Original scientific paper
UDC 613.26:[528.573.41+582.683.2(549)

DEVELOPMENT AND ORGANOLEPTIC EVALUATION OF *MORINGA - ALOE VERA* BLENDED NUTRACEUTICAL DRINK

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Abstract

The core purpose of the current research was to develop nutraceutical drink having acceptable sensory attributes by blending *Aloe vera* and *Moringa* leaf extracts at different levels.

The leaves of *Moringa oleifera* and *Aloe barbadensis* used for this study were collected from mature plant present in the experimental fields of Institute of Agricultural Sciences, University of the Punjab Lahore, Pakistan. The *Moringa* powder infusion and *Aloe vera* juice was blended, filtered and mixed with sugar syrup of 70 °Brix, and after this water was added up to volume of 250 mL. Then citric acid and preservative (sodium benzoate) were added and stored at refrigerating temperature. Physicochemical properties like: pH, acidity, total soluble solids (TSS), ash%, moisture% and vitamin C of *Moringa - Aloe vera* blended beverage were determined through the methods described by AOAC, while organoleptic analysis was performed at Institute of Agricultural Sciences in Pakistan by 20 trained panelists for sensory attributes like: appearance, color, flavor, taste and overall acceptability.

Results showed that moisture and ash content were in range from 99.18 to 98.89% and 0.015 to 0.069%, respectively, while pH ranged from 4.35 - 4.46 and total acidity 0.160 - 0.128. Additionally, total soluble solids (14 - 11 °Brix) and high ascorbic acid content (135.06 - 138.84 mg/mL) was also observed. Moreover, sensory properties of treatment T_2 (50 : 70 v/v *Moringa - Aloe vera* blend) scored highest points at hedonic scale i.e. 6.5, 6.4, 6.5, 7.5, 8.5 and 8.3 for color, aroma, flavor, mouth feel, taste and overall acceptability respectively. Overall, the current investigation has provided a succinct resume of information regarding the physicochemical composition and organoleptic characteristics of Moringa-Aloe vera blended nutraceutical beverage.

Key words: *Moringa oleifera, Aloe barbadensis, organoleptic evaluation, physicochemical analysis, functional drink.*

1. Introduction

Medicinal plants are source of pharmacologically-active substances that play their role as therapeutic components and have been successfully used in different diet based therapies against different human maladies. These phytochemicals being natural and easily accessible have close resemblance with the human chemistry, therefore they have no or minimal side effects and have proved alternate for synthetic drugs (Bansode *et al*., [6]). About 60% of world population in both developed and under developed countries is using herbal medicines (Mythilypriya *et al*., 2007).

Moringa oleifera called miracle plant belongs to the family *Moringacea*. It is evergreen, deciduous, fast growing tree native to South Asia (Ganatra *et al*., [8]). All parts of Moringa such as leaves, roots, seeds, flowers, bark, stem bark, and pods have remarkable medicinal uses and higher nutritional value. The leaves of Moringa possess remarkable medicinal and nutritional attributes. Its leaves are rich in vitamins A and C. Different pharmacologically active compound were

also identified in *Moringa* leaf like niazirin and niazirinin three mustard oil glycosides, 4-[(4'-O acetylalpha-L-rhamnosyloxy)benzyl] isothiocyanate, Pyrrole alkaloid (pyrrolemarumine 400-O-a-Lrhamnopyranoside) and 40- hydroxyphenylethanamide (marumosides A and B), α and γ- tocopherol. These phytochemicals are significantly effective against infectious and degenerative diseases.

Aloe barbadensis known as *Aloe vera* belong to the *Liliaceae* family. Recent scientific studies have proved the medicinal properties of *Aloe vera* which have made it valuable ingredient for food, cosmetics as well as pharmaceutical industry (Boghani *et al*., [5]). In food industry, it has been used for the production of gel and as an ingredient for functional food development and it is preferred as a natural product with medicinal and therapeutic properties (Dutt, [7]). It has been demonstrated that *Aloe vera* (*Aloe barbadensis* Miller) leaf extracts contain high antioxidant activity, directly related to their phenolic content (Hu *et al.,* [9]). The *Aloe vera* gel can be utilized as a valuable ingredient in food because of its biological activity and functional properties (Kojo and Qian, [10]).

