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RESEARCH ARTICLE

STUDIES ON PHYSICOCHEMICAL AND SENSORY CHARACTERISTICS OF WHEY-HERBAL-SPICE MIXTURE

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ABSTRACT

The study was designed to prepare whey herbal spice mixture, which was used as constituent of Pani Puri. Pani puri a spicy food item liked by many Indian peoples and it is popular throughout India. Puri is puffed made round, made up of wheat flour which is consumed after filling it with sour, hot and spicy chilled water known as pani. Pani is consumed with Puri utilizing whey at the place of water, by adding some flavor of whey. Whey is a by-product obtained during coagulation of milk by using acid. It contains about half of the milk solids in which nutritional components such as lactose, protein and minerals are present in large amount. Pani puri from whey water was prepared in three flavors by adding cumin seeds (II), asafoetida (III) and tamarind (IV) respectively. Sample I was Plain without adding any flavor. Method of preparation includes whey, addition of spice mixture (20%), addition of flavoring agents like cumin, asafoetida, tamarind (1.5%) with proper mixing and chilling, filtering and storage at low temperature (4.0±1ºC). The prepared beverage has light green color, highly acceptable taste and overall acceptability. Sensory evaluation of the products was done using nine point hedonic scale on the basis of appearance, color, palatability, flavor and overall acceptability. Physicochemical analysis of the products was done by estimating pH, moisture and ash percentage. Total soluble solids, acidity and pH were found to be acceptable by the end of 0-10 days storage. Products were judged for acceptability at 5 days of interval of time. This may allow the consumers to consume whey without changing its original attributes.

INTRODUCTION

Whey is a nutritious by product from Cheese, Chhana and Paneer industry containing valuable nutrients like lactose, proteins, minerals and vitamins etc. which have indispensable value as human food. 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 (Horton, 1995). In India, it is estimated that about 100 million kg of whey is annually derived as a by-product which may cause substantial loss of about 70,000 tonnes of nutritious whey solids (Parekh, 2006).Whey and its biological components have proven its effects in treatments of servical chronic diseases like cancer, cardiovascular diseases and HIV etc. As it is nutritionally too rich, it can also be used in beverages along with infant, geriatric and athletic food (Devrag *et al*., 2005). Preparation of coagulated milk products from milk leaves behind a large amount of whey as a by product. This whey is considered to be rich in nutrients, which is good for health. In dairy sector, generally this whey goes waste or remains underutilized. There is need to explore the ways to use this whey for human consumption. Whey is the greenish-yellow colored liquid which is drained off of the coagulated cheese curd during the cheese making process (Smithers *et al*., 1996). The chhana and paneer whey give the major contribution (about 80%) in total whey production. By realizing the functional properties of whey, many industries targets upon utilizing whey as the functional food ingredient. Hence the conversion of whey into beverage is one of the most attractive avenues for utilizing whey for human consumption (Goyal and Gandhi, 2009). Considerable work has been done through out the world to utilize whey for production of whey protein concentrate (WPC), whey powder, lactose, lactic acid, whey paste etc. (Panesar *et al*., 2007). Whey based fruits beverages are more suitable for health as compared to other drinks (Sarvana Kumar, 2005).Many attempts have been done on utilization of whey in the formulation of various dairy products but, still there is a lot of scope to explore the possibilities for its utilization in beverage industries.Now a day's Indian dairy industries looking for new product ideas and technologies to meet the consumer's requirement and to increase the profitability of the products. Product diversification is quite feasible using whey as water replaces without much change in the composition (Patel *et al*., 2007).

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MATERIALS AND METHODS

Present study was conducted at Dairy Technology Unit of Division of Livestock Products Technology, Indian Veterinary Research Institute (IVRI), Bareilly, Uttar Pradesh (India). Study was conducted to prepare different products of whey-herbal spice mixture utilized in pani-puri instead of pani. Cream from the milk was separated using a manually operated separating machine and the skim milk was used to prepare other milk products. This yielded a large amount of whey, which was utilized to prepare whey herbal spice mixture. Total four variations numbered as sample I, II, III, IV were prepared with different flavors such as plain, cumin seeds, asafoetida and tamarind.

