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Prospects of Aloe Vera juice in Supplementing Nutrition and Antioxidantal Properties

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Abstract

The city of Lucknow and the territories around it were searched for fresh *aloe vera* leaves. In order to produce a consistent weight of leaves, the *aloe vera* leaves were first washed in distilled water, and then they were dried at a temperature of 50°C. After making *aloe vera* juice, measurements were taken to determine its total amount of protein, carbs, fat, vitamins, and minerals. Dry powder of *aloe vera* juice was prepared for the determination of Total Phenol Content (TPC), Total Flavonoid Content (TFC), saponins, and terpenoids. Following the passage of the powder through the Soxhlet apparatus in both methanol and ethanol as distinct solvents, the substance was put to further concentration with the use of a rotatory vacuum evaporator. Following this, a statistical extract using the paired t-test was carried out on the mean values of both the methanolic and ethanolic extracts at a significance threshold of 5%. "Total Phenol Content (g /100g), Total Flavonoid Content (g /100g), Saponin Content (g /100g) and Terpenoids content (g /100g) of extract of *Aloe vera* were respectively 2.39, 3.85, 1.10 and 2.62". Total Antioxidant Capacity (TOAC) was determined by using fresh *aloe vera* leaves, which were afterwards extracted in methanol that had a concentration of 99 percent on the dry mass. According to the findings of the study, *aloe vera* is an abundant source of both dietary nutrients and free radical fighting antioxidants.

Keywords: Aloe-Vera, Nutritional quality, Total Phenol Content, Total Flavonoid Content, Antioxidant Activity, Saponins, Terpenoids.

Introduction

The flowering succulent plant known as aloe vera, which also goes by the name Aloe barbadensis Mill, is a member of the family Asphodelaceae. At the moment, it has been naturalised in a significant number of tropical and tropical countries. It has been put to considerable use in traditional medicine for a long duration because of its diuretic and purgative effects, and it has been used for a long time to treat a variety of skin disorders and other ailments [1]. Today, this species is utilised all over the world as an advantageous component in a broad

variety of functional meals (such as healthy drinks and other beverages), cosmetics (including creams, lotions, soaps, and shampoos), and medications (such as tablets and capsules) [2].

The plant's leaf, which functions much like a dagger and is also the component that is utilised the most, is considered to be the most valuable part of the plant. Within these leaves, there are two major fractions that can be distinguished: the outer, photosynthetically active green cortex, also known as the rind, and the inner parenchyma, also known as the pulp or the fillet. Both of these fractions are referred to in common parlance as the rind and the pulp, respectively. The rind and the pulp, respectively, are the two names referred to each of these fractions of the fruit. In addition, the leaf is responsible for the secretion of two different exudates: "the reddish yellow latex, which is produced by the pericyclic cells located located beneath the cutinized epidermis, and the clear, slippery mucilage or gel, which is produced by the thin-walled tubular cells located within the inner parenchyma of the plant". Both of these exudates can be distinguished from one another by their colour and consistency [3,4]. Both of these exudates are secreted by the leaf. The gel has an average concentration of 98 percent water, and the non-aqueous component is mostly composed of acemannan, which is a bioactive form of acetylated glucomannan, in addition to other polysaccharides, sugars, minerals, organic acids, and vitamins [1,4-6]. Internally, it is used to treat a wide variety of illnesses, such as diabetes, constipation, coughs, and ulcers, amongst others [1,7]. It is traditionally used topically to the affected area in order to heal wounds, treat mild burns, and soothe skin irritations. In point of fact, the latex contains hydroxyanthracene derivatives, such as anthraquinone C and O-glycosides. Other examples include: Hydroxyanthracene is a naturally occurring chemical that is well-known for its propensity to cause catharsis. Additionally, hydroxyanthracene is utilised as an element in bittering agents that are added to alcoholic beverages [8,9].

