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Biochemical and nutritive analysis of underutilized green leafy vegetable - Beta Vulgaris, L.

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Abstract
The beetroot is a traditional and popular vegetable in many parts of the world. It is, especially rich in fiber as well as in sugar, but has a moderate caloric value. Beet leaves are rich source of potent nutrient, potassium and vitamin A, K and C, which are important for cardiovascular health. Beetroot leaves are used to reduce blood pressure, as a tool to fight against cancer. The main objective of this study is to analyze the biochemical, vitamins and mineral composition and compare with the RDA value and beetroot. The present study revealed that *Beta vulgaris,* L. leaves can be suggested to children, adults, pregnant womens and diabetes patients.

Keywords: Green leafy vegetable, *Beta vulgaris,* L. biochemical and nutritive values

1. Introduction
Nutrition is a science of food and its relationship to health. Nutrition refers to nourishment that sustains life. The nutrient requirements and the diet providing requirements are also known as nutrition. Proper nutrition is required for prevention of illness as well as for treatment of the illness. The body needs the protein, carbohydrate, fat, vitamins and minerals only through the intake of plants. In common, food is the most efficient way of obtaining the energy and nutrients. The food we eat consists mainly of cereals, fruits and vegetables. Green leaves are ideal for weight management as they are typically low in calories. The high level of Vitamin K is important for the production of a protein essential for bone health. Green leafy vegetables are a major source of iron and calcium for any diet. The leafy vegetables have been used in prevention of chronic diseases, such as cancer, cardiovascular disease and diabetes. The present study aims to explore the underutilized green leafy vegetable of *Beta vulgaris,* L.

1.1 Review of Literature
Bhupinder Singh and Bahadur Singh Hathan (2014) [2] reported chemical composition, functional properties and processing of beetroot Dried beetroots can be consumed directly in the form of chips as a substitute of traditional snacks. Joao Silva Dias (2012) studied nutritional quality and health benefits of vegetables. The article makes a review and discusses the nutritional quality and health benefits of the major groups of vegetables. More interdisciplinary work is required that involves nutritional and food scientists as well as biomedical fields. Parpinello *et al.,* (2004) [11] reviewed characterization of sugar beet. Proteins are natural components of sugar beet root leaf. It approaches to estimate the effectiveness of protein extraction was proposed. Kumkum agarwal and Ranjana varma (2014) [7] reviewed the biochemical screening of beetroot leaf. Nidhal Maraie *et al.,* (2014) [10] observed the antimicrobial and antioxidant activities of the plant extracts which can be applied clinically for treatment of many topical diseases. Kenneth Richardson (2014) [6] studied preliminary evaluation of the leaf and nutrient composition of beetroot indicates the excellent sources of nutrition and can be recommended as a part of our balanced diet.

2. Materials and Method
2.1 Collection of plants
The young leaves of *Beta vulgaris*, L. were collected from Nilgiri District, Kotagiri (Plate: 1) during the month of December (2016).

2.2 Preparation of the sample
The collected leaves were washed in running tap water and distilled water. The leaves were spread on newspaper to remove the excess water. Then the leaves were shade dried, powdered and stored in air tight container for further analysis.

Plate: 1

The Carbohydrate, Starch, Protein, Amino acid, Vitamins and Minerals were analyzed in the laboratory by following standard methods.

2.3 Plant description

2.3.1 Systematic Position

Kingdom: Plantae
Order: Caryophyllales
Family: Chenopodiaceae
Genus: Beta
Binomial name: *Beta vulgaris*, L

Plate 2

Beet root (*Beta vulgaris*, L.) (Plate: 2) is native to Mediterranean region and widely cultivated in America, Europe, North Africa, Brazil and throughