Standardization of Recipe of Value-Added Functional Aloe Vera Drink Enriched With Moringa Leave

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Abstract:
This study aimed to investigate the standard formulation of aloe Vera drinks using different moringa leaf extract levels and assess the quality parameters. The result showed the moisture content of the formulated samples was 99.85 to 99.80%, with higher in sample T2 and lowered in the control sample (T0). The protein content for all samples ranged from o.11 to 0.42%, with the highest found in sample (T3) and lowest found in sample T0. The pH was increased from 3.8 to 4.13 for all samples. The mean values of TSS of aloe Vera drink for all samples were ranged between 11.33 to 13.67 %. The acidity for all samples was in the ranges of 0.25 to 0.31%. The sensory attributes of drinks were evaluated in terms of color, flavor, taste, and overall acceptability. After increasing, the moringa leaves percentage; the consumer acceptance was gradually decreased. Overall, sample T1 containing 1% moringa leaves blended with 4% aloe Vera showed a reliable result compared to other samples.

Keywords: Aloe Vera, Moringa leaves, Drinks, Acidity, Sensory Evaluation.

1.0. Introduction

The Moringa oleifera L. plant belonging to the family of Moringaceae is native to India and cultivated globally for its characteristic nutritional properties and variety of end-uses [1]. Every part of moringa plants like leaves, pods, and seeds are promising sources of nutrition due to various essential phytochemicals. The leaves are rich in minerals, vitamins, and other important phytochemicals. Many reported studies have shown that M. Oleifera leaves are exceptionally high in protein compared to other leaves consumed as food [2]. Moringa is said to provide seven times more vitamin C than oranges, ten times more vitamin A than carrots, seventeen times more calcium than milk, nine times more protein than yogurt, fifteen times more potassium than bananas, and twenty-five times more iron than spinach [3]. The extracts from the leaves are used to treat malnutrition, augment breast milk in lactating mothers. It is used as a potential antioxidant, anticancer, anti-inflammatory, antidiabetic and antimicrobial agent [4]. With its high nutritive values, every part of the tree is suitable for either nutritional or commercial applications like bread, biscuit, cake, cookies, yogurt, cheese and soup-making [2].

Aloe vera is a popular plant that has been traditionally used for its medicinal and therapeutic properties. The Aloe vera gel from the Aloe vera plant is the transparent, slippery mucilage produced by the thin-walled tubular cells found in the leaf parenchyma. It contains 55% Polysaccharides,17% sugar, 16% minerals, 7% protein, 4% lip, and 1% phytochemical on a dry basis [5]. Aloe Vera's health benefits are recognized globally, such as wound healing, treating burns, minimizing frostbite damage, protection against skin damage from x-rays, lung cancer, intestinal problems, increasing high-density lipoprotein (HDL), reducing low-density lipoprotein (LDL), reducing blood sugar in people with diabetes, fighting acquired immune deficiency syndrome (AIDS), allergies and improving the immune system [6]. It is currently being promoted as a valuable ingredient for the food, pharmaceutical, and cosmetic industries [7]. Aloe vera has been utilized as a form of Concentrate, gel fillet, juice and powder in various food products like Squash, jam, jellies, candies, bar, munch, chewing gum, health drink, soft drink, diet drink, yogurt, curd, 'lassi', ice-cream, and aloe vera 'laddu, etc. [8].

Nowadays, common strategies have been adopted to enhance the nutritional properties of a particular food that provide to the consumer to extend their health benefits, reducing nutrient deficiencies without compromising eating habits to the population by the incorporation of various functional ingredients during formulation [1]. In this context, aloe vera products are more popular due to their functional and medicinal properties. On the other hand, Moringa leaves (dark green leafy vegetables) belong to a food group particularly rich in nutrients and natural antioxidants [3]. In this framework, the use of Moringa oleifera L. leaf extract in aloe Vera drinks formulation could be considered a promising strategy was aiming to improve the overall nutritional quality, especially protein, of this food product.

