

## A Study on Nutritional and Phytochemicals of Five Edible Green Leafy Plants

P. Kousalya, V. Senthamarai Selvi and R. Deepa

Department of Biochemistry,  
Bharathidasan College of Arts and Science, Erode, Tamilnadu, India

**Abstract:** The study was to analyse the nutritional value and phytochemicals of five leafy green plants. Leafy vegetables are known to add taste and flavor, as well as substantial amount of proteins, fiber, minerals and vitamins to the diet. Phytochemical contents of the leafy vegetables serve as supplements for food and also have the potential to improve the health status of its users as a result of the presence of various compounds vital for good health. Some of the nutritional factors like carbohydrate, protein, total solids and qualitative phytochemicals of the following five leafy greens like *Alternanthera sessilis*, *Diplazium esculentum*, *Solanum nigrum*, *Bidens biternata* and *Amaranthus spinosus* were analysed. Qualitative tests were done by using five leafy greens, *B. biternata* showed the highest activity of phytochemicals. *A. sessilis* shows highest carbohydrate content (120 mg/100 mg of extract). Protein content was found high in *B.s biternata* (173 mg/500mg of extract). Total solids was found high in *S. nigrum* (66.2%)

**Key words:** Leafy Green • Nutritional Value • Phytochemicals

### INTRODUCTION

Plant based foods are becoming increasingly important to ensure a long and healthy life. Plants as they are famous for healing several diseases and are considered as a healthy source for life [1-4]. Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions and to defend against attack from predators such as insects, fungi and herbivorous mammals [5,6]. Plants have great importance due to their nutritive value and continue to be a major source of medicines as they have been found throughout human history [7,8]. Human beings require number of complex organic compounds as added caloric requirements to meet the need for their muscular activities, carbohydrates, fats and proteins, while minerals and vitamins form comparatively a smaller part, plant materials form a major portion of diet; their nutritive value is important [9, 10].

Plant kingdom is a good source of natural preparations containing effective compounds which can be used for different application, particularly as food additives and health promoting ingredients in the formation of functional food and nutraceuticals. Leafy

vegetables are known to add taste and flavor, as well as substantial amount of proteins, fiber, minerals and vitamins to the diet [11]. Vegetables are highly recommended due to their relatively high nutritional value and are also important in food security [12].

Phytochemical contents of the leafy vegetables serve as supplements for food and also have the potential to improve the health status of its users as a result of the presence of various compounds vital for good health. Their fiber content provides bulk in the diet and this helps to reduce the intake of starchy foods, enhance gastrointestinal function, prevent, constipation and may this reduce the incidence of metabolic diseases like maturity onset diabetes mellitus and hypercholesterolemia. Some of the vegetables are also potent antibiotics, anti-hypertensive and blood building agents and also improves fertility in females [13].

Plants have basic nutritional importance by their content of protein, carbohydrate, fats and oils minerals, vitamins and water responsible for growth and development in man and animals. These phytochemicals reduce LDL i.e. the cholesterol involved in depositing fat in the arteries, prevent blood clotting which can reduce the risk for a heart attack or a stroke. Sulphur compounds,

which are examples of phytochemicals, are known also to reduce the cholesterol production in the body and through that keep the blood pressure down [14]. They do this either by working alone or in the combination of vitamins and other nutrients in foods [15]. The present study was aimed to analyse the nutritional value and phytochemicals ..... on mostly used five types of leafy greens. They are *Alternanthera sessilis*, *Diplazium esculentum*, *Solanum nigrum*, *Bidens biternata* and *Amaranthus spinosus*.

## MATERIALS AND METHODS

**Collection of Leafy Greens:** The fresh leafy greens were collected in December 2012 in and around Wayanad, India. The selected five major leafy greens were *A. sessilis*, *D. esculentum*, *S. nigrum*, *B. biternata* and *A. spinosus*. The plants were identified by a taxonomist in M.S Swaminathan Research Foundation, Wayanad, India. Five leafy green were used for the quantitative determination of nutritional factors and phytochemicals.

**Sample Preparation:** The leaves which are used for the edible purpose were collected and dried in shade. After drying, the plants were ground well using a grinder and kept in air tight containers.

**Preliminary Phytochemical Screening:** The aqueous and methanolic extract of leaves were prepared from *A. sessilis*, *D. esculentum*, *S. nigrum*, *B. biternata* and *A. spinosus* were tested for the presence of various phytochemicals quantitatively.

**Qualitative Analysis of Phytochemicals:** Quantitative analysis of phytochemical was done according to Harborne and Harborne [16]. These tests were done to find the presence of the active chemical constituents such as alkaloids, flavanoids, terpenoids, tannin, anthraquinone, glycosides and phenols etc.

**Estimation of Carbohydrate by Phenol-sulphuric Acid Method:** Carbohydrate was estimated using standard protocol [17]. Weigh 100 mg of sample and boiled with 2.5 N Hydrochloric acid for three hours. Neutralize it with sodium carbonate until the effervescence ceases. Make up the volume to 100 ml with distilled water. Centrifuge and take 0.1 ml of supernatant from it. Pipette out 0.1 ml of sample to the test tube. Make up the volume to 1 ml with distilled water. Pipette out 0.2, 0.4, 0.6, 0.8 and 1 ml of working standard of concentration ranging from 0.02-0.1

mg to all the test tube and make up the volume to 1 ml with distilled water. Add 1 ml of phenol and 5 ml of concentrated sulfuric acid to all the tubes. Mixed well and kept for 30 minutes undisturbed to the development of orange yellow color. Read the optical density at 490 nm [17].

**Estimation of Protein by Lowry's Method:** Protein was estimated using standard protocol [17]. Weigh 0.5 g of sample and grind it with 5- 10 ml of phosphate buffer. Centrifuge and take 0.1 ml of supernatant from it. Pipette out 0.2, 0.4, 0.6, 0.8 and 1 ml of working standard of concentration ranging from 0.04-0.2 mg of protein into a series of test tube. Take 0.1 ml of sample solution as a test. Make up the volume to 1 ml with distilled water. Add 5 ml of alkaline copper reagent to all the test tubes. Mixed well and allowed to stand for 10 minutes. Add 0.5 ml of Folin-Ciocalteu reagent to all the test tube. Mixed well and incubate at room temperature in dark for 30 minutes. Blue color developed was read at 660 nm.

**Estimation of Total Solids:** Total solids were estimated using standard protocol [17] Total solids were determined by oven dry method. 1.5 g of well mixed sample was accurately weighed in clean, dried crucible ( $W_1$ ). The crucible was allowed in an oven at 100-105°C for 8-12 hours until a constant weight was obtained. Then the crucible was placed in the desiccator for 30 minutes to cool. After cooling, it was weighed again ( $W_2$ ). The percentage moisture was calculated. The total solids were estimated by deducing percent moisture from hundred.

$$\% \text{ Total solids} = 100 - \% \text{ moisture}$$

## RESULTS AND DISCUSSION

**Qualitative Determination of Phytochemicals:** All the plants were showed the presence of phytochemicals. The phytochemicals present in the plants can inhibit the growth of many phytopathogenic fungi. Inhibition of pathogen may be due to the presence of these phytochemicals. The results of phytochemicals are tabulated in the Table 1.

The phytochemicals analysis of 5 plants results were showed in the Table 1. The results showed that plant *B. biternata* contain all the phytochemicals. *A. sessilis* contain alkaloid, terpenoid, glycoside, phenol, anthraquinone and tannin. *D. esculentum* contain glycoside, phenol and tannin. *A. spinosus* contain alkaloid, glycoside, phenol and tannin. *S. nigrum* contain

Table 1: Qualitative determination of phytochemicals

Phytochemicals	Name of the Plants				
	<i>Alternanthera sessilis</i>	<i>Diplazium esculentum</i>	<i>Amaranthus Spinosus</i>	<i>Solanumnigrum</i>	<i>Bidens biternata</i>
Alkaloid	+	-	+	+	+
Flavanoid	-	-	-	-	+
Terpenoid	+	-	-	+	+
Glycosides	+	+	+	+	+
Phenol	+	+	+	+	+
Tannin	+	+	+	+	+
Anthraquinones	+	-	-	-	+

