Original Research Article

Development of Tomato and Pumpkin blended Puree for Value Addition and Shelf life with different levels of preservatives

ABSTRACT

The lab experiment was conducted in the year 2021-2022 at Post Harvest Lab, Department of Horticulture, Nani Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh to analyse the physico-chemical properties and shelf life of the puree during storage at refrigerated condition and overall acceptability with different treatment combinations of preservatives. The Experiment was laid out in Completely randomized design (CRD) with 9 treatments.

Keywords: Pulp, Sodium benzoate and Titrable Acidity.

1 Introduction

Tomatoes (*Lycopersicon escullentum*) are propagated and consumed globally both in raw and processed forms with providing an adequate amount of antioxidants in daily diet mainly carotenes and phenolic compounds. Carotenes contain group of phytochemicals promoting good health and protection from diseases. In epidemiological studies, research shows that tomatoes contain antioxidant which has many health benefit properties like avoidance from prostate cancer **(Damian *et al.*, 2013).**

Tomato is considered as vegetable by consumption, but according to its botanical aspects tomato is classified as fruit. Watery portion is 93 to 95% contributing as a major constituent whereas the solid content is 5.5 to 9.5% in which 1% of the solid content is seeds and peel. Cultivars, irrigation, environmental and soil conditions are the causes for this wide- range in solid content. The prime acid in tomato is citric acid. In tomatoes antioxidants are also present in appreciable amount which are vitamin C (160 to 240mg/1000g), vitamin A carotenes (6 to 9mg/1000g), lycopene (30 to 200mg/1000g) and phenolic compounds like flavonoids (5 to 50mg/kg). Vitamin E is also present (5 to 20mg/1000g). Minerals present in tomatoes are iron, zinc, copper and manganese **(Nasir *et al.*, 2015).**

Puree is a form of concentrated juice which acts as convenience food and used in preparation of curries during shortage as well as costliest tomato accessible in the market. Nowadays, many national and multinational companies are tomato is processed in the form of pulp, paste, juice, ketchup, sauce, puree .

It has a limited storage life and cannot be stored over extended periods.

The pumpkin *(Cucurbita moschata*) is the predominant cucurbit in tropical areas of the Caribbean and Latin America **(Martínez, 2012).** This vegetable is an excellent source of ascorbic acid and carotenoids, which have antioxidant functions as vitamin C and vitamin A precursors, respectively **(Provesi *et al.*, 2012).** Its fat content is low as well as its energy intake. Many authors have reported the health benefits of pumpkin, as it has anti-inflammatory, antibacterial, antiparasitic, antitumoral and analgesic properties.

Also, it has the capability of reducing risky diseases such as diabetes, cancer, hypercholesterolemia, hypertension, atherosclerosis, arthritis, cataracts, cardiovascular and intestinal diseases. Its mesocarp tissue is rich in fiber and provides a basis for the development of functional foods **(De Escalada Pla *et al.*, 2009).** This vegetable can be consumed in various forms, either as a whole vegetable or as an ingredient of stews, sauces, desserts, jellies, jams, purees and other products, however, the primary form of commercialization is as a fresh vegetable. Nonetheless, pumpkin puree can be found on the market as canned food, ready to be eaten

2. Material and Methods

Fresh tomato and pumpkin were purchased from local fruit sellers in Prayagraj, India. The tomato and pumpkin were then kept at refrigeration temperature until the time of conducting the experiment. The spice was purchased from local general stores in Prayagraj. The Ripe pumpkin was then kept at refrigeration temperature until the time of conducting the experiment. Food grade Sodium benzoate was used as pre-treatment chemical during the experiment. Every research study is based on an experimental plan, table no.1.

Table no.1 Experimental Plan

Variables / Parameters	Levels	Description
Product	1	Tomato and Pumpkin Puree
Ingredients	6	Tomato pulp, Pumpkin pulp, Spices, Salt, sugar and Sodium Benzoate,
Processing	1	Grinder
Physico-chemical Analysis	5	Moisture Content, pH, Titrable acidity, Vitamin-C, Texture analysis.
Sensory Analysis	6	Aroma, Flavour, Texture, Taste, Colour and Appearance
Storage conditions	1	Refrigerated temperature
Packaging material	1	Glass Bottle

Table no. 2 Standard recipe for tomato and pumpkin puree

Pulp	1 kg
Water	500 ml
Sugar	250 g
Salt	50 g

Spice	Ginger, Garlic, Onion, Cinnamon, Cardamon, Cumin

Physico-chemical analysis

- Total soluble solid (^{0}Brix)
- Acidity (%)
- Ascorbic acid (mg/100g)
- pH
- Self life