The present study aimed to develop a standard formulation of aloe Vera drinks with moringa leaves, assess the quality parameters in terms of protein, moisture, acidity, pH, TSS, and evaluate consumer acceptance.

2.0. Materials and Methods

2.1. Sample Collection and Sample Preparation

Aloe Vera was purchased from the local market of Manikganj, Dhaka, and Moringa leaves were collected from the orchard of Manikganj, Dhaka. In a laboratory, the gel was collected from raw leaves of aloe Vera after washing and cutting leaves using a spoon, and then the gel was blended. After blending, the gel was filtered, and the freshly filtered gel was used every time. On the other hand, after collecting, raw leaves of moringa were dried in the sunshine and then made using grinder powder. After that, moringa powder was packed in a polyethylene bag and stored for further analysis.

2.2. Chemical and Reagents

CMC, ascorbic acid, citric acid, potassium sorbet, sugar, distilled water, NaOH, phenolphthalein, sulphuric acid, hydrochloric acid, copper sulfate, sodium sulfate etc.

2.3. Formulation Table of Aloe Vera Enriched Moringa Leaves

By the trial and error and reviewed from the literature following formulations were made:

Sample	Moringa leaves (%)	Aloe Vera gel (%)	CMC (%)	Ascorbic acid (%)	Citric acid (%)	Potassium sorbet (%)	Sugar (%)	Water (%)
T0	0	4	0.1	0.1	0.1	0.03	16	As needed
T1	1	4	0.1	0.1	0.1	0.03	16	As needed
T2	2	4	0.1	0.1	0.1	0.03	16	As needed
T3	3	4	0.1	0.1	0.1	0.03	16	As needed

T0-Control, T1-Sample 1, T2-Sample 2, and T3-sample 3; using the above formulation, 1400 ml drinks were made for this study.

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2.4. Preparation of Aloe Vera Drinks Enriched with Moringa Leave

First, prepared aloe Vera gel, dried moringa leaves, and other chemicals were weighed according to the formulations. Then in a boiling pan, all ingredients were mixed with water, and liquid drinks were boiled at 75-80°C for 5-6 minutes. After cooling the drinks, color was added. After filtering, filled into the bottle (Figure 1).

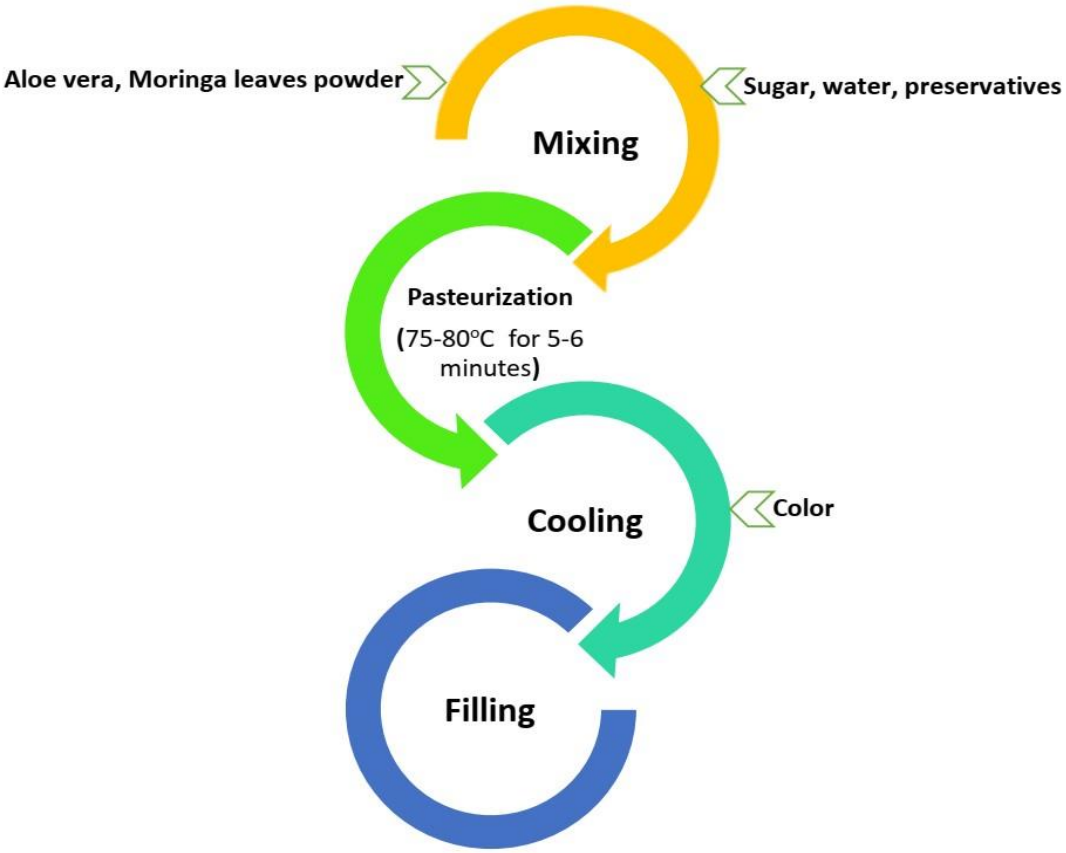


Figure 1. Flowchart for manufacturing of moringa leaves enriched aloe vera drinks

2.5. Determination of pH

The pH of the drinks samples was determined using a pH meter (Model: LMPH-10).

2.6. Determination of Titrable Acidity

The titrable acidity of the drinks sample was estimated according to the slightly modified method reported [8]. About 5 ml of sample was diluted to 95 ml of de-ionized-distilled water, and then 10 mL diluted sample was taken in a conical flask. After that, 2-3 drops of phenolphthalein indicator were added to the flask. Then the solution was titrated against 0.1N NaOH solution until the endpoint was reached. The acid content of the sample was calculated based on the volume of 0.1 N NaOH used for neutralizing the acid content in the sample and multiplying by a correction factor of 0.064 to estimate titratable acidity as a percentage of citric acid. The following equation calculated the titratable acidity:

$$\text{Acidity (\%)} = \frac{\text{ml NaOH} \times \text{0.1N NaOH} \times 0.064}{\text{Sample volume (ml)}} \times 100$$

2.7. Determination of Total Soluble Solid

Total soluble solid (°Brix) of drinks samples were determined using a handheld refractometer (Model: HT119-ATC).

2.8. Determination of Moisture Content

The moisture content of drinks was determined using the oven drying method reported with slight modification [9]. 100gm drinks samples were taken into a crucible and then put into an oven dryer at 105°C for 24hrs. After that, it cooled in a desiccator and weighed. Moisture content was calculated using the following equation:

$$\text{Moisture (\%)} = \frac{\text{Weight loss}}{\text{Weight of sample}} \times 100$$

2.9. Determination of Protein Content

The protein content of the drinks sample was measured by using the micro Kjeldahl method reported with slight modification [10]. Twenty (20) ml of each sample was digested with 30ml of concentrated sulphuric acid using 2g of copper sulfate and 16.0g of sodium sulfate salt until a clear green solution was obtained. This was dissolved in distilled water and made up to 100ml in a volumetric flask. 12.5ml of the digest was measured into a semi-micro Kjeldahl Markham distillation apparatus and treated with 12.5ml of 1.25% sodium hydroxide (NaOH) solution. This was distilled with 10ml of the boric acid double indicator. The distillate was then titrated with 0.1% HCL solution until a light pink end-point was reached. Blank titration was also carried out similarly. Distillation was carried out in triplicates, and the percentage nitrogen was obtained by appropriate calculation and protein factor 6.25.

$$\text{\% Nitrogen} = \frac{1.4 \times (\text{HCL sample} - \text{HCL blank}) \times \text{N of HCL}}{\text{Weight of sample (digest) taken}} \times 100$$

$$\text{\%Protein} = \text{\%Nitrogen} \times \text{Protein Factor}$$

2.10. Sensory Evaluation

Sensory characteristics of aloe Vera drinks samples were performed. Semi-trained fifteen-panel members were selected from the university community. Randomly, the samples were served to the panel members. Aloe Vera drinks samples were evaluated organoleptically for color, flavor, taste, and overall acceptability, according to the hedonic scale of nine points (9-like extremely to 1- dislike extremely) as reported [11].

2.11. Statistical Analysis

All data were analyzed statistically by the statistical software R (windows version 2.13.1). Results were measured in triplicate for each sample. Results were expressed as mean values with standard deviation (±SD). DMRT (Duncan Multiple Range Test) was performed to evaluate the significance of the difference between mean values at the level of 5%.

3.0. Results and Discussion

The proximate composition of moringa enriched different aloe Vera drinks are shown in table 1. The moisture content for all samples was 99.85 to 99.80%, with higher in sample T2 and lowered in the control sample (T0). Similar moisture content results reported by moringa blended aloe Vera drinks were between 99.18 to 98.89% [12]. A group researchers reported that the moisture contents of sorghum stem sheath-moringa infused drinks ranged from (98.00 to 98.20) %; this value was slightly lower than our results [13]. It has clearly shown that the protein content of the samples was increased with the increase of moringa leaves extract (Table 1). The protein content for all samples ranged from o.11 to 0.42%, with the highest found in sample (T3) and lowest found in sample T0. Our results were a little bit lower than the work of who reported the Roselle-apple drink contained protein ranging from 0.47 to 0.63% [14]. Generally, moringa leaves contain 8.1% protein this was relatively higher than our findings due to the tiny amount of moringa leaves extract used [15].

Table 1. Proximate composition of aloe Vera drinks with moringa leaves

Sample	Moisture (%)	Protein (%)
T0	99.80±0.02^{a}	0.11±0.04^{c}
T1	99.83±0.01^{a}	0.32±0.04^{b}
T2	99.85±0.04^{a}	0.38±0.04^{ab}
T3	99.83±0.03^{a}	0.42±0.04^{a}

Mean±Standard Deviation

$^{a-c}$ Means followed by different superscript letters of alphabets in each column significantly different from among the sample

Figure (2) shows the pH values for different Alo vera drinks enriched with moringa leaves. From the graph, it was observed that pH was increased from 3.8 to 4.13 for all samples. Infusion of Moringa powder is slightly acidic due to oxalic, phenolic, and chlorogenic acids presence. The highest pH was found in sample T3, and the lowest was found in sample T0 (control). Our obtained values were higher than the work of who observed a study with a different treatment on aloe vera drink got a pH value of 3.08 [16]. A group reserchers reported that artificial litchi drinks possess pH 3.60 was comparable with our findings [8]. Mishra & Sangma reported aloe vera-based RTS beverage contained 4.6 pH higher than our investigation [17]. Usually, commercial fruit drinks have 4.2 pH [18]. The variation of pH values in drinks might be due to the ingredient's variations during formulations.