'+' and '-' indicate the presence and absence of phytochemicals respectively

Table 2: Estimation of carbohydrate, Protein and Total Solids

Sl.No.	Leafy greens	Carbohydrate (mg/100mg of extract)	Protein (mg/500 mg of extract)	Solid (%)
1.	<i>Alternanthera sessilis</i>	120	8.85	43.7
2.	<i>Diplazium es culentum</i>	80	120	58.33
3.	<i>Solanum nigrum</i>	40	153.3	66.2
4.	<i>Bidens biternata</i>	80	173.3	54.07
5.	<i>Amaranthus spinosus</i>	60	106.67	41.27

alkaloid, glycoside, phenol, terpenoid and tannin. *B. biternata* contain almost all the phytochemicals such as alkaloid, flavanoid, glycosides, phenol, tannin and anthraquinones and it showed the high activity of phytochemicals. Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties, they are found generally in plants [18]. Phytochemical analysis is very useful in the evaluation of some active biological components of some vegetables and plants [19]. Phytochemical contents of the leafy vegetables serve as supplements for food and also have the potential to improve the health status of its users as a result of the presence of various compounds vital for good health [13].

#### Estimation of Carbohydrates by Phenol-sulphuric Acid

**Method:** Carbohydrates are made of complex chains of sugars that the body breaks down into tiny glucose molecules that feed the cells, provide energy and promote cell stability. The amounts of carbohydrates in five leafy greens were estimated by using phenol-sulphuric acid method and are tabulated in Table 2.

The results of estimation of carbohydrates were shown in the Table 2 and the amounts were expressed in milligrams. *A. sessilis* contain the highest carbohydrate content (120mg/100mg of extract). While the *Solanum nigrum* showed the lowest content of carbohydrate. Both *D. esculentum* and *B. biternata* were contained the same amount. The amount of carbohydrate in *A. spinosus* lies between the values of *S. nigrum* and *D. esculentum*.

Carbohydrates are one of the most important components in many foods. Carbohydrates may be present as isolated molecules or they may be physically

associated or chemically bound to other molecules. Some carbohydrates are digestible by humans and therefore provide an important source of energy. Carbohydrates also contribute to the sweetness, appearance and textural characteristics of many foods [20].

**Estimation of Protein:** Proteins are polymer chains made of aminoacids linked together by peptide bonds. They are essential nutrients for the human body. They are one of the building blocks of body tissue and can also serve as a fuel source. As a fuel, proteins contain 4 Kcal per gram. In nutrition, proteins are broken down in the stomach during digestion by enzymes known as proteases into smaller peptides to provide amino acids for the body including the amino acids that cannot be synthesized by the body itself.

The amount of proteins present in the five leafy greens were showed in the Table 2.. The amounts of proteins in five major leafy greens range from 78.85-173.3 mg/ 500mg of extract and *Bidens biternata* having the highest content (173.3 mg) of protein. While the amount of protein is less in the *Alternanthera sessilis* compared with other four leafy greens. The amount of protein in the *Solanum nigrum* comes in the second position followed by *Bidens biternata*.

Proteins are important constituents of foods for a number of different reasons. They are a major source of energy, as well as containing essential amino-acids, such as lysine, tryptophan, methionine, leucine, isoleucine and valine, which are essential to human health, but which the body cannot synthesize. Proteins are also the major structural components of many natural foods, often determining their overall texture, e.g., Tenderness of meat

or fish products. Food analysts are interested in knowing the total concentration, type, molecular structure and functional properties of the proteins in foods [20].

**Estimation of Total Solids:** Total Solids are those materials which are left in a substance after evaporation and drying of water. This material can include carbonate, bicarbonate, chloride, sulfate, phosphate, nitrate, calcium, magnesium, sodium, organic ions and other ions [20].

From the Table 2 it is clear that the solid contents of the five major leafy greens ranged from 41.27 to 66.2 and they were expressed in percentage. *Solanum nigrum* showed the highest percentage of solid (66.2 %). While the *Amaranthus spinosus* showed the lowest content of solid. The solid contents of *Alternanthera sessilis*, *Bidens biternata* and *Diplazium esculentum* lie in between the solid contents of *Solanum nigrum* and *Amaranthus spinosus*.

### CONCLUSION

The present study deals with the analysis of the nutritive value of five major leafy greens present in the Wayanad district of Kerala. Qualitative and quantitative tests were carried out by using both fresh and powdered sample. Qualitative tests were done by using five leafy greens and *B. biternata* showed the highest activity of phytochemicals. Most of the leafy greens were showed the high activity of phytochemicals. Quantitative tests were done to estimate nutritional value of five major leafy greens. Quantitative results revealed that *B. biternata* contained the highest amount of nutritional factors and *A. sessilis* coming in the second position among the five leafy greens.

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