Today, aloe vera is produced on a large scale in various areas around the world in order to fulfil the need of a market that is always growing and plays an important role in the global economy [1]. Processing the leaves may be done in one of two ways: either by grinding the inner fillet of the leaf after removing the rind (which is classified as biowaste) and washing away the latex, or by utilising the entire leaf. Both methods remove the rind and wash away the latex. The gel from the aloe vera plant may be obtained using either approach. In the second situation, on the other hand, it is important to carry out an extra step of filtration and purification in order to get rid of unwanted components, in particular those that originate from latex [10,11]. In addition to being marketed either fresh or as a powdered concentration, the gel has also been put into a wide variety of other formulations for use in the culinary, health, and cosmetic sectors [9,10,12]. These formulations may be found in a variety of different places.

In the course of the last few decades, the leaf of the Aloe vera plant has been the subject of a number of scientific studies [4-6,13,14] that were carried out with the intention of elucidating the chemical and biological characteristics that it has. In spite of this, there are aspects of the plant's composition and bioactivity that need more study, and the flower is still a relatively underutilised part of the plant overall. In addition, a common issue that arises in a lot of studies is the lack of information on the particular part of the plant that was examined or even the species that was the focus of the study. There are certain descriptions that are ambiguous as a consequence of the fact that a number of terms, including fillet, pulp, mucilage, gel, and parenchyma, amongst others,

have been used interchangeably. These descriptions concentrate mostly on the inner part of the leaf. Fillet and pulp refer to the fleshy inner part of the leaf that retains the cell walls, whilst gel and mucilage refer to the viscous clear liquid that is kept within the parenchyma cells [4]. In this context, "gel" and "mucilage" refer to the viscous transparent liquid, but "fillet" and "pulp" refer to the fleshy inner part of the leaf. Gel and mucilage are both phrases that refer to the viscous clear liquid, therefore technically speaking, both terms do not refer to the same part of the plant.

This in-depth research was carried out with the intention of examining and contrasting the compositional characteristics and bioactive properties of a number of Aloe vera's constituent components. In addition to the flower, these components comprise the leaf, which was previously dissected to reveal its fillet, mucilage, and rind. To be more specific, the goal was to determine the nutritional and chemical composition of the edible fillet, as well as the profiles in phenolic compounds of the four sample extracts, as well as their capacities for antioxidant defence, anti-inflammatory defence, antimicrobial defence, tyrosinase inhibition, and cytotoxicity. In addition to this, the profiles of the phenolic chemicals included within each of the four sample extracts were to be analysed. This will supply accurate and up-to-date study details about aloe vera.

Material and methods

Development of nutraceutical juice using *Aloe vera*

In order to harvest the *aloe vera* plant for juice, remove three to four leaves at a time, making sure to select thick and healthy leaves from the plant's outer sections. The leaves should first be washed and dried before being trimmed with a knife to trim the sharp edges. First, cut the aloe gel into slices or cubes, and then remove the gel from the inside of the leaf and place it on a cutting board. To extract the juice from *aloe vera*, you will need 1 cup of liquid for every 2 tablespoons of *aloe vera* gel. Mix your beverage using a food processor or a blender, and feel free to add any other components, such as pieces of fruit.

Nutritional analysis

Preparation of Aqueous Extract

In order to do the aqueous extraction, first weigh out 5 grammes of *aloe vera* pulp and then combine it in a beaker with 200 millilitres of distilled water. Twenty minutes are spent heating the mixture on a hot plate to a temperature between 30°C-40°C while stirring it continuously. After passing through Whatmann filter paper, the mixture is filtered, and the filtrate obtained is used for further preliminary nutritional analysis.

- ***Total Energy***

When a certain quantity of a food item is entirely burned in oxygen, the amount of heat that is generated may be used to calculate the caloric value of the food item. It is put out in a device known as a "bomb calorimeter," in which the oxygen is introduced under a significant amount of pressure. It has been referred to as a bomb calorimeter due to the fact that it requires a calorimeter with a robust design.

- ***Total carbohydrate***

Carbohydrates are dehydrated with conc H_2SO_4 to form furfural. Anthrone's enol tautomer, anthranol, is the substance's active form. This form of the agent interacts by condensing with the carbohydrate furfural derivative to give a green colour in diluted solutions and a blue colour in concentrated solutions, which may be identified colorimetrically. At a wavelength of 620 nm, the blue-green solution exhibits maximum absorption.

