World Journal of Agricultural Sciences 10 (3): 141-145, 2014
ISSN 1817-3047

DOI: 10.5829/idosi.wjas.2014.10.3.1811

Preparation, Quality Evaluation and Shelf Life Studies of Whey-Guava Beverage

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Abstract: Experiments were conducted on the development and storage of beverage prepared from whey and guava pulp and development of process would be of great benefit to the dairy industry. The beverage was pasteurized at different temperatures and periods for estimating its shelf life. The ratio of whey and guava pulp that was used for the preparation of beverage is 67.5:20 (%). Treatments which include different temperature and time combination were 60°C, 65°C and 70°C for 15, 25 and 35 minutes. However the beverage which was pasteurized at 65°C for 25 minutes was scored much than the others treatments. Samples were evaluated initially and after that at an interval of 15, 30, 45, 60, 75 and 90 days for sensory analysis which included taste, color, flavor, appearance and overall acceptability. The samples were analyzed for their chemical and microbiological analysis at regular intervals. Storage study showed an increasing trend in TSS, acidity, reducing sugar and a decreasing trend in the pH, lactose and ascorbic acid. Total viable count was analyzed using standard methods.

Key words: Whey · Guava Pulp · Chemical Analysis · Storage · Sensory Characteristics · Microbiological Quality

INTRODUCTION

Whey or Milk serum is the liquid remaining after milk has been curdled and poured through a perforated material. It is a byproduct of cheese or casein manufacturing industry and has several commercial uses. Whey contains about 50% of the milk solids originally present in milk. It is the most potent pollutant of all the dairy wastes and possess higher amount of organic matter (6-7%) comprising of fat, protein, sugar, minerals and water soluble vitamins. Regulations have been passed for the disposal of whey and research for revealing the functional and health benefits of whey components is increasing at a fast rate. It established the role of whey and whey components for their nutritional, physiological, immunological and functional benefits [1, 2]. Whey constitutes 45-50% of total milk solids, 70-90% minerals present in milk, 20% milk proteins (65% of beta-lactoglobulin, 25% alpha-lactaalbumin, 8% of serum albumin and trace amounts of glycomacropeptide, bovine serum albumin, lactoferin, immunoglobulins and phospholipoproteins), 70% lactose and almost all the water soluble vitamins present in the milk. The water soluble vitamins include 40-70% of vitamin B12; 55 -75% of vitamin B6 and pantothenic acid; 70-80% of riboflavin and biotin; 80-90% of thiamine, nicotinic acid, folic acid and ascorbic acid [3]. Whey proteins have a biological value of 100, which is more as compared to the value for casein, beef, soy protein and also possess higher content of sulphur containing amino acids such as cysteine and methionine. Whey is a good source of electrolytes such as potassium and sodium having role in retaining water in body and hence prevention against diarrhea. Magnesium, calcium and phosphorus are present in solution and also partly bound to proteins. Zinc is present in trace amounts [3]. Lactose helps in the absorption of mg and zinc ions, present in trace amounts [4]. In India there has been a considerable increase in the production of whey due to increased consumption of indigenous dairy products [5]. In India about two million tons of nutritious whey solids are produced annually, which possess about 130,000 tones of valuable milk nutrients [6]. In addition, it is adding Biological oxygen demand (B.O.D) load to the effluent (approx 35,000 to 45,000 mg/l) in the range of 39,000 to 48,000 ppm, Which is roughly 200 times more as treat the whey before disposal, which is found to be uneconomical. Obviously development of any process for its economical utilization would be of great benefit to the

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dairy industry. Whey beverages have been recognized as a genuine thirst quencher, light, refreshing, healthful and nutritious. Whey based fruits beverages are more suitable for health as compared to other drinks. Whey and its biological components have proven its effects in treatments of cervical chronic diseases like cancer, cardiovascular, HIV etc. As it is nutritionally too rich it can also be used in beverages infant Geriatric and Athletic food. Several attempts have been made for the conversion of whey into beverages through fermentation or without fermentation for human consumption as a delicious and novel drink. [7, 8, 9].

