

EFFECT OF ANTIOXIDANTS AND PRESERVATIVE ON KEEPING QUALITY OF PEDA STORED AT SUB-ZERO TEMPERATURE*

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ABSTRACT

This study was carried out with respect to the use of antioxidants to extend the shelf life of peda. Buffalo milk with 6% fat was used for preparation of peda for the experimental trials. Tocopherol acetate at the rate of 10, 12 and 16 ppm and sodium ascorbate at the rate of 400, 600 and 800 ppm were added in the peda. The peda samples were subjected to organoleptic evaluation by using 9 point hedonic scale by 8-10 trained and semi trained judges. None of the treatments effected the overall acceptability of peda significantly so the lowest concentration, that is 10 ppm and 400 ppm for tocopherol acetate and sodium ascorbate, respectively, were chosen for further studies. Potassium sorbate at the rate of 0.2 % (w/w) was added in the peda as preservative. Peda samples were packed in LDPE (50-55 micron) packages and stored for further studies. During storage sensory quality, physico-chemical quality and bacteriological quality of peda was analysed. The present study revealed that the peda samples could be stored for more than 60 days at $-15 \pm 2^\circ \text{C}$. It could be concluded that sodium ascorbate and tocopherol acetate at the rate of 10 ppm and 400 ppm, respectively, could be used for checking the increase in TBA value of peda during storage at -15°C . None of the treatments had significant effect on free fat of peda during storage. Potassium sorbate treatment could be used effectively for controlling SPC of peda during storage.

Key words : Peda, Antioxidants, Tocopherol acetate, Sodium ascorbate, Shelf life.

INTRODUCTION

Peda is an Indian sweetmeat the production of which exceeds that of any other indigenous milk based sweet (Aneja *et al.*, 2002). The base material used in peda preparation is khoa to which sugar is added and additionally cardamom, pistachio etc may also be added. Then the balls are made of about 30 grams each with hand. There are large variations in color, flavour and other attributes of peda from region to region and shop to shop, since it is mostly made by local halwais. The peda from Mathura is quite brown in color with very low moisture content while from Hansi (Haryana) it is white in color with higher moisture content, and so on. As is true for other food products also, peda because of its unhygienic handling has a heavy microbial load and has a very short shelf life, the span depending upon various factors. The shelf life of peda at ambient

temperature is hardly more than two days. During festival season, the demand of sweets including peda increases many folds and the manufacturers find it difficult to meet the same. There have been many attempts to increase the shelf life of khoa and khoa based sweets. Majority of them revolve around antimicrobial agents and packaging materials.

Some attempts have been made to enhance the shelf life of peda using Modified Atmosphere Packaging (MAP) and vacuum packaging coupled with low temperature storage (Birader *et al.*, 1985). But as a result of vacuum packaging, crushing/squeezing of peda takes place making its appearance far less appealing.

In the present study antioxidants *viz.* tocopherol acetate and sodium ascorbate were used in addition to a preservative potassium sorbate, to

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study their effect on keeping quality of peda stored at sub-zero temperature.

MATERIAL AND METHODS

Procurement of Milk : The buffalo milk was procured from the “Experimental Dairy Plant” of APT Department, CCS Haryana Agricultural University, Hisar.

Procurement of Antioxidants and Preservative : Tocopherol Acetate, Sodium Ascorbate and Potassium sorbate were procured from “Himedia Laboratories” Mumbai (Bombay)-400086, India.

Procurement of LDPE Bags : LDPE bags (50-55 micron) were used which were procured from the Department of Animal Products Technology, CCS Haryana Agricultural University, Hisar.

Khoa Making Machine : An electricity operated khoa making machine with 30 ltr. capacity fabricated by “SOLAR ARKS Pvt. Ltd., Kohlapur” with 105 ltr. Container and S.S. side cover, was used for the preparation of khoa. LPG was used as a source of heating.

Standardization of Milk : The buffalo milk was standardized to 6 % fat and the excess fat of buffalo milk was removed by using cream separator.

