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Determination of storage stability of *Aloe vera* based whey beverage prepared from camel and goat milk

Nitesh Chand Sharma, Basant Bais and Jayesh Vyas

Abstract
Aloe vera juice, honey, black salt and whey may be used to form a medicinal, prophylactic and nutritionally rich product, which might boost its demand in the food and beverage business. The purpose of the research was to formulating the different types of whey beverages and estimate the Storage Study of whey beverage which prepared from camel and goat milk (70%:30%). The formation of whey beverages blended in various combinations of whey, *Aloe vera* juice (5%, 10%, 15%), honey (5%) and black salt (1%). On the basis of sensory evaluation or overall acceptability the preparation of 79% whey and 15% *Aloe vera* juice (T_1A_3) was further selected as whey beverage for storage study with different parameters like pH, TA (Titratable acidity), DPPH (2, 2′-diphenyl-1-picrylhydrazyl), ABTS (2, 2′-azinobis (3-ethylbenzthiazoline-6-sulphonic acid) and TBA (2-Thio Barbituric Acid) over period of 0, 3, 6, 9 and 12th day. Between storage period drop in pH, DPPH and ABTS value whereas increase in TA and TBA were measured. Whey beverage has the most antioxidant and functional characteristics when consumed fresh, according to storage study.

Keywords: *Aloe vera* juice, pH, TA, DPPH, ABTS, TBA, whey beverages

1. Introduction
Whey is the liquid component left over after making cheese, chhana and paneer. Whey is a good source of nutrients, and its biological components have been shown to help with cancer, cardiovascular disease, HIV, and other chronic disorders (Khamrui and Rajorhia, 1998) [5]. Whey-based beverages continue to get a lot of attention, which indicating that people are becoming more aware of the market potential of these goods. These beverages are excellent in nutritional value and have high energy content. These might be especially effective in areas where there is a scarcity of food and poor nutrition. Therefore, conversion of whey into fermented or non-fermented beverages is one of the most promising avenues for utilization of whey for human consumption. The development of any process for its economical utilization would be of great advantage to the dairy industry (Sakhale *et al*., 2012) [15]. The camel (Rajasthan's state animal) is an integral part of India's delicate desert environment. Camel's milk has an opaque white colour, a subtle sweetish odour, and a strong taste, which can be salty at times (Abbas *et al*., 2013) [1]. Camel milk supplementation was found to be effective in the management of type 1 diabetes, with a significant reduction in insulin doses, a rise in BMI, and improved diabetic quality of life, but no change in lipid profile or insulin levels (Agarwal *et al*., 2003) [2]. Goat milk has higher digestibility, alkalinity, buffering capacity and some therapeutic values in medicine and human nutrition than cow or human milk (Park, 2012) [10]. Goat milk also provides a number of advantages, including the ability to treat malabsorption syndrome and malnourished kids (Sebtiarin *et al*., 2016) [17]. *Aloe vera* is recognized for its antioxidant, anti-inflammatory, antidiabetic, sunburn treatment, immunological boost, anti-aging, and anticancer qualities. (Langmead *et al*., 2004) [7]. It has the ability to prevent and treat gastric ulcers, also has anti-inflammatory properties, healing effects, mucus relaxation and gastric secretion control (Suvitayavat *et al*., 2004) [20]. Whereas, Glycoproteins and polysaccharides of *Aloe vera* make it a potent chemo-preventive agent that is useful against different cancer forms (Reynolds and Dweck, 1999) [12]. Honey has the ability to improve human health and nutrition. Whereas, it's antibacterial, anti-inflammatory and anti-oxidant properties have been attributed to these positive effects. Intriguingly, honey is increasingly being recognized as a supplemental and/or alternative therapeutic option in modern medicine (Manyi-Loh *et al*., 2011) [9]. The black salt contains vital minerals such as iron, calcium, and magnesium, all of which are helpful to human health, making it preferable to other table salts (Chander *et al*., 2020) [3].

Based on these findings, a study was done to developed the beverages using whey, *Aloe vera* juice, coconut water, honey and black salt as well as to investigate its storage stability.