- ***Total Sugars***

In a test tube, an aliquot of carbohydrate solution measuring 1 millilitre was rapidly mixed with 3 millilitres of strong sulfuric acid and then vortexed for thirty seconds. After adding the sulfuric acid, the temperature of the mixture shot up rapidly in a matter of ten to fifteen seconds. In order to reduce the temperature of the solution down to room temperature, it was chilled in ice for two minutes. At last, a UV spectrophotometer was used to determine the amount of UV light that was absorbed at 315 nm. The reference (reagent blank) solutions were made by following the same process as described above, with the exception that the carbohydrate aliquot was substituted with distilled deionized water.

- ***Total fat***

The amount of fat in a sample may be determined by the weight of fat that is lost. The Soxhlet method is a strategy that involves semicontinuous solvent extraction. During this step of the process, the sample is submerged entirely in a solvent for five to ten minutes, and then it is syphoned back into the boiling flask. One example of the discontinuous solvent extraction method is the Mojonnier test.

- ***Total Dietary fiber***

Total dietary fibre is calculated using phosphate buffer systems for the Total Dietary Fiber measurement. Duplicate sections of a sample of dry foods are gelatinized, partly digested using alpha-amylase, and then enzymatically digested with protease and amyloglucosidase to mimic human digestion. The sample's protein and starch are eliminated during this procedure, leaving just the sugars. One half of the sample is used to determine its protein content, while the other is used to determine its ashd content. By subtracting the weight of the protein and ash from the weight of the residue, the total quantity of dietary fibre is calculated, and the result is reported as a percentage of the weight of the original sample.

- ***Total protein***

For the purpose of determining the amount of crude protein, 2 grammes of finely powdered *aloe vera* leaves were combined with 10 millilitres of extraction buffer that had a pH of 7.0 and contained 100 millimetres of monobasic potassium phosphate, 1 percent polyvinylpyrrolidone-40 (PVP-40), and 2 millimetres of ethylenediaminetetraacetic acid. The mixture was given a vortex shake until the tissue was homogenized. We collected the supernatant in Eppendorf tubes and stored it at a temperature of -20ºC. In addition, the Bradford method was used in order to complete the quantitative analysis (1976).

- ***Vitamin analysis***

The level of L-ascorbic acid in the sample was determined with the use of the tritimetric method of 2,6 dichlorophenol-indophenol (Merck KGaA, Darmstadt, Germany), which was carried out in accordance with AOAC method No. 967.21. (AOAC, 2000). The content of vitamin C that was found in A. vera gel samples that were either freshly extracted or rehydrated was evaluated using the same methodology. On a total of 10 ± 0.1 g of the material that had been triturated, the following procedures were carried out: weighing, filtering, and diluting the sample to a volume of fifty millilitres. The content of vitamin C is expressed as milligrammes of ascorbic acid per one hundred grammes of dry matter, and every single measurement was performed three times.

- ***Mineral analysis***

Roots, stems, and dried leaves were used to conduct the analysis, and the results were used to determine the mineral content. At the conclusion of the pot experiment, the mature plants were carefully removed, surface-sterilized, and oven dried before being evaluated for mineral updates. This was done to eliminate any and all pollutants that may have been adhering to their asparagus. The mineral content of the leaves was measured in mature leaves that ranged in length from around 20-30 cm. The leaves were taken off of the main plant and set aside. To dry the plants, all of them were put in an oven with hot air that had been preheated to 80°C, and the root, stem, and leaves of the main plant were retained in separate containers. In addition, an atomic absorption spectrophotometer was used to determine the levels of content, calcium, iron, and potassium. Acid digestion with H_2SO_4 was used to prepare the AAS samples before analysis.

Antioxidant capacity

The *Aloe vera* peel sample was dissolved in 6 millilitres of 0.008% methanol solution that included 1, 1diphenyl-2-picrylhydrazyl (DPPH) as the radical scavenging agent. This was done in order to determine the level of antioxidant activity (Braca et al. 2001). Following the completion of the reaction mixture, the sample was put through a spectrophotometer at 517 nm and the results of the antioxidant activity test were examined.

Flavonoid estimation

The *aloe vera* sample was broken up and dissolved in the solvent at a concentration of 1 mg/ml. After that, 1 ml of an aluminium chloride ($AlCl_3$) solution containing 2% methanol was added and well mixed. After that, the mixed sample was kept in an incubator for an hour at room temperature. In accordance with Quettier et al., the sample was put through a spectrophotometer and the reading was taken at 415 nm after it had been incubated (2000).