Preparation of Peda : Khoa was prepared in the above mentioned semi-automatic khoa making machine. After making khoa, sugar was added to hot khoa at the rate of 7% of milk weight basis. Then the balls were made of about 30 gm each.

Antioxidants used : Preliminary trials were conducted using three levels of tocopherol acetate (10, 12 and 16 ppm) and sodium ascorbate (400, 600 and 800 ppm). The best concentration for further studies was selected on the basis of sensory evaluation. It was 10 and 400 ppm for Tocopherol acetate and Sodium ascorbate, respectively.

Potassium Sorbate : It was used at the rate of 0.20 percent (w/w) of peda.

Chemical Analysis of Peda :

Moisture : The moisture of samples was determined by Gravimetric method as described in AOAC (1995).

Fat : Fat in sample was determined by Mojonnier method (IS: 4079-1967).

Protein : Protein estimation was carried out as described in AOAC (1995).

Lactose : Lactose content in the Peda samples was determined by Lane-Eynon method as per BIS (1981).

Ash : Ash was determined as per AOAC (1995).

Microbial Analysis (SPC) : The pour plate method of BIS (1981) was followed to estimate the standard plate count. For this readymade plate count agar media of Himedia Laboratories, Mumbai (Bombay)-400086, India was used.

Storage Studies :

Free fat : For free fat estimation the method described by Rangadham and Rajorhia (1989) was followed.

Free Fatty Acids (FFA) : The method of Koniecko (1979) was followed for the determination of FFA.

Thiobarbituric Acid Value (TBA) : The TCA extraction method of Strange *et al.* (1977) was followed. TBA value was determined by blending 20 gm of Peda with 100 ml of 20 per cent TCA and filtering it through whatman # 1 filter paper. A 5 ml aliquot of the TCA extract was mixed with 5 ml of 0.01 M2- thiobarbituric acid in test tubes. The test tubes were immersed in boiling water bath for 30 minutes and the colour developed was measured as absorbance at 532 nm and TBA values were computed from the standard curve.

Non Protein Nitrogen (NPN) : The method of Rowland (1938) was followed to determine the NPN content in peda samples by precipitating peda with 15 per cent TCA and using filtrate for nitrogen estimation.

Sensory Evaluation : Peda samples were evaluated for its sensory attributes such as flavour, body and texture, colour and appearance and overall acceptability by a panel of eight to ten trained and semi trained judges using 9 – point hedonic scale (Nelson and Trout, 1964).

Statistical analysis : The data obtained was statistically analyzed for ANOVA with the help of computer program designed by Sheoran and Pannu, (1999).

RESULTS AND DISCUSSION

Sensory quality : The results pertaining to sensory quality of peda are presented in Table 1, 2, 3. and 4.

Colour and appearance : The interaction between treatments and duration was found to be non significant as far as changes in colour and appearance of peda is concerned. There was significant decrease in colour and appearance of peda with time. Tocopherol acetate and sodium

ascorbate treated samples were found to be best with regard to colour and appearance while potassium sorbate treated samples scored minimum points on the hedonic scale.

Body and texture : There was significant effect on body and texture of peda in all the treatments with time. Significant decrease in body and texture with time was observed. All the treatments were found to decrease the body and texture of peda significantly. Combination (tocopherol acetate +

Table 1. Effect of additives on color and appearance of Peda stored at $-15 \pm 2^\circ \text{C}$.

Duration (Days)	Treatments								Mean
	C	PS	TA	SA	TA+PS	SA+PS	TA+SA	TA+SA+PS	
0	8.18	8.16	8.31	8.26	8.18	8.21	8.23	8.22	8.21
15	8.12	8.08	8.19	8.16	8.10	8.09	8.11	8.13	8.12
30	8.04	7.91	8.11	8.07	8.01	8.02	8.01	8.03	8.02
45	7.91	7.88	8.04	7.96	7.89	7.91	7.93	7.92	7.93
60	7.86	7.81	7.89	7.83	7.81	7.83	7.88	7.86	7.84
Mean	8.02	7.96	8.10	8.05	7.99	8.01	8.03	8.03	8.023

CD (T) : 0.05, CD (D) : 0.04, CD (T×D) : N.S., C : Control, PS : Potassium sorbate treated (0.20 %), TA : Tocopherol acetate treated (10 ppm), SA : Sodium ascorbate treated (400 ppm), T : Treatments, D : Duration.

