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Physicochemical properties and sensory attributes of chocolate coated chhana confection incorporated with mango powder and pineapple powder

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Abstract
The study was designed to evaluate the effect of mango powder and pineapple powder on the quality characteristics of chocolate coated chhana confection. The product was developed by incorporating different levels of mango powder and pineapple powder (2%, 4% and 6%) and the prepared samples were analysed for proximate, physicochemical and sensory parameters. Moisture content of chocolate coated chhana confection increased significantly ($p<0.05$) at 6% level of mango powder incorporation whereas no significant ($p>0.05$) effect was observed on moisture content of confection incorporated with pineapple powder. Ash content increased significantly ($p<0.05$) by addition of mango powder at 6% level and pineapple powder at 4% and 6% level as compared to control samples. pH value showed a significant ($p<0.05$) decrease at 4% and 6% level of mango powder and pineapple powder incorporation. Titratable acidity was significantly ($p<0.05$) higher in the chhana confection treated with mango powder at 4% and 6% level and pineapple powder at 6% level as compared to control. Cooking yield was significantly ($p<0.05$) higher at 4% and 6% level of mango powder addition whereas addition of pineapple powder had no significant ($p>0.05$) effect on cooking yield of the product. Chocolate coating loss from the surface of chhana confection was found to be significantly ($p<0.05$) higher at 6% level of mango powder incorporation whereas in control samples coating loss was significantly less. For colour analysis, L* value increased significantly ($p<0.05$) at 4% and 6% level and b* value at all levels of mango powder incorporation. Pineapple powder addition had no significant ($p>0.05$) effect on L* value but b*value increased significantly ($p<0.05$) at 4% and 6% level when compared to control. Chhana confection exhibited superior sensory characteristics at 4% level of mango powder and pineapple powder addition as compared to control samples.

Keywords: chhana, chocolate, mango powder, pineapple powder, quality parameters

Introduction
Indian dairy market is amongst the largest and fastest growing market with milk production stands at 155.5 million tonnes (Ministry of Agriculture, 2015-16; Puri, 2018) [24]. Fluid milk accounts for the largest product category accounting for approximately 55-60% of total dairy market. However a significant proportion of milk has been used in India for preparing a wide variety of Indian delicacies and other specialties from different regions of the country. Nearly 40-45 per cent of the total milk produced in India is converted into a variety of traditional milk products (Anon, 2014) [4]. Traditional milk products such as khoa, chhana, paneer, dahi, ghee, shrikhand play a significant role in the economic, social, religious and nutritional well being of the Indian masses. Chhana for which about 4% of total milk produced in India is utilized, is a product obtained by acid coagulation of hot milk (kumar *et al*., 2015) [18]. According to FSSAI (2006), "Chhana is the product obtained from cow milk or buffalo milk or combination thereof by precipitation with sour milk, lactic acid or citric acid. It should not contain more than 70% moisture and the milk fat content should be not less than 50% of the dry matter." Chhana is used as a base for production of wide variety of traditional Indian dairy sweets like rasgolla, sandesh, rasmalai, rajbhog, chhana murki and cham-cham etc but limited shelf life of chhana and chhana-based sweets is the major hurdle in their industrial production.
Confectionery is the collective term applied to edible products usually compounded of sugar as a common ingredient. Generally, confections are low in micronutrients and protein content but high in calories. Dairy based ingredients are natural and traditional ingredients which are valued by the confectionery Industry for enhancing the flavour, colour, texture and nutritional value particularly the protein profiles in many products. Confections made with dairy ingredients can help satisfy consumer's sweet cravings with rich, full flavour that contains

Nutritional value. A number of innovative products have been realized over the last few years, intended to fortify confections with high protein. Keeping in view the demand for nutritious foods, chocolate coated chhana confection was developed by addition of natural fruit powders like mango and pineapple in the chhana base to increase nutritional profile of market candies and confections.

Material and Methods

Raw materials

Fresh cow milk was obtained from the Dairy farm of SKUAST-Jammu. Whole milk powder and food grade crystalline sugar of good quality were purchased from the market of Jammu, mango and pineapple powder manufactured by Sri Nuthatch Nutricare Technologies Pvt. Ltd, Bengaluru, was purchased and stored in plastic airtight container for subsequent use. Dark chocolate of brand name "Desire" manufactured by Bunge India Private Limited, New Delhi was purchased and used for coating of chhana based confection.