Phenolic Content

In order to make the reaction mixture, we combined 0.5 ml of plant extract solution, 2.5 ml of Folin-reagent Ciocalteu's dissolved in water at a concentration of 10%, and 2.5 ml of Na_2CO_3 aqueous solution at a concentration of 7.5%. After that, the samples were kept in an incubator at a thermostat of 45°C for 45 min. Utilizing a spectrophotometer with a wave length of 765 nm, the absorbance was calculated.

Saponins

This technique was repeated numerous times in order to extract saponins from an aqueous ethanol solution containing 20%. A separating funnel containing diethyl ether was used to produce two distinct layers, one of which was recovered to become the aqueous phase. The concentrate was then transferred into the diethyl ether. It is repeated numerous times, n- butanol is mixed, and then it is washed twice with 10 ml of aqueous sodium chloride solution that is 5% concentration. The remainder of the solution was warmed up in a water-based container. After the evaporation sample, the samples that were collected were dried in the oven until they reached a consistent weight, and then the saponin percentage was determined (Obadoni and Ochuko. 2001).

Terpenoids

It was taken that a powdered form of *aloe vera* weighing around 10 grams needed to be soaked in alcohol for a period of one day. It was then filtered, and the petroleum ether was used to remove the filtrate; the resulting ether extract was treated to be the total terpenoids (Ferguson, 1956).

Result and Discussion

Aloe vera was gathered from Lucknow and the surrounding regions, and it was put through a series of tests to test its nutritional profile as well as its phytochemical profile. The amount of energy, carbohydrate, fat, protein, fibre, and mineral content that was found in fresh *Aloe vera* leaves after they had been dried at 50°C was subjected. These results are in total accord with those that have been found elsewhere in the relevant literature (Dharajiya et al. 2017; Kumar et al., 2016).

Table 1.Nutritional Analysis

S. No.	Parameter	Test Result as per 100 gm	Protocol
1.	Total Energy	73.96 Kcal	By Calculation
2.	Total Fat	0.10 gm	AQAC
3.	Protein	1.10 gm	IS: 7219
4.	Dietary Fiber	14.28 gm	AQAC
5.	Total carbohydrate	17.29 gm	By Calculation
6.	Sugar	0.85 gm	AQAC
7.	Vitamin C	7.38 gm	AQAC
8.	Calcium	28 mg	AAS
9.	Potassium	47 mg	AAS
10.	Vitamin A	0.0IU	AQAC
11.	Iron	2.17 mg	AAS
12.	Sodium	2.90 mg	Spectrophotometer

Total Phenolic Content (TPC)

Table 2 displays the total polyphenol content (TPC) of a methanolic extract of whole Aloe vera leaves, which was determined to be 2.39 milligrams per one hundred grammes of dry weight. This result is in line with those of the study by Kumar et al. (2016), in which it was discovered that the values ranged from 32.9 to 65.7 mg GAE per g of dry weight. Additionally, a sample taken in Kerala and this finding are consistent, where the TPC of methanolic extract of the entire *Aloe vera* plant was measured to be 32.9 ± 0.19 mg of GAE per g of dry weight. The highest TPC values were found in the accessions from the states of Punjab, Jammu, and Himachal Pradesh. In the study carried out by Kumar et al., the states of Kerala, Telangana, and West Bengal all had significantly lower TPC values than the other accessions (2016). The phytochemical variety and antioxidant capacity of an *Aloe vera* plant are both affected by the variety of agroclimatic circumstances that it grows in (Kumar et al., 2017).