Table 2. Effect of additives on body and texture of Peda stored at $-15 \pm 2^\circ \text{C}$.

Duration (Days)	Treatments								Mean
	C	PS	TA	SA	TA+PS	SA+PS	TA+SA	TA+SA+PS	
0	8.36	8.29	8.33	8.26	8.24	8.31	8.28	8.26	8.29
15	8.14	8.11	8.12	8.08	8.11	8.13	8.12	8.06	8.11
30	7.98	7.92	7.89	7.88	7.91	7.92	7.92	7.82	7.90
45	7.91	7.84	7.73	7.69	7.71	7.78	7.78	7.64	7.76
60	7.81	7.76	7.59	7.53	7.54	7.65	7.62	7.41	7.61
Mean	8.04	7.98	7.93	7.88	7.90	7.95	7.94	7.83	7.931

CD (T) : 0.04, CD (D) : 0.03, CD (T×D) : 0.10, C : Control, PS : Potassium sorbate treated (0.20 %), TA : Tocopherol acetate treated (10 ppm), SA : Sodium ascorbate treated (400 ppm), T : Treatments, D : Duration.

Table 3. Effect of additives on flavor of Peda stored at $-15 \pm 2^\circ \text{C}$.

Duration (Days)	Treatments								Mean
	C	PS	TA	SA	TA+PS	SA+PS	TA+SA	TA+SA+PS	
0	8.31	8.26	8.29	8.32	8.27	8.28	8.29	8.21	8.27
15	8.16	8.11	8.12	8.10	8.04	8.11	8.14	8.01	8.09
30	8.01	7.98	7.86	7.89	7.86	7.85	7.93	7.79	7.89
45	7.86	7.85	7.68	7.67	7.68	7.67	7.78	7.56	7.71
60	7.78	7.74	7.57	7.51	7.48	7.56	7.58	7.31	7.56
Mean	8.02	7.98	7.80	7.89	7.86	7.89	7.94	7.77	7.894

CD (T) : 0.05, CD (D) : 0.04, CD (T×D) : 0.10, C : Control, PS : Potassium sorbate treated (0.20 %), TA : Tocopherol acetate treated (10 ppm), SA : Sodium ascorbate treated (400 ppm), T : Treatments, D : Duration.

Table 4. Effect of additives on Overall acceptability of Peda stored at $-15 \pm 2^\circ \text{C}$.

Duration (Days)	Treatments								Mean
	C	PS	TA	SA	TA+PS	SA+PS	TA+SA	TA+SA+PS	
0	8.45	8.32	8.51	8.42	8.36	8.25	8.57	8.15	8.36
15	8.31	8.31	8.43	8.36	8.17	8.14	8.38	8.12	8.29
30	8.16	8.23	8.10	8.14	8.14	8.02	8.15	8.03	8.12
45	8.03	8.13	7.82	7.96	7.87	7.82	7.85	7.82	7.91
60	7.85	7.83	7.61	7.54	7.53	7.67	7.63	7.42	7.63
Mean	8.16	8.16	8.09	8.08	8.01	7.98	8.11	7.90	8.061

CD (T) : 0.07, CD (D) : 0.06, CD (T×D) : 0.16, C : Control, PS : Potassium sorbate treated (0.20 %), TA : Tocopherol acetate treated (10 ppm), SA : Sodium ascorbate treated (400 ppm), T : Treatments, D : Duration.

Table 5. Effect of additives on free fat (%) of Peda stored at $-15 \pm 2^\circ \text{C}$.