Methodology of preparation of chocolate coated chhana confection

Chhana preparation

It was prepared by following the procedure explained by Bhattacharya *et al*. (1971) [7]. Standardized milk having 4.5% fat content was heated at 82° C for 5 minutes and cooled to 70° C followed by coagulation with citric acid (1% solution), which was added slowly to the milk with continuous stirring until a curd and clear whey separated out. The mixture was allowed to settle down for 10 minutes and the whey was drained out through a muslin cloth. The coagulum so obtained was collected as chhana.

Kneading and ball formation of chhana

The standardized formulation for chhana confection contained chhana base (95%) and whole milk powder (5%). Different levels of mango powder and pineapple powder (2%, 4% and 6%) were incorporated separately in the standardized formulation of confection, replacing chhana in the formulation. The mixture was then given vigorous working for at least 5-10 minutes manually till all ingredients mixed together in dough form. The dough was moulded into small balls weighing around 12g by revolving between palms.

Preparation of sugar syrup

Sugar solution of 50° Brix concentration was prepared in water for cooking of chhana balls at low flame. To maintain the 50° Brix concentration, water was added time to time to compensate for evaporated water.

Cooking of chhana base in sugar syrup

Sugar syrup was brought to boil in a container and chhana balls were dropped in it. After putting balls in the sugar syrup, the flame was set on low to avoid burning of upper surface of chhana balls. Balls were gently stirred continuously with the help of ladle for 10 minutes. After cooking, chhana balls were removed from sugar syrup and left aside to cool. This was followed by coating of product with chocolate in silicon moulds.

Coating of chhana base with chocolate

Chocolate was melted in hot air oven (Macro Scientific Works Pvt. Ltd., Delhi, India) at 40° C. After melting, chhana balls were coated with chocolate in the silicon moulds. Then the product was kept in refrigerator for solidification of chocolate coating.

Analytical procedures

Stability of coating material

Around 50g of the sample was taken in a conical flask. Conical flask was shaked continuously using automatic flask shaker (Oracles Automatic Flask Shaker, Delhi, India) for 30 minutes. The samples were removed and the weight of the coating retained in the flask during shaking was recorded (kaji, 2009) [12].

$$\text{Loss of coating \%} = 100\ (W1-W2) / W3-W2$$

Where, W1 = weight of flask with coating material, W2 = Empty weight of flask and W3 = weight of flask and sample.

Weight and thickness of coating

Ten pieces of chocolate coated chhana confection were taken and the dimensions of each were measured by using vernier calliper (6X6X7 cm, Bexco brand, Chandigarh, India). The weight of each piece was also recorded. After removing the coatings of chocolate and caramel by scrapping, their weight and dimensions were again measured and the difference between the two observations was taken to calculate the weight and thickness of coating (Kaji, 2009) [12].

PH

PH of the product was measured soon after products preparation by the method of Keller *et al*. (1974) [14] with slight modifications. The sample (10g) was homogenized with 50 ml distilled water by using pestle and mortar for 1 minute. The pH of the suspension was recorded by immersing combined glass electrode of digital pH meter (Systronics Digital pH Meter, Gujrat, India)

Proximate composition

The moisture, protein, fat and ash content of chhana delights were determined by a standard method using hot air oven (Macro Scientific Works Pvt. Ltd., Delhi, India**)**, kjeldahl assembly (H. L. Scientific Industries, Ambala, India), Soxhlet extraction apparatus (Proxor Group, Chennai, India) and Muffle furnace (Servo Enterprises, Chennai, India), respectively, per AOAC (1995) [1].

Moisture content

Mashed sample (10g) was transferred in pre-weight flat bottom aluminum moisture cup, which was transferred to hot air oven at 101± 1° C and kept for 16-18 hours. Dried sample was then placed in desiccators having silica gel as desiccant. After 1 hour, the cup containing dried sample was weighed. Moisture content was calculated by applying the following formula:

$$\text{Moisture (\%)} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where, W_1 = Weight of empty cup, W_2= weight of cup + sample, W_3= Weight of cup + dried sampl

Protein content

The sample (2-2.2g) was digested using Micro- Kjeldahl digester in presence of digestion mixture which acts as catalyst (sodium sulfate/potassium sulfate: copper sulfate=5:1) and 40 ml sulphuric acid. Flask was placed in an inclined position and heated gently until solution became clear. The sample was then cooled and distilled water was added to make the volume up to

