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Storage stability of cranberry fortified whey beverage under refrigerated conditions

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Abstract
Whey is a protein rich liquid obtained as a y-product during heat and acid-coagulated products preparation. However, lack of membrane processing plants results into improper utilization of whey as most of it is discarded as waste. This not only contributes to losses of valuable nutrients, but also adds to environmental pollution. A possible strategy could be to utilize the whey for preparation of fruit extract added functional beverages. The present study was undertaken to evaluate the storage stability of cranberry fortified whey beverage. The samples were packaged in glass bottles and stored under refrigerated conditions for 21 days. It was observed that the anti-oxidant activity of the cranberry extract fortified whey beverage remained stagnant during the first three weeks of storage at refrigerated temperature, but on fourth week, it decreased significantly using FRAP method. Sensory scores for cranberry fortified whey beverage appeared to be higher at earlier stages of storage than later. Flavor score remained higher for fortified sample throughout the storage period, but color and appearance and overall acceptability scores were lower for fortified beverage than plain beverage at the later stages of storage.

Keywords: Whey beverage, cranberry extract, storage stability

Introduction
Over the last two decades, the emergence of the concept that plant-derived polyphenols act to promote health and prevent chronic diseases has stimulated much interest. Antioxidants are substances that, at low concentrations, prevent or retard the oxidation of easily oxidisable biomolecules such as lipids, proteins and DNA. The antioxidant capacity of phenolic compounds has long been recognized for their strong chain-breaking actions and ability to scavenge radicals, thereby protecting cells against the detrimental effects of reactive oxygen species. Berries are rich in a large variety of different phenolic compounds. Benefits provided by phenolic compounds are assumed to be partly due to their antioxidant activity in chelating metal ions, scavenging radicals, and inhibiting pro-oxidant enzymes. Phenolic compounds such as proanthocyanidins, anthocyanins, flavonols, and phenolic acids predominate in berries (Amorati *et al*., 2006) [1]. Several anti-oxidants are found in cranberries and other products containing cranberry. Organic cranberry juices contain less sugar and more metal ions such as zinc. Cranberries have additional properties over to preventing cancer, they have also been shown to decrease risk related to kidney stone, urinary tract infections, lower LDL, help with ulcers and prevent tooth decay. Whey and especially whey proteins are rapidly being acknowledged for possessing many healthful properties as well as having many useful functional properties that can be useful to the food processing industries (Ha and Zemel, 2003) [8]. Whey proteins and amino acid supplements have gained a strong position in the sports nutrition market based on the purported quality of proteins and amino acids they provide (Colbert and Decker, 1991) [5] along with their unique functional properties, including emulsification, gelation, thickening, foaming and water-binding capacity. Whey has antioxidant properties as well. Lactoferrin and lactoferricin, two minor proteins in whey, function as antioxidants via their iron binding capacity (Gutteridge *et al*., 1981) [7].
In India, whey is obtained as a by product in the preparation of chhana, paneer, cheese and casein. Out of 165 tons of global whey production, 270 million kg per annum in India is produced and still disposed as raw whey into sewage which leads to serious environment pollution and nutritional loss to the country. A possible strategy to utilize the whey is to prepare different whey beverage by addition of different additives, *viz*., anti-oxidants, fruit extracts, etc. Considering this, a whey beverage was developed by addition of cranberry. In this paper, we have provided the storage stability of the developed beverage.

Materials and Methods

Materials

Fresh whey was collected from the Experimental Dairy, National Dairy Research Institute, Karnal. Whey protein concentrate was procured from the Modern Dairies, Karnal. Sucralose was procured from M/S Hi-Media laboratories pvt ltd. Mumbai. Pectin was procured from C P kelko A Hubber company, Mumbai. Frozen commercial fruit concentrate (1Kg pack) of Cranberry was procured from ORANA Pvt. Ltd., Gurgaon, Haryana and stored at -20 °C till use. Glass bottles were procured from Tarsons products Pvt. Ltd., Kolkata, India. All chemicals used during the investigation were AR grade and obtained from standard suppliers. Microbiological media e.g. Potato Dextrose Agar, Violet Red Bile Agar, Plate count agar were obtained from M/s Hi-Media, laboratories pvt ltd. Mumbai.