Nutraceutical foods and beverages have physiological as well as nutritional importance against the risk of chronic diseases. Now a day, different studies have been reported to modify the sensory properties of different leaf extracts to enhance their consumer tolerability with minimal decreases in the health benefits of the product. Processing of medicinal plant components may become a big industry due to their vast application in food and beverage industries (Ramachandra and Srinivasa, [13]). The nutritional awareness and the consumer's demand for the healthier lifestyle have created immense demand for the evolution of functional foods and beverages. Usually, the medicinal plant juices are not preferred by the consumers due to their bitter and unpleasant taste but no one deny their nutritional and medicinal benefits. Keeping in view the consumer demand, this study was designed to make a nutraceutical beverage by blending of *Moringa* and *Aloe vera* juices with enhanced consumer acceptability.

2. Materials and Methods

2.1 Materials

The leaves of *Moringa oleifera* and *Aloe barbadensis* used for this study were collected from mature plant present in the experimental fields of Institute of Agricultural Sciences, University of the Punjab Lahore, Pakistan. All of the chemicals and reagents used in present study were obtained from Sigma Aldrich, Germany.

2.2 *Moringa* leaves processing

Both young and old leaves are suitable to make a dried leaf powder. After collection, leaves were removed from branches and spread on clean trays for drying. Shade drying was performed because earlier studies showed that under sunlight only 20 - 40% of vitamin A is retained as compared to shade drying where 50 - 70% of vitamin A is retained, moreover protein denaturation was also observed at high temperatures (Martin, [11]). After drying leaves were pulverized by using grinder (Black & Decker model FX 1000) into fine powdery form by passing it through 270 mesh filter. To avoid the nutrient degradation *Moringa* powder was stored in air tight containers under dry, cold and dark condition. Then conventional extraction of *Moringa* powder was done according to the method described by Xia *et al*. [17]. Two gram *Moringa* powder was extracted with 300 mL water for 10 min. and filtered the infusion and cooled this at room temperature and refrigerated until further used.

2.3 *Aloe vera* juice processing

Aloe vera pulp was extracted and processed into juice using the method described by Ramachandra and Srinivasa [13]. Then *Aloe vera* gel was procured by peeling the aloe leaves, and juice was produced by blending *Aloe vera* pulp in a blender (Black & Decker 1000W model FX 1000). Furthermore, it was filtered through activated charcoal and pH was maintained at 3.0 by addition of ascorbic acid and citric acid.

2.4 Preparation of blended beverage

The treatment plan for *Moringa* - *Aloe vera* blended beverage is given in Table 1. The *Moringa* powder infusion and *Aloe vera* juice was blended. Further, it was filtered and mixed with sugar syrup of 70 °Brix. After this add water to make the volume up to 250 mL. Then citric acid and preservative (sodium benzoate) were added and stored at refrigerating temperature.

Table 1. Treatment plan of Moringa-Aloe vera blended nutraceutical drink (250ml)

Treatment	*Moringa* powder infusion	*Aloe vera* juice	Sugar syrup	Citric acid
T_1	50 mL	50 mL	50 mL	0.25 g
T_2	50 mL	70 mL	50 mL	0.25 g
T_3	50 mL	90 mL	50 mL	0.25 g
T_4	50 mL	110 mL	50 mL	0.25 g

2.5 Physiochemical analysis

Physicochemical properties like pH, acidity, total soluble solids (TSS), ash%, moisture% and vitamin C of *Moringa* - *Aloe vera* blended beverage were determined through the methods described by AOAC [2]. While TSS was determined by hand held refractometer model

ATC and was expressed in degree Brix. The pH was directly measured with the help of digital pH meter Model V215-02 and total acidity was measured by titration and expressed as citric acid. Furthermore, indophenol titrimetric method was used to determine the ascorbic acid content. Moreover, viscosity was measured by Brookfield DV-E Viscometer at 25^0 C.

