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Tomato skin: A source of natural antioxidant for ghee during storage

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Abstract
Ghee (*Clarified butterfat*), a popular dairy product of the Indian subcontinent, develops off-flavor during storage due to autoxidation. Addition of tomato skin, a source of natural antioxidants, @ 0.4%, increased the antioxidant potential of ghee in terms of without affecting sensory and physicochemical properties. Peroxide value analysis revealed that shelf life of ghee added tomato skin was significantly higher than that of control ghee. Thus the study suggested that tomato skin could be used as a source of natural antioxidants for increase the oxidative stability of ghee.

Keywords: Ghee, oxidation, tomato skin, peroxide value

Introduction
The application of chemical antioxidants to extend shelf life of food products has been widely accomplished. Although the applications of antioxidants in food products are regulated by certain laws. The applications of natural antioxidants are highly accepted now these days due to the adverse health effect of synthetic antioxidants. Therefore, now consumers demand less use of synthetic antioxidants (Membre *et al.*, 2001) [1]. Various fruits and vegetables have been recognized for their antioxidant activity and can serve as a source of natural antioxidants. The antioxidant activity of fruits and vegetables is attributed to their phytochemicals content such as carotenoids, poly-phenols, tocopherol, ascorbate etc. Therefore, it is evident that the use of fruits and vegetables as source of natural antioxidants is a promising alternative to the use of synthetic antioxidants (Van, 1986) [2].
Tomato, among antioxidant rich vegetable, has achieved an enormous status because of its widespread consumption. Tomato skin is one of the potent source of lycopene; which act as a natural antioxidant. Lycopene is a photochemical as well as a colouring pigment that belongs to carotenoid family (Burri., 2002) [3]. It is also considered the most dominant carotenoid that is recognized in human blood stream (Rao and Agarwal., 1999) [4]. Scientific findings already proved the multiple health benefits of Lycopene including anti-cancer activity (Giovannucci *et al*., 1995) and anti-cardio-vascular activities (Agarwal and Rao, 2000) [5]. Lycopene possess of an unique biological properties of natural antioxidant (Rao and Ali, 2007) [6]. The system of conjugation of double bonds helps Lycopene molecules to appease the energy from singlet oxygen thus able to scavenge free radicals. So in this present study tomato skin evaluated as a source of natural antioxidant (Lycopene) to retard the oxidation of ghee during accelerated storage (80±2 °C).

Materials & Methods
Preparation of ghee
White butter was collected from the Dairy Technology department, Vidya dairy, Anand and local market of Anand. Butter so obtained was washed gently with cold water and then heated in a stainless steel vessel (pan) to remove moisture. Heating was continued till the curd become golden brown and the final temperature was not allowed to exceed 115 °C for no hold. The prepared ghee was allowed to settle and filtered through a double folded muslin cloth at 105 °C. The samples were filled in clean and dry beakers, cooled to room temperature and thereafter stored in incubator at 80 °C ± 2 °C.
Tomato skin was added at two different stages (after clarification or before clarification) of the ghee preparation. In each set of experiments tomato skin was added at the rate of 0.4 per cent. In one set of experiment, tomato skin added before heat clarification of butter fat in to ghee. The sample of butter was taken in to clarification pan and the tomato skin was added when butter got melted and made ghee. After clarification of butter fat in to ghee, the prepared sample of ghee was filtered through muslin cloth.

In second set of the experiment, tomato skin was added after filtration (105 °C) of heat clarified (115 °C no hold) butter fat in to ghee, the sample was thoroughly mixed with the help of dry glass rod for uniform mixing of the tomato skin, followed by re-filtration (at 65 °C) through four folded muslin cloth. The samples of ghee without addition of tomato skin were also prepared to serve as control samples. All the samples were stored at 80 °C ±2 ^{0}C. Total six replications were conducted. All the samples were subjected for sensory evolution for flavor score and analyzed for peroxide value when fresh and interval of every two days. On basis of flavor score and peroxide value score we had selected addition of tomato skin after heat clarification of butter into ghee. The collected data were subjected to statistical analysis. The data show obtained were analyzed by completely randomized design and critical difference test at 5% level of significance (P<0.05) to compare the different treatments means (Rudolf *et al*., 2010) [7]

Sensory evaluation

All the samples of ghee made in laboratory were evaluated for their sensory characteristics on a 9 point hedonic scale by a panel of nine judges. The samples were evaluated for their flavor.

Determination of Peroxide Value

The peroxide value of ghee was determined by the method (iodometric method) as described by the Indian Standards Institution (ISI: 3508-1966) [8].

One gram of ghee sample was taken in a 150 x 25 mm test tube and 1 g of potassium iodide and 20 ml of the solvent mixture (prepared by mixing two volumes of glacial acetic acid, AR and one volume of chloroform, AR) was added. The contents were heated to boil within 30 sec in a boiling water bath and allowed to boil for not more than 30 sec. The test tubes were transferred to a 250 ml conical flask containing 20 ml of freshly prepared 5 per cent potassium iodide solution. The test tube was rinsed well with about 25 ml of distilled water and all washings were transferred to the above flask. The contents were titrated against 0.002 N Sodium thiosulphate solutions using 2 ml of starch indicator, near to end point. A blank was also performed without using ghee sample.

