

Studies on physico-chemical properties of whey based custard apple (*Annona squamosa* L.) pulp beverage

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The present investigation was carried out in the laboratory of Department of Animal Husbandry and Dairy Science, Dr. PDKV, Akola during the year 2016-2017. During present investigation beverage was prepared with different combinations of whey and custard apple pulp as 97:03 (T₁), 94:06 (T₂), 91:9 (T₃), 88:12 (T₄) and 85:15 (T₅). The results revealed that, moisture content of beverage was 92.92, 92.55, 92.26, 91.86 and 91.53, fat content of the beverage was 0.32, 0.34, 0.35, 0.37 and 0.39, Protein content of beverage was 0.44, 0.48, 0.51, 0.53 and 0.56, total sugar content was 13.55, 13.93, 14.36, 14.74 and 15.20, titratable acidity content was 0.28, 0.31, 0.35, 0.40 and 0.45 and pH content was 5.13, 5.11, 5.08, 5.06 and 5.03 for the treatment T₁, T₂, T₃, T₄ and T₅, respectively.

Key Words : Whey, Custard apple, Beverage, Blending, Chemical analysis

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INTRODUCTION

Whey is a nutritious by product obtained from Cheese, Chhana and Paneer industry containing valuable nutrients like lactose, proteins, minerals, vitamins, etc., which have indispensable value as human food. In India, there has been a substantial increase in the production of paneer, resulting in an increased accessibility of whey. India's annual production is estimated at 1,50,000 tones of paneer and concerning 2 million tones of whey, containing about 1,30,000 tonnes of valuable milk nutrients produced per annum (Goyal and Gandhi, 2009). Whey constitutes 45-50% of total milk solids, 70% of milk sugar (lactose), 20% of milk proteins and 70-90% of milk

minerals and most importantly, almost all the water soluble vitamins originally present in milk. Nearly 70-80 per cent of minerals present in milk pass on to the whey (Sachdeva *et al.*, 1998). It also contain significant amount of vitamins such thiamine (B1), riboflavin (B2), pantothenic acid, folic acid and ascorbic acid (vitamin C) (Puranik and Rao, 1996).

Whey fortified with fruit pulp/syrup and vegetable juices not only enhances its quality but also attracts the consumer as a variety product. The custard apple (*Annona squamosa* L.) is a native of tropical America and was introduced in India by Portuguese. Custard apple is mostly used as desert fruit for its delicious taste and nutritive value. The pulp of custard apple is sweet with slight acidity and has pleasant flavor. The fruit contain 45% edible portion, 100 g of which has a composition of 70.5 g moisture, 23.5 g carbohydrate, 1.6 g protine, 0.4 g fat, 17mg calcium, 47mg p, 1.5mg iron (Bose and Mitra, 1990). The custard apple contains various vitamins *i.e.* vitamin C 35.9 g, Thiamine 0.10 g, Riboflavin 0.06 g and

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Niacin 0.89 g (Bose *et al.*, 2002). The custard apple is still not used for the preparation of whey beverage. Therefore in present investigation the emphasis has given to develop the whey based custard apple beverage and evaluate for its chemical analysis.

METHODOLOGY

The present investigation was carried out in the laboratory of Department of Animal Husbandry and Dairy Science, Dr. PDKV, Akola during the year 2016-2017. Good quality fresh milk was procured and then strained through muslin cloth. The milk was transferred to stainless steel vessel and brought to boil by heating at 82°C. The vessel was then removed from the fire. The coagulant *i.e.* citric acid @ 2 per cent was added slowly and stirred to have uniform mixing. Then the mass was poured over stretched piece of clean muslin cloth over another vessel to drain of the whey and press in paneer presser to remove excess whey from mass. The clear drained whey was collected in the vessel. The whey was again heated to a temperature of 100°C for 5 minutes, so as to remove the traces of fat and curd particles. The yellowish green whey was then used for preparation of whey beverage (De, 2009). The pulp was obtained from fully ripened custard apple fruit by using the procedure given by Dhumal *et al.* (1996). The method described by Panghal *et al.* (2007) was used for preparation of whey based custard apple beverage with slight modification. Beverage was prepared with different combinations of whey and custard apple pulp as 97:03 (T₁), 94:06 (T₂), 91:9 (T₃), 88:12 (T₄) and 85:15 (T₅) with five replications. Good quality, clean crystalline cane sugar was used @ 8 % by weight of whey and custard apple pulp