2.6 Organoleptic analysis

The organoleptic analysis was performed at IAGS (Institute of Agricultural Sciences, University of the Punjab Lahore, Pakistan) by 20 trained panelists for sensory attributes like appearance, color, flavor, taste and overall acceptability. Blended beverage was chilled at 50^0 C for 48 hours prior to sensory evaluation. Each panelist was served with beverage sample in a random arrangement order, a bottle of water for rinsing and crackers for consumption between intervals of evaluation. Each panelist was served with 40 - 50 mL of blended beverage in transparent glasses which were coded with three digit random codes. The organoleptic analysis of blended beverages was conducted on 9 point hedonic scale in which 1 and 9 represent extremely dislike and extremely like respectively (Stone and Sidel, [14]).

3. Results and Discussion

This study was designed to probe the nutraceutical potential of *Moringa - Aloe vera* blended nutraceutical drink by evaluating its physicochemical properties and overall acceptability through sensory evaluation.

3.1 Physicochemical analysis of *Moringa - Aloe vera* drink

The results of physicochemical analysis of *Moringa - Aloe vera* blended beverage are presented in Table 2.

Table 2. Physicochemical composition of different treatments of *Moringa - Aloe vera* blended nutraceutical drink

Treatment	pH	Acidity	TSS	Moisture %	Ash %	Vitamin C mg/100 mL
T_1	4.35	0.160	14	99.18	0.015	135.06
T_2	4.39	0.145	12	99.07	0.023	136.75
T_3	4.41	0.134	12	98.95	0.057	137.29
T_4	4.46	0.128	11	98.89	0.069	138.34

3.1.1 Total acidity, pH and TSS

Titratable acidity and pH is a parameter of the sourness of the product (Otu *et al*., 2013). However, it was observed that mean value of pH was increased from 3.96 to 4.41. Infusion of *Moringa* powder is slightly acidic due to the presence of oxalic, phenolic and chlorogenic acids. This high pH has direct relation with enhanced content of *Aloe vera* juice in the blend. Present study revealed that pH of *Moringa - Aloe vera* blended nutraceutical drink gradually increased with the increase of *Aloe vera* juice concentration. The mean pH values of blended nutraceutical drink are presented in Table 2.

Acidity plays remarkable role in the flavor of a product. The mean values of total acidity decreased from 0.16% to 0.12%. It was observed in present study that with the increase in *Aloe vera* percentage, titratable acidity of the blend decreased. According to the results acidity was highest 0.160 in T_1 followed by 0.145 in T_2, 0.134 in T_3 and 0.128 in T_4.

Previous studies showed that *Aloe vera* and *Moringa* extracts, fall under the category of acidic foods (Boghani *et al.*, [5]). In present study it was observed that *Moringa* and *Aloe vera* leaf extracts generally have very low TSS, however T_4 treatment of blended beverage showed lowest TSS i.e. 11 °Brix. Current results prove that TSS of blended nutraceutical drink increased with the associated rise in the *Aloe vera* juice. The mean values of °Brix in Table 2 reveals that highest TTS (14) were present in T_1 followed by 12 in T_2, 12 in T_3 and 11 in T_4. Earlier studies conducted by Zulueta *et al.*, [18] confirmed that greater brix and density contribute in the stability of antioxidants present in the sample.

3.1.2 Moisture, ash and vitamin C

Moisture content has direct relation with the shelf stability of the foods and beverages, which mean that higher moisture content, result in lower shelf stability. It is evident from the results given in Table 2 that maximum moisture content was observed in T_1 (99.18%) and minimum in T_2 (99.07). However, 98.95% and 98.89% were observed in T_3 and T_4, respectively.

