple (*Ananas comosus* L.) is an important tropical fruit grown in India. It is known for its nutritive and medicinal value but it is not an easy to eat out of hand item. It has got great potential in processed forms, such as candy. Attempts are being made to produce products that are not only nutritionally delicious but also acceptable among consumers. The medicinal, nutritional, and organoleptic quality of pineapple candy can be improved by the addition of different syrups in the pineapple candy like mint syrup, rose syrup, tulsi syrup, ginger syrup and cardamom syrup. The experiment conducted consist of 6 different treatments comprising the different syrups (Sugar syrup, Mint syrup, Rose syrup, Tulsi syrup, Ginger syrup and Cardamom syrup) with the addition of the standard recommended dosage of citric acid. The investigation was laid out in a completely randomized design with three replications. The pineapple candy samples were tested for physico-chemical changes after preparation, and sensory evaluation was done based on the 9-point hedonic scale tested on a panel of 7 experts. These candies were stored for about 90 days at ambient temperature. From the storage studies, it was revealed that the total soluble solid and pH increase gradually till the end of the experiment while titrable acidity and ascorbic acid are in decreasing order. On the basis of the organoleptic test, it was concluded that treatment T3 (Pineapple + Sugar syrup @ 60 % + Rose extract @ 10 %) is the best flavoured pineapple candy.

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Comment [EP5]: replications

Key words: pineapple, candy, citric acid, and syrup.

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1. INTRODUCTION

Pineapple (*Ananas comosus* L.) is an important tropical fruit grown in India. Pineapple has recently gained much prominence for its health promoting properties. Pineapple mainly contains sugar, protein, digesting enzyme bromelain, citric acid, malic acid, vitamin A, B, carotene and refreshing sugar-acid balance and is a very rich source of vitamin C and organic acids (Bartolomew et al. [1]). Pineapple is known for its nutritive and medicinal value. Eating pineapples may help in treating cold and cough, strengthen bones and teeth, prevents cancer, reduce symptoms of arthritis, prevents hypertension, reduces risk of blood clots, etc. Pineapple is not an easy to eat out of hand item. The fruit has got great potential in processed forms, such as candy, pickles, preserve (murabba), sauce, jam, jelly, dried chips, tablets, etc. Candy is one of the most popular pineapple products. A fruit, when impregnated with sugar free of syrup, drained and dried, is called candied fruit. It is plump, tender, and exceedingly sweet with a strong flavour and without sticking. Pineapple candy can be improved by the addition of different syrups in the pineapple candy like mint syrup, rose syrup, tulsi syrup, ginger syrup and cardamom syrup. Peppermint (*Mentha piperita* L.) is a prominent medicinal herb and largely acknowledged by medicinal and food processing industries due to its excellent health benefits. Rose or Queen of flowers (*Rosa* spp.) belongs to the family of Rosaceae. Rose is a very nutritive flower that contains a lot of vitamin C, carotenoids, phenolic components, minerals, and essential oil. Tulsi (*Ocimum sanctum*) is also known as Holy Basil or Tulasi in Sanskrit. The plant's extracts are commonly used to treat a variety of diseases, including the common cold, irritation, intestinal illness, coronary illness, migraines, stomach troubles, kidney stones, heart issues, and malaria treatment. Ginger (*Zingiber officinalis* L.) is a member of the Zingiberaceae family. Ginger's unique aroma and medicinal qualities are due to the presence of gingerol and oleoresin (a mix of volatile oils and resin). Gingerol components have therapeutic benefits for the treatment of poor digestion, heartburn vomiting, and preventing motion sickness. Cardamom extract also have significant antibacterial activity and is also very useful in the discovery of novel antibiotics.

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"In the text, citations should be indicated by the reference number in brackets [3]."

Other citation style is author/authors and year of publication (without reference number in brackets).

For example:
Bartolomew et al. 1995

Comment [EP8]: Not suitable term for Original Research Article.

Comment [EP9]: Confusing, inaccurate. Maybe more suitable is:

Fruits of rose (*Rosa* spp.) contains a lot

Comment [EP10]: Scientific names are written in italics.

2. MATERIALS AND METHODS

2.1 Raw Material

Mature pineapples were purchased from a local fruit market at Mahewa, Prayagraj. Other ingredients like sugar, mint, rose, tulsi, ginger, cardamom and citric acid were brought from local shops in Prayagraj.