Preparation of whey beverage

For preparation of cranberry fortified whey beverage, paneer whey was clarified using muslin cloth followed by addition of flavor (@0.01%), stabilizer addition (@0.05%) and artificial sweetener (@0.15%). The contents were then adjusted to pH 4.0 using citric acid and filled in bottles. The packaged samples were sterilized at 121 ^{0}C for 15 minutes. This was followed by cooling the contents to ambient temperature and addition of cranberry extract (@5% total phenolic content). The prepared product were stored under refrigerated conditions (4 ^{0}C) for 21 days and analysed for different attributes (Fig 1). Control sample was prepared in the similar fashion but was devoid of cranberry extract addition.

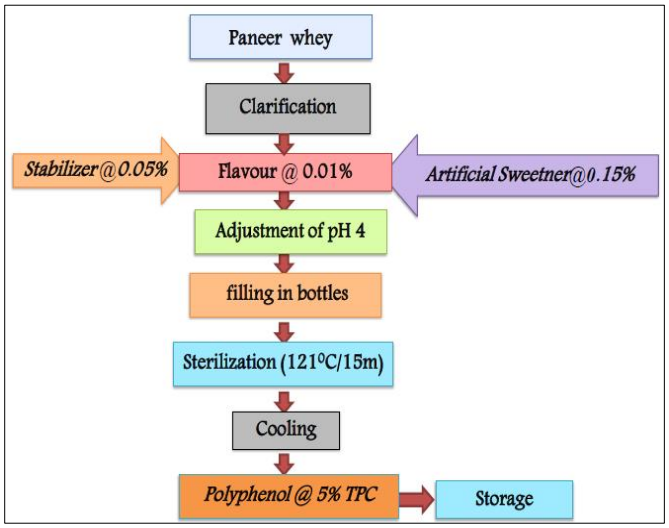

Fig 1: Flow diagram for preparation of cranberry fortified whey beverage

Analysis of the samples

The antioxidant potential of prepared samples was evaluated by DPPH method as provided by Koffi *et al*. (2005) [9]. Total Flavonoids content and DPPH activity in the samples were analyzed using Aluminum Chloride Colorimetric method as provided by Chia-chi *et al*. (2002) [4]. For sensory analysis, the samples were presented to a panel of experts comprising of faculty members and students of the division. A nine-point Hedonic scale score card was provided to the panellists to evaluate the quality of the product with respect to appearance, flavour and overall acceptability. The data obtained during the physic-chemical and sensory evaluation of the samples were analyzed by SAS statistical software (version 9.1.3, SP4) using one way ANOVA. The Duncan's New Multiple Range Test (DNMRT) was used to compare the difference among the samples.

Results and Discussion

Changes in antioxidant capacity of cranberry fortified whey beverage during storage

The DPPH free radical scavenging activity (Table 1) decreased slightly after three weeks of storage at refrigerated temperature. There was no difference observed in the total phenolic content of whey beverage during storage up to three weeks. Similar trend was observed in the anthocyanin content and total flavanoid content during storage. FRAP values (Table 2) of the developed whey beverage showed different antioxidant capacity during storage at refrigerated temperature for four weeks. It was observed that during storage period of three weeks no significant decrease in antioxidant capacity was observed, however, at the completion of fourth week a significant decrease in antioxidant activity was observed.

In the cranberry whey beverage the hydrophilic phenolic compounds were present *viz*., phenolic acids, anthocyanins, and flavonol glycosides make up the more polar fraction of cranberry phenolics (Naczk and Shahidi, 2003) [10]. The anthocyanins in cranberries are mainly 3-glucosides of anthocyanidins. The affinity of phenolics to behave as antioxidants is highly dependent on factors such as pH and the presence of other molecules such as proteins. The chemical form of anthocyanins is very much dependent on pH. At low pH (1-3), anthocyanins are heavily protonated, and the very stable flavylium cation predominates (Salminen and Heinonen, 2010) [11]. Thus the preparation of whey beverage at pH 3.6 showed good stability of antioxidant activity during storage up to 3 weeks.