Ash content represents the mineral content in food products (Akhter *et al.*, [1]). The ash content of *Moringa - Aloe vera* blended nutraceutical drink ranged from 0.069 to 0.015%. The variation in ash content may be attributed to the *Aloe vera* concentrations. This lower ash content indicates the low mineral content in *Moringa - Aloe vera* blended nutraceutical drink (Akhter *et al.*, [1]). An overall increase in ash content was observed by increasing the amount of *Aloe vera* juice among the treatments.

Vitamin C plays a vital role of antioxidant in food products. It is also an influential antioxidant, defending the human body from oxidative stress (Bender, [4]). The data for ascorbic acid (vitamin C) for different treatments of *Moringa - Aloe vera* blended nutraceutical drink is presented in Table 2. Maximum ascorbic acid content was observed in T4 as 138.34 followed by 137.29 in T_3, 136.75 in T_2 and 135.06 T_1. According to the Zulueta *et al.*, [18], pH helps to stabilize the activity of ascorbic acid. Results show that with the increase in *Aloe vera* concentration the ascorbic acid content increased gradually.

3.2 Organoleptic analysis

Table 3 illustrates the results for sensory analysis of the *Moringa - Aloe vera* blended nutraceutical drink. The first impression of the quality and acceptability of any food is judged by its color (Neilsen, [12]). The trained panelists score in range of "good" for all treatments because there was not such naked difference between all formulations. All treatments were greenish yellow in color. The highest score for color was observed in T_2 (6.5) followed by T_1, T_3 and T_4 as 6.2, 6.2 and 6.0 respectively.

Aroma has great impact on the product acceptability. The highest score for aroma was observed in T_2 (6.4) followed by 6.3 in T_3, 6.1 in T_1 and 5.5 in T_4. The highest acceptability of T_2 among the sensory experts might be due to more suitable proportion of *Moringa* and *Aloe vera* juices, ultimately improving the quality and gives attractive colors and aromas in the finished product (Vázquez-Araújo *et al*., [16]).

Several studies have shown that taste is the major concerned in the acceptance and purchasing behavior of consumers while purchasing any food product (Urala & Lahteenmaki, [19]). Moreover, cultural values have also been connected with human taste perceptions and hedonic responses (Rozin, [15]). In present study *Moringa - Aloe vera* blended nutraceutical drink T_2 scored highest (6.5) for taste followed by 6.4 in T_4, 5.8 in T_3 and 5.0 in T_1.

According to Aronson and Ebeler [3], polyphenols are major non-volatile components that contribute to mouth feel attribute or interact with volatile compounds in the beverage. It can be observed from the Table 3 that mouth feel of beverage improved with increased concentration of *Aloe vera* juice up to 70 (Boghani, [5]) while further increase in *Aloe vera* juice content reduced mouth feel due to bitterness. The highest score for mouth feel was observed in T_2 (7.5) followed by 6.8 in T_1, 6.4 in T_3 ad 6.2 in T_4. In overall acceptance, treatment T_2 containing 70 mL *Aloe vera* juice was preferred by judges while, T_4 was least acceptable with the score of 6.2.

4. Conclusion

- This study was designed to develop the *Moringa - Aloe vera* nutraceutical drink having acceptable attributes by blending with *Moringa* leaf extracts and *Aloe vera* juice at different levels.

- The outcomes of the current studies suggest that T_2 and T_3 formulations containing 70 mL and 90 mL *Aloe vera* juice respectively proved as best product in terms of color, aroma, flavor, taste, mouth feel and overall acceptance.

- This research, ultimately resulted in the development of a functional *Moringa - Aloe vera* beverage blend with good consumer acceptability. However, further studies are suggested to probe this nutraceutical drink for different bio-active moieties that may prove effective against different chronic diseases.

5. References

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Table 3. Scores for Organoleptic attributes of *Moringa - Aloe vera* blend

Treatment	Color	Aroma	Flavor	Mouth feel	Taste	Overall acceptability
T_1	6.2	6.1	5	6.8	5.5	6.3
T_2	6.5	6.4	6.5	7.5	8.5	8.3
T_3	6.2	6.3	5.8	6.4	6.5	6.8
T_4	6.0	5.5	6.3	6.2	6.5	6.2

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