NUTRACEUTICAL CONTRIBUTION OF ALOE-VERA GEL FOR MAKING OF MILK CAKE DURING FESTIVE SEASONS IN INDIA

Monika Saini1, Shriya Garg1, Raj Kapoor2, Rishabh Chitranshi3 and Rajiv Dutta*

1Shri Ram Group of colleges, circular road, Muzaffarnagar, U.P., 251001, India
2National Commodities Management Services Limited, Udyog Vihar, Sector-19, Gurugram-122016, India
3School of Biological Engineering and Sciences, Shobhit University, Gangoth, Saharanpur UP- 247341, India

*Corresponding author E-mail: director.sbt@gmail.com
(Date of Receiving : 29-07-2023; Date of Acceptance : 30-09-2023)

ABSTRACT

This research was carried out to develop a homemade, nutrient-rich milk cake for the Indian festive season. This milk cake has been prepared with condensed milk, aloe vera gel, and honey as a sweetener. Each component utilized has undergone a thorough analysis to determine its nutritional worth. Energy (72.96 kcal), total protein (1.12 g), total carbohydrate (17.24 g), total fat (0.11 g), total sugar (0.83 g), vitamin C (4.49), calcium (27 mg), potassium (46 mg), iron (2.15 mg), and salt (2.89 mg) All of these included in an analysis of aloe gel's nutritional content. While the total flavonoid concentration (3.90/100 g) and fibre content illustrate the antioxidant potential of aloe gel. The same kind of study was done on honey, taking into various factors like moisture percentage (17.2), reducing sugar (71.80), specific gravity at 27 °C (1.37), and total sugar (76.56) per 100 g. FTIR analysis of gel was also done during this work and it was observed throughout the duration of this assessment that the final product, which was made using just natural food ingredients and no chemicals, can prove to be a highly beneficial and popular appetite suppressant among individuals of all ages. This is owing to the fact it is energized and offers a variety of health advantages.

Keywords : Milk product, Aloe milk cake, Honey milk sweets, Nutraceutical Contribution.

Introduction

Aloe vera scientifically known as Aloe barbadensis, belongs to the family Lilaceae. The term “Aloe “originated from the Arabic word "aloeh," which means "bitter". (Sheikh et al. 2021) Because of its extraordinary abilities, the aloe vera plant is preferred for herbal and Ayurvedic medicines (Sánchez-Machado et al., 2017). Due to its vast medicinal and functional benefits, its adoption in producing contemporary culinary goods has increased (Campestriani et al., 2013; Pirsa and Hafezi, 2022). Water, as well as several other minerals, enzymes, vitamins, amino acids, and other high-quality nutrients, make up most aloe vera leaves (Ebrahim et al., 2020). Aloe vera has been utilized as emollient, anti-inflammatory, laxative, anti-microbial, aphrodisiac, antifungal, and antioxidant in homeopathic, allopathic, and Ayurvedic medicine because of these qualities (Sahu et al., 2014). Additionally, it has many aesthetic benefits, and indigenous tribes also utilize it as their food (Benzidia et al. 2019). According to Nizam et al. (2021) the prolonged period of time between the extraction of Aloe vera juice and its concentration before being turned into powder alters the rheological qualities and may be caused by ongoing enzyme activity and oxidation. They discovered that HPP enhances the texture of the cubes by speeding up the moisture transfer rate in Aloe vera, a food ingredient (Bhatta et al., 2020). Because of its significant medicinal benefits, aloe vera is included in a variety of dairy products, including yoghurt and buttermilk. Aloe vera gel with yoghurt is a fantastic way to get bioactives in a tasty form. Aloe Vera enriched curd was attempted to be made by Govindammal et al. (2017) Aloe vera enriched yoghurt was shown to contain less fat and more fibre as well as phytonutrients such steroids, phlobatemin, saponins, and anthraquinones when compared to the controlled. Aloe vera's healing abilities and positive impacts are due to its high fibre content, low fat, and vitamin E, C, and content (Hęś et al., 2019). While in maize and soybeans, the tocopherols b and c predominate is found in abundant amount. Moreover, vegetable oils rich in tocopherols a and c, vitamin E (tocopherol) is extensively dispersed across the plant kingdom (Ubaldi et al. 2005) Because, it acts as an antioxidant and an inhibitor of cholesterol formation, vitamin E has a significant impact on nutrition (Tiwari and sonker, 2022). In the current study, dried and crashed gel with natural ingredients will be used to create an Aloe vera-based food product (Sweets). The new aloe-based cuisine will then be evaluated for several nutritional factors. It is possible to overlook the issues posed by antioxidant and other dietary deficiencies using this unique technique.

Material and Methods

Preparation of milk Cake with Aloe vera gel:

1. 3-4 fresh, healthy and plump aloe vera leaves were taken at a time from the outer parts of the plant. Wash gently
and let them dry properly. Separate the inner gel from the leaf and cut the aloe gel into slices or cubes. To make milk cakes, boil 1 Letter of milk till the half of its quantity at low flame till light brown color is appeared. Add 150 mL of aloe vera gel along with 100 g honey gently in the milk at luck warm temperature. Stirrer the mixture continually. Moreover, any other ingredients, such as fruits, dry fruits, etc., were also added at this time. The prepared mixture was spread on a tray and allowed to dry for a good shape.

Aloe Gel Nutritional analysis:

Preparation of Extract

The aqueous extraction is done with 05 g of aloe vera pulp and 200 mL of distilled water in a beaker. The mixture is cooked between 30 and 40 degrees Celsius on a hot plate for 20 minutes while being continually stirred. The mixture is filtered using Whitman filter paper, and the filtrate is used for further preliminary nutritional analysis.

Available Energy

The caloric value of aloe gel was determined by measuring the heat produced when a given amount is completely burnt in oxygen. ‘Bomb calorimeter’ method was used in which the oxygen is put in under considerable pressure. Since it requires a calorimeter of robust construction, it has been called a bomb calorimeter.

Total carbohydrate

Carbohydrates are dehydrated by conc. H₂SO₄ to form furfural. Active form of the reagent is anthranol, the enol tautomer of anthrone, which reacts by condensing with the carbohydrate furfural derivative to give a green color in dilute and a blue color in concentrated solutions, which is determined colorimetrically. The blue - green solution shows absorption maximum at 620 nm.

Total Sugars

A 1 mL aliquot of carbohydrate solution was rapidly mixed with 3 mL of concentrated sulfuric acid in a test tube and vortexed for 30 s. The temperature of the mixture was raised rapidly within 10–15 s after addition of sulfuric acid. The solution was cooled in ice for 2 min to bring it to room temperature. Finally, UV light absorption at 315 nm was measured using a UV spectrophotometer. Reference (reagent blank) solutions were prepared following the same procedure as above, except that the carbohydrate aliquot was replaced with distilled deionized water.

Total fat

Fat content is measured by the weight of fat loss of the sample. Soxhlet method is a semi continuous solvent extraction approach. In this procedure, the sample is soaked completely for 5–10 min in a solvent and then siphoned back into the boiling flask. The Mohonnier test is an example of the discontinuous solvent extraction method (FSSAI 2022).

Total available Dietary fiber

Total Dietary Fiber measures total dietary fiber using phosphate buffer systems. Duplicate portions of sample of dried (defatted if necessary) foods are gelatinized and partially digested with alpha-amylase and then enzymatically digested with protease and amyloglucosidase to remove the protein and starch present in the sample, simulating human digestion. One portion of the sample is analyzed for protein and the other is ashed. Total dietary fiber is calculated as the weight of the residue minus the weight of the protein and ash, reported as a percentage of the original sample weight (FSSAI, 2022)

Total protein analysis

For the determination of crude protein, 2 gm fine powder of aloe vera leaves was mixed with 10 mL of extraction buffer (100 mM monobasic potassium phosphate, 1% polyvinylpyrrolidone-40 (PVP-40) 2mM EDTA, pH 7.0) and vortex shake till the tissue was homogenized which may takes about 20-25 seconds, then centrifuged for12 min at 4°C. The supernatant was collected in Eppendorf tubes and stored at -20°C. Further, the quantification was carried out by the Bradford method (1976).