Duration (Days)	Treatments								Mean
	C	PS	TA	SA	TA+PS	SA+PS	TA+SA	TA+SA+PS	
0	38.25	38.86	38.17	37.69	38.40	38.84	38.73	38.91	38.48
15	39.86	39.92	39.71	39.21	39.62	39.92	39.85	40.03	39.76
30	41.59	40.83	40.75	40.86	40.63	40.84	40.79	41.84	41.01
45	42.91	42.13	41.92	41.97	41.73	41.95	41.83	42.32	42.09
60	44.09	43.50	42.56	43.06	42.85	42.87	42.76	43.82	43.18
Mean	41.34	41.04	40.62	40.55	40.64	40.88	40.79	41.38	40.91

CD (T) : N.S., CD (D) : 0.64, CD (T×D) : N.S., C : Control, PS : Potassium sorbate treated (0.20 %), TA : Tocopherol acetate treated (10 ppm), SA : Sodium ascorbate treated (400 ppm), T : Treatments, D : Duration.

Table 6. Effect of additives on FFA (%) of Peda stored at $-15 \pm 2^\circ \text{C}$.

Duration (Days)	Treatments								Mean
	C	PS	TA	SA	TA+PS	SA+PS	TA+SA	TA+SA+PS	
0	0.050	0.050	0.052	0.051	0.050	0.054	0.054	0.051	0.051
15	0.053	0.053	0.053	0.053	0.052	0.054	0.053	0.053	0.053
30	0.056	0.054	0.055	0.054	0.053	0.055	0.055	0.055	0.055
45	0.057	0.057	0.057	0.056	0.055	0.056	0.057	0.056	0.056
60	0.060	0.062	0.059	0.058	0.058	0.062	0.059	0.059	0.059
Mean	0.055	0.055	0.055	0.054	0.054	0.056	0.055	0.055	0.054

CD (T) : N.S., CD (D) : 0.001, CD (T×D) : N.S., C : Control, PS : Potassium sorbate treated (0.20 %), TA : Tocopherol acetate treated (10 ppm), SA : Sodium ascorbate treated (400 ppm), T : Treatments, D : Duration.

sodium ascorbate + potassium sorbate) treated samples scored minimum points.

Flavour : There was significant effect of all the treatments with time. Potassium sorbate treated samples were found to be best as for as changes in flavour is concerned. There was significant decrease in flavour of all the samples of peda with time.

Overall acceptability : There was significant effect of all the treatments with time. Potassium sorbate, tocopherol acetate and combination

(tocopherol acetate + sodium ascorbate) treated samples were found to be best and equally acceptable. Combination (tocopherol acetate + sodium ascorbate + potassium sorbate) treated samples scored minimum on hedonic scale as for as changes in overall acceptability is concerned.

Physico-chemical quality : The result pertaining to changes in free fat, free fatty acids, thiobarbituric acid value, non-protein-nitrogen and SPC are presented in Table 5, 6, 7, 8 and 9, respectively. The

Table 7. Effect of additives on TBA (mg malonaldehyde/kg) value of Peda stored at $-15 \pm 2^\circ \text{C}$.

Duration (Days)	Treatments								Mean
	C	PS	TA	SA	TA+PS	SA+PS	TA+SA	TA+SA+PS	
0	0.620	0.628	0.628	0.623	0.625	0.627	0.622	0.630	0.624
15	0.667	0.676	0.678	0.681	0.668	0.683	0.671	0.677	0.675
30	0.736	0.726	0.724	0.722	0.725	0.721	0.726	0.732	0.727
45	0.787	0.784	0.778	0.786	0.774	0.786	0.779	0.786	0.783
60	0.855	0.832	0.824	0.820	0.825	0.825	0.820	0.819	0.828
Mean	0.733	0.729	0.725	0.727	0.724	0.728	0.724	0.729	0.727

CD (T) : 0.007, CD (D) : N.S., CD (T×D) : N.S., C : Control, PS : Potassium sorbate treated (0.20 %), TA : Tocopherol acetate treated (10 ppm), SA : Sodium ascorbate treated (400 ppm), T : Treatments, D : Duration.

Table 8. Effect of additives on non protein nitrogen (%) of Peda stored at $-15 \pm 2^\circ \text{C}$.

Duration (Days)	Treatments								Mean
	C	PS	TA	SA	TA+PS	SA+PS	TA+SA	TA+SA+PS	
0	0.114	0.112	0.108	0.110	0.113	0.109	0.112	0.116	0.112
15	0.119	0.119	0.116	0.120	0.121	0.118	0.123	0.124	0.120
30	0.126	0.127	0.125	0.130	0.130	0.122	0.131	0.133	0.128
45	0.134	0.136	0.138	0.141	0.140	0.136	0.139	0.141	0.138
60	0.149	0.142	0.143	0.149	0.148	0.146	0.148	0.150	0.147
Mean	0.128	0.127	0.126	0.130	0.131	0.126	0.131	0.133	0.129

CD (T) : N.S., CD (D) : 0.01, CD (T×D) : N.S., C : Control, PS : Potassium sorbate treated (0.20 %), TA : Tocopherol acetate treated (10 ppm), SA : Sodium ascorbate treated (400 ppm), T : Treatments, D : Duration.

Table 9. Effect of additives on SPC (\log_{10} CFU/g) of Peda stored at $-15 \pm 2^\circ \text{C}$.

Duration (Days)	Treatments								Mean
	C	PS	TA	SA	TA+PS	SA+PS	TA+SA	TA+SA+PS	
0	3.289	3.306	3.378	3.233	3.293	3.498	3.420	3.359	3.347
15	3.592	3.521	3.553	3.484	3.501	3.603	3.614	3.516	3.548
30	4.026	3.823	3.992	3.843	3.985	4.085	3.802	3.881	3.930
45	4.682	4.267	4.481	4.367	4.461	4.514	4.672	4.386	4.479
60	5.135	4.803	5.068	5.018	5.109	5.113	4.998	4.837	5.010
Mean	4.145	3.944	4.094	3.989	4.070	4.163	4.101	3.996	4.063

CD (T) : 0.103, CD (D) : 0.081, CD (T×D) : N.S., C : Control, PS : Potassium sorbate treated (0.20 %), TA : Tocopherol acetate treated (10 ppm), SA : Sodium ascorbate treated (400 ppm), T : Treatments, D : Duration.

interaction between treatments and durations was found to be non significant as for as changes in free fat, free fatty acids, thiobarbituric acid, NPN and SPC of peda are concerned. This shows that these treatments are independent of each other and have no synergistic and antagonistic effect on all these parameters of peda.

All the treatments have no significant effect on free fat of peda. There was significant increase in the free fat of peda with storage time. This may

be due to the reason that crystal formation at low temperature ruptures the fat globule membrane and the fat may ooze out of the fat globule at room temperature or higher during testing.

Free fatty acids : There was significant increase in free fatty acids of peda with time. None of the treatments have significant effect on the free fatty acids of peda.

TBA value : There was no significant increase in TBA value of peda with time of storage. Tocopherol

acetate, combination (tocopherol acetate + potassium sorbate) and combination (tocopherol acetate + sodium ascorbate + potassium sorbate) treated samples were found best and equally effective in checking the increase in TBA value of peda.

Non Protein Nitrogen (NPN) : None of the treatment was found to be significant in checking the increase in NPN of peda. There was significant increase in NPN of peda with time. This may be due to the presence of proteolytic bacteria present in peda.

SPC (log CFU/g) : There was significant increase in SPC of peda with time. Potassium sorbate, sodium ascorbate and combination (tocopherol acetate + sodium ascorbate + potassium sorbate) treated

samples were found best for checking the increase in SPC of peda. This may be due to the antimicrobial activity of potassium sorbate in peda.

CONCLUSION

The present study revealed that the shelf life of peda stored at $-15 \pm 2^\circ \text{C}$ is beyond 60 days. It can be concluded that sodium ascorbate and tocopherol acetate at the rate of 400 ppm and 10 ppm, respectively, can be used for checking the increase in TBA value of peda during storage at $-15 \pm 2^\circ \text{C}$. None of the treatments has significant effect on free fat of peda during storage. Potassium sorbate treatment could be used effectively for controlling SPC of peda during storage. No significant effect of additives and preservative on the NPN and FFA was observed during storage at $-15 \pm 2^\circ \text{C}$.

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