Preparation of Chhana Whey

The chhana whey was obtained during the manufacture of chhana using milk containing 3.5 % fat and 8.5 % solid not fat (SNF). Milk was coagulated using 2% percent citric acid solution as coagulant. The Whey was filtered and centrifuged to remove the fat. Fat separation was done at 45°C. To precipitate proteins, whey was heated to 105°C at pH 4.6 and then was filtered and stored under refrigerated condition until used.

Preparation of whey herbal spice mixture

The whey-herbal-spice mixture was prepared by method indicated in Fig. 1. Preparation of whey herbal spice mixture from whey water was used. It was filtered through the muslin cloth. Total four flavors (I, II, III, and IV) of whey herbal spice mixture was prepared using plain, cumin seeds, asafoetida and tamarind. Bottles containing whey were stored at refrigerated temperature (4±1ºC) for 10 days. Samples were drawn at interval of 5 days for evaluatation.

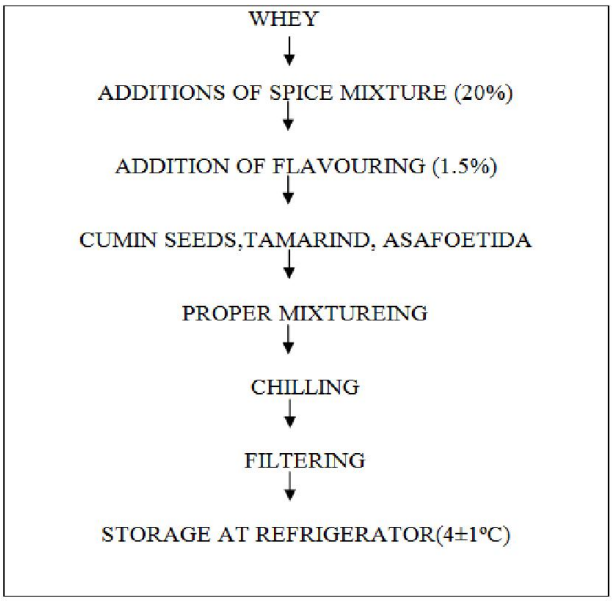

Fig. 1. Flow chart of preparation of whey herbal spice mixture

Physicochemical analysis

The physicochemical parameters like moisture, protein, ash were done by AOAC method. Total soluble solids content in the fresh and stored product was determined using hand Refractometer and acidity was determined by titration method against the standard 0.1 N NaOH solution using phenolphthalein as an indicator by using method as suggested by Ranganna (2004). The pH of product was determined by using digital pH meter.

Sensory analysis of whey herbal spice mixture

All the samples were evaluated for sensory characteristics and overall acceptability by a panel of judges selected from Division of Livestock Products Technology, IVRI using nine point Hedonic scale as described by Larmond (1997). The research was carried out to study the quality of whey herbal spice mixture prepared with different flavors. Pani puri was analyzed for physicochemical and sensory characteristics. The samples were evaluated for appearance, colour, palatability, flavor and overall acceptability. The evaluation was done at an interval of 5 days during the storage period of 10 days.

Statistical analysis

The data was analyzed with the help of suitable statistical tools to find out the effect of different whey herbal spice mixtures and storage period on the physicochemical and sensory characteristics of the product.

RESULTS AND DISCUSSION

The study was planned to prepare whey herbal spice mixture with different types of flavors. Total four products were prepared for the present study to characterize for physicochemical and sensory evaluation of whey herbal spice mixture. There have been enough articles which discusses about the functional properties of whey and their digestibility. But in present investigation, we had emphasized on the use of mixture of whey along with flavors like cumin seeds, asafoetida and tamarind in Pani Puri (chat item) in the place of water.

Protein Percentage

Table 1 Statistical analyses showed significant difference ($P<0.05$) within the protein contents of different whey herbal spice mixtures. The mean protein content of plain whey, cumin whey, asafoetida whey and tamarind whey was 0.17 and 0.18, 0.16, 0.19 along with standard deviation of 0.01, 0.02, 0.01, and 0.03 respectively. Wazir Singh (1999) developed a soft beverage from paneer whey and guava revealing percentage of protein as 0.31%.

Moisture Percentage

The mean moisture content of plain whey, cumin whey, asafetida whey, and tamarind whey was 94.37, 93.51, 93.61 and 95.31 respectively along with standard deviation of 0.20, 0.12, 0.31 and 0.24 Table 1.