250 ml. The diluted sample (10ml) was distilled with 10 ml of 40% NaoH using Micro-Kjeldahl distillation unit. Steam was distilled over 2% boric acid (25 ml) containing mixed indicator (1 part 0.2% methyl red +2 part 0.2% bromocresol green dye) for 30 minutes. The ammonia trapped in boric acid was determined by titration with 0.1 N sulphuric acid. The nitrogen % was calculated using following formula:

$$\text{Nitrogen (\%)} = \frac{\text{(A-B)} \times 0.0014 \times \text{Total volume made}}{\text{Weight of sample taken} \times \text{Volume of distillate}} \times 100$$

Where, A =Titrated value for sample, B= Titrated value for blank

Protein% was determined by conversion of nitrogen % to protein by using conversion factor (6.38) assuming that all the nitrogen in sample was present as protein i.e. Protein% = N% × 6.38.

Fat content

Fat Content in the sample was extracted in Soxhlet extraction unit. Soxhlet extractor was set with reflux condenser and oil flask which was previously dried and weighed. Sample (3-4g) was taken into fat free extraction thimble, dried in hot air oven for 6 hours at 100-102° C and placed in Soxhlet extraction apparatus. 150 ml of petroleum ether (BP: 60-80° C) was then poured into extraction flask and condenser was joined and placed on electric heater in order to boil the solvent gently. Extraction was carried out for 16 hours. Fat content was calculated by using the following formula:

$$\text{Fat (\%)} = \frac{W_2 - W_1}{W_3} \times 100$$

Where, W_1 = Weight of empty oil flask, W_2= Weight of oil flask+ Fat, W_3= weight of sample

Ash content

The fresh sample in minced form (5-10g) was transferred in a pre-weighed crucible and transferred to Muffle furnace at (550° C) for 4-5 hours. Ashed sample was transferred to desiccator having silica gel as desiccant. After 1 hour, the crucible was weighed. The ash content was calculated by the following formula:

$$\text{Ash (\%)} = \frac{\text{Weight of ashed sample}}{\text{Weight of sample taken}} \times 100$$

Total carbohydrate

The total carbohydrate content of the sample was obtained by difference i.e. Total carbohydrate (%) = 100 – (% Moisture + % Fat + % Total protein + % Ash).

Titratable acidity

The method as described by AOAC (1995) [1] for cheese was followed to determine the titratable acidity of chhana confection. To 10g of sample, distilled water at 40^{0}C was added to make the volume up to 105 ml. The contents were shaken vigorously, filtered through whatman no. 1 paper and 25 ml of filtrate representing 2.5g of sample was titrated against 0.1 N sodium hydroxide solution using phenolphthalein solution as indicator. Result was expressed as lactic acid (%). Titratable acidity was calculated by using following formula:

$$\text{Titratable acidity (\% lactic acid)} = 0.009 \times V \times 40$$

Where, V = ml of 0.1 N sodium hydroxide solution used in the titration

Assay of total Cholesterol

Total cholesterol in the lipid extracts was determined by adopting the Tschugaeff reaction as modified by Hanel and Dam (1955) [10]. Fifty micro-litre of lipid extract and standard cholesterol solution (1mg in 1ml chloroform was evaporated to dryness) was taken in separate test tubes to which 2ml of chloroform, 1 ml of $ZnCl_2$ reagent (reagent was prepared by dissolving 40g anhydrous zinc chloride in 153 ml glacial acetic acid at 80° C for two hours and filtered through Whatman no. 1 filter paper) and 1 ml of acetyl chloride was added and heated in a water bath at 60^{0}C for 10 minutes. The same was also done with blank containing 2 ml of chloroform and 1 ml of each zinc chloride and acetyl chloride at the same time. The colour complex developed was measured by reading optical density at 528nm in a spectrophotometer (Systronics UV-VIS Spectrophotometer, Gujrat, India) and expressed as mg per 100g of sample.