2. Materials and Methods

2.1 Preparation of whey beverages

Formulation of whey was done by using different ratio of camel and goat milk. Best results were obtained on the basis of yield and consistency of whey by using combination of 70% camel milk and 30% goat milk was used for the preparation of good quality whey. The milk was heated in a stainless-steel vessel to 90 °C. The hot milk was acidified by adding citric acid (2%) followed by continuous stirring resulting in complete coagulation of milk protein (casein). The liquid (whey) was filtered using a muslin cloth and stored for further use.

Fresh and best quality *Aloe vera* leaves was procured from the local market. Freshly harvested *Aloe vera* leaves were washed thoroughly with tap warm water and kept for flash cooling to 5 °C for gel stabilization. Further leaves were cut vertically into two half and gel was separated using stainless steel knife, it was allowed to settle for 12 hrs. And then homogenized using mixer grinder. Then it was filtered through a muslin cloth for a clear *Aloe vera* juice and stored.

The different formulations (treatments) of *Aloe vera* based whey beverages (ABWB) were prepared by using constant level of honey 5% and black salt 1% in different combinations of whey and *Aloe vera* juice *viz.* T_0 (94% whey: 0% *Aloe vera* juice), T_1A_2 (89% whey: 10% *Aloe vera* juice) and T_1A_3 (79% whey: 15% *Aloe vera* juice). The treatments so prepared were thoroughly mixed. The treatments were heated to 90^0C for 5 minutes to dissolve the added ingredients followed by filling in the sterilized glass bottles then sealed.

2.2 Storage study of prepared whey beverages

The pH, titratable acidity (percent lactic acid), antioxidant activity (ABTS activity & DPPH activity), and lipid peroxidation (TBA value) of *Aloe vera* based whey beverages were measured during storage at (4 ± 1 °C) for various durations of time (0, 3, 6, 9 and 12 days). The changes in parameters and oxidative stability of *Aloe vera* and coconut water-based whey beverages over a period of 3 days in refrigerated storage (4 ± 1 °C) up to 12 days were detected.

2.3 Statistical analysis of whey beverages

All the experiments of study were repeated three times and samples were drawn in duplicate. Data collected during the present investigation were subjected to statistical analysis by adopting appropriate methods of analysis of variance as described by Snedecor and Chochran (1994) [19]. Wherever, the variance ratio was found significant at 5% and highly significant at 1% levels of probability, the significance of mean differences was tested by Duncan's New Multiple Range Test (Duncan's Range Test) as modified by (Kramer, 1957) [6].

3. Results and Discussion

3.1 Preparation of whey beverages

A lot of reviews have been collected and studied before formulating the whey beverages under the present investigation *i.e.* (Sasi, 2015) [16], (Gorachiya *et al.*, 2018) [4] and (Rohit *et al.*, 2020) [13]**.** The following treatment combinations were formulated T_0 (Control) - Whey beverage contains 94% plain whey, 5% honey and 1% black salt.

T_1A_2 - *Aloe vera* based whey beverage contains 89% whey, 10% *Aloe vera* juice, 5% honey and 1% black salt.

T_1A_3 - *Aloe vera* based whey beverage contains 79% whey,15% *Aloe vera* juice, 5% honey and 1% black salt.

3.2 Storage study of prepared whey beverages

Formation of *Aloe vera* based whey beverages in strictly hygienic condition then stored in refrigerator at (4 ± 1 °C). After formation of these whey beverages further used for storage study. Among of them only two treatments T_0 (Control) and T_1A_3 were selected for determination of storage stability. Following parameters were used for determination of storage stability which was as under-

The determination of pH of prepared whey beverages was done under refrigerated storage condition (0, 3, 6, 9 and 12 days). The data of pH has been shown in table 1.

