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A Comparative Nutritional and Bioactive Profiling of Sprouts and Microgreens of *Vigna Radiata*

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A B S T R A C T

This study aims in evaluating the nutritional composition of sprouts and microgreens of Vigna radiata. Sprouts and microgreens of Vigna radiata were subjected to qualitative phytochemicals analysis. Quantification of carbohydrates, protein, phenol, iron and alkaloids were performed. Antioxidant potential was assessed by DPPH assay. Antimicrobial property was analyzed by disc method using E.coli. Sprouts of Vigna radiata was reported to be high in carbohydrates, protein, vitamin C and alkaloids. Microgreens of Vigna radiata was reported to be high in iron, phenol and antioxidants. Sprouts and microgreens are dense in nutrition. The Antimicrobial activity of microgreens was higher when compared with sprouts of Vigna radiata.

Keywords: Microgreens, Sprouts, Phytochemicals, Antioxidants, Antimicrobial

INTRODUCTION

Germination is a natural process that induces biochemical and nutritional changes in plants that enhances bioavailability of nutrients. Sprouts and microgreens are plant based nutrient dense food loaded with proteins, vitamins, minerals and phytochemicals. Nutritional composition varies with growing stage [1]. Sprouts are harvested before the true leaves develop. Sprouts are produced under dark with high humidity for 3-5 days after seed hydration and cotyledon remain underdeveloped [2]. Sprouts are abundant in proteins and carbohydrates. During germination hydrolytic enzymes are active and the anti-nutritional factors including phytic acid, tannins, trypsin inhibitors are decreased. These biochemical changes increases the nutritional quality, phytochemicals, antioxidants and palatability of germinated seeds [3].

Microgreens are have a central stem with two cotyledon leaves and one or more pairs of emerging leaves. Microgreens are harvested after 7-21 days of germination. During this developmental stage plant synthesize vitamins, phytochemicals and anti-oxidants. Microgreens possess anti-hyperglycemic, anti-cancer, anti-inflammatory properties [5]. Sprouts and micro greens are called as functional and super foods due to their nutritional and antioxidant potential [6]. Sprouts and microgreens possess low calories (29-130kcal/100g) and low glycemic index [7]. *Vigna radiata*, commonly known as green gram or mung bean is loaded with nutrients. Seeds are rich in carbohydrates, proteins, phytochemicals, vitamins and minerals. Germination enhances nutritional availability. This study was undertaken to comparatively assess the nutritional, phytochemicals, antioxidants and antimicrobial activity of sprouts and microgreens of *Vigna radiata*.

Materials and Method

Sample Collection

Seeds of *Vigna radiata* were collected from local markets of Erode.

Preparation of Plant Material

Seeds of *Vigna radiata* were soaked in water for 8-12 hours and then sprouting was carried out in dark. Microgreens were grown by transferring the presoaked seeds to the soil. After sprouting of seeds water was sprinkled and kept under sunlight for 3-4 hours and grown until leaves appear (7-9 days). The leaves were harvested and used for further analysis.

Sample Preparation

Freshly collected leaves and sprouts were taken and subjected to aqueous extraction (1g sprouts/ microgreens in 25ml water). The aqueous extract of sprouts and microgreens were used for further analysis.

Estimation of Ash and Moisture Content

An empty silica crucible was cleaned well and heated over a Bunsen flame to red hot. Then Cooled in a desiccator and weighed. Heating, cooling and weighing were repeated to obtain constant weight. About 1.0 gm of sample was taken in two different crucibles. The crucibles were heated over a Bunsen burner until the sample turned into ash. Heating, cooling and weighing were repeated until constant weight were got.

Ash = (Weight of the crucible + ash)-(Weight of the empty crucible)

Moisture = (Weight of crucible + Sample before heating) – (Weight of crucible + Sample after heating)

From this, the percentage of ash and moisture value were calculated.

Qualitative Phytochemical Analysis

Qualitative phytochemical Analysis were performed according to standard protocol.

Quantitative Analysis of Carbohydrates

Into a series of test tubes, pipette out 0.2 to 1.0 ml of the working standard glucose solution corresponding to the 40 to 200µg values respectively. 0.2 ml of the extract sample was pipette out into a standard flask and made upto 100 ml and 1 ml was taken for the experiment. The volume was made upto 1.0 ml with distilled water in all the tubes. Set up a blank with 1.0 ml of distilled water. Add 5.0 ml of Ortho toluidine reagent to all the tubes and heated for 15 minutes in a boiling water bath. Cooled the tubes and read the intensity of green colour developed at 640 nm in a colorimeter.

Quantitative Analysis of Proteins

Into a series of test tubes, pipette out 0.2 to 1.0 ml of working standard solution corresponding to 40 to 200 µg values respectively. 0.1 ml of extract samples were taken for the experiment. The values in all the tubes were made up to 1.0 ml with distilled water. A blank was set by taking 1.0 ml of distilled water and added 4.5 ml of Protein reagent to all the tubes. After 10 minutes, 0.5 ml of Folin's phenol reagent was added to all the test tubes. The blue colour developed was read at 640 nm after 20 minutes.

Quantitative Analysis of Phenol

In a series of test tubes, pipette out 0.2ml to 1.0ml of the working standard solution corresponding to 5µg to 20µg values respectively. Pipette out 1.0ml of the *Vigna radiata* extracts in two other test tubes. The volume of all the tubes were made upto 1ml with distilled water was taken as blank. To all the tubes added 1ml of folin’s phenol after 3 minutes, 1ml of saturated Sodium carbonate (~35%) was added. The blue colour developed was read calorimetrically at 650nm.

Quantitative Analysis of Alkaloid

In a series of test tubes, pipette out 0.5ml to 2.5ml of the working standard solution corresponding to 5µg to 25µg values respectively. 1ml of extract was taken and pH maintained at 2.0 to 2.5 with dilute Hydrochloric acid. Added 2.0ml of Dragendroff reagent precipitated the alkaloids and centrifuged. After centrifugation, the centrifuge was discarded completely and the precipitate was washed with alcohol. The filtrate was discarded and the residue was treated with 2.0mml of sodium sulfide. Brownish black precipitate was formed. 2 drops of sodium sulfide checked completion of precipitation. The residue was dissolved with 2.0ml of concentrated nitric acid and this solution was diluted to 10ml of distilled water. 1ml of the solution was taken as the test sample. The blank was prepared by taking 5ml of distilled water and all the tubes were made into 5ml using distilled water. Then 5.0ml of thiourea was added to all the tubes and the yellow colour complex developed was read colorimetrically at 435 nm against the reagent blank.

Quantitative Analysis of Iron

Into a series of test tubes S1 to S5 pipetted out 1.0 to 5.0 ml of working standard solution corresponding to the concentration of 100 µg – 500 µg respectively. 1.0 ml of the sample solution was added to all the test tubes. A blank was prepared by taking 7.7 ml of distilled water. The volume of all the tubes were made upto 7.7 ml with distilled water. Then

3.0 ml of concentrated sulphuric acid, 0.4 ml of saturated potassium persulphate and 1.6 ml of potassium thiocyanate were added to all the tubes and the red color developed was read colorimetrically at 540 nm against the reagent blank.

Quantitative Analysis of Vitamin C

Pipetted out 0.1 to 0.5ml of Standard dehydroascorbic acid solution of concentration range 20-100 µg into a series of test tubes S1-S5. In another tube 1 ml of sample solution is added. The volume in all the tubes were made up to 5 ml with distilled water. A blank was set up by taking 5 ml of distilled water. And 1 ml of thiourea and 1 ml of DNPH reagents was added and mixed thoroughly and incubated at 37ºC for 3 hours. After incubation the tubes were cooled in an ice bath. Dissolved the orange red ozone results formed by adding 2.0 ml of 85% H2SO4 drop wise while the tubes were still in the water bath. The tubes in the ice bath were removed and allowed to stand for 30 minutes at room temperature and measured the absorbance at 540 nm.

Determination of DPPH

To the aqueous extract of *Vigna radiata* added 0.4ml of DPPH (0.1mM) solution and

0.4 ml of 50mM TrisHcl. The solutions are mixed well and incubated in dark condition at room temperature for 30 minutes, the absorbance of the mixture was read at 517 nm. 3ml of DPPH was taken as control.The percentage radical scavenging activity of the *Vigna radiata* extracts were calculated using the following formula,

DPPH (%) = Control OD- Test OD/Control OD X 100

Antimicrobial Activity

At 45ºC, 40ml of the culture media with agar is poured into the petri plate. After the agar is set, under the aseptic conditions moistened a swab with the *E.coli* and spread it uniformly over the surface of the nutrient media in the petri plate by using cotton swab or L- Rod. The Impregnated discs with the fermented rice water are placed over the nutrient media by using the sterilized forceps. Tap the disc gently with the forceps to fix it in the position. Incubate the petri dishes at 37ºC for 24hrs and kept the petri dish as upside down. After the incubation period, the zone of inhibition was determined. The result was obtained by measuring the zone of inhibition in mm/ diameter.