2.2 Preparation of Candy

Pineapple candy was prepared with different syrup solution i.e., Sugar syrup, Mint syrup, Rose syrup, Tulsi syrup, Ginger syrup and Cardamom syrup.

Comment [EP11]: The procedure for preparing individual syrups is not indicated. This information is essential - it must be part of the methodology.

Comment [EP12]: The definition of shelf life and method it's evaluation method is not mentioned in part 2 Material and Method (the results of the evaluation of this parameter are presented in the part Results). It is necessary to supplement the method of shelf life evaluation. in part 2. Material and Methods..

Comment [EP13]: Do you know variety/cultivar of used species ?
Many plants (medical plants also) are bred and cultivars of plant are grown.
Were used local genotypes of used plant species ?

The sliced pineapple fruits were pricked with fork and soaked in 2 % salt solution (24 hrs). After washing the soaked pineapple slices in clean tap water, blanched it for about 4-5 minutes.

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The blanched pineapple slices are steeped into the different syrup. After the completion of steeping time, the syrup was drained and pineapple slice were spread on the trays. Then pineapple slice in the trays were kept for drying in the dehydrator for 24 hours at 100 °C.

After drying, the samples of the dehydrated pineapple candies were collected and packed in LDPE bags for storage purposes. Candies were stored at room temperature for 3 months for storage studies.

Comment [EP15]: The blanched pineapple slices were steeped into the different syrup. After the completion of steeping time, the syrup was drained and pineapple slice were spread on the trays. Then pineapple slices laid in the trays were kept for drying in the dehydrator for 24 hours at 100 °C. After drying, the samples of the dehydrated pineapple candies were collected and packed in LDPE bags for storage purposes. Candies were stored at room temperature for 3 months for storage studies.

2.3 Treatment Details

T1- Pineapple + Sugar syrup (60%)

T2- Pineapple + Sugar syrup (60%) + Mint extract (10%)

T3- Pineapple + Sugar syrup (60%) + Rose extract (10%)

T4- Pineapple + Sugar syrup (60%) + Tulsi extract (10%)

T5- Pineapple + Sugar syrup (60%) + Ginger extract (10%)

T6- Pineapple + Sugar syrup (60%) + Cardamom extract (10%)

Comment [EP16]: Variants used in experiment

2.4 Physico-chemical and Organoleptic Quality of Pineapple Candy

2.4.1 Titrable acidity (%)

Titration was determined by titrating a known quantity of sample (10ml) of the homogenized sample was taken and made up to 100 ml volume in a volumetric flask. The contents were filtered through Whatman No. 1 filter paper. Titration against 0.1N NaOH was performed with a 10 ml aliquot using phenolphthalein as an indicator. The turn of the aliquot to light pink colour which persists for 15 seconds was considered an endpoint. The titratable acidity was estimated in terms of percent citric acid analyzed as per the Ranganna [2].

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or

Physico-chemical analysis and evaluation of organoleptic quality of pineapple candy

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2.4.2 pH

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

Comment [EP20]: Titratable acidity was determined by titrating. 10ml of the homogenized sample was taken and made up to 100 ml volume in a volumetric flask. The contents were filtered through Whatman No. 1 filter paper. Titration against 0.1N NaOH was performed with a 10 ml aliquot using phenolphthalein as an indicator. The turn of the aliquot to light pink colour which persists for 15 seconds was considered an endpoint. The titratable acidity was estimated in terms of percent citric acid analyzed as per the Ranganna [2].

2.4.3 Total soluble solids (°Brix)

The percentage of total soluble solids was determined by using a hand refractometer (Erma, Japan) by placing a drop of the filtered juice on the prism of the refractometer and observing the coincidence of the shadow of the sample with the reading on the scale and expressed as °Brix. ~~Brix~~ to standard procedure as given in Ranganna [2].

Comment [EP21]: It is a **degrees** Brix (not the number 0).

2.4.4 Ascorbic acid (mg/100g)

Determination of ascorbic acid was done by the 2, 6-dichlorophenol indophenols dye method as described by Ranganna [3]. A known quantity of sample was blended with 3 percent metaphosphoric acid (HPO₃) to make the final volume of 100 ml and then filtered. A known quantity of aliquot was titrated against 0.025 percent 2, 6-dichlorophenol indophenols dye to a pink color endpoint. The ascorbic acid content of the sample was calculated taking into consideration the dye factor and expressed as mg of Ascorbic acid per 100g.

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2.4.5 Organoleptic Evaluation

To assess consumer preference, the sensory evaluation of the experimental sample was conducted at different intervals by a panel of 7-8 judges. The sample was evaluated for colour and appearance, taste, aroma, and overall acceptability. Samples were served on coded plates. The judges scored the quality characteristics of each sample on the nine-point hedonic rating scale described by Srilakshmi, [4].

Comment [EP23]: Were the mentioned parameters evaluated in general?

For example, in the case of still wines, in the case of taste are evaluated genuineness, positive intensity, harmonious persistence, quality. Other possibility of taste evaluation is evaluation intensity of sweet, bitter, sou taste.

Comment [EP24]: Who were the judges? Did the jurors have experience with organoleptic evaluation (were holders of an evaluator's certificate) or were they trained or were they untrained non-experts?

The samples were to be evaluated by the same evaluators, in the same number at each evaluation date.

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Comment [EP26]: I suggest add also term of evaluation.

Perhaps:

To assess consumer preference, the sensory evaluation of the experimental sample was conducted at different intervals by a panel of 7-8 judges. Colour and appearance, taste, aroma, and overall acceptability of samples were evaluated. Organoleptic evaluation was carried out in four terms (0, 30, 60, 90 DAS). Samples were served on coded plates. The judges scored the quality characteristics of each sample on the nine-point hedonic rating scale described by Srilakshmi, [4].

