

Microbial and Chemical Evaluation of Whey-Based Mango Beverage

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Abstract: This study was carried out on the development and storage of Whey Based Mango beverage. The storability of the beverage was studied at $4\pm 1^\circ\text{C}$ for 30 days. The storage study showed that there is an increasing trend in the TSS, acidity, and reducing sugar and a decreasing trend in the pH and ascorbic acid but total sugar has non significant effect during storage. Total viable count, Yeast and mold count, Coliform count, and *Salmonella* count was analyzed using standard methods. The Total Viable Counts (TVC) was high ranging from $2.60\text{-}2.76\times 10^4$ cfu/mL. Yeast and mould count varied between $3.60\text{-}2.61\times 10^3$ cfu/mL where as Coliforms include both the presence of fecals $4.5\text{-}3.6\times 10^4$ cfu/mL and non fecals $2.61\text{-}3.00\times 10^2$ cfu/mL and *Salmonella* were not observed in most of the tested samples. This research is aimed at production of whey/mango beverage. At later stages of the project, whey will be introduced into other products.

Key words: Chemical analysis, Mango beverage, microbial quality, storage, Whey

INTRODUCTION

Whey is a nutritious by product from cheese. Regulations for preventing disposal of untreated whey and recognition of the value of whey components accelerated in the late 20th century. It resulted in to unraveling the secrets of whey proteins and other components and established a sound basis for their nutritional and functional value (Smithers, 2008). 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). However, Rao and Salooza (1990) reported several methods for efficient disposal of whey such as treatment of whey prior to disposal in sewage or utilization/conversion of whey for several whey based product or by products.

Considerable work has been done throughout the world to utilize whey for production of Whey Protein Concentrate (WPC), whey powder, lactose, lactic acid, whey paste etc., (Panesar *et al.*, 2007). The conversion of whey into beverages through fermentation or without fermentation is one of the most attractive a venues for the utilization of whey for human consumption. Beverages based on fruit and milk products are currently receiving considerable attention as their market potential is growing. Besides being delicious, these beverages are highly nutritious. In terms of functionality, whey protein enhances protein content of beverage while improving its quality. The production of a beverage from whey butter cheese and acerola juice has been shown to have good commercialization potential, uniting the benefits provided by the former with those latter, including the ingestion of essential amino acids and increasing vitamin C content,

resulting in a product of differentiated nutritive value (Cruz *et al.*, 2009). Mango (*Mangifera indica* L.) is one of the favored fruits in the tropical and subtropical regions. It has an excellent flavour, attractive fragrance, delicious taste and high nutritional value that have made it one of the best fruits (Pal, 1998).

The fruits are very much relished for their succulent, exotic flavour and delicious taste. Sikder *et al.* (2001) formulated different blends of whey beverages by using various levels of mango pulp (8-12%) with 0.04% acidity. 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 day's Indian dairy industries looking for a 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). The broad objective of the project was; to produce mango juice with good nutritional, sensory and storage properties and acceptable to consumers using the cheese whey, also to increase the economical and commercial value of whey which is considered as by-product.

MATERIALS AND METHODS

This study was carried out in September 2010; the analysis was done at the laboratory of the department of food biotechnology, Food Research Centre, Khartoum North, Sudan. Sterilization, serial dilution and preparation of the media were done according to (Harrigan and Mac-Cance, 1976).

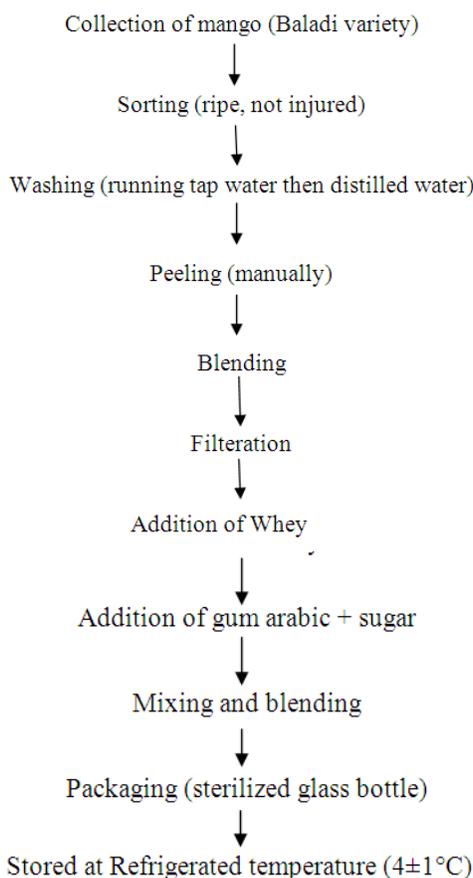


Fig. 1: Flow chart of preparation of Whey-Based Mango beverage (storage studies)

Table 1: Chemical constituents of fresh and stored Beverages

Storage (days)	TSS (%)	Acidity (%)	pH	Ascorbic acid (mg/ 100 g)	Reducing sugar (%)	Totasugar (%)
0	14.13	0.15	4.86	0.68	2.13	16.28
10	14.22	0.15	4.85	0.67	2.33	16.27
20	14.23	0.52	4.78	0.66	2.56	16.19
30	14.35	0.53	4.75	0.66	2.85	16.17

