FOOD SCIENCE RESEARCH JOURNAL;
Volume 1 Issue 2
(October, 2010) Page : 51-55

RESEARCH ARTICLE

Accepted :*May, 2010*

Effect of storage on nutrients and microbial quality on tomato puree

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ABSTRACT

The present investigation was conducted to study the effect of storage on -carotene, ascorbic acid and lycopene content of tomato puree prepared from two genotypes of tomato (SEL-7 and ARTH-3) and to study their microbial quality. Tomato purees were prepared by preserving with 750 ppm sodium benzoate and acetic acid and stored for a period of six monthes .By the end of third month of storage period, ascorbic acid was 53.84 and 52.02 mg per 100 g and at the sixth month it was 23.13 and 23.42 mg per 100 g retention of 97.22 and 97.42 per cent of lycopene content, b-carotene content was 17.37 and 15.08 mg per 100 g in tomato puree prepared from SEL-7 and ARTH-3, respectively. Tomato purees were found to be microbiologically safe up to six months.

Key words : Tomato puree, Microbial quality, Storage period, Nutrient

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) as vegetable and fruit occupies an important place in healthy daily diet. Tomato is grown extensively throughout India for fresh consumption and commercial processing (Maini and Kaur, 2000; Prakash, 2000). Carotenoids and ascorbic acid are antioxidant present in tomato (Giovanelli *et al.*, 2001). Tomato is highly perishable and large quantities of tomato fruits go as a waste due to poor storage facilities. It has been estimated that out of 74.41 lakh tones of annual tomato production in the country, 25-30 per cent of tomato fruits get spoiled in India due to glut in the market and improper handling and storage conditions (Mangal and Siddiqui, 2000). With the increase in fruit production, more emphasis should be laid on the extensive use in processing and prevention of spoilage. Proper storage of tomatoes in some preserved form during the seasons of glut will ensure its availability and utilization during the deficiency period. Therefore, to fulfill consumer requirements, considerable amount of tomato has to be processed, and used as the component of the various vegetable dishes and food additives (Giovannucci *et al.*, 2002). Tomato is commonly used fruit in different food preparations and with the seasonal variability, the demand remains unchanged throughout the year. So making of fresh tomato replacement like and puree at the time of glut can facilitate daily cuisines and preparations during off season.

MATERIALS AND METHODS

Tomato purees were prepared with each genotype (SEL-7 and ARTH-3) by preserving with 750 ppm sodium benzoate and acetic acid .Tomato purees were stored in wide mouth glass bottles which were previously sterilized.

β-carotene, ascorbic acid and lycopene content in tomato purees at the interval of one month were evaluated as per standard method as β-carotene in the sample and was separated by column chromatography and estimated calorimetrically according to the standard method of (A.O.A.C., 1995) analysis. The content of lycopene was estimated using the procedure outlined by Adsule and Ambadan (1979). Ascorbic acid in the sample was estimated by titration method of (A.O.A.C., 1995) and presence of bacteria, mould and yeast was determined in the products to study their keeping quality as per method described by Harrigan and McCance (1976). The non-enzymatic browning was tested using method of Maria and Alberto, (1999), The increase in absorbance of the sample at 440 nm was taken as a measure of non-

Gupta, Aditi, Kawatra, A. and Sehgal, S. (2010). Effect of storage on nutrients and microbial quality on tomato puree, *Food Sci. Res. J.,* **1** (2) : 51-55.

enzymatic browning of the purees prepared was done at each one month interval up to six months to study the effect of storage.

RESULTS AND DISCUSSION

Storage study was conducted for six months storage of the tomato puree prepared from both genotypes (SEL-7 and ARTH-3).Effect of storage on various parameters are presented below:

-carotene :

The effect of storage on β-carotene content in tomato purees are depicted in Table 1 and Fig. 1.

At zero period, the b-carotene content was 26.91 and 27.79 mg/100g in tomato purees made from SEL-7 and ARTH-3, respectively. There was significant ($p<0.05$) reduction of β-carotene in the tomato puree at the first month of storage. The per cent reduction of β-carotene observed was 8.68 and 7.20 in puree prepared from SEL-7 and ARTH-3, respectively. At the second month of storage, the per cent reduction was found to be 10.47 in the tomato puree prepared from SEL-7 genotype and 7.20 in puree prepared from ARTH-3. The observed values of reduction are similar to those reported earlier by Vashishta(1998) who observed 11.16 per cent loss in β-carotene of tomato products stored for two months.