Vitamin analysis

L-ascorbic acid was determined by the 2,6 dichlorophenol–indophenol (Merck KGaA, Darmstadt, Germany) titrimetric method according to AOAC method No. 967.21 (AOAC, 2000). The vitamin C content in fresh and rehydrated A. vera gel samples was similarly evaluated. A total of 10 ± 0.1 g of triturated sample was weighed, filtered, and diluted to a volume of 50 mL. All measures were done in triplicate; the vitamin C content is expressed as mg AA/100 g d.m. (FSSAI, 2022).

Analysis of honey

Raw honey is used in whole process is for healthy sweetener. The quality parameters of honey were analyzed as per Indian standards (IS): 4941: 1994. RA: 2002.

Mineral analysis of aloe vera gel

The mineral content was measured in roots, stems, and leaves dried tissue. At the end of pot experiment the mature plants were carefully removed and surface-sterilized, to remove all kinds of impurities sticking their asparagus, and oven dried then analyzed for mineral updates. Mineral content of leaves were measured in mature leaves approximately 20–30 cm of length. The leaves were separated from the main plant. All the plants were placed in a pre-heated hot air oven to dry at 80°C in which the root, stem and leaves of the main plant were kept separately. Further, Na, Ca, Fe, and K content were determined by atomic absorption spectrophotometer. The AAS samples were prepared via acid digestion with H₂SO₄ (FSSAI, 2022).

Antioxidant capacity

For estimation of antioxidant activity, Aloe vera peel sample was dissolved in 6 ml of 0.008% methanol solution containing 1, 1diphenyl-2-picrylhydrazyl (DPPH) as radical scavenging agent After the reaction mixture, sample was analyzed through spectrophotometer at 517 nm for examination of antioxidant activity (López, 2013).

Flavonoid estimation

Aloe vera sample was crushed and dissolved in solvent (1mg/ml) and further 1 ml of 2% aluminium chloride (AlCl₃) solution (methanol) was added and mixed well. Afterwards, mixed sample was incubated at room temperature for 1 h. After incubation, sample was examined through spectrophotometer at 415 nm as per Hwang et al., 2015.

Phenolic Content
The reaction mixture was prepared by mixing 0.5 ml of plant extract solution, 2.5 ml of 10% Folin-Ciocalteu’s reagent dissolved in water and 2.5 ml of 7.5% of Na₂CO₃ aqueous solution. The samples were thereafter incubated in a thermostat at 45°C for 45 min. The absorbance was determined using spectrophotometer at wave length 765nm. (Tiwari and Shankar, 2022).

**Terpenoids**

About 10 gm of Aloe vera powdered was taken and soaked in alcohol for 24 hours. It was filtered and filtrate extracted with petroleum ether; this ether extract was treated as total terpenoids (Doughari, and Saa-Aondo, 2021)

**Fourier transform Infrared Spectrometer (FTIR)**

The gel used in this preparation further undergo with Fourier Transform Infrared Spectrometer (FTIR) technique on eE-FTIR Spectrophotometer, Bruker, USA, over a spectrum range of 500–4000 cm⁻¹ with powder dried aloe gel samples. Pellets of the driedsamples were prepared using KBr and scanned under thespectrum with a scanning frequency of 24 scans with a scanning resolution of 4 cm⁻¹ (Chitranshi and Kapoor, 2022).

**Table 1 : Nutritional Analysis**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameter</th>
<th>Test Result as per 100 gm</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Total Energy</td>
<td>72.96 Kcal</td>
<td>By Calculation</td>
</tr>
<tr>
<td>2.</td>
<td>Total Fat</td>
<td>0.11gm</td>
<td>AAS</td>
</tr>
<tr>
<td>3.</td>
<td>Protein</td>
<td>1.12gm</td>
<td>IS: 7219</td>
</tr>
<tr>
<td>4.</td>
<td>Dietary Fiber</td>
<td>14.25gm</td>
<td>AAS</td>
</tr>
<tr>
<td>5.</td>
<td>Total carbohydrate</td>
<td>17.24gm</td>
<td>By Calculation</td>
</tr>
<tr>
<td>6.</td>
<td>Sugar</td>
<td>0.83gm</td>
<td>AAS</td>
</tr>
<tr>
<td>7.</td>
<td>Vitamin C</td>
<td>7.49gm</td>
<td>AAS</td>
</tr>
<tr>
<td>8.</td>
<td>Calcium</td>
<td>27 mg</td>
<td>AAS</td>
</tr>
<tr>
<td>9.</td>
<td>Potassium</td>
<td>46 mg</td>
<td>AAS</td>
</tr>
<tr>
<td>10.</td>
<td>Vitamin A</td>
<td>0.01IU</td>
<td>AAS</td>
</tr>
<tr>
<td>11.</td>
<td>Iron</td>
<td>2.15 mg</td>
<td>AAS</td>
</tr>
<tr>
<td>12.</td>
<td>Sodium</td>
<td>2.89 mg</td>
<td>Spectrophotometer</td>
</tr>
</tbody>
</table>