Determination of lactose in chhana delights by Lane-Eynon volumetric method

Determination of lactose content of product was done as per Lane-Eynon volumetric method (Adriano *et al*., 1934) [3]. Triturated sample (25g) was taken into a conical flask and it was diluted by adding 200 ml of distilled water. This was followed by addition of 3.75 ml of 10% acetic acid solution. It was boiled to get a clear filtrate and after cooling it was transferred quantitatively to a 250 ml volumetric flask to make final volume up to mark with distilled water. The burette was filled with this filtrate and 5 ml of each of Fehling solution A and B was taken into 250 ml conical flask. Then a preliminary titration was made by adding the filtrate containing lactose, from the burette, 1 ml at a time, to the Fehling solution kept boiling till the blue colour changed to red. Then another 10 ml of Fehling A and B was taken in another conical flask and the whole volume of the filtrate required previously for reduction of Fehling solution was added to it from burette, so that not more than 0.5 to 1 ml of filtrate is required for complete titration. Above mixture was heated to boiling and 5 drops of methylene blue indicator was added to the boiling mixture and titration was completed within a total boiling time of 3 minutes by addition of 4 to 6 drops of the filtrate. The end point was indicated by the change of blue colour to colourless supernatant. Lactose content was calculated by the following formula:

$$\text{Weight of lactose present in 100 ml of milk} = W/V \times 250 \times 100/25 \text{ mg}$$

Where, V = Volume of the filtrate required for complete reduction of 10 ml of Fehling solution and W = Lactose equivalent in mg for v ml.

Colour measurement

The colour of the chhana confection was measured in the Division of Food and Technology, SKUAST-Chatha, India using a Colorflex colorimeter (Hunter Associated Laboratory, Virginia, USA). Before the test, the instrument was calibrated with standard black and white tile as specified by the manufacturer. The finely ground sample was placed in the transmission port of the optical unit of a colour difference

meter. Light energy from a controlled source was directed through the specimen into an integrating sphere. Phototubes were positioned at the top of the sphere to view the interior of the sphere. Electrical signals proportional to light quantities present were directed by cable to the measuring unit, where they were read directly as L*, a* and b* colour values.

Water activity (aw)

Water activity was measured using water activity meter Aqua Lab (Decagon Devices, Washington, USA) in the Division of Food Science and Technology, SKUAST-Chatha, Jammu.

Sensory evaluation

A trained sensory panel of seven members evaluated the chocolate coated chhana confection for various sensory parameters namely colour and appearance, texture, aroma, flavour and overall acceptability. The experiments were replicated three times (n = 21). The panel members were scientists and postgraduate scholars of the Faculty of Veterinary sciences, SKUAST- Jammu and conducted the sensory analysis on the basis of nine-point hedonic scale (Pavon, 2003) [22]. Chocolate coated chhana confections were served to panellists in random order without disclosing the identity of samples.

Statistical analysis

The study was conducted in three independent experimental trials, and all the samples were analysed in duplicate (n = 6). SPSS version 16.0 software program was used to analyze the data generated by repeating the experiments for all quality parameters. One-way ANOVA was used to analyze the means of different parameters. Duncan post hoc multiple range test was used to see significant differences between the treatments at 5 per cent level of significance (Snedecor and Cochran, 1994).

Result and Discussion

Proximate composition of chocolate coated chhana delights incorporated with mango powder and pineapple powder

The mean values of proximate composition of the chocolate coated chhana delights incorporated with different levels of mango powder and pineapple powder (2%, 4% and 6%) separately are presented in table 1 and 2 respectively. No significant ($p>0.05$) effect was observed on moisture content of chocolate coated chhana confection up to 4% level of mango powder incorporation, however, it increased significantly ($p<0.05$) at 6 % level. The results for moisture content were in accordance with the study of Hossain *et al.* (2012) [11] who observed an increase in moisture content of fruit yoghurt with addition of strawberry, orange and grape juice. Awad *et al.* (2015) [6] also reported an increase in moisture content of kareish cheese with increase in the level of skimmed milk powder. No significant difference ($p>0.05$) was recorded in the mean values of fat, protein, lactose, cholesterol and carbohydrate content in all the mango powder and pineapple powder incorporated treatments as compared to control. Ash percent of chhana confection increased significantly ($p<0.05$) at 6% level of mango powder addition and 4% and 6% level of pineapple powder addition as compared to control. Atallah and Hassan (2017) [5] also observed a similar increase in ash content of non- dairy soft ice milk with addition of soya milk. Similar findings were also reported by Abdullah *et al.* (2003) [2] in soya milk incorporated ice-cream and Awad *et al.* (2015) [6] in skimmed milk powder incorporated cheese.