Whey beverages are highly nutritious. Guava fruits are cholesterol, saturated and sodium free, plus low in fat and calories. It contains key nutrients like: vitamin, carotenoids (vitamin A), folate, potassium, fiber, calcium and iron. Additional of guava which adds excellent nutritive value, flavor and meditational properties and show great potential for processing into valuable products [10]. It is useful in survey, cough and digestion. Because of availability of fruit in abundance during the season of production, it causes glut in the market. In addition to this fruit are highly perishable in a nature and there is a lot of spoilage in rainy season guava due to insect and rain. So the fruit is available at a very remunerative price during the season of processing.

MATERIALS AND METHODS

Preparation of Whey: Standardized milk is used for the preparation of good quality whey. Milk was heated at 80°C for 5 minutes and milk was coagulated using 2% citric acid solution as coagulant.

Preparation of Guava Pulp: Guava fruits were dipped in water and those guavas which were half dipped in water were selected for extracting guava pulp. The selected fruits were peeled and cut into small pieces. After that we weight the fruits, water was added in the ratio of (1:1), then mixed in a mixer and finally refined through a muslin cloth to get the guava pulp. Processing depends upon the addition of up to 250 mg/l ascorbic acid to the fruit being milled or immediately after pressing.

Product Development: Whey (67.5%) was heated at 45°C to dissolve sugar (12.2%) and citric acid (0.3%). Guava pulp (20%) was thoroughly mixed with the above mixture and then finally we added sodium alginate (1%) as stabilizer. Heat the mixture at 80°C for 15 minutes. After this the whole mixture was filtered, after this the beverage was filled into glass bottles which were sterilized at 121°C for 10 minutes, then sealed. Then we did pasteurized at 63°C for 15 minutes, 25 minutes, 35 minutes for control and 60°C for 15 minutes, 25 minutes, 35 minutes: 65°C for 15 minutes, 25 minutes, 35 minutes; 70°C for 15 minutes, 25 minutes and 35 minutes, for treatments. This type of whey guava beverage contains at least 20% fruit juice/pulp and 15% total soluble solids and also about 0.3 % acid. It is highly energetic instant energy drink and is not diluted before serving.

Microbiological Analysis

Standard Plate Count: Samples of whey guava beverage are taken. Six 9 ml ringer's solution tubes were labeled as 1 to 6 and placed in a test tube stand. The petridishes were labeled for 10^{-3} to 10^{-6} dilution in duplicates. 1 ml of the sample was transferred aseptically with a sterile pipette to the tube no1. The pipette was discarded and the culture was diluted 10 times to 10^{-1} 1 ml sample from test tube no 1 was transferred to test tube no 2 with a fresh pipette. The culture was thus diluted 100 times to 10^{-2}. This procedure was repeated up to 10^{-6} dilution. From 10^{-3} dilution 1 ml of suspension was taken and transferred into the plates. This procedure was repeated for10^{-4}, 10^{-5}, 10^{-6}. The temperature of the molten agar was checked to assure the temperature was 45°C. Using sterile techniques the agar was poured into 8 different plates and the plates were rotated gently to ensure uniform distribution of the cells in the medium. Once the agar has solidified; the plates were incubated in an inverted position for 24-48 hours at 37°C.

Chemical Analysis: Total soluble solids content in fresh and stored product was determined by using hand Refractometer and the acidity was calculated in terms of lactic acid of whey and ascorbic acid in beverage can be determined by using titration method as described in Asian manual of food analysis.The pH of the product was determined by using digital pH meter. Reducing and Total sugar was determined by the Lane and Eyan method as described in [11]. The ascorbic acid was determined by titration method using 2, 6 dichlorophenol indophenols dye to estimate ascorbic acid. Protein content in fresh and stored product was determined according to [12].

Determination of Lactose in whey guava beverage was done by Lane and Eynon Volumetric method. Fat was determined by Gerber method. Protein content was determined by kjeldahl method using kjel-plus digestion and distillation system [13].