**Total Phenolic Content (TPC)**

TPC of methanolic extract of whole Aloe Vera leaves was found to be 2.35gm/ 100g of dry weight which is shown in Table-2. This finding is in agreement with the study done by Kumar et al. (2017) where the values ranged from 32.9 to 65.7 mg GAE per g of dry weight. And this finding is concomitant with sample from Kerala whose TPC of methanolic extract of whole Aloe Vera plant was 32.9 ± 0.19 mg GAE/ g of dry weight. Maximum values of TPC were obtained for Punjab, Jammu and Himachal accessions. Kerala, Telangana and West Bengal showed low TPC values as compared with other accessions in the study by (Chhetri and Khatri, 2017). Different agro-climatic conditions have effects on phytochemical diversity and antioxidant potential of Aloe Vera plant (Kumar et al., 2017).

**Total Flavonoid Content (TFC)**

This study showed Total Flavonoid Content (TFC) of methanolic extract of Aloe Vera to be 3.90gm QE/ 100 gm of dry weight. The findings of this study are more than the study done by Lefahal et al. (2018) where total flavonoid content of methanolic extract of crude gel was found to be 44.09 ± 2.13 mg QE/g of crude extract. The difference is probably due to the difference in the part of the plant used and also due to difference in the chemical used to prepare standard curve (Asuk et al., 2015). The flavonoid concentration of methanolic extract of P. capillacea was 91.58 ± 3.74QE/ mg which is near to the flavonoid content of Aloe Vera (Formaggio et al., 2014). Aloe Vera is also concomitant to the study of leaves of Zapoteca portoricensis where TFC of methanolic extract was found to 63.67 ± 0.20 mg QE/g (Agbo et al., 2015).This study showed total flavonoids of ethanol extract of Aloe Vera to be 54.95±2.46 mg QE/g dry weight of extract as shown in Table-2. This result is higher than the study done by Botes et al. (2008) which showed that total flavonoids (mg of CE/100g ± SD) of 95% Aqueous Ethanol Leaf Gel Extracts (ELGE) was 20.2 ± 0.50. Other study showed flavonoid content of ethanol extract of Aloe Barbadensis flower was 13.20 ± 0.09 mg CE/g of dry mass (Debnath et al., 2018). Some flavonoids are antioxidants and have been proved to exhibit a wide range of biological activities like antimicrobial, anti-inflammatory, antiangiogenic, analgesic, anti-allergic, cytostatic and antioxidant properties.

**Total Antioxidant Capacity (TOAC)**

In the study, TOAC of 99% methanolic extract of Aloe Vera was found to be in good percentage (Table-2). This finding is concomitant to the study done in Ethiopia in green tea where TOAC was 80.0 ± 0.63% (Bizuaychu et al., 2016). The antioxidative potential of plant extracts can be measured using various in vitro assays and each assay is based on at least one feature of antioxidant activity. However, total antioxidant properties of plants cannot be evaluated by any single method because of their complex nature of phytochemicals. Therefore, two or more methods should always be employed in order to evaluate the total antioxidative effects of plant extracts (Gunathilake and Ranaweera, 2016). Antioxidants prevent free radical induced tissue damage by preventing the formation of radicals, scavenging them, or by promoting their decomposition (Lobo et al., 2010).