The β-carotene content further decreased significantly in both the puree with the increase in storage period. By the sixth month of storage, the β-carotene level was 17.37 and 15.08 mg per 100 g in tomato puree prepared from SEL-7 and ARTH-3, respectively. The data indicate that on average in tomato puree there was 64 per cent retention of -carotene after six months of storage. Similar to this study, Giovenelli *et al.* (2001), in their ageing study of tomato puree (3 months at 40^0C) observed 30-40 % loss of β-carotene. Inspite of significant reduction of β-carotene content, these tomato purees had good amount of β-carotene which can work as rich source of β-carotene.

Ascorbic acid :

The effect of storage on ascorbic acid content in selected tomato puree are presented in Table 2 Fig. 2.

On zero day of storage, the ascorbic acid was found to be 83.20 and 81.40 mg per 100 g in puree prepared from tomato genotypes SEL-7 and ARTH-3, respectively. At third month of storage, the ascorbic acid loss was 35.36 and 36.15 per cent in puree prepared from SEL-7 and ARTH-3, respectively. Higher values of ascorbic acid

Table 1 : Effect of storage time on -carotene content in of tomato purees (mg/100 g , as is basis)

Tomato puree	Storage time (months)							
	0	1	2	3	4	5	6	Mean
SEL-7	26.91	24.58(8.68)	23.89(11.23)	22.51(16.38)	20.94(22.21)	19.65(27)	17.37(35.47)	22.19
ARTH-3	27.79	25.79(7.20)	24.89(10.47)	23.50(15.47)	22.05(20.67)	20.06(26.38)	15.08(33.65)	22.73
Mean	27.04	25.17	24.39	23.00	21.49	19.85	16.29	

C.D. (P=0.05)
Tomato products 0.17 g
Storage 0.22 months
Treatment × Storage 0.46 g × months
Values are mean of four replications
Figures in parentheses show per cent increase compared to zero period

Table 2 : Effect of storage time on ascorbic acid in tomato puree (mg/100 g , as is basis)

Tomato product	Storage time (months)							
	0	1	2	3	4	5	6	Mean
HAS-7	83.20	69.78	61.32	53.84	38.94	28.93	23.13	57.305
		(16.14)	(26.35)	(35.36)	(53.26)	(65.24)	(72.27)	
ARTH-3	81.40	67.42	62.52	52.02	46.28	39.79	23.42	53.264
		(17.18)	(23.25)	(36.15)	(43.15)	(51.25)	(71.24)	
Mean	82.30	68.59	61.92	52.93	42.61	34.36	23.37	

C.D. (P=0.05)
Tomato puree 0.12 g
Storage 0.16 months
Treatment × Storage 0.32 g × months
Values are mean of four replications
Figures in parentheses show per cent increase compared to zero period