RESULTS AND DISCUSSION

The experiments were conducted to study the preparation, quality evaluation and shelf life studies of whey-guava beverage. Studies on quality were based on physicochemical characteristics (protein, lactose content, vitamin C content, fat and mineral content) and sensory characteristics, which were determined for fresh and stored samples. The sensory characteristics viz. color, taste, flavor, appearance and overall acceptability were done on 9 point hedonic scales are presented in Table 1. Storage periods significantly decreased the rating for color, appearance, flavor and overall acceptability. Storage period results in the loss of volatile aromatic substances from the beverage as reported by [14]. The characteristics of whey-guava beverage were influenced by packaging material, storage of environmental condition and chemical constituents of beverage. The storage studies were conducted at an interval of 15 days up to 90 days. The ratio of 67.5% (Whey):20% (guava juice) was found best for the formulation of whey-guava beverage. The product standardization was done by a panel of judges with the help of nine point hedonic scale. The products were pasteurized at 60°C, 65°C and 70°C for 15, 25 and 35 minutes. Similar temperature combinations were given by [15]. The protein content of control and experimental beverages of whey-guava beverage varied from 0.306 to 0.298 and 0.318 to 0.330 (Table 2) respectively and pasteurization temperatures and timings did not affect the protein percentage of whey-guava beverage to a greater extent. [16] developed a soft beverage from paneer whey and guava and the percentage of protein was 0.31%. The lactose content of control and experimental beverage varied from 5.24 to 3.42 and 5.15 to 4.88 (Table 2) respectively. Lactose is largely removed in the whey during paneer making. Lactose content was higher in cheese whey, which is a limitation of cheese whey as a base for whey beverages against lactose intolerance. During acid precipitation, more highly ionized calcium was produced which leads to higher calcium quantities in paneer whey. This was conceptualized by [17] and later confirmed by [18]. The pH of control and experimental beverage varied from 4.10 to 3.83 and 3.93 to 3.87, (Table 2) and there was not much difference among the samples and pasteurization at different temperatures and timings did not affect the pH of beverage, but during the storage period the pH of whey guava beverage was slightly decreased. But during the storage the acidity of control and experimental whey – guava beverage varied from 1.37 to 1.46 and 1.31 to 1.42 (Table 2). The acidity of whey-guava beverage was slightly increased due to increase in lactic acid and amino acids from lactose and protein present in whey as confirmed by [19] for mango RTS. [20] found and increase in acidity of guava R.T.S. and nectar during storage of four months. Similar observation were recorded by [21].

The vitamin C in mg/100g of control and experimental beverage varied from 36.86 to 20.87 and 35.82 to 18.68 (Table 3). Storage of juices resulted in significant losses of ascorbic acid. Variation can also be created by differences in processing methods. The extent of loss is primarily a function a function of storage temperature and time.

Total sugar content of various treatment of Whey-guava beverage ranged from 24.36 to 24.85, while reducing and non-reducing sugars ranged from 5.251 to 5.578 and 12.45 to 19.36 (Table 3). Pasteurization and storage for one and half months did not affect total sugars and increase in reducing sugars was significant. This is in conformity with [22], who found that Total sugar content in whey-based mango herbal beverage did not show significant variation with storage. Increase in reducing sugars may be due to inversion of non-reducing sugar to reducing sugar as reported by [23, 24]. However, non-reducing sugars decreased non-significantly during the storage period probably due to low hydrolysis of sucrose as shown by concomitant reduction in total sugars. During storage inversion of sucrose occurs with a corresponding increase in the contents of the reducing sugars, glucose and fructose [25]. Similar results have been reported by [26] for jackfruit beverages. Total bacterial count and yeast and mold count of various treatments of whey-guava beverage was between 24753 to 28350/ml and 423 to 973/ml, (Table 3) which reduced to negligible level on pasteurization and remained stable during the entire storage period.

CONCLUSION

Organoleptic evaluation showed that whey-guava beverage prepared by using whey and guava pulp in the proportion of 67.5:20 (%) was found to be more acceptable as compared to samples prepared by using different whey: guava concentrations, as it gave good color, flavor, aroma, taste, mouth feel and overall acceptability. It is therefore concluded that a good quality of guava beverage can be prepared by using Whey from

coagulated milk product mainly paneer. This beverage has high protein and vitamin C content; it will be cost effective and will reach the weaker sections of consumer who are deprived of such delicious nutritive beverage. At the same time, whey will be utilized rather than be drained of in stream causing an increase in BOD level, thereby polluting the environment. Whey-guava beverage is regarded as regimen for man in all seasons without discrimination of nature, time, place or age.

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