Beverage samples were analyzed for following physicochemical properties. The moisture was determined as per method cited in (IS 1479) Part – II 1961. Fat content was determined as per Gerbers method

described in IS 1224 (part-1) 1958. The protein was determined as per the method prescribed by Indian Standard Institute in I.S.I. Handbook of Food Analysis, Dairy Products, Part I (1980). The sugar content was determined by Lane and Eyon's method as suggested by Ranganna (2002). The titratable Acidity of the finished product was determined as per the procedure described in ISI (SP-18 (Part XI) 1981. The pH of the sample was measured using digital pH meter.

Statistical analysis:

The data obtained in the present investigation was statistically analyzed by Completely Randomized Design (CRD) as per suggested by Panse and Sukhatme (1989).

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Chemical composition of whey and custard apple pulp :

The data regarding average chemical composition of whey and custard apple pulp are presented in Table 1.

It is revealed from Table 1 that the average chemical composition of whey utilized for whey beverage preparation was moisture 93.50 per cent, total solid 6.12 per cent, fat 0.30 per cent, protein 0.40 per cent, ash 0.60 per cent, acidity 0.22 per cent, carbohydrates 5.00 per cent, pH 5.13 per cent, while Custard apple pulp were moisture 75.97 per cent, total solid 24.3 per cent, fat 0.57 per cent, protein 1.15 per cent, ash 0.67 per cent, acidity 0.38 per cent, carbohydrates 23.5 per cent, pH 5.10 per cent. The results reported by Ingale *et al.* (2009) are comparable to this. They studied the development of whey based custard apple (*Annona squamosa* L.) beverage. The custard apple pulp analyzed for different parameters

Table 1 : Average chemical composition of whey and custard apple pulp

Sr. No.	Constituent (%)	Whey	Custard apple pulp
1.	Moisture	93.50	75.97
2.	Total solid	6.12	24.3
3.	Fat	0.30	0.57
4.	Protein	0.40	1.15
5.	Ash	0.60	0.67
6.	Acidity	0.22	0.38
7.	Carbohydrates	5.00	23.5
8.	pH	5.13	5.10

and the results show that the custard apple contains sugars (16.2%), protein (1.17%), total solids (24.5%) and acidity (0.36%).

Physico-chemical analysis of whey based custard pulp beverage:

The whey beverage prepared with different blends of custard apple pulp was also subjected to physico-chemical evaluation for determination of moisture, fat, protein, titratable acidity, total sugar and pH content. The results in respect of physico-chemical analysis of whey based custard apple pulp beverage are tabulated in Table 2.

Moisture:

It is observed from Table 2, that highest moisture content *i.e.* 92.92 per cent was recorded in the treatment T₁ with 3 per cent blending of custard apple pulp, while the lowest moisture content 91.53 per cent was recorded in the treatment T₅ with 15 per cent blending of custard apple pulp in the whey. Moisture content of whey beverage was significantly decreased with increased levels of custard apple pulp. Moisture content of whey beverage was significantly decreased with increased levels of custard apple pulp, treatment T₁ with 3 per cent blending of custard apple pulp was found to have higher moisture content than rest treatments. This might be due to the addition of custard apple pulp in respective treatment with lower moisture content than whey. The results are in agreement with the results reported by Ingale *et al.* (2009) for whey based custard apple beverage and Bhavsagar *et al.* (2010) for moisture content of pineapple flavoured beverage.

Fat content :

The average fat content of whey beverage by

blending with different levels of custard apple pulp *i.e.* 0.32, 0.34, 0.35, 0.37 and 0.39 for treatments T₁, T₂, T₃, T₄ and T₅, respectively. Fat content of whey beverage was significantly affected with increased levels of custard apple pulp. The results are in agreement with the results reported by Ingale *et al.* (2009) for whey based custard apple beverage, Bhavsagar *et al.* (2010) for pineapple flavoured chhana whey beverage and David (2015) reported for fat percentage in whey based mango beverage.