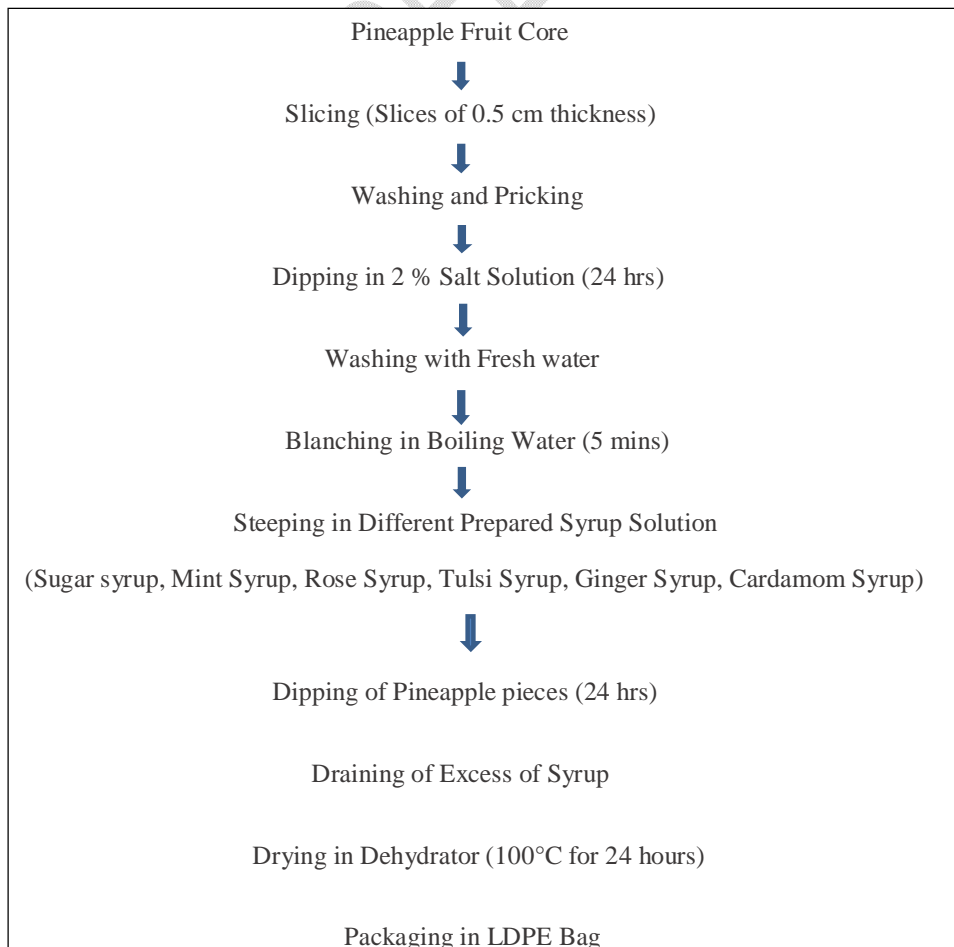




Chart 1: Flowchart of Pineapple Candy preparation

3. RESULTS AND DISCUSSION

3.1 Titrable Acidity (%)

During the storage term (90 days) at ambient room temperature, a gradual decrease was reported in the titrable acidity of pineapple candy (Table 1). The maximum value (0.40) was observed in treatment T2 treatment T2 (Pineapple + Sugar syrup @ 60% + Mint extract @ 10%) and minimum 0.37 was recorded in treatment T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10%). The decreasing trend observed in acidity of candy might be due to the various types of treatment employed to them during processing for candy and could also be mainly due to formation of sulphurous acid during storage as reported by Kumar and Kirad[5], in a study conducted on pineapple candy.

3.2 pH

The gradual increase in pH during the storage period (90 days) was reported from pineapple candy (Table 1). The maximum value (3.88) was observed in treatment T4 (Pineapple + Sugar syrup @ 60% + Tulsi extract @ 10%) and T5 (Pineapple + Sugar syrup @ 60% + Ginger extract @ 10%) and minimum pH value was observed in treatment T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10%) with a value of 3.74. Variation in pH might be due to the changes in chemical properties of pineapple candy which are affected during storage conditions. Similar reports have been observed by Dindeet *al.*[6] in Karonda candy.

3.3 Total Soluble Solids ($^{\circ}$ Brix)

This gradual increase in total soluble solids during the storage period (90 days) of pineapple candy (Table 1) might be due to the conversion of polysaccharides into sugars during the hydrolysis process. Similar observations of gradual increase in total soluble solid was reported by Ghanwatet *al.*[7] in aonla candy and Jain *et al.* [8] in osmotic dehydration of

Comment [EP27]: I recommend placing Chart 1 after chapter 2.2.

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Comment [EP29]: titratable

Comment [EP30]: Treatment /preparation of candy) was same/uniform, the difference was in terms of the syrups used.

Sulphurous acid was used ?
Sulfur dioxide is often used in the case of dried fruits as an antioxidant and antimicrobial agent.

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Comment [EP33]: The gradual increase in pH during the storage period (90 days) was reported in pineapple candy (Table 1). The maximum value (3.88) was observed in variant T4 (Pineapple + Sugar syrup @ 60% + Tulsi extract @ 10%) and T5 (Pineapple + Sugar syrup @ 60% + Ginger extract @ 10%) and minimum pH value was observed in variant T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10%) with a value of 3.74.

pH value depends on acid content and type of acids.

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papaya cubes. The maximum value (66.33°Brix) was observed in treatment T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10%) and minimum value (63.58°Brix) was observed in T2 (Pineapple + Sugar syrup @ 60 % + Mint extract @ 10 %).

3.4 Ascorbic Acid

This gradual reduction in ascorbic acid during the storage period (90 days) of pineapple candy (Table 1). The loss of vitamin C in processed pineapple candy was mainly due to leaching in syrup as well as thermal dehydration. It might also be due to oxidation by trapped oxygen in the packaging container, which results in the formation of dehydroascorbic acid. Similar observations of gradual decrease in ascorbic acid were reported by Kumar and Singh [9] in aonla products and Deepika *et al.*[10] in quality of enriched fruit bars during storage. The maximum value (4.93 mg/100g) was observed in treatment T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10%) and the minimum ascorbic acid of 4.60 mg/100g was recorded in treatment T6 (Pineapple + Sugar syrup @ 60% + Cardamom extract @ 10%).

3.5 Organoleptic Evaluation

In the organoleptic evaluation such as colour and appearance, taste, aroma, and overall acceptability from initial to 90 days storage period, treatment T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10%) was found to be the highest sensory score of 6.68, 7.21, 7.08, and 6.99 (Tables 2) in all parameters of organoleptic attributes, it indicated that it was well-received by the judges.