The antioxidant capacity of paneer whey was observed to be 0.35 mM TE / L by FRAP method and 0.15 mMol TE / L with DPPH method. The antioxidant capacity of whey is due to presence of whey proteins, urate and residual vitamin C as low molecular weight component. The difference in antioxidant capacity by different methods could be related to the difference in reactivity of sample component. The results obtained previously in our lab (Bajaj *et al*., 2005) [2] for antioxidant capacity of acid whey for buffalo milk was 0.49 mMol TE / L, based on ABTS method, and this antioxidant capacity was observed to be distributed equally between high molecular weight fraction and low molecular weight fractions. The lower values observed in present study for paneer whey could be due to relative lower content of protein. Chen *et al*, (2003) [3] reported antioxidant capacity of acid whey as 0.28 mMol TE / L based on ABTS method and 0.175 mMol TE / L using FRAP method. The total phenolic content in paneer whey using Folin's method was found to be 9 mg GAE /100ml.

Changes in sedimentation values of cranberry fortified whey beverage during storage

Changes in the sedimentation behaviour of whey beverages containing CB concentrate are presented in table 3. The sedimentation value was greater than that for control. Thermal denaturation of whey protein together with protein - polyphenol interaction might be responsible for it. Koffi *et al*., (2005) [9] found greater sedimentation capacity and syneresis in UHT beverages made from whey plus banana pulp, the changes being directly proportional to the storage temperature. Djuric *et al*., (2004) [6] reported that in the

preparation of whey beverages with various fruit pulps, the main factors influencing the quality of these products were interactions between different constituents and pH. This fact demonstrates the importance of knowing the characteristics of the raw materials in the process of elaborating whey based beverages, especially the nature of the whey and the fruit juice/pulp that will make up the mix and stabilizer to be used as processing parameters like homogenization time and pressure, pasteurization and storage temperature, to guarantee stability and quality.

Table 1: Antioxidant capacity of cranberry fortified whey beverage during storage at refrigerated temperature using DPPH (µM TEAC) method

Days	Storage Period (Days)			
	1	7	14	21
Control	152±2.2	150±2.7	147±3.0	146±2.8
Cranberry fortified whey Beverage	1120.26±6.7^{a}	1040.47±3.8^{a}	980.58±5.4^{a}	958.27±4.9^{b}

Data are presented as means ± SD (n=3)
Means with different superscript differ significantly (p<0.05)

Table 2: Antioxidant capacity of cranberry fortified whey beverage during storage at refrigerated temperature using FRAP (µM TEAC) method

Sample	Storage Period (Days)			
	1	7	14	21
Control	390±4.1	390±3.6	420±3.3	441±2.8
Cranberry fortified whey Beverage	3212±7.7^{a}	3208±7.9^{a}	3016±8.1^{a}	2847±6.9^{b}

Data are presented as means ± SD (n=3)
Means with different superscript differ significantly (p<0.05)

Table 3: Effect on Sedimentation value (ml/100ml) of Cranberry fortified whey beverage during storage

Sample	Storage Period (Days)			
	1	7	14	21
Control	0.2±0.006	0.4±0.004	0.6±0.007	0.8±0.003
Cranberry fortified whey Beverage	0.3±0.008^{b}	0.7±0.009^{a}	0.9±0.005^{a}	0.9±0.004^{a}

Data are presented as means ± SD (n=3)
Means with different superscript differ significantly (p<0.05)

Change in sensory attributes of cranberry fortified whey beverage stored at refrigeration temperature

The whey beverage having cranberry extract was stored at refrigerated temperatures and was studied for changes in its sensory attributes by sensory analysis of the product weekly by trained panellist having adequate knowledge about the product. The results obtained for sensory evaluation for cranberry extract fortified whey beverage and control (without cranberry extract) whey beverage indicated that flavour score for the test sample decreased with the increase in storage period but it had higher scores than control sample even at the end of storage study (Figure 2). Color and appearance and overall acceptability followed similar trend i.e., the scores decreased with the increase in the storage period for test sample, but the control sample had relatively similar scores throughout the storage study.