Statistical Analysis

All the test were done in triplicates. The results are expressed as mean ± SD.

Results and Discussion

Sprouts and microgreens of *Vigna radiata* is shown in the Figure 1.



Fig. 1- Sprouts and Microgreens of *Vigna radiata*

Analysis of Ash and Moisture Content of Sprouts and Microgreens of *Vigna radiata*

Ash was prepared by burning sample extracts in bunsen burner in a crucible. Ash content of *Vigna radiata* microgreens was found to be 40% and sprouts was found to be 33.7%. Ash content analysis indicates the mineral content. Based on the results *Vigna radiata* microgreens showed good mineral content when compared with the *Vigna radiata* sprouts. Moisture was prepared by heating extracts in a bunsen burner. Moisture content of Vigna *radiata* microgreens was found to be 45% and sprouts was found to be 37.3 %. Moisture content was found to be high in microgreens when compared with the sprouts of *Vigna radiata*.



Fig. 2 - Estimation of Ash and Moisture Content of Sprouts and Microgreens of *Vigna radiata*

Quantitative Phytochemical Analysis of Sprouts and Microgreens of *Vigna radiata*

Phytochemical analysis of sprouts and microgreens of *Vigna radaita* revealed the presence of alkaloids, flavonoids, phenols, carbohydrates, proteins, tannin and saponins in the aqueous extract of *Vigna radiata* sprouts and microgreens.

Table 1- Qualitative phytochemical analysis of aqueous extract of *Vigna radiata* sprouts and microgreens

S.No	Phytochemical Constituent	Sprouts of *V.radiata*	Microgreens of *V.radiata*	Name of the Test
1.	Alkaloids	+ - +	+ + -	Wagner's Test Draggendroff's Test Mayers Test
2.	Flavonoids	+ +	+ +	Shinoda Test Lead Acetate Test
3.	Phenols	- +	+ -	Phosphomolybdic Test Folins Phenol Test
4.	Carbohydrates	+ +	+ +	Molisch's Test Fehlings Test
5.	Protein	+ +	+ +	Millon's Test Ninhydrin Test
6.	Sterol	-	-	Salkowski Test
7.	Anthraquinone	-	-	Borntrager's Test
8.	Glycosides	-	-	Glycoside Test
9.	Tannin	+	+	Ferric chloride Test
10.	Saponin	+	+	Foam Test

Quantitative Analysis of Carbohydrates of Sprouts and Microgreens of *Vigna radiata*

Carbohydrate content was estimated in the aqueous extract of *Vigna radiata* microgreens and sprouts. The amount of Carbohydrate present in aqueous extract of microgreens and sprouts in *Vigna radiata* was found to be 5 ± 0.40 and 8 ± 0.20 mg/g respectively. The carbohydrate content was found to be high in sprouts when compared with microgreens of *Vigna radiata*.

Quantitative Analysis of Proteins of Sprouts and Microgreens of *Vigna radiata*

Protein content was estimated in the aqueous extract of *Vigna radiata* microgreens and sprouts**.** The amount of protein present in aqueous extract microgreens and sprouts in *Vigna radiata* was found to be 9.0 ± 0.35 and 14.7 ± 0.70 mg/g respectively. The protein content was found to be high in sprouts when compared with microgreens of *Vigna radiata.*

Quantitative Analysis of Phenols of Sprouts and Microgreens of *Vigna radiata*

Phenol content was estimated in the aqueous extract of *Vigna radiata* microgreens and sprouts. The amount of phenol present in aqueous extract of microgreens and sprouts of *Vigna radiata* was found to be 2.0 ± 0.35and 0.8 ± 0.25mg/g respectively. The phenol content was found to be high in microgreens when compared with sprouts of *Vigna radiata*.

Table 2 - Quantitative analysis of aqueous extract of *Vigna radiata* sprouts and microgreens

S.No.	Biochemical Constituents	Sprouts of *V.radiata*	Microgreens of *V.radiata*
1.	Carbohydrates (mg/g)	8.0 ± 0.20	5.0 ± 0.40
2.	Protein (mg/g)	14.7±0.70	9.0±0.35
3.	Phenol (mg/g)	0.8 ±0. 25	2.0 ± 0.35
4.	Alkaloids (mg/g)	2.4 ± 0.40	1.5 ± 0.30

S.No.	Biochemical Constituents	Sprouts of *V.radiata*	Microgreens of *V.radiata*
5.	Iron (mg/g)	2.5 ± 5.03	5.0 ± 5.51
6.	Vitamin C	8.5 ± 0.50	7.0 ± 0.40
7.	DPPH Scavenging Potential (%)	54.6	58.2

Quantitative Analysis of Alkaloids of Sprouts and Microgreens of *Vigna radiata*

Alkaloid content was estimated in the aqueous extract of *Vigna* microgreens and sprouts. The amount of alkaloid present in aqueous extract microgreens and sprouts of *Vigna radiata* was found to be 1.5 ± 0.30 and 2.4 ± 0.40 mg/g respectively. The alkaloid content was found to be high in sprouts when compared with microgreens of *Vigna radiata*.

Quantitative Analysis of Iron of Sprouts and Microgreens of *Vigna radiata*

Iron content was estimated in the aqueous extract of *Vigna radiata* microgreens and sprouts. The amount of iron present in aqueous extract microgreens and sprouts of *Vigna radiata* was found to be 5.0 ± 5.51 and 2.5 ± 5.03 mg/g respectively. The Iron content was found to be high in microgreens when compared with sprouts of *Vigna radiata*.

Quantitative Analysis of Vitamin C of Sprouts and Microgreens of *Vigna radiata*

Vitamin C content was estimated in the aqueous extract of *Vigna radiata* microgreens and sprouts. The amount of Vitamin C present in aqueous extract microgreens and sprouts of *Vigna radiata* was found to be 7.0 ± 0.40 and 8.5 ± 0.50 mg/g respectively. The Vitamin C content was found to be high in sprouts when compared with microgreens of *Vigna radiata.*

DPPH Assay of Sprouts and Microgreens of *Vigna radiata*

The free radical scavenging activity was determined by DPPH method. The DPPH % of aqueous extracts of microgreens and sprouts of *Vigna radiata* was found to be 58.2 and 54.6% respectively. Microgreens possess higher free radical scavenging potential when compared with sprouts. The Antioxidant property of *Vigna radiata* can scavenging free radicals and reduces the risk of cellular damage.

Antimicrobial Activity of Sprouts and Microgreens of *Vigna radiata*

Antimicrobial activity of aqueous extract of *Vigna radiata* microgreens and sprouts was assessed using *E.coli.* The zone of inhibition for *E.coli* was found to be 11mm using aqueous extract of *Vigna radiata* sprouts and microgreens.

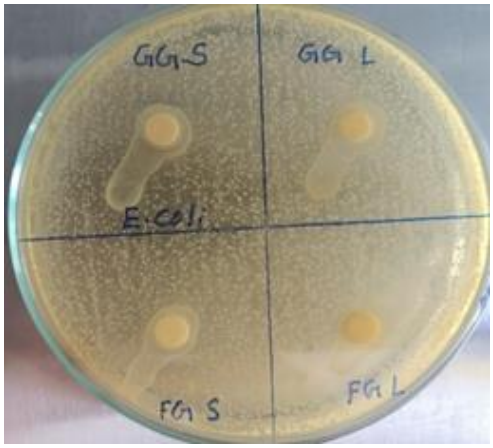


Fig. 3 - Antimicrobial Activity of *Vigna radiata* Microgreens and Sprouts

Conclusion

The current study showed that *Vigna radiata* sprouts and microgreens differed significantly in terms of phytochemistry and nutrition. Alkaloids, flavonoids, phenols, tannins, saponins, proteins, carbohydrates, and other bioactive components were all present in both. While microgreens had higher levels of iron and phenolic compounds, as well as greater DPPH free-radical scavenging and antimicrobial activities against *E.coli.* Sprouts had relatively higher levels of proteins, carbohydrates, vitamin C, and alkaloids. These results imply that *Vigna radiata* nutritional and bioactive content is greatly influenced by its developmental stage, with microgreens potentially offering higher antioxidant, mineral, and antibacterial potential while sprouts are a rich source of macronutrients and vitamin C. These findings reveal the nutritional and bioactive poteintial of *Vigna radiata* sprouts and microgreens, supporting their values as a balanced functional food.

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