3.6 Shelf life of Pineapple Candy

From the shelf life point of view during the storage period (90 days), the highest was recorded in treatment T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10%) at 89.24 and minimum (87.56) in treatment T1 (Pineapple + Sugar syrup @ 60%) respectively.

Comment [EP37]: Observed gradual increase in total soluble solids during the storage period (90 days) of pineapple candy (Table 1) might be due to the conversion of polysaccharides into sugars during the hydrolysis process. Similar observations of gradual increase in total soluble solid was reported by Ghanwat et al. [7] in aonla candy and Jain et al. [8] in osmotic dehydration of papaya cubes. The maximum value (66.33°Brix) was observed in variant T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10%) and minimum value (63.58°Brix) was observed in T2 (Pineapple + Sugar syrup @ 60 % + Mint extract @ 10 %).

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or
thermal degradation ?

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Comment [EP41]: Gradual reduction in ascorbic acid during the storage period (90 days) of pineapple candy was observed (Table 1). The loss of vitamin C in processed pineapple candy was mainly due to leaching in syrup as well as thermal dehydration. It might also be due to oxidation by trapped oxygen in the packaging container, which results in the formation of dehydroascorbic acid. Similar observations of gradual decrease in ascorbic acid were reported by Kumar and Singh [9] in aonla products and Deepika et al. [10] in quality of enriched fruit bars during storage. The maximum value (4.93 mg/100g) was observed in variant T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10%) and the minimum ascorbic acid content (4.60 mg/100g) was recorded in variant T6 (Pineapple + Sugar syrup @ 60% + Cardamom extract @ 10%).

Comment [EP42]: By the organoleptic evaluation colour and appearance, taste, aroma, and overall acceptability carried out in four terms (0, 30, 60, 90 DAS) variant T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10%) obtained the highest sensory score of 6.68, 7.21, 7.08, and 6.99 (Tables 2) in all parameters of organoleptic ... [1]

Comment [EP43]: Which exactly means shelf life in case of candies?

The definition and evaluation method must be specified in the part 2 Material and Methods.

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Comment [EP45]: variant

Table 1. Changes in acidity, pH, and TSS and Ascorbic acid in the pineapple candy during storage period

Treatments	Titration Acidity (%)				pH				TSS (° Brix)				Ascorbic acid (mg/100g)			
	0 DAS	30 DASDAS	60 DASDAS	90 DAS	0 DAS	30 DASDAS	60 DASDAS	90 DAS	0 DAS	30 DASDAS	60 DASDAS	90 DAS	0 DAS	30 DASDAS	60 DASDAS	90 DAS
T1	0.45	0.43	0.41	0.39	3.65	3.71	3.80	3.83	64.67	65.29	65.38	65.55	5.25	5.21	4.94	4.79
T2	0.47	0.46	0.42	0.40	3.60	3.72	3.79	3.82	62.93	63.07	63.57	63.58	5.23	5.20	4.93	4.80
T3	0.41	0.41	0.40	0.37	3.54	3.69	3.71	3.74	64.00	64.33	65.35	66.33	5.25	5.20	5.10	4.93
T4	0.44	0.42	0.40	0.38	3.68	3.82	3.83	3.88	62.67	64.10	64.32	64.46	5.22	5.18	4.78	4.65
T5	0.46	0.45	0.41	0.39	3.65	3.72	3.78	3.88	62.83	63.63	64.15	64.50	5.26	5.21	5.08	4.89
T6	0.48	0.47	0.42	0.39	3.62	3.71	3.73	3.79	63.67	63.07	64.13	64.67	5.21	5.18	4.84	4.60
F-test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
S. Ed(±)	0.007	0.011	0.005	0.007	0.025	0.023	0.036	0.038	0.349	0.30	0.247	0.272	0.008	0.007	0.480	0.038
C. D. @ 5 %	0.016	0.023	0.016	0.016	0.056	0.05	0.079	0.083	0.769	0.662	0.545	0.599	0.017	0.015	0.106	0.084

Table 2. Changes in colour and appearance, taste, aroma, overall acceptability and shelf life of the pineapple candy during storage period