The peroxide value of ghee was calculated as mill equivalents of peroxide oxygen per kg of ghee.

Peroxide value (mill equivalents of peroxide oxygen/kg of ghee) = 2T/W

Where,

T= Volume in milliliters of 0.002 N Sodium thiosulphate, and

W= Weight in g of sample

Results & Discussions

Effect of Stage of Tomato Skin Addition on Flavor Score during Storage

The samples of ghee were subjected to sensory evaluation in 9 Point Hedonic scale when fresh and at an interval of every two days. The average results obtained from six different replications for changes in flavor score of the ghee samples are given in Table 1.1 and graphically represented in Figure 1.1.

Statistical data revealed that addition of tomato skin on irrespectively on two different stages and storage period have significant (P<0.05) effect on changes in flavor score of ghee during storage. The interaction effect of period of storage and addition of tomato skin on two different stages was also significant.

Table 1: Effect of stage of tomato skin addition on flavor score during storage

Storage period (days)	Different stage of tomato added in ghee		
	Control (None)	After	Before
1	8.40	8.60	8.60
3	8.10	8.10	8.30
5	5.40	7.60	7.10
7	5.10	7.20	6.90
9	4.90	7.00	5.80
11	4.30	5.60	5.20
13	3.50	5.10	4.30
15	2.40	4.20	3.90
Anova Table			
Source of Variation	**Storage period**	**Treatment (Tomato variety)**	**Storage period × Treatment**
S. Em	0.089	0.055	0.155
C. D	0.251	0.153	0.434
Test	*	*	*
C V percentage	6.28		

=significant, *=highly significant, ns=non-significant

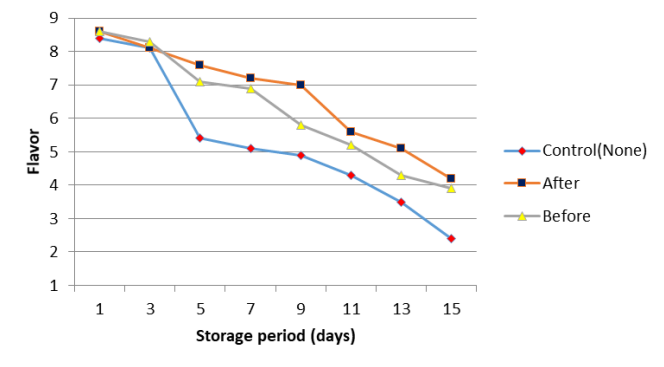

Fig 1: Effect of stage of tomato skin addition on flavor score of ghee during storage

During first three days of storage study; flavor value of control sample was non-significantly (P<0.05) differed (lower) from the samples of ghee added with tomato skin irrespectively two different stage of addition of tomato skin (before or after). On first day when ghee samples were fresh, flavor score of the ghee samples added with tomato skin irrespectively on two different stages of addition(after or before) were same. After that, throughout whole storage period, flavor score of ghee sample added with tomato skin after heat clarification was significantly higher than that of the sample added with tomato skin before heat clarification (except third day of storage).

The graphical results indicated that the initial flavor score of the control sample of ghee was slightly lower than that of the samples of ghee added with tomato skin at two different stages (after or before clarification). During the storage the flavor score of control sample declined at a faster rate and reached below 6 on fifth day of the storage. Flavor scores of the tomato skin (irrespective two stages of addition) added samples of ghee remained higher compare to that of the control sample throughout whole storage periods. The flavor score of ghee samples decreased at almost similar rate for both of the cases whether tomato skin was added before or after clarification. The score of ghee added with tomato skin before heat clarification went below 6 at the ninth day of

storage whereas ghee sample added with tomato skin after clarification went below 6 at the eleventh day of storage.

Effect of Stage of Addition of Tomato Skin on peroxide value of Ghee during storage

The samples of ghee were analyzed for peroxide value at an interval of every two days for period of 15 days.

The statistical analysis of the data indicated that the period of storage, addition of tomatoes skin irrespectively on two stages and interaction between period of storage and addition of tomato skin on two different stages were significant (P<0.05). Thus, statistical analysis of results revealed that addition of tomato skin on irrespectively on two different stages and storage period have significant effect on changes in flavor score of ghee during storage. The interaction effect of period of storage and addition of tomato skin on two different stages was also significant.

Table 2: Effect of stage of tomato skin addition on peroxide unit value of ghee during storage

Storage period (days)	Different stage of tomato added in ghee		
	Control (None)	After	Before
1	1.86	1.65	1.70
3	2.86	2.60	2.65
5	10.20	3.71	4.48
7	12.12	4.71	6.40
9	12.45	6.73	7.36
11	17.52	8.85	9.58
13	18.60	12.66	16.41
15	24.37	16.18	19.60
Anova Table			
Source of Variation	Storage period	Treatment (Tomato variety)	Storage period × Treatment
S. Em	0.276	0.169	0.478
C. D	0.773	0.473	1.339
Test	*	*	*
C V percentage	13.71		

=significant, *=highly significant, ns=non-significant

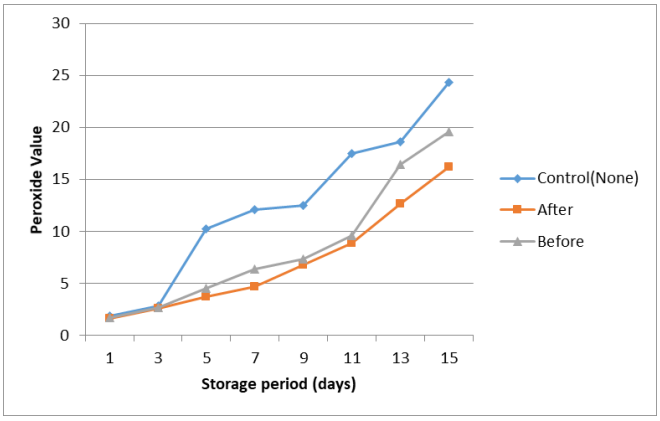

Fig 2: Effect of stage of tomato skin addition on peroxide value of ghee during storage

Except for first three days of storage through-out whole storage periods; peroxide value of control sample was significantly higher than that of tomato skin added sample irrespectively two different stages of addition. For first three days of study peroxide value difference between two samples added with tomato skin irrespectively two different stage of addition was non-significant to each other and this trend followed up to seventh day of storage. On fifth day of storage peroxide value of two tomato skin added samples (on different stages) was at-per to each other.

Graphical data also represented that the peroxide values (milli equivalents per kilogram) of the control ghee sample and the samples added with tomato irrespective of stage of addition were more or less similar during first three days of storage. On further storage, peroxide values of control ghee sample increased with very faster rate. The peroxide value of tomato skin added ghee samples remained below the control sample throughout the whole storage period. The peroxide values of the ghee samples added with tomato skin before or after clarification remained almost very close throughout entire storage period. From thirteenth day peroxide value of ghee samples added with tomato before and after heat clarification became significantly (P<0.05) differed from each other, from thirteenth day peroxide value of both the samples increased sharply. At fifteenth day sample of ghee added with tomato skin after clarification was lower as compare to sample of ghee added with tomato skin before clarification.

Changes in peroxide value of all the samples of ghee during storage were well collaborated with changes in flavor score of the corresponding samples of ghee. The control sample having highest peroxide value and corresponding lowest flavor score compare to samples of ghee added with tomato skin at two different stages. The sample of ghee added with tomato skin after clarification had lowest peroxide value correspondingly highest flavor score almost entire storage periods.

Thus two different stages of addition for tomato were found to have very close effect on oxidative stability of ghee. Still peroxide value of the ghee sample added with tomato skin after clarification was little bit lower than the sample added with tomato skin before clarification. These results might be due to the thermodynamic behavior of “lycopene”- that is the main carotenoid present in tomato skin. Changing in flavor score of ghee and changes in peroxide value of ghee during storage had conclusively suggested that addition of tomato skin after heat clarification of butter into ghee was best to retain the flavor ghee by inhibiting oxidative degradation.

Conclusion

On the basis of flavor score and peroxide value analysis during storage, had conclusively suggested that skin of tomato was best to retain the flavor of ghee by inhibiting oxidative degradation. Thus two different stages of addition for tomato were found to have very close effect on oxidative stability of ghee. However the addition of tomato skin @ 0.4% after heat clarification of ghee seemed very effective, hence tomato skin could be use as an alternative antioxidant to prevent the oxidative rancidity of ghee.

References

1. Membre JM, Kubaczka M, Chene C. Growth rate and growth-no-growth interface of *Penicillium brevicompactum* as functions of pH and preservative acids. Food Microbiol, 2001; 18:531.
2. Van Esch. Toxicological effects of tert. Butyl hydroxyquinone (TBHQ) Food. Chem. Toxic. 1986; 24:1063.
3. Burri BJ. Lycopene and human health. Phytochem in Nutrit and Heal. 2002, 157.
4. Rao AV, Agarwal S. Role of Lycopene as antioxidant carotenoid in the prevention of chronic diseases: a review. Nutrition research. 1999; 19(2):305-323.

5. Agarwal S, Rao AV. Tomato Lycopene and its role in human health and chronic diseases. Cand Med Asso J. 2000; 163(6):739-744.
6. Rao AV, Ali A. Biologically active phytochemicals in human health: Lycopene. Int J Food Prop. 2007; 10(2):279-288.
7. Rudolf JF, Donna M, William JW. Statistical Methods, 3rd ed., Elsevier Inc., UK. 2010.
8. ISI. Methods of sampling and analysis of ghee (Butter fat). ISI: 3508-1966. Bureau of Indian Standards, New Delhi, India, 1966.