**Table 2 : Antioxidant Analysis**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Result as per 100 gm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total Flavonoid Content</td>
<td>3.90</td>
</tr>
<tr>
<td>2. Saponins</td>
<td>1.15</td>
</tr>
<tr>
<td>3. Terpenoids</td>
<td>2.60</td>
</tr>
<tr>
<td>4. Total Phenolic Content</td>
<td>2.35</td>
</tr>
</tbody>
</table>

**Properties of honey**

During the study of Honey using IS 4941:1994 protocols the moisture was fond about 17.2% in 100grms. Reducing Sugars are 71.80; Specific gravity 27°C is 1.37; Sucrose is 4.52, Total Sugars is 76.56, FG ratio is 0.99 and 72.06 HMF is found.
Table 3: Honey Analysis

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameter</th>
<th>% in 100 gms</th>
<th>Protocols</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Moisture</td>
<td>17.2</td>
<td>IS 4941:1994</td>
</tr>
<tr>
<td>2.</td>
<td>Reducing Sugars</td>
<td>71.80</td>
<td>IS 4941:1994</td>
</tr>
<tr>
<td>3.</td>
<td>Specific gravity</td>
<td>1.37</td>
<td>IS 4941:1994</td>
</tr>
<tr>
<td>4.</td>
<td>Sucrose</td>
<td>4.52</td>
<td>IS 4941:1994</td>
</tr>
<tr>
<td>5.</td>
<td>Total Sugars</td>
<td>76.56</td>
<td>IS 4941:1994</td>
</tr>
<tr>
<td>6.</td>
<td>FG ratio</td>
<td>0.99</td>
<td>IS 4941:1994</td>
</tr>
<tr>
<td>7.</td>
<td>HMF</td>
<td>72.06</td>
<td>IS 4941:1994</td>
</tr>
</tbody>
</table>

FTIR analysis

Phytochemical screening of saponins was done using Fourier Transform Infrared (FTIR) spectrometer (Fig 01). Absorption spectra obtained in the range of 4000-400 cm⁻¹ show the presence of a hydrogen-bonded hydroxyl group (−OH). In gel extracts, sharp peaks were seen in the range of 400 - 4000 cm⁻¹, showing C-H stretching and the carboxylic group. In continuation peaks obtained in the range of 1700 to 1800 confirm the presence of esters (C=O). While, peaks observed at 1400-1600 cm⁻¹ indicated the presence of (C=C) group in the extracted compounds. In gel extracts, peaks were observed in the range of 1000-1200 cm⁻¹ confirms the presence of carbonyl (C=O) and ether (C-O-C) groups. Thus, the FTIR analysis confirms the existence of saponins in aloe vera by confirming the presence of carboxylic hydroxyl, esters, and ether functional groups after compare with standards.

Fig. 1: FTIR analysis of Aloe vera gel

Conclusion

In concluding remark the antioxidant activity of the methanolic and ethanolic extract was observed in Aloe vera gel. Whereas, in phytochemical analysis flavonoids, steroids, terpenoids, proteins, phenols, carbohydrates, reducing sugar, starch, tannins, glycosides were also detected in Aloe vera gel except saponin. Along with this the additional use of honey was prove as chary on cake during this food product development. Remarkable result was observed in making of testy milk cake which is full of health benefits during festivals.

Conflict of interest

Author(s) of this lookup work has no conflict with any ones interest comes under this work or any other.

Author’s contribution

In this research author first and second execute all the laboratory experiments including collection of ingredients required in make of cake. Further, third author helps in quality analysis of end product. Author four helps in write-up, data analysis and compilation for this study. Finally, the corresponding author gives his remarkable suggestions in manuscript writing.

Acknowledgement

The authors of this paper are very thankful to the Honorable Chancellor Shobhit University, Gangoh, Saharanpur, Director & administration Sri Ram group of Colleges Muzaffarnagar for providing the financial support and research facilities in the departmental & individual labs to complete this work properly. Also thankful to management & lab head NCML labs, Gurugram, Haryana.

Funding Information

Regular funding was provided by Shobhit university Gangoh, Saharanpur & Sri Ram Group of Institutions Musaffarnagar UP in there departmental labs. NCML Lab also helps in providing analysis results on priority basis.

References