4.2 Sensory attributes

- Aroma
- Color
- Flavour
- Overall acceptability

Flow-chart for Tomato and Pumpkin Puree

Sample Collection
↓
Procurement of material
↓
Pulp Extraction
↓
Blending of tomato and Pumpkin Pulp
↓
Pasteurization
↓
Packaging
↓
Storage (refrigerated conditions)

Fig.no. 1 Schematic flow chart of Tomato and Pumpkin Puree

Preparation and storage of tomato and pumpkin puree

At first processed tomato and pumpkin pulp will be taken and weighted by a balance. Then total tomato and pumpkin pulps will be separated into three parts in order to processing of three kinds of sample. After that tomato and pumpkin pulps will be mixed with weighted according to the described formulation. Mixed pulp will be heated at 80-90 ^{0}C for 10 minutes and cooled, then puree is poured in to the glass bottles, the bottles are kept open till the temperature become normal and then it is closed and kept in refrigerator.

Chart 1: Treatment Combinations

Treatment	Treatment Combination
T_0	**Tomato Pulp (100 %)** (Control)
T_1	Tomato Pulp (90 %) + Pumpkin Pulp (10%) + Sodium Benzoate (0.10 %)
T_2	Tomato Pulp (80 %) + Pumpkin Pulp (20%) + Sodium Benzoate (0.10 %)
T_3	Tomato Pulp (70 %) + Pumpkin Pulp (30%) + Sodium Benzoate (0.10 %)
T_4	Tomato Pulp (60 %) + Pumpkin Pulp (40%) + Sodium Benzoate (0.10 %)
T_5	Tomato Pulp (90 %) + Pumpkin Pulp (10%) + Sodium Benzoate (0.05 %)
T_6	Tomato Pulp (80 %) + Pumpkin Pulp (20%) + Sodium Benzoate (0.05 %)
T_7	Tomato Pulp (70 %) + Pumpkin Pulp (30%) + Sodium Benzoate (0.05 %)
T_8	Tomato Pulp (60 %) + Pumpkin Pulp (40%) +Sodium Benzoate (0.05 %)

Statistical Analysis

The experiment was conducted by adopting a completely randomized design; the data recorded during the course of investigation were statistically analyzed by the 'Analysis of variance- two-way classification. This technique was developed by **Dr. R. A. Fisher** in **1923** gave an appropriate method capable of analyzing the variation of population variance. The significant effect of treatment was judged with the help of 'F' (variance ratio). Calculated F value was compared with the table value of F at 5% level of significance. If the calculated value exceeded the table value, the effect was considered to be significant. The significance of the study was tested at 5% level.

Results and Discussion

Chemical Analysis (Table No. 3)

Total soluble Solids(^{0} Brix): In tomato and pumpkin puree were found lowest TSS content of 8.60 °Brix was recorded in treatment T_0 whereas, treatment T_3 recorded the highest TSS content of 9.16 °Brix. (Table no. 3). The statistical results revealed that treatment and storage has a significant ($P < 0.05$) effect on total soluble solid content of tomato puree. The decrease in total soluble solid content of tomato puree might be due to break down or sedimentation of some solid content. Similar result was produced by **(Adedeji *et al.,* 2012)**, who observed decrease in value of TS and TSS during storage due to break down of pectin into other acidic components in tomato puree.

Titratable Acidity: The treatment T_5 the highest titratable acidity content of 0.46 per cent and the lowest acidity content of 0.41 per cent was recorded in treatment T_2 (Table no.1). The increase in titrable acidity might be due to break down of amino acids and conversion into other acids. **(Nasir *et al.*, 2015)**, Also found increase in acidity in his research on tomato processing which is due to break down of some amino acids into components like glutamine and asparagine conversion into glutamic acid and aspartic acid.

Ascorbic Acid (mg/100g): The ascorbic acid content in of tomato and pumpkin puree showed significant changes among treatments and storage durations. The highest ascorbic acid content of 14.46 mg/l00g was recorded in treatment T_2 and followed by the treatment T_3 (14.20) and the lowest ascorbic acid content of 12.34 mg/l00g was recorded in treatment T_0 (Table no. 2). The decrease in ascorbic acid content of tomato puree might be due to oxidation at high temperature. The results are similar with **(Sarkar *et al.*, 2015),** who also found decrease in ascorbic acid content of tomato pulp at room temperature (25°C) due to oxidation which is greater at higher temperature.

pH: Highest pH content % observed was 4.46 % for treatment T_2 at and followed by T_3 (4.38) and the lowest pH content % observed was 4.32 % for treatment T_4 (Table no.3), but in initial moisture content of product were high. The decrease in pH of tomato puree possibly due to high refrigerated condition and increase in acidity of the tomato puree samples. He observed that increase of acidity results in decrease of pH. Whereas **(Khan *et al.*, 2011)**, also reported the decrease in pH in his studied the effect of chemical preservatives on the storage life of tomato paste stored at ambient temperature. He noticed that high temperature is also responsible for decrease in pH.

Shelf life: The shelf life of tomato and pumpkin puree showed changes among treatments and storage durations. The highest shelf life were found in all the treatment T_3 (0.14), followed by T_6 (0.13) and the lowest value were found T_0 (0.03) (Table no.3).

Table no. 3 Effect of different blending ratio of Tomato and pumpkin with various levels of preservatives on physiochemical analysis during storage

Treatment	Total Soluble Solids (^{0}Brix)	Titratable Acidity	Ascorbic Acid	pH	Shelf life
T_0	8.72	0.45	12.34	4.34	0.03
T_1	8.98	0.42	14.06	4.40	0.07
T_2	9.06	0.41	14.46	4.46	0.10
T_3	9.16	0.43	14.20	4.38	0.14
T_4	8.90	0.45	13.88	4.32	0.06
T_5	8.84	0.46	13.54	4.34	0.12
T_6	9.00	0.44	13.88	4.36	0.13
T_7	8.95	0.44	13.77	4.37	0.07
T_8	9.13	0.42	13.87	4.32	0.10
Mean	8.97	0.44	13.78	4.37	0.09

F Test	S	S	S	S	S
SE (m)	0.041	0.013	0.004	0.178	0.010
CD at 5%	0.020	0.006	0.002	0.089	0.010

Sensory Analysis

Color: The colour scores were observed visually for tomato and pumpkin puree was judged the best for colour parameter by scoring. The treatment T_3 was found the highest score as 8.58 and lowest colour appearance T_0 was found (7.52) (Table no.4). The decrease in the colour of tomato puree might be due to lycopene which is major pigment for red colour in tomato and different reactions i.e. Millard and Caramelization. The study of **(Siddiqui and Singh, 2014),** also reported that lycopene and beta carotene is highly sensitive to heat and time.

Flavour: The highest flavor score of 8.44 was recorded by treatment T_3 and the lowest flavor score of 7.28 was recorded by treatment T_0 (Table no.4). Flavour of puree was significantly influenced by storage period and the interaction between treatments and storage was found to be significant ($p < 0.05$).

Aroma: The lowest score of 7.88 was recorded in treatment T_0 and treatment the highest score of 8.48 was observed in treatment T_2 (Table no.4). As the storage period advanced, the aroma score showed a decreasing trend. The decrease in aroma of tomato puree might be due to escape of some volatile compounds and storage temperature and time. According to **(Baldwin *et al.*, 2004).**

Overall acceptability: The highest acceptability score of 8.36 was recorded in treatment T_3 and the lowest texture score of 7.63 was observed in treatment T_0 (Table no.4). The decrease in overall acceptability is due to decrease in all other sensory attributes, studied in his research work with the passage of time and presence of temperature responsible in breakdown of quality which results in decline in overall acceptability similar study was found by **(Ayub *et al.*, 2005).**

Table no.4 Effect of different blending ratio of Tomato and pumpkin with various levels of preservatives on sensory analysis during storage

Treatment	Colour	Flavour	Aroma	Overall acceptability
T_0	7.52	7.28	7.88	7.63
T_1	8.30	8.04	8.24	8.23
T_2	7.96	7.94	8.02	8.11
T_3	8.58	8.38	8.48	8.38
T_4	8.32	8.14	8.36	8.27

T_5	8.02	8.26	8.18	8.16
T_6	8.44	8.30	8.38	8.34
T_7	8.16	8.06	8.22	8.16
T_8	8.12	8.10	8.13	8.16
Mean	8.16	8.07	8.21	8.16
F Test	**S**	**S**	**S**	**S**
SE (m)	**0.09**	**0.10**	**0.06**	**0.07**
CD at 5%	**0.05**	**0.05**	**0.03**	**0.03**

CONCLUSION

Based on the current investigation, it was concluded that the treatment combination of (Tomato Pulp (70 %) + Pumpkin Pulp (30%) + Sodium Benzoate (0.10 %) T_3 was best in terms of physicochemical analysis and shelf life of products under refrigerated conditions and also in terms of overall acceptance in the sensory analysis: Aroma, Colour, flavour and Taste.

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