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Studies on physico-chemical properties of apple value added products

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Abstract
The present investigation was undertaken in the Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology & Sciences Allahabad. The experiment was laid out Complete Randomized Design with 10 treatments and 3 replications. The study was compared of one cultivar of Apple i.e. Maharaji and 3 Value additions (Pistachionut, Walnut and Chirongi nut). It was observed that T_2 (Pisatchionut 10%) in apple cheese gave significantly best result in relation to TSS (79.88^{0}Brix), ascorbic acid (1.71 mg), pH (3.28), acidity (0.631), flavor (8.50), texture (8.50) and in organoleptic quality with higher benefit cost ratio (1.56).

Keywords: physico-chemical properties, cultivar of Apple, apple cheese

Introduction
Apple (*Malus domestica* Borkh), belongs to family Rosaceae and sub family Pomoideae. Apple is highly nutritive food. It contains minerals and vitamins in abundance. The food value of the Apple is chiefly constituted by its contents of sugar which ranges from 9 to 11% of this, fruit sugar constitutes 60% and glucose 25% and cane sugar only 15% per 100 gm of Apple contains moisture 84%, protein 0.2%, fat 0.5%, Minerals 0.3%, Fibre 1.0% carbohydrates 13.4%. Among mineral and vitamins it contains 10 mg of Ca, 14 mg of phosphorus and 1 mg iron per 100 gm of fruit. 100 gm of Apple gives calorific values of 59 Calories. Thus fruit are an important supplement of the human diet as they possess almost all the nutritive components required for the growth and development of the human body leading to a healthy physique and mind. Also these are a ready source of energy with a unique capacity to guard against many deficiency diseases. The excellent nutritive and therapeutic value of Apple offers great potentiality for processing it into several quality products which can attract national and international markets. Apple is not only an important table fruit but has also a great potential for processing industry. Apple is processed into few popular products like Jam, preserve, chutney and cider, besides these products Apple has tremendous scope for the preparation of new products like "value added cheese". Fruit cheese has recently become very popular. It is a confection of the type of Karachi Halwa and is prepared from fruits like Guava, Apple, Pear and Plum. Fruit cheeses have a long shelf life (Srivastava and Kumar, 2007) [11]**.** In India very less work is carried out in Apple preservation especially in case of cheese. It is highly nutritive, having good keeping quality, remunerative and has good export potential. Cheese is only one product which can be preserved for long duration and available trough out the year. Therefore it is very important to conduct the researches develop the new recipes and for value addition from different cultivars of Apple.

Materials and Methods
The present investigation was laid out in the complete Randomized Design with 10 treatment and 3 replications in post harvest laboratory of Horticultural Department, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad. The fruits of apple variety were purchased from fruit market of Allahabad and stored in the research Post harvest laboratory of Department of Horticulture. Total no. of treatment were 10 *viz:*T_0 - Control (standard recipe only), T_1- Standard recipe + Pistachio 5%, T_2- Standard recipe + Pistachio 10%, T_3- Standard recipe + Pistachio15%, T_4- Standard recipe + Walnut 5%, T_5- Standard recipe + Walnut 10%, T_6- Standard recipe + Walnut 15%, T_7- Standard recipe +Chirongi nut 5%, T_8- Standard recipe + Chirongi nut 10%, T_9- Standard recipe + Chirongi nut 15%. During this experiment different physic-chemical properties of apple value added product were studied.

Experimental results and discussion
The pH content of Apple Cheese showed decreasing trend in all treatments during storage.

Maximum (3.28) was recorded in T_0 and minimum (2.81) was with T_2. Similar results were reported by Chaddha (1992) in guava cheese.

An increasing trend in the acidity was recorded till the end of storage in all values addition of Apple. Maximum (0.631%) was recorded in T_2 and minimum (1.204%) was with T_0. The increasing trend in acidity during the storage may be due to formation of organic acid by ascorbic acid degradation or the increase in acidity could have also occurred due to the hydrolysis of pectin are reported by Lal *et al*.,(1967) [8] in Jams and Jellies.

The colour and appearance showed increasing trend in all treatment. The initial colour and appearance was recorded maximum (8.00) in T_2 (Standard recipe + Pistachio nut 10%) followed by T_5 (Standard recipe + Walnut 10%) score was (7.50) and minimum score (5.75) was observed in T_0 (Control). The colour and appearance was probably due to setting abilities of different value added Apple Cheese prepared prom different value additive. Pectin present in the fruit is responsible for setting the value added Apple Cheese more pectin content means early end point and less cooking. These findings are in confirmative with reports of Crease *et al*., (1948), Canson (1988) [1], Dong *et al.*, (1972) Drzozga and Jechra (1996) and Vail *et al*,. (1978) [9].

The aroma showed in increasing trend in all treatment. The initial aroma was recorded at zero days of storage among the different treatment combination the maximum score (7.75) observed in T_2 (Standard recipe + Pistachio nut 10%) followed by T_5 (Standard recipe + Walnut 10%) score was (7.50) and minimum changes (5.25) observed in T_0 (Control).At 60 days of storage the maximum aroma score was (8.25) found in T_2 (Standard recipe + Pistachio nut 10%) followed by T_5 (Standard recipe + Walnut 10%) score was (8.17) and minimum score (5.75) was found in T_0 (Control).Similarly at 90 days of storage the maximum aroma score (8.50) was found in T_2 (Standard recipe + Pistachio nut 10%) followed by T_5 (Standard recipe + Walnut 10%) score was (8.25) and minimum was found (6.00) in T_0 (Control). Similar finding has been reported by Gersons and Bronkhost, (1974) Siddhappa (1959), Tarr and Baker, (1985) Warlnuch, (1989) and Ester land (1991).