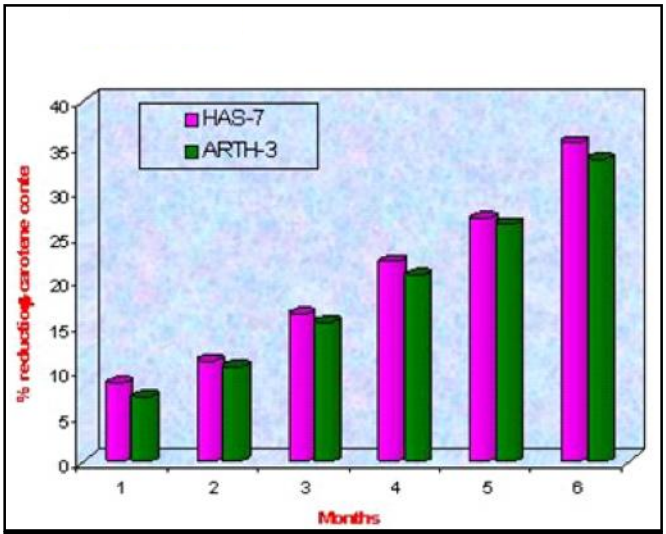

Fig. 1 : Storage time and -carotene content of tomato puree

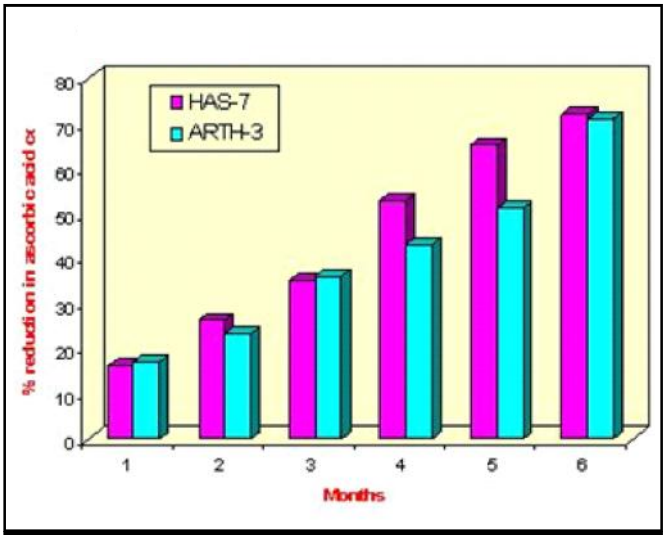

Fig. 2 : Storage time and ascorbic acid in tomato puree

losses have been reported by Giovenelli *et al.* (2001) and the vitamin C loss was found to be 55 per cent.

With further increase in storage period, there was significant ($p<0.05$) reduction in ascorbic acid content of tomato puree at six month of storage. After six month storage, the ascorbic acid level found was 23.13 and 23.42 mg per cent in tomato purees prepared from SEL-7 and ARTH-3, genotypes, respectively. Data revealed that there was 27.73 to 28.76 per cent of retention of ascorbic acid after six month storage of tomato puree. It implies that the tomato puree prepared contained good range of ascorbic acid after six month storage which it can be compatible with other vitamin C rich fruit sources.

Lycopene :

The effect of storage on lycopene content in selected tomato puree are presented in Table 3 Fig. 3.

The lycopene content was 14.38 and 17.20 mg per 100 g in tomato purees prepared from SEL-7 and ARTH-3, respectively at zero month of storage. At the second month of storage, lycopene content was 14.32 and 17.14 mg per cent in tomato purees prepared from SEL-7 and ARTH-3, respectively. There was gradual reduction in lycopene content with increase in storage time. At the six month of storage, the total amount of lost lycopene was

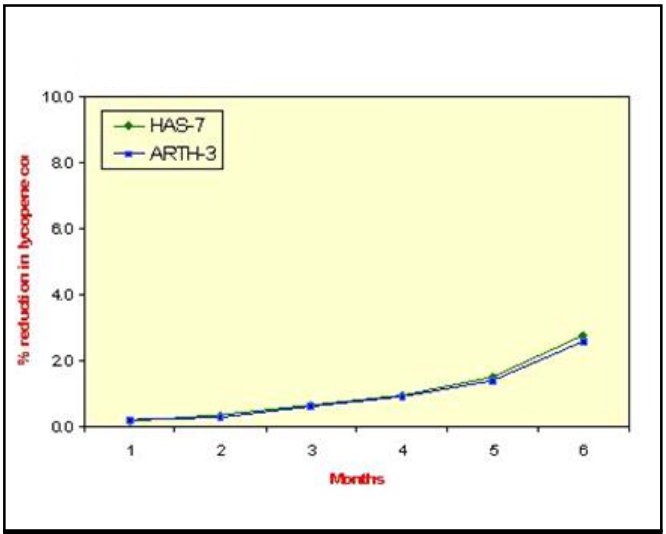

Fig. 3 : Storage time and lycopene content in tomato puree

Table 3 : Effect of storage time on lycopene content in selected in tomato puree (mg/ 100 g , as is basis)

Tomato puree	Storage time (months)							
	0	1	2	3	4	5	6	Mean
HAS-7	14.38	14.35(0.17)	14.32(0.38)	14.28(0.67)	14.23(0.98)	14.15(1.53)	13.98(2.78)	14.24
ARTH-3	17.20	17.16(0.22)	17.14(0.31)	17.09(0.62)	17.04(0.93)	16.95(1.42)	16.75(2.58)	17.04
Mean	15.79	15.75	15.73	15.68	15.63	15.55	15.36	

C.D. (P=0.05)
Tomato products 0.13 g
Storage 0.18 months
Treatment × Storage 0.35 g × months
Values are mean of four replications
Figures in parentheses show per cent increase compared to zero period.