Protein content:

The highest protein content, 0.56 per cent was recorded in the treatment T₅ with 15 per cent blending of custard apple pulp, while the lowest protein content 0.44 per cent was recorded in the treatment T₁ with 3 per cent blending of custard apple pulp in the whey. Protein content of whey beverage was significantly increased with increased levels of custard apple pulp. Babar *et al.* (2008) reported that protein content in CWB ranged from 0.394 to 0.544 per cent. Bhavsagar *et al.* (2010) reported that the protein content of pineapple flavoured beverage with the addition of 0, 5, 10 and 15 per cent of pineapple pulp in chhana whey was 0.57, 0.66, 0.73 and 0.78 per cent, respectively. Ingale *et al.* (2009) for whey based custard apple beverage, Gaikwad (2010) studied preparation of chhana whey beverages using 0, 5, 10 and 15 per cent of sapota pulp and reported that the protein content was 0.38, 0.40, 0.41 and 0.42 per cent, respectively.

Total sugar content:

The results of Table 2 shows that the average total sugar content of whey beverage by blending with different levels of custard apple pulp were 13.55, 13.93, 14.36, 14.74 and 15.20 for treatments T₁, T₂, T₃, T₄ and T₅,

Table 2 : Effect of incorporation different levels of custard apple pulp on Physico-chemical composition of whey beverage (%)

Treatments	Mean values of five replications in per cent					
	Moisture	Fat	Protein	Total sugar	Titratable acidity	pH
T ₁	92.92	0.32	0.44	13.55	0.28	5.13
T ₂	92.55	0.34	0.48	13.93	0.31	5.11
T ₃	92.26	0.35	0.51	14.36	0.35	5.08
T ₄	91.86	0.37	0.53	14.74	0.40	5.06
T ₅	91.53	0.39	0.56	15.20	0.45	5.03
'F' test	Sig	Sig	Sig	Sig	Sig	Sig
S.E.±	0.058	0.0055	0.0059	0.4564	0.0087	0.0061
C.D. (P=0.05)	0.176	0.0164	0.0178	1.3756	0.0263	0.0184

respectively. Total sugar content of whey beverage was significantly increased with increased levels of custard apple pulp. This might be due to the addition of custard apple pulp in respective treatment with higher total sugar content than whey. Same trends was reported by various researchers like Ingale *et al.* (2009) for whey based custard apple beverage, Babar *et al.* (2008) reported that total sugar content of chakka whey beverage was increased with addition of pomegranate juice. Ahmed *et al.* (2011) found that the initial total sugar content of control is increased in the whey- based mango beverage.

Titrateable acidity (%L.A.) :

The highest titrateable acidity *i.e.* 0.45 per cent was recorded in the treatment T₅ with 15 per cent blending of custard apple pulp, while the lowest titrateable acidity 0.28 per cent was recorded in the treatment T₁ with 3 per cent blending of custard apple pulp in the whey. Titrateable acidity of whey beverage was significantly increased with increased levels of custard apple pulp. Treatment T₅ with 15 per cent blending of custard apple pulp was found to have higher titrateable acidity than rest treatments. This might be due to the addition of custard apple pulp in respective treatment with higher titrateable acidity than whey. Ingale *et al.* (2009) for whey based custard apple beverage and Bhavsagar *et al.* (2010) recorded same trends for pineapple flavoured chhana whey beverage. Dhamsaniya and Varshney (2013) also found that the acidity of whey based RTS beverage from ripe banana juice was increased with increase in level of banana juice from 0.15 to 0.40. The results obtained are in contrast with Mohamed *et al.* (2014) who found that the titrateable acidity value was slightly decreased with increase in papaya pulp ratio upto third blend, then fixed and began to increase in blend 5 and 6 of papaya-whey beverage.

pH content:

Table 2 indicate that the average pH content of whey beverage by blending with different levels of custard apple pulp were 5.13, 5.11, 5.08, 5.06 and 5.03 for treatments T₁, T₂, T₃, T₄ and T₅, respectively. pH content of whey beverage was significantly decreased with increased levels of custard apple pulp. Ingale *et al.* (2009) for whey based custard apple beverage and Bhavsagar *et al.* (2010) recorded same trends for pineapple flavoured chhana whey beverage. Chavan *et al.* (2015) reported that the pH content of mango flavoured beverage with

the addition of 2, 4, 6, 8, and 10 per cent of mango pulp in chhana whey was pH 4.30, 4.25, 4.18, 4.11 and 4.08 per cent, respectively.

Conclusion :

From the results of present investigation it is concluded that, moisture and pH content were numerically decreased while fat, protein, total sugar and titrateable acidity were increased with increase in the levels of custard apple pulp in whey beverage.

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