Table 1: Effect of different levels of mango powder on the proximate composition of chocolate coated chhana confection (Mean ± SE) *

Levels of incorporation (%)				
Parameters	**Control**	**T1**	**T2**	**T3**
Moisture (%)	20.60±0.61 [b]	21.44±0.68 [ab]	22.12±0.50 [ab]	22.67±0.57[a]
Fat (%)	14.45±0.34	14.30±0.42	14.13±0.41	13.93±0.52
Protein (%)	10.47±0.45	10.17±0.58	9.84±0.46	9.67±0.43
Ash (%)	0.85±0.06 [b]	0.87±0.06 [b]	0.91±0.08 [b]	1.25±0.11 [a]
Lactose (%)	2.83±0.41	2.71±0.53	2.28±0.36	1.98±0.34
Cholesterol (mg/100g)	15.83±1.38	15.76±0.96	15.19±1.43	14.98±1.12
Carbohydrate (%)	50.72±0.31	50.41±0.56	50.64±0.32	50.44±0.41

(Control) = 5g milk powder + 95g chhana base
(T1) 2g mango powder + 5g milk powder + 93g chhana base
(T2) 4g mango powder + 5g milk powder + 91g chhana base
(T3) 6g mango powder + 5g milk powder + 89g chhana base

Table 2: Effect of different levels of pineapple powder on the proximate composition of chocolate coated chhana delights (Mean ± SE) *

Levels of incorporation (%)				
Parameters	**Control**	**T1**	**T2**	**T3**
Moisture (%)	22.18±0.73	22.33±0.76	22.41±0.94	23.96±0.55
Fat (%)	14.39±0.48	14.10±0.59	13.81±0.62	13.74±0.58
Protein (%)	10.06±0.49	9.68±0.31	9.60±0.32	9.53±0.32
Ash (%)	0.91±0.05 [c]	0.97±0.04 [c]	1.31±0.09 [b]	1.79±0.07[a]
Lactose (%)	2.87±0.63	2.70±0.49	2.65±0.56	2.39±0.47
Cholesterol (mg/100g)	16.14±1.55	15.93±1.15	15.68±1.35	14.93±1.26
Carbohydrate (%)	49.52±0.36	50.17±0.72	50.19±0.55	48.44±0.51

(Control) = 5g milk powder + 95g chhana base
(T1) 2g pineapple powder + 5g milk powder + 93g chhana base
(T2) 4g pineapple powder + 5g milk powder + 91g chhana base
(T3) 6g pineapple powder + 5g milk powder + 89g chhana base

Physicochemical parameters of chocolate coated chhana delights incorporated with mango powder and pineapple powder

The mean values of physicochemical parameters of the chocolate coated chhana delights incorporated with different levels of mango powder and pineapple powder (2%, 4% and 6%) separately are presented in table 3 and 4 respectively. A significant ($p<0.05$) decreasing trend was observed in the pH of chhana confection incorporated with 4% and 6% level of mango powder and pineapple powder as compared to control. Results were in agreement with Roy *et al*. (2015) [25] who observed a decrease in pH with addition of fruit pulps in yoghurt. Santo *et al*. (2012) [26] also observed reduction in pH of probiotic yoghurt with addition of passion fruit peel powder. The values for titratable acidity were significantly ($p<0.05$) higher at 4% and 6% level of mango powder incorporation and 6% level of pineapple powder incorporation as compared with control. No significant difference ($p>0.05$) was recorded in the mean values of water activity, weight of coating and mean thickness of coating in all the treatments incorporated with mango powder and pineapple powder as compared to control. Cooking yield of the chhana confection increased significantly ($p<0.05$) with addition of mango powder at 4% and 6% level when comparable to control. Similar observations were reported by Kohinkar *et al*. (2014) [15] who observed an increase in yield of mixed fruit toffee by using fig: guava in ratio of (75:25). Chatli *et al.* (2017) [8] also reported an increase in yield of buffalo mozzarella cheese with increase in level of sodium alginate. Coating loss was found to be significantly ($p<0.05$) higher at 6% level of mango powder incorporation as compared to control and other two treatments. This could be because of high moisture absorption at 6% level of mango powder incorporation which oozes to the surface of chhana balls causing loss of chocolate coating on shaking. No significant difference ($p>0.05$) was recorded in the mean values of cooking yield and coating loss in all the pineapple powder treated confections as compared to control. Colour analysis for all the four treatments was done and from the analysis it was observed that all values are in positive. L* value increased significantly ($p<0.05$) at 4% and 6% level of mango powder incorporation as compared to control, b* value showed a similar increasing trend at all levels of incorporation, whereas no significant ($p>0.05$) effect was observed on a* value. However with pineapple powder addition, b* value increased significantly at 4% and 6% level as compared to control. This might be due to bright colour of the product as well as orangish-yellow appearance of the chhana base incorporated with mango and pineapple powder. Similar findings were observed in chhana jalebi and Khoa jalebi by Panneerselvam and Ramanathan, (2015) [21] and Pagote and Rao (2012) [20].

Table 3: Effect of different levels of mango powder on the physicochemical parameters of chocolate coated chhana delights (Mean ± SE) *

	Levels of incorporation (%)			
Parameters	**Control**	**T1**	**T2**	**T3**
pH	6.58±0.08 ^{a}	6.48±0.04 ^{a}	6.16±0.06 ^{b}	5.93±0.04 ^{c}
Titratable acidity (%)	0.283±0.007^{b}	0.281±0.003 ^{b}	0.301±0.004 ^{a}	0.311±0.006 ^{a}
Water activity	0.866±0.004	0.863±0.005	0.876±0.004	0.880±0.009
Coating Loss (%)	0.133±0.006 ^{b}	0.136±0.006^{ab}	0.140±0.005^{ab}	0.153±0.004 ^{a}
Cooking yield (without coating) (%)	84.01±0.52 ^{b}	85.19±0.59^{ab}	86.00±0.66 ^{a}	86.57±0.64 ^{a}
Wt of coating (g)	4.08±0.31	4.20±0.29	4.12±0.39	4.17±0.33
Mean Thickness of coating (cm)	0.235±0.005	0.243±0.011	0.233±0.009	0.240±0.012
Colour characteristics (L)*	29.54±0.34 ^{b}	30.09±0.18 ^{ab}	30.83±0.52 ^{a}	31.30±0.43^{a}
(a)*	7.88±0.30	7.85±0.21	7.59±0.26	7.24±0.21
(b)*	17.42±0.40 ^{c}	18.28±0.17 ^{b}	20.52±0.22 ^{a}	21.21±0.27 ^{a}

(Control) = 5g milk powder + 95g chhana base
(T1) 2g mango powder + 5g milk powder + 93g chhana base
(T2) 4g mango powder + 5g milk powder + 91g chhana base
(T3) 6g mango powder + 5g milk powder + 89g chhana base

Table 4: Effect of different levels of pineapple powder on the physicochemical parameters of chocolate coated chhana delights (Mean ± SE) *

	Levels of incorporation (%)			
Parameters	**Control**	**T1**	**T2**	**T3**
pH	6.63±0.06 ^{a}	6.51±0.07 ^{ab}	6.35±0.05 ^{bc}	6.16±0.05 ^{c}
Titratable acidity (%)	0.278±0.007 ^{b}	0.286±0.004 ^{b}	0.293±0.008 ^{b}	0.308±0.006 ^{a}
Water activity	0.885±0.004	0.883±0.004	0.890±0.006	0.898±0.008
Coating Loss (%)	0.141±0.009	0.138±0.006	0.145±0.005	0.158±0.006
Cooking yield (without coating) (%)	84.88±0.64	85.09±0.56	85.19±0.45	85.41±0.64
Wt of coating (g)	4.36±0.39	4.19±0.29	4.09±0.35	4.12±0.33
Mean Thickness of coating (cm)	0.225±0.007	0.221±0.016	0.218±0.011	0.206±0.010
Colour characteristics (L)*	29.34±0.44	30.17±0.14	30.21±0.39	30.23±0.40
(a)*	7.95±0.29	7.85±0.17	7.79±0.59	7.66±0.17
(b)*	17.92±0.36 ^{c}	18.45±0.30 ^{c}	20.36±0.19 ^{b}	21.36±0.29 ^{a}

(Control) = 5g milk powder + 95g chhana base
(T1) 2g pineapple powder + 5g milk powder + 93g chhana base
(T2) 4g pineapple powder + 5g milk powder + 91g chhana base
(T3) 6g pineapple powder + 5g milk powder + 89g chhana base

Sensory attributes of chocolate coated chhana delights incorporated with mango powder and pineapple powder