Total Flavonoid Content (TFC)

According to the findings of this study, the Total Flavonoid Content (TFC) of methanolic extract of *Aloe vera* was 3.85 grams of quinone equivalents per one hundred grams of dry weight. The results of this study are greater than those observed in the study carried out by Taukoorah and Mahomoodally (2016), who discovered that the total flavonoid content of the methanolic extract of crude gel had a value of 60.95 ± 0.97 µg RE/mg of crude extract. The difference is likely attributable to the fact that a different portion of the plant was utilized to generate the standard curve (Asuk et al., 2015), and it is also likely attributable to the fact that a different chemical was employed to prepare the standard curve. The methanolic extract of *P. capillacea* has a flavonoid concentration of 91.58 ± 3.74QE/mg, which is quite close to the flavonoid content of *aloe vera* (Formagio et al., 2014). The study on the leaves of *Zapotecaportoricensis*, in which the TFC of methanolic extract was determined to be 63.67 ± 0.20 mg QE/g, was carried out at the same time as the research on *Aloe vera* (Agbo et al., 2015). The total flavonoids in the ethanolic aloe vera extract were 54.95 ± 2.46 mg QE/g dry weight of the extract, according to the study's results. Table 2 has this information. ± This result is superior than that of the study found by Botes et al. (2008), which showed that the total flavonoids (mg of CE/100g ± SD) of 95% aqueous ethanol leaf gel extracts (ELGE) were 20.2 ± 0.50. According to a different study, the ethanol extract of the Aloe Barbadensis flower contains 13.20 ± 0.09 mg CE of flavonoids per gramme of dry mass (Debnath et al., 2017). It has been shown that certain flavonoids are antioxidants and have a broad variety of biological activities, including antibacterial, anti-inflammatory, antiangiogenic, analgesic, anti-allergic, cytostatic, and antioxidant characteristics.

Saponin content

1.10 gram of saponin were found on the *Aloe vera* (L.) peel after being extracted at a temperature of 80°C for an hour. In comparison to the saponin content of the raw material, which was 5.43%, this value was lower. In their study, Shi et al. (2009) reported that the medium and techniques of cooking had a significant degradation on the amount of saponin B that was degraded. Rickert et al. (2004) conducted study that was quite similar to this one. They found that the impacts of process temperature (25°C or 60°C) on plant extract that included saponin led to an increased amount of saponins being extracted. There were also similar findings reported by Alupului et al.

(2007). This was because the heating process had to be carried out at a specific temperature in order for a disorder of mechanical activity to take place in the cell walls of the plant. As a result, saponin caused the period to become dislodged and extricated. Extraction time was another factor that led to a reduction in the amount of saponin present in a material. According to some reports, time plays an important role in the process of extraction. If extraction is allowed to continue for a longer period of time, the amount and quality of the material extracted will deteriorate, and the analyses will show this.

Total Antioxidant Capacity (TOAC)

According to the findings of the study, Table-2 contains the TOAC of methanolic extract of *Aloe vera* that is 99% pure. This finding coincides with the results of a study that was conducted in Ethiopia on green tea, which found that TOAC was 80.0 ± 0.63% (Bizuaychu et al., 2016). There are a variety of in vitro assays that may be used to evaluate the antioxidative potential of plant extracts, and each of these tests is measured on the antioxidant activity of at least one component. On the other hand, due to the complex structure of plants' phytochemicals, it is impossible to determine the total antioxidant properties of a plant using only one method. For this reason, while attempting to assess the total antioxidative effects of plant extracts, it is recommended that at least two different methodologies be used (Gunathilake and Ranaweera, 2016). Antioxidants protect cells from harm caused by free radicals in three radical ways: by preventing the creation of radicals, by scavenging them, or by stimulating their tissue (Young and Woodside, 2001).

Table 2.Antioxidant Analysis

S. No.	Parameter	Result as per 100 gm
1.	Total Flavonoid Content	3.85
2.	Saponins	1.10
3.	Tarpenoids	2.62
4.	Total Phenolic Content	2.39

Conclusion

The study of the antioxidant activity of the methanolic and ethanolic extract derived from *Aloe vera* has been the primary focus of this work that we have been doing. In the leaves of *Aloe vera*, "flavonoids, steroids, terpenoids, proteins, phenols, carbohydrates, reducing sugar, starch, tannins, and glycosides" were found to be present, but saponin was not. The phytochemical analyses revealed this information. According to the findings, *aloe vera* has the potential to be a plant that contains phytochemicals, and the antioxidant properties of *aloe vera* may be used in the treatment of many life-threatening illnesses and the creation of various medical products. However, further research has to be done on the toxicological properties of the plant.

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