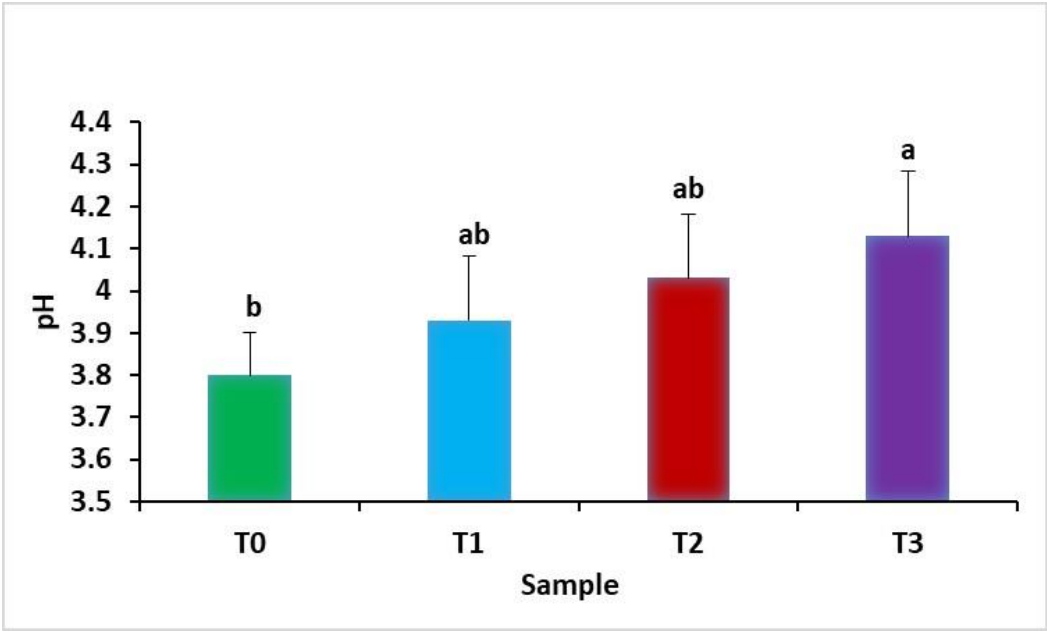


Figure 2. pH values of aloe vera drinks enriched with moringa leaves

The data about the TSS (Brix) of aloe vera drinks of different formulations are presented in Figure 3. It was observed that, increasing moringa leave results in increasing TSS of drinks except for sample T3 which is significantly different (P≤0.05) from other samples. The mean values of TSS of aloe vera drinks for all samples were ranged between 11.33 to 13.67 %. Our obtained value is closely related to the findings of reported that TSS of moringa enriched aloe vera drinks from 11 to 14% [12]. Mishra and Sangma found aloe vera-based beverages contained TSS of about 13 Brix) [18]. A similar result was found for honey nut drinks that had a TSS of about 13 Brix [8].

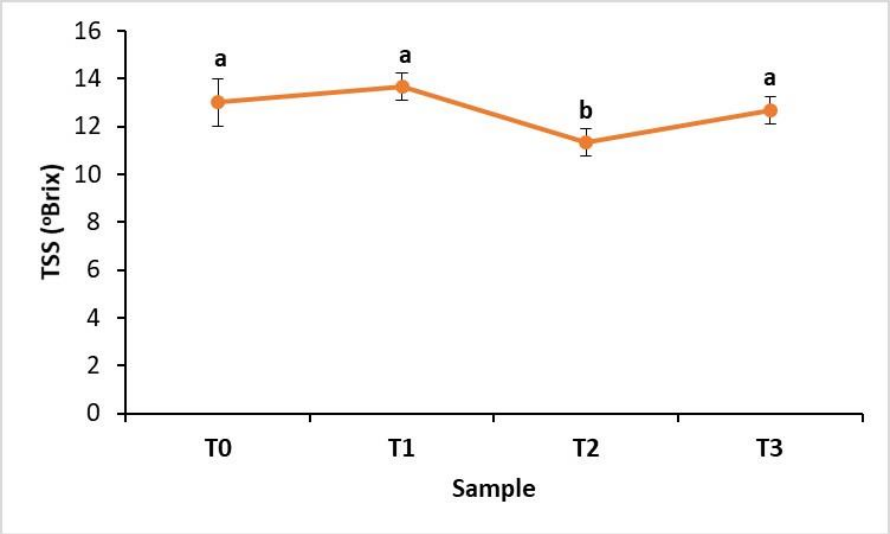


Figure 3: TSS (Brix) values of aloe vera drinks enriched with moringa leaves

The mean values of acidity (%) of moringa leave enriched aloe Vera drinks of different formulations has shown in Figure 4. It was seen that the acidity for all samples was increased by adding moringa leave extract and ranged from 0.25 to 0.31%. Sample T2 retained the highest acidity, whereas the lowest was found in sample T0 (control). A group researchers reported that the acidity of moringa enriched aloe vera drinks ranged from 0.13-0.16%, which was almost half of our obtained values [12]. According to the report found 0.15-0.18% acidity of Moringa-avocado drink was lower than our work [19]. Our obtained acidity values were lower than the findings of who found the acidity of the cucumber-melon drink was 0.44% [20]. A group researchers was recorded, the titratable acidity of Aloe vera drink was 0.33%, comparable with our investigation [16]. The results were agreed with Mishra & Sangma reported that aloe Vera based RTS formulations contained 0.24 to 0.29% acidity [18]. The acidity is directly correlated with the pH of the sample increase in acidity results in an increase in pH. A similar trend was observed from our results.