The mean values of various sensory parameters of the chocolate coated product incorporated with different levels of mango powder and pineapple powder (2%, 4% and 6%) are presented in table 5 and 6. Significant ($p<0.05$) effect of mango powder and pineapple powder was observed on all the sensory attributes of chocolate coated chhana confection. Colour and

appearance and aroma scores increased with incorporation of mango powder and pineapple powder at 4% and 6% level. Kamble (2010) [13] also reported high colour and appearance scores for burfi prepared with addition of 15% pineapple pulp. Textural scores decreased significant ($p<0.05$) at 6% level of mango powder and pineapple powder incorporation, as compare to control. This could be due to increase in moisture content resulting in slight spreading of product in sugar syrup while cooking. Kulkarni and Joshi (2013) [16] also observed a similar decrease in textural scores with increase in level of papaya powder beyond 2.5% in biscuits. Scores for flavour were significantly ($p<0.05$) higher at all levels of mango powder and pineapple powder incorporation as compare to control. Pravin and Sanita (2017) [23] also reported higher scores for flavour of biscuits incorporated with 6% mandarin peels powder. Overall acceptability scores were recorded significantly ($p<0.05$) higher at 4% level pineapple powder incorporation. Kamble (2010) [13] reported increase in overall acceptability scores in burfi blended with 15 % pineapple pulp. Kumar (2016) [17] reported similar trend for overall acceptability scores in papaya-guava fruit bar with incorporation of 50% papaya pulp and 50% guava. Similarly Hamad (2018) [9] reported maximum acceptance of Guava probiotic dairy beverages with incorporation of 35% whey.

Table 5: Effect of different levels of mango powder on the sensory parameters of chocolate coated chhana delights (Mean ± SE) *

Levels of incorporation (%)				
Sensory parameters	Control	T1	T2	T3
Colour and appearance	7.23±0.12 b	7.45±0.11 b	7.70±0.07a	8.21±0.17 a
Texture	8.21±0.17 a	7.97±0.12 a	8.00±0.16 a	6.80±0.14 b
Aroma	8.02±0.13 b	8.07±0.14 b	8.47±0.10 a	8.54±0.12 a
Flavour	7.64±0.21 c	8.09±0.15 b	8.40±0.13ab	8.50±0.09 a
Overall acceptability	8.06±0.21ab	8.09±0.13ab	8.54±0.16 a	7.88±0.20 b

(Control) = 5g milk powder + 95g chhana base
(T1) 2g mango powder + 5g milk powder + 93g chhana base
(T2) 4g mango powder + 5g milk powder + 91g chhana base
(T3) 6g mango powder + 5g milk powder + 89g chhana base

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Table 6: Effect of different levels of pineapple powder on the sensory parameters of chocolate coated chhana delights (Mean ± SE) *

Levels of incorporation (%)				
Sensory parameters	**Control**	**T1**	**T2**	**T3**
Colour and Appearance	7.30±0.12 b	7.54±0.13 b	8.16±0.19a	8.00±0.12 a
Texture	8.14±0.18a	7.90±0.14 a	7.92±0.15 a	6.97±0.17 b
Aroma	7.95±0.13 b	8.07±0.15 b	8.42±0.10a	8.45±0.10 a
Flavour	7.26±0.16 c	8.09±0.15 b	8.38±0.14 ab	8.64±0.09a
Overall acceptability	7.90±0.21 b	8.16±0.13 ab	8.66±0.13 a	8.19±0.18ab

(Control) = 5g milk powder + 95g chhana base
(T1) 2g pineapple powder + 5g milk powder + 93g chhana base
(T2) 4g pineapple powder + 5g milk powder + 91g chhana base
(T3) 6g pineapple powder + 5g milk powder + 89g chhana base

Conclusion
Based on the physico-chemical and sensory characteristics, It may be concluded that mango and pineapple in powder form could be successfully utilized for the preparation of chocolate coated chhana confection. The most acceptable quality chhana confection was prepared by using 4 % mango powder and pineapple powder because of positive effect on colour and appearance, flavour, aroma and overall acceptability. On the basis of sensory quality, use of mango and pineapple powder at 6 % level did not show any beneficial effect as the texture of the confection disintegrated while cooking in sugar syrup at 50° Brix concentration. Thus, mango and pineapple powder up to 4 % level could be very well utilized to prepare chocolate coated chhana based confection.

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