Treatments	Colour and Appearance				Taste				Aroma				Overall Acceptability				Shelf life 90 DAS
	0 DAS	30 DAS	60 DAS	90 DAS	0 DAS	30 DAS	60 DAS	90 DAS	0 DAS	30 DAS	60 DAS	90 DAS	0 DAS	30 DAS	60 DAS	90 DAS	
T1	5.41	5.10	4.60	3.89	5.58	5.48	5.15	4.92	5.77	5.67	5.49	5.30	5.59	5.42	5.08	4.70	87.56
T2	6.13	5.90	5.67	5.08	6.57	6.45	6.17	5.87	6.86	6.35	6.29	6.13	6.52	6.24	6.04	5.69	88.64
T3	7.75	7.62	6.88	6.68	7.98	7.92	7.59	7.21	8.12	7.91	7.34	7.08	7.95	7.82	7.27	6.99	89.24
T4	6.31	6.20	5.88	5.18	6.98	6.82	6.59	6.20	7.50	7.38	7.15	6.44	6.93	6.80	6.54	5.94	89.15
T5	5.98	5.59	5.09	4.89	6.25	6.10	5.79	5.49	6.97	6.59	6.19	5.54	6.40	6.09	5.69	5.30	88.82
T6	5.53	5.22	4.92	4.75	6.11	5.99	5.74	5.14	6.19	5.79	5.42	5.34	5.94	5.67	5.27	5.08	88.30
F-test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
S. Ed(±)	0.344	0.303	0.235	0.284	0.288	0.299	0.258	0.293	0.249	0.258	0.237	0.316	0.325	0.326	0.372	0.418	0.241
C. D. @ 5 %	0.758	0.668	0.519	0.625	0.635	0.658	0.569	0.646	0.549	0.568	0.521	0.697	0.716	0.717	0.819	0.921	0.531

Table 3. Economics of different treatments on benefit cost ratio of pineapple candy

Comment [EP46]: variants

Treatments	Treatment Combination	Total Cost of preparation (Rs.)	Pineapple Candy output (80g)	Selling Rate (Rs./Package)	Gross Return (Rs.)	Net Return (Rs.)	Benefit cost ratio
T1	Pineapple + Sugar Syrup (60%)	106.14	3	80	240	133.86	2.26
T2	Pineapple + Sugar Syrup (60%) +Mint extract (10%)	131.14	3	100	300	168.86	2.29
T3	Pineapple + Sugar syrup (60%) + Rose extract (10%)	146.14	3	120	360	213.86	2.46
T4	Pineapple + Sugar syrup (60%) + Tulsi extract (10%)	131.14	3	100	300	168.86	2.29
T5	Pineapple + Sugar syrup (60%) +Ginger extract (10%)	131.14	3	100	300	168.86	2.29
T6	Pineapple + Sugar syrup (60%) + Cardamom spice (10%)	131.14	3	95	285	153.86	2.17

4. CONCLUSION

In this investigation, the treatment T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10 %) was found most suitable treatment in terms of Physico-chemical properties i.e., total soluble solids (66.33), titrable acidity (0.37), pH (3.74) and ascorbic acid (4.93) and organoleptic test i.e., colour and appearance (6.68), taste (7.21), aroma (7.08) and overall acceptability (6.99). As a result, one of the forthcoming value added food products could be the produced Pineapple candies. They might have a healthy commercial market and be able to draw in consumers of all ages. The maximum shelf life (89.24) was recorded in T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10 %). Similarly, the treatment T3 (Pineapple + Sugar syrup @ 60% + Rose extract @ 10 %) showed the highest BC ratio (1:2.46). Thus, it is ultimately determined that the processing method created for making pineapple candy is technologically and economically viable and may therefore be used commercially.

Comment [EP47]: variant

Comment [EP48]: ... was the best variant from point of view physico-chemical properties i.e., total soluble solids (66.33), titrable acidity (0.37), pH (3.74) and ascorbic acid content (4.93 mg/100g) and organoleptic properties i.e., colour and appearance (6.68), taste (7.21), aroma (7.08) and overall acceptability (6.99).

Comment [EP49]: variant

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Comment [EP50]: Check the References format (style) according to instructions for authors (look <https://journalijps.com/index.php/IJPSS/about/submissions#authorGuidelines>).

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UNDER PEER REVIEW