Table 2: Microbial counts during storage period

Storage (days)	Total viable	Yeast and molds	Fecal coliform	Non-fecal coliform	Salmonella
0	2.60×10^4	3.60×10^3	4.5×10^4	2.61×10^2	-ve
10	2.67×10^4	3.54×10^3	3.6×10^4	3.33×10^2	-ve
20	2.57×10^4	2.41×10^3	3.6×10^4	3.62×10^2	-ve
30	2.76×10^4	2.61×10^3	3.6×10^4	3.00×10^2	-ve

Preparation of the beverage: The whey based mango beverage was prepared by method indicated in Fig. 1. Bottles containing beverages were stored at refrigerated temperature ($4 \pm 1^\circ\text{C}$) for 30 days. Samples were drawn at intervals of 10 days and evaluated for microbial properties.

Microbiological methods:

Preparation of serial dilutions: Representative 10 mL were aseptically mixed with 90 mL distilled water and homogenized by shaking. Subsequent decimal dilutions

were prepared with the same diluents and in all cases duplicate-counting plates were prepared of appropriate dilutions (Harrigan and Mac-Cance, 1976).

Total viable count: Total viable count was carried out using the pour plate method described by Harrigan, (1998).

Total yeast and moulds: Yeasts were enumerated by surface plating on malt extract agar (Oxoid) with 0.01% chloramphenicol as bacterial inhibitor and incubated

aerobically at 25°C for 2-3 days (Harrigan and MacCance, 1976).

Coliform bacteria and *E. coli*: The coliform test was done according to Harrigan, (1998) by plating one ml sample onto MacConkey broth media. The plates were incubated at 37°C for 48 h and the counts were presented as colony forming unites per gram (cfu/g). Plates showing positive coliform were subjected to the confirmed test using Brilliant green bile lactose broth in test tubes with Durham tubes. The test tubes were then incubated at 44°C for 48 h. Each confirmed positive tube was subcultured into E.C. broth medium and then incubated at 44.5°C for 24 h. Tubes showing any amount of gas production were considered to be positive *E. coli* presence.

Detection of *Salmonella*: The stage of the pre-enrichment of *Salmonella* medium was done by mixing 25 g of sample with 225 mL of buffer peptone water in a sterile microbiological bag. The pre-enrichment culture was incubated for 24 h at 37°C. The stage of the selective enrichment of *Salmonella* was done by peptetting 1 mL of the pre enrichment culture to 10 mL of selective Selenite broth and incubating at 37°C for 24 h. The stage of plating on selective agar media was done by transferring a loopfull of the selective enrichment media to the surface on selective agar media (bismuth sulphate agar) and spreading to obtain isolated colonies.

Chemical analysis: 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. Reducing and Total Sugar were determined by the methods described by Ranganna (2004). The ascorbic acid was determined by titrating it against by Ranganna (2004).

RESULTS AND DISCUSSION

The initial Total sugar content of the Whey- Based Mango beverage was 16.28 decreased to 16.17 after 30 days of storage. This indicates that there was no appreciable change in total sugar content in the samples with the progress of storage period. The initial Ascorbic acid content of the Whey- Based Mango beverage 0.68 decreased to 0.66 after 30 days of storage. This decrease in ascorbic acid may be due to increase in acidity content in the stored product. It is due to the degradation of ascorbic acid to carboic acid under high acidic condition (Table 1).

In the present study the juice samples were summarized account of the results obtained for the

microbiological analysis of the juice are given in Table 1. Total Viable Counts (TVC) were high ranging from 2.60×10^4 cfu/mL at zero time and reached 2.76×10^4 cfu/mL at the end of storage period. Yeast count were 3.6×10^4 cfu/mL at zero time and reached 2.61×10^3 cfu/mL at the end of storage period, where coliforms include both the presence of fecal 4.5×10^4 cfu/mL and non fecal 2.61×10^2 cfu/mL and *Salmonella* were absent in most of the tested samples (Table 2). Pathogenic microorganisms can enter fruits through damaged surfaces that occur during growing or harvesting. But the main sources of contamination in fruit juices are untidy instruments and utensils, unhygienic water for dilution (Fig. 1), dressing with contaminated ice, prolonged preservation without refrigeration, unhygienic surroundings often with swarming houseflies and fruit flies and airborne dust. Such juices have shown to be potential sources of bacterial pathogens notably *E. coli* O157:H7, species of *Salmonella*, *Shigella* and *S. aureus* (Buchaman *et al.*, 1999; Sandeep *et al.*, 2004; Barro *et al.*, 2006; Lewis *et al.*, 2006). In spite of the potential benefits offered by fruit juices, concerns over their safety and quality have been raised; as freshly prepared juices have no process or steps to minimize the microorganisms if they are contaminated (Mahale *et al.*, 2008).

CONCLUSION

The results of the study showed that whey could be successfully incorporated in beverages. The Storage of whey-based mango juice significantly resulted in increasing the TSS, acidity, reducing sugar and a decreasing in the pH and ascorbic acid. However, we could produce different whey-based products with good nutritional, sensory and storage properties, the thing that could increase the economical and commercial value of whey which is considered as by-product.

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