The initial pH of control T_0 was 4.68^{e} ± 0.052 which decreases to 4.37^{a} ± 0.023 and initial pH of was T_1A_3 4.68^{e} ± 0.052 which decreases to 4.37^{a} ± 0.023 after 12 days of storage. The pH value of the whey beverages decreased highly significantly (P≤0.01) was also reported by Gorachiya *et al.* (2018) [4]. Titratable acidity values of whey beverages were significantly higher on the 3rd, 6th, 9th and 12th day of refrigerated storage. Similar results of significantly increase in titratable acidity were also observed in the study conducted by Sasi (2015) [16] and Sabokbar *et al*. (2015) [14].

Table 1: Storage study of prepared whey beverage (T_1A_3)

Parameter	Day 0		Day 3		Day 6		Day 9		Day 12	
	T_0	T_1A_3	T_0	T_1A_3	T_0	T_1A_3	T_0	T_1A_3	T_0	T_1A_3
pH	4.74±0.047	4.61^{e}±0.026	4.68±0.029	4.56^{d}±0.034	4.61±0.032	4.49^{c}±0.046	4.56±0.047	4.43^{b}±0.026	4.41±0.020	4.28^{a}±0.015
TA	1.70±0.012	1.82^{a}±0.018	1.83±0.028	1.91^{b}±0.011	1.92±0.028	2.01^{c}±0.025	2.13±0.028	2.31^{d}±0.023	2.24±0.017	2.45^{e}±0.030
ABTS	12.06eA±0.017	31.56^{e}±0.012	11.93^{dA}±0.017	28.35^{d}±0.020	9.84^{cA}±0.024	24.26^{c}±0.012	8.34^{bA}±0.024	22.46^{b}±0.088	6.83^{aA}±0.017	19.54^{a}±0.018
DPPH	4.63^{eA}±0.018	18.35^{e}±0.014	3.54^{dA}±0.017	17.26^{d}±0.018	2.34^{cA}±0.017	15.91^{c}±0.020	1.95^{bA}±0.020	14.37^{b}±0.011	0.933^{aA}±0.018	12.45^{a}±0.023
TBA	0.053^{aA}±0.014	0.071^{a}±0.020	0.082^{bA}±0.011	0.124^{b}±0.020	0.126^{cA}±0.012	0.156^{c}±0.024	0.167^{dA}±0.014	0.275^{d}±0.017	0.196^{eA}±0.018	0.346^{e}±0.011

** = Highly Significant (*P*≤0.01)

The determination of the ABTS activity (% inhibition) and DPPH activity was done to test the antioxidant properties of all the treated whey beverages developed under study (Table 1). The statistical analysis of data revealed that there was a highly significant (*P*≤0.01) decrease in the ABTS activity and DPPH activity of whey-based beverages of samples T_0 (Control) and T_1A_3. Same trend of significant decrease of the ABTS activity and DPPH activity with respect to the storage period were also reported by Gorachiya *et al.* (2018) [4], Prajapat (2019) [11] and León-López *et al*. (2020) [8].

The determination of 2-Thio Barbituric acid (TBA) value, which gave the idea about rancidity of whey-based beverages, was performed under refrigerated storage condition (0, 3, 6, 9 and 12 days). TBA values of whey beverages were found significantly (*P*≤0.01) higher from 0 to 12 days of storage (Table 1). Similar results of TBA value were also observed by

various research workers like Prajapat (2019) [11] and Singh (2020) [18].

4. Conclusion

The main contribution of this study was to know about new products with its health benefits and nutritious properties. Whey beverages prepared from camel and goat milk (70% and 30%) with addition of different levels of *Aloe vera* juice with also added constant level of honey and black salt was found to be highly acceptable. In comparison to control whey beverage, fortified whey-*Aloe vera* beverage was found to be more acceptable as it gave good flavour and taste and overall acceptability. In this connection, T_1A_3 *Aloe vera* (15%) based whey beverage obtained maximum acceptability, antioxidant property and best for production then control T_0. Since the beverages were made from discarded whey water, it contributes to a lower cost and has thus proved to be commercially viable. The findings of this study will enable household clients and related industries to sell this overall health-oriented whey beverage focused on coconut water-based beverage and *Aloe vera* based whey beverage.

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