The texture showed increasing trend in all treatment. The maximum score (7.75) was observed in T_2 (Standard recipe + Pistachio nut 10%) followed by T_5 (Standard recipe + Walnut 10%) score was (7.50) and minimum (5.75) observed in T_0(Control).At 30 days of storage maximum score (8.00) for texture was with T_2 (Standard recipe + Pistachio nut 10%) followed by T_5 (Standard recipe + Walnut 10%) score was (7.75) and minimum score (6.00) was observed with T_0 (Control).At 90 days of storage maximum score (8.50) for texture was with T_2 (Standard recipe + Pistachio nut 10%) followed by T_5 (Standard recipe + Walnut 10%) score was (8.25) and minimum score (6.25) was observed with T_0 (Control).The texture is directly related to the setting of product and setting is a result of good pectin. T_2 (Standard recipe + Pistachio nut 10%) was judged best for texture of value added Apple cheese prepared from it. These results coincide with the studies conducted by Ishii *et al.*, (1989) Jain, (1967) Lal *et al*., (1967) [8] Vail *et al.*, (1978) [9].

The data of flavour on effect of value additive stored at room temperature are shown in table 2. The data were found statistically significant at 30, 60 and 90 days of storage. The flavour showed increasing trend in all treatment. The initial flavour was recorded maximum score (8.00) was observed in T_2 (Standard recipe + Pistachio nut 10%) followed by T_5 (Standard recipe + Walnut 10%) score was (7.88) and minimum (5.50) was observed with T_0 (Control).At 90 days of storage among the different additive the maximum score (8.50) was found in T_2 (Standard recipe + Pistachio nut 10%) followed by T_5 (Standard recipe + Walnut 10%) score was (8.38) and minimum score was found with T_0 (Control) (6.00).The investigation is in conformity with the reported by Garson's and Bronkelost (1974), Siddhappa (1959), Tass and Baker (1985).

Table 1: Acidity (%) of value added Apple Cheese as influenced by different Treatments during storage

Treatments	Acidity (%) of value added Apple Cheese			
	0 Day	30 Days	60 Days	90 Days
T_0- Control (Standard recipe only)	1.190	1.184	1.196	1.204
T_1- Standard recipe + Pistachio nut 5%	1.012	1.009	1.014	1.016
T_2- Standard recipe + Pistachio nut 10%	0.611	0.619	0.629	0.631
T_3- Standard recipe + Pistachio nut 15%	0.864	0.863	0.865	0.868
T_4- Standard recipe + Walnut 5%	1.167	1.164	1.174	1.183
T_5- Standard recipe + Walnut 10%	0.642	0.639	0.644	0.655
T_6- Standard recipe + Walnut 15%	0.875	0.872	0.876	0.879
T_7- Standard recipe + Chirongi nut 5%	1.177	1.174	1.178	1.188
T_8- Standard recipe + Chirongi nut 10%	0.854	0.851	0.855	0.857
T_9- Standard recipe + Chirongi nut 15%	0.895	0.892	0.896	0.903
F- test	NS	S	S	S
S. Ed. (±)	-	0.007	0.005	0.005
C. D. at 5%	-	0.014	0.010	0.010

Table 2: Scores for flavour of value added Apple Cheese as influenced by different Treatments during storage

Treatments	Scores for flavour of value added Apple Cheese			
	0 Day	30 Days	60 Days	90 Days
T_0- Control (Standard recipe only)	5.50	5.63	5.75	6.00
T_1- Standard recipe + Pistachio nut 5%	6.88	7.00	7.25	7.38
T_2- Standard recipe + Pistachio nut 10%	8.00	8.17	8.38	8.50
T_3- Standard recipe + Pistachio nut 15%	7.38	7.50	7.68	7.75
T_4- Standard recipe + Walnut 5%	6.50	6.88	7.00	7.25
T_5- Standard recipe + Walnut 10%	7.88	8.00	8.17	8.38
T_6- Standard recipe + Walnut 15%	7.17	7.25	7.50	7.68
T_7- Standard recipe + Chirongi nut 5%	6.00	6.17	6.38	6.50
T_8- Standard recipe + Chirongi nut 10%	7.50	7.75	7.88	8.00
T_9- Standard recipe + Chirongi nut 15%	7.00	7.17	7.38	7.50
F- test	NS	S	S	S
S. Ed. (±)	-	0.04	0.03	0.03
C. D. at 5%	-	0.09	0.07	0.06

Conclusion

It was concluded from research that the Apple Cheese prepared with Pistachio nut 10% (T_2) was most suitable in terms of quality and making cheese. pH value of apple cheese was found highest in standard recipe (Control) and lowest was found with standard recipe with Pistachio nut 10%. Acidity of Apple Cheese was found highest in Standard recipe (Control) and lowest was found with standard recipe with Pistachio nut 10%. In Apple Cheese score of colour, aroma, texture, taste, flavour was found highest in standard recipe with Pistachio nut 10% and lowest in standard recipe (Control). Score of overall acceptability of apple cheese was found highest in standard recipe with Pistachio nut 10% and lowest score was found with standard recipe (Control).

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