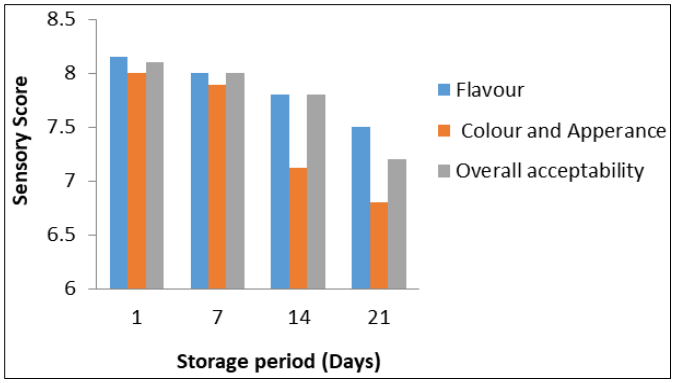

Fig 2: Changes in sensory attributes of cranberry fortified whey beverage stored at refrigeration temperature

Changes in microbiological counts of cranberry fortified whey beverage: All the microbial counts done in the present investigation (standard plate count, colifrom count, yeast and mold count) were found to be absent in both the whey beverages (control and polyphdenol fortified) after 21 days of storage at refrigerated temperatures, indicating effective sterilization and good microbiological quality of the product.

Conclusion

The present study was undertaken to evaluate the storage stability of cranberry fortified whey beverage. Anti-oxidant activity of the CB extract fortified whey beverage remained stagnant during the first three weeks of storage at refrigerated temperature, but on fourth week, it decreased significantly using FRAP method. Sedimentation value for CB extract fortified whey beverage increased during the 21 days of storage at refrigerated temperature, while the same increased from 0.2 to 0.8 for control whey beverage. During the course of storage study, sensory scores for cranberry fortified whey beverage appeared to be higher at earlier stages of storage than later. Flavor score remained higher for fortified sample throughout the storage period, but color and appearance and overall acceptability scores were lower for fortified beverage than plain beverage at the later stages of storage. The study may find its applications in small scale dairies looking for economically utilize the whey for functional beverages preparation.

References

1. Amorati R, Pedulli GF, Cabrini L, Zambonin L, Landi L. Solvent and pH effects on the antioxidant activity of caffeic and other phenolic acids. J Agric Food Chem. 2006;54:2932-37.
2. Bajaj R, Mann B, Sangwan RB, Rajput YS. Free radical scavenging activity of milk and whey. NDRI annual report, 2005, 35.

3. Chen J, Lindmark-Mansson H, Gorton I, Akesson B. Antioxidant capacity of bovine milk as assayed by spectrophotometric and amerometric methods. Intl. Dairy J. 2003;13:927-935.
4. Chia-chi C, Ming-hua Y. Estimation of Total Flavonoid Content in Propolis by Two Complementary Colorimetric Methods. J Food Drug Analy. 2002;103:178-182.
5. Colbert LB, Decker EA. Antioxidant activity of an ultrafiltration permeate from acid whey. J Food Sci. 1991;56:1248-1250.
6. Djuric M, Caric M, Milanovic S, Tekie M, Panic M. Development of whey based beverages. Europ Food Res Tech. 2004 ;219(4):321-328.
7. Gutteridge JMC, Paterson SK, Segal AW, Halliwell B. Inhibition of lipid peroxidation by iron-binding protein lactoferrin. Biochemical Journal. 1981;199:259-261.
8. Ha E, Zemel MB. Functional properties of whey, whey components, and essential amino acids: mechanisms underlying health benefits for active people. J Nutr Biochem, 2003, 251-258
9. Koffi E, Shewfelt R, Wicker L. Storage stability and sensory analysis of UHT processed whey beverages. J Food quality. 2005;28(4):386-401.
10. Naczk M, Shahidi F. Biosynthesis, classification, and nomenclature of phenolics. In: Food and nutraceuticals. Boca Raton p. CRC Press, 2003.
11. Salminen H, Heinonen M. Antioxidant Effects of Berry Phenolics Incorporated in Oil-in-Water Emulsions with Continuous Phase β-Lactoglobulin. J Amr Oil Chem's Society. 2010;87:419-428.