Table 4 : Effect of storage time on non-enzymatic browning in tomato puree (O.D. at 440 nm)

Tomato puree	Storage time (months)							
	0	1	2	3	4	5	6	Mean
HAS-7	0.273	0.295(08.05)	0.315(15.30)	0.345(26.30)	0.358(31.11)	0.376(37.70)	0.402(47.27)	0.338
ARTH-3	0.293	0.315(07.50)	0.321(09.50)	0.342(16.920)	0.363(23.80)	0.395(34.81)	0.429(46.40)	0.351
Mean	0.283	0.305	0.318	0.344	0.361	0.385	0.415	

C.D. (P=0.05)
Tomato products 0.001 g
Storage 0.002 months
Treatment × Storage 0.003 g × months
Values are mean of four replications
Figures in parentheses show per cent increase compared to zero period

2.78 and 2.58 mg per cent only in tomato purees prepared from SEL-7 and ARTH-3, respectively. The data revealed that lycopene content remained almost stable by the end of storage of six months. Sethi (1994) also reported good retention of lycopene during nine months of storage of whole tomato concentrate at 24 to 38^{0}C.

Effect of storage on non-enzymatic browning in tomato puree :

Optical density of tomato puree stored was determined as an index of browning and the data regarding change in browning on storage are presented in Table 4.

A perusal of data (Table 4) showed that browning in tomato powder and puree increased steadily with the increase in storage period. On zero day of storage, 0.273 and 0.293 OD was noted in tomato puree prepared from SEL-7 and ARTH-3, respectively which increased by 47.27 and 46.40 per cent by the end of six months. Significant increase in non enzymatic browning (OD value at 440 nm) was observed in tomato puree as an increase in storage months.Sethi (1994) also reported low non-enzymatic browning in tomato paste samples preserved with 200 ppm each of sodium benzoate and sulpher dioxide.

Microbial examination of stored tomato purees :

Presence of micro-organisms in the edible products affect the quality and safety of the products for consumption. Microbiological spoilage of food is a competitive process occurring among microbes. Microorganisms which are either present in food or get incorporated during processing multiply tremendously during storage and render the product unfit for human consumption. Tomato powder and purees selected were stored and studied for their microbial counts to see the effect of storage on microbes.

The data revealed that there was gradual increase in the total number of microbial counts during storage. The yeast was not present initially in ARTH-3 based puree but was present in SEL-7 based puree and it was up to 3 log CFU/g.

There was very gradual increase in the colonies of yeast and it was 5.98 CFU/g and 5.69 CFU/g in tomato puree prepared from SEL-7 and ARTH-3 genotypes, respectively after six month of storage. This probably may be due to the fact that yeast might have been destroyed with slight increase in temperature and high temperature was used for preparation of purees.

Hassan *et al.* (1992) also revealed that the presence of heat treatment helped in keeping the microbial load and could be kept with in permissible limits.

Conclusion:

Shelf-life study indicated that there was gradual decrease in lycopene content and significant reduction in ascorbic acid and b-carotene during storage of tomato purees for six months. The results thus indicated that all the tomato purees had a good nutrient profile. It can be consumed daily to complete vitamin C, lycopene and β-carotene in the diet of people. About 25 g puree can meet 50% RDA of ascorbic acid.

The microbial counts were within safe limits upto six months in stored tomato puree which may be due to use of preservatives and higher acidity of puree . These tomato purees can be used to replace fresh tomatoes during off season. They can also serve as good source of nutrients especially of lycopene β-carotene and vitamin C in the diets and will also help in reduction of post harvest losses of tomato.

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