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EFFECTS OF DIFFERENT LEVELS OF '*PANEER* WHEY' ON PHYSICO-CHEMICAL PROPERTIES OF WHEY BASED JELLY CONFECTION

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ABSTRACT
The object of this study was to find out suitability of whole '*paneer* whey' for producing jelly confection. *Paneer* whey tested total solids (6.36 ± 0.04%), titrable acidity (0.38 ± 0.01%), total protein (0.35 ± 0.01%) and total ash (0.40 ± 0.14%). Five different proportions of *paneer* whey and potable water *viz*., T1 (00:100 Control), T2 (25:75), T3 (50:50), T4 (75:25) and T5 (100:00) were individually concentrated with aqueous orange colour (0.1%), flavour (0.2%), citric acid (1%), pectin (1.5%) and ground sugar (47.5%) till 65°Brix and allowed to set in moulds. Physico-chemical properties of finished products (T1 to T5) *viz*., total moisture, titrable acidity, total protein, total sugar and total ash ranged from 34.85-30.76%, 0.40-0.44%, 0.03-0.25%, 65.01-68.50% and 0.09-0.42% respectively. Results revealed that jelly confection can be enriched with the incorporation of valuable whey proteins & minerals. The level of nutrients in the product increases with the increasing levels of '*paneer* whey'.

INTRODUCTION

Present work was aimed to study the effects of different levels of *paneer* whey on physico-chemical properties of finished product. Different scientists have tried to utilize varied levels of whey in jelly, jam and other confectionery products. Similarly, Wright (2007) stated that many companies who are firmly established in the confectionery segment are adding healthy ingredients to their brands as functional confectionery continues to pique the interest of both: companies and consumers. Food manufacturers are increasingly viewing whey products as an ideal means of achieving added value, but because of high mineral content and low pH, *paneer* whey pose considerable difficulties in its use, there fore mostly remain unutilized (Gupta, 2008).

Jelly is a confectionery product which is made from simple ingredients that includes soluble solids in the form of sugar as well as hydrocolloids like pectin and additional simpler components like acid and water (Patrella, 2008). It gives pleasant mouth feeling, good looking appearance to the product, higher accessibility to food products and satisfy craving for sweets (Ognean *et al*., 2007). Whey, one of the largest by-products of world dairy industry (Changade *et al*., 2012), contains approximate 6% total solids (70% lactose, 11% whey proteins) (Zall, 1984), most of the water soluble vitamins, minerals (Sahu *et al*., 2005), calcium, phosphorus and all the essential amino acids, making it highly nutritious in nature (Saravana and Manimegalai, 2005). It is used for producing WPC, whey powder, lactose (Changade *et al*., 2012), hydrocolloid 'xanthan gum' (Nikam *et al*., 2011), carbon and nitrogen source (Kumari and Dhingra, 2013) *etc.*

Inspite of the significant nutritional properties of whey, out of 85 million tones of global production 40% is still disposed as raw whey in to sewage (Dhawale *et al*., 2009). Also, its Biological Oxygen Demand is very high (39,000-48,000 ppm) which is 200 times higher as compared to domestic sewage (Sahu *et al*., 2005). Primary treatment of five lakh liters of whey would cost $10,000 per day (Khamrui and Rajorhia, 1998). Today, it is not possible to dump whey as it is because of possible pollution hazards and it is not economically feasible to build a purification plant also; this leaves us with only one alternative, 'utilize whey' (Knipschildt, 1977). Hence diversification of whey solids to human food chain employing cost effective technologies appear to be the best alternative to utilize whey (Changade *et al*., 2012).

However, Sharma and Raghuwanshi (2003) concluded that whey cannot be utilized in preparation of fruit preserves. Rao *et al*. (2003) and Sharma (2014) also agreed with this finding due to perishable nature of fruits. But, Patel and Arora (2005) stated that the native functional virtues of whey proteins along with the fiber functionality of pectin will greatly elevate the status of dairy products for the benefit of consumers of all age groups. Hence, an attempt was made to combine the gelling property of pectin.

MATERIALS AND METHODS

Preparation

Fresh composite sample of *paneer* whey was obtained free of

cost for all the treatments (T2 to T5) and the five replications of each treatment, from local dairy producing *paneer* by using 1-2% citric acid solution as coagulant. The *paneer* whey was filtered thrice using sterilized muslin cloth. It was analyzed for total solids, titrable acidity, total ash and total protein content according to the standard procedure recommended in ISI (1981). *Paneer* whey based jelly confection was prepared according to Human (1949) with slight modification. *Paneer* whey and potable water in different proportions viz., 00:100 (T1, Control), 25:75 (T2), 50:50 (T3), 75:25 (T4) and 100:00 (T5) mixed with food grade aqueous orange colour of 'Trishul' brand, aqueous orange flavour of 'Flying Bird' brand, analytical grade citric acid of 'Himedia' make (RM-6826), 'Himedia' make (RM-396) powdered form high methoxyl pectin of jelly grade 150±5 and ground sucrose used @ 0.1%, 0.2%, 1%, 1.5% and 47.5% respectively and mixture was concentrated till total soluble solids reached to minimum 65°Brix for preparing jelly confection.

Physico-chemical analysis

Fresh treatment samples were utilized for further investigation. Average analytical values were obtained. Each treatment was replicated five times. Titrable acidity and total sugar content of treatment T1 to T5 were calculated as per the standard procedure prescribed by Ranganna (2004). Total moisture and total ash were determined according to the standard process given in ISI (1980). Total protein content analyzed by standard Micro Kjeldahl method (AOAC, 1970). All the data obtained during the course of studies was recorded and statistically analyzed using Completely Randomized Design as described by Snedecor and Cochran (1967). In all 25 samples were studied.

RESULTS AND DISCUSSION

Physico-chemical analysis

The *paneer* whey was analyzed for various components (Table 1) which are similar with the findings of Kumar and Saxena (2008). The physico-chemical analysis of fresh treatment samples T1 to T5 was carried out and results obtained are shown in Table 2. The control (T1) recorded highest moisture content while the lowest was recorded for treatment T5. Decrease in the moisture content from treatment T1 to T5 may be due to the increase in total solids content because of addition of *paneer* whey and total solids present in it. Results recorded are in harmony with Carvalho *et al*. (2012) for sapota pulp jelly. Significant differences were observed for per cent moisture among the treatments.

Table 1 : Composition of *paneer* whey

Sr. No.	Parameters	Average values
1	Total solids	06.36±0.04%
2	Titrable acidity	00.38±0.01%
3	Total protein	00.35±0.01%
4	Total ash	00.40±0.14%

The per cent titrable acidity recorded for different treatments indicate that there was increase in acidity with increase in the proportion of *paneer* whey from T1 to T2. The values recorded are in line with Islam *et al*. (2012a) for dragon fruit jelly. The differences among the values of treatments were significant and decreased from T1 to T5 may be due to increase in acidity on account of the addition of different levels of *paneer* whey. Similar reason is depicted by Hossen *et al*. (2009) for guava jelly and similar values of titrable acidity were obtained by Joshi (1980) for wood apple and guava jelly.

The highest total protein content was found in T5 treatment which may be due to highest level of whey proteins, while lowest total protein content was noted in control treatment T1 as it was made from potable water. Pectin only was responsible for the protein value in treatment T1. The values recorded for total protein content in case of treatment T4 and T5 are similar with those obtained by Kumari and Sandal (2010) for whey based mango jam.

The values recorded for total sugar content were statistically analyzed and it was found that the differences among the treatments were significant. The highest total sugar was recorded for T5 and the lowest total sugar value was recorded for treatment T1. The results indicate that there was increase in total sugar content with increase in the proportion of *paneer* whey from T1 to T5. This may be due to increase in level of lactose in *paneer* whey which increases the total sugar of whey based jelly confection. The values recorded are in accordance with Islam *et al*. (2012b), Carvalho *et al*. (2012), Yuyama *et al*. (2008) and Thomas and Kulwal (2002) for strawberry jam/jelly, sapota pulp jelly, cubiu jelly and ber jam samples respectively.

Statistically all the treatments have shown significant differences for total ash. The increase in total ash from treatment T1 to T5 may be due to increasing mineral content contributed by rising levels of *paneer* whey. Similar values were observed by Hossen *et al*. (2009) for guava jelly samples.

Hence, it can be concluded that the physico-chemical properties of finished products (T1 to T5) *viz*., total moisture, titrable acidity, total protein, total sugar and total ash ranged from 34.85-30.76%, 0.40-0.44%, 0.03-0.25%, 65.01-68.50% and 0.09-0.42% respectively. Results revealed that jelly confection can be enriched with the incorporation of valuable whey proteins and minerals. The level of nutrients in the product increases with the increasing levels of '*paneer* whey'. This

Table 2 : Effects on physico-chemical properties of *paneer* whey based jelly confection

Treatments	Moisture(%)	Titrable acidity (% citric acid)	Total protein (%)	Total sugar(%)	Total ash(%)
T1	34.85 ±0.01^{a}	0.40 ±0.01^{e}	0.03 ±0.01^{e}	65.01 ±0.01^{e}	0.09 ±0.01^{e}
T2	34.28 ±0.03^{b}	0.41 ±0.01^{d}	0.09 ±0.01^{d}	65.41 ±0.04^{d}	0.19 ±0.01^{d}
T3	32.73 ±0.05^{c}	0.42 ±0.02^{c}	0.15 ±0.02^{c}	66.8 ±0.06^{c}	0.27 ±0.01^{c}
T4	31.80 ±0.05^{d}	0.43 ±0.01^{b}	0.22 ±0.02^{b}	67.52 ±0.08^{b}	0.34 ±0.01^{b}
T5	30.76 ±0.11^{e}	0.44 ±0.27^{a}	0.25 ±0.02^{a}	68.50 ±0.12^{a}	0.42 ±0.01^{a}

Data represented as mean ± standard deviation. Means with different; superscripts in a column differ significantly at 5% level of significance (n = 5)

facilitated utilization of *paneer* whey at its 'production point' itself, to prepare a novel whey based confection, mitigating problems concerning whey treatment, disposal and related environmental pollution.

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