Table 1. Physicochemical Analysis (Mean±SD) of Whey Herbal spice mixture

Parameters	Plain	Cumin	Asafoetida	Tamarind
Protein%	0.17±0.01	0.18±0.02	0.16±0.01	0.19±0.03
Moisture%	94.37±0.20	93.51±0.12	93.61±0.31	95.31±0.24
Ash %	1.75±0.01	1.73±0.06	1.49±0.20	1.53±0.14

Values are mean ± SD.
The values are the means compared at a significance level of 5%

Table 2. Effect of storage period on TSS, Acidity and pH (Mean ± SD) of whey herbal spice mixture

Parameters	TSS%			Acidity %			pH%		
	0^{th} Day	5^{th} Day	10^{th} Day	0^{th} Day	5^{th} Day	10^{th} Day	0^{th} Day	5^{th} Day	10^{th} Day
Plain (A)	12.74	12.92	13.34	0.16	0.18	0.21	3.70	3.63	3.52
Cumin(B)	12.42	12.85	13.43	0.22	0.25	0.27	4.48	4.32	4.26
Asafoetida(C)	12.36	12.98	13.46	0.19	0.21	0.23	3.62	3.56	3.51
Tamarind(D)	12.22	12.79	13.65	0.23	0.25	0.27	4.21	4.15	4.12

Values are mean ± SD.
The values are the means compared at a significance level of 5%

Table 3. Organoleptic evaluation (Mean ± SD) of whey herbal spice mixture

Parameters/Samples	Appearance	Colour	Palatability	Flavour	Overall acceptability
Plain (A)	6.62±1.21	7.13±0.73	7.12±0.85	7.82±0.25	7.53±0.60
Cumin (B)	7.04±0.80	7.40±0.36	7.4±0.24	7.87±0.42	7.86±0.34
Asafoetida (C)	6.84±0.49	7.14±0.85	8.03±0.34	7.82±0.47	7.71±0.45
Tamarind (D)	7.06±0.65	7.73±0.21	7.68±0.37	7.62±0.70	7.87±0.25

Values are mean ± SD
The values are the means compared at a significance level of 5%

Ash Percentage

The mean ash content of plain whey, cumin whey, asafetida whey and tamarind whey was 1.75, 1.73, 1.49 and 1.53 along with standard deviation of 0.01, 0.06, 0.20 and 0.14. Significant differences ($P<0.05$) were found among those mean values of all four samples Table 1.

Effect on storage period of whey herbal spice mixture

The data on storage period of whey herbal spice mixture is presented in Table no 2.The storage study showed that there was an increasing trend in the TSS and acidity with decreasing trend in the pH. The initial TSS % of the plain whey herbal spice mixture (12.74) had increased to 12.92 per cent after 5 days and 13.34 per cent after 10 days of storage. The initial TSS % of the cumin seeds whey herbal spice mixture (12.42) had increased to 12.85 per cent after 5 days and 13.43 per cent after 10 days of storage. The initial TSS % of the asafoetida whey herbal spice mixture was 12.36 per cent which had increased up to 12.98 per cent after 5 days and 13.46 per cent after 10 days of storage. The initial TSS % of the tamarind whey herbal spice mixture was 12.22 per cent which was increased to 12.79 per cent after 5 days and 13.65 per cent after 10 days of storage. The initial acidity (0.16 %) of the plain whey herbal spice mixture had increased to 0.18 per cent after 5 days and 0.21 per cent after 10 days of storage. The initial acidity (0.22 %) of the cumin seeds whey herbal spice mixture had increased to 0.25 per cent after 5 days and 0.27 per cent after 10 days of storage. The initial acidity (0.19%) of the asafoetida whey herbal spice mixture was increased to 0.21 per cent after 5 days and 0.23% after 10 days of storage. The initial TSS (0.23%) of the tamarind whey herbal spice mixture had increased to 0.25 per cent and 0.27 per cent after 5 and 10 days of storage time respectively. Singh (1985) reported the increase in acidity of guava RTS and nectar during storage of four months. The initial pH of plain whey herbal spice mixture (3.70) decreased to 3.63 after 5 days of storage which gets again reduction up to 3.52 after 10 days of storage. The initial pH of the cumin seeds whey herbal spice mixture (4.48) had decreased to 4.32 after 5 days and 4.26 after 10 days of storage. The initial pH of the Asafoetida Whey herbal spice mixture (3.62) had decreased to 3.56 after 5 days and 3.51 after 10 days of storage. The initial pH of the tamarind whey herbal spice mixture (4.21) had decreased to 4.15 after 5 days and 4.12 after 10 days of storage. This decrease in pH may be due to increase in acidity content in the stored product. But during the storage period the pH of whey guava beverage was slightly decreased. Singh and Natha (2004) reported pH of 3.93 to 3.95 of whey protein enriched with Bale juice beverage.