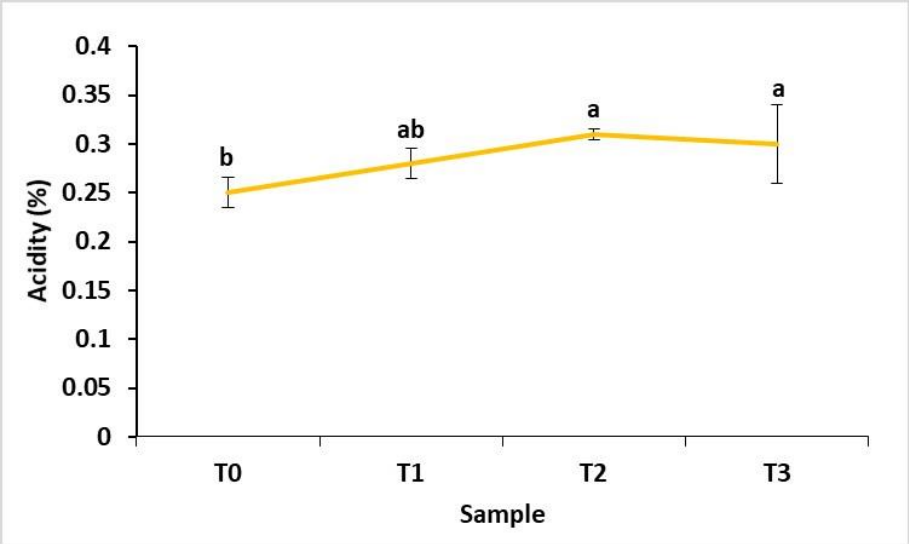


Figure 4. Acidity (%) of aloe Vera drinks enriched with moringa leaves

Table (2) shows the sensory characteristics of aloe Vera drinks enriched with moringa leaves. The sensory attributes were evaluated in terms of color, flavor, taste, and overall acceptability. The highest value was obtained for color by samples T0 and T1, and the lowest was in sample T3. Similarly, the flavor for control (T0) sample had a higher sensory value than other samples. In the same way, Taste was higher for sample T0. Furthermore, overall acceptability was higher in the control sample than in others. It was observed that after increasing moringa leaves percentage, the consumer acceptance was gradually decreased. Although the control sample had the highest sensory values, sample T1 was closely related to sample T0, and there was no significant difference ($P \leq 0.05$) found.

Table 2. Sensory evaluation of aloe Vera drinks enriched with moringa leaves

Sample	Color	Flavor	Taste	Overall acceptability
T0	7.87±0.35^{a}	7.73±0.59^{a}	7.40±0.51^{a}	7.47±0.74^{a}
T1	7.87±0.35^{a}	7.40±0.74^{a}	7.13±0.35^{ab}	7.40±0.51^{a}
T2	6.80±0.86^{b}	6.20±0.41^{b}	6.67±0.62^{b}	5.93±0.46^{b}
T3	6.20±0.41^{c}	5.93±0.88^{b}	5.60±1.06^{c}	5.67±0.62^{b}

Mean±Standard Deviation

$^{a-c}$Means followed by different superscript letters of alphabets in each column significantly different from among the sample

4.0. Conclusion

In this study, different levels of moringa leaves were used to formulate aloe Vera drinks, and then proximate composition and sensory characteristics of the prepared samples were investigated. The outcomes of this study suggested that the formulation T1 containing 1% moringa leaves blend with 4% aloe Vera had better results than other formulations. Further studies are recommended to probe this nutraceutical drink that contains bioactive compounds that may have an activity to combat various chronic diseases.

5.0. Acknowledgments

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