Sensory scores of whey herbal spice mixture

Organoleptic Evaluation: The organoleptic evaluation of whey herbal spice mixture is presented in Table no 3. All the samples i.e. (A) Plain whey (B) Cumin whey (C) Asafoetida whey (D) Tamarind whey were evaluated for sensory attributes like appearance, color, palatability, flavor, overall acceptability on nine point hedonic scale (9 for extremely like and 1 for extremely dislike) by the scientists of Division of Livestock Products Technology.

1. Appearance Acceptability

The mean values of appearance plain whey, cumin whey, asafoetida whey and tamarind whey (A, B, C and D) were 6.62, 7.04, 6.84 and 7.06 with standard deviation of 1.21, 0.80, 0.49 and 0.65 respectively. Statistical analysis showed that significant difference exists among the appearance of different samples ($P\leq0.05$.The mean value of appearance 7.06 of

tamarind whey (D) is more as compared to others. In the appearance test, hedonic scale showed that the whey herbal spice mixture of tamarind (D) scored excellent, whey cumin (B) sample scored very good and whey asafoetida (C) scored good while plain whey (A) scored least by the subjects as compared to other samples.

2. Colour Acceptability

The mean values of colour of plain whey, cumin whey, asafoetida whey and tamarind whey (A, B, C, and D) were 7.13, 7.40, 6.84 and 7.14 with standard deviation of 0.73, 0.36, 0.85 and 0.21 respectively. Statistical analysis revealed significant difference among colour (7.40) of different samples ($p \leq 0.05$). The mean value of colour 7.40 of cumin whey (B) scored more as compared to others. In the color test hedonic scale, whey spice mixture cumin whey sample (B) scored excellent, whey tamarind (D) scored very good, and plain whey (A) scored good while whey asafoetida (C) scored least acceptable.

3. Palatability Acceptability

The mean values of palatability of plain whey, cumin whey, asafoetida whey and tamarind whey were 7.12, 7.4, 8.03 and 7.68 (A, B, C, D) with standard deviation of 0.73, 0.36, 0.85 and 0.21 respectively. Statistical analysis showed significant ($p \leq 0.05$) difference among the palatability of different samples. The mean value of palatability 8.03 of asafetida whey (C) is more as compare to others. In the palatability test hedonic scale, asafoetida whey (C) scored excellent; whey tamarind (D) scored very good, plain whey (A) scored good whereas whey cumin (B) scored as least acceptable as compared to others.

4. Flavour Acceptability

The mean values of flavour of plain whey, cumin whey, asafoetida whey and tamarind whey were 7.82, 7.87, 7.82 and 7.62 (A, B, C and D) with standard deviation of 0.25, 0.42, 0.47 and 0.70 respectively. Significant difference exists among the overall acceptability pattern of different samples ($p \leq 0.05$). The mean value of flavor 7.87 cumin whey (B) is more as compared to others. Hedonic scale showed excellent score to whey cumin (B) sample, whey asafoetida and plain whey (C, A) scored very good while whey tamarind (D) were scored as acceptable sample and obtained less scores as compared to others.

5. Overall Acceptability

Overall score were given by the judges on the basis of appearance, colour, flavour and palatability, the mean values of overall acceptability of plain whey, cumin whey, asafoetida whey and tamarind whey were 7.53, 7.86, 7.71 and 7.87 (A,B,C,D) with standard deviation 0.60, 0.34, 0.45 and 0.25 respectively. Statistical analysis showed that significant difference among the overall acceptability of different samples ($p \leq 0.05$). Higher score were obtained by tamarind whey (D) 7.87. Overall acceptability by scoring method of whey cumin (B) was very good. W hey asafoetida (C) scored good, plain whey (A) scored least as compared to others but acceptable by the judges.

Conclusion

The results of the present study showed that whey could be successfully incorporated in whey herbal drinks. However we could produce different whey-based products by adding different flavors with good nutritional, sensory and storage properties which will increase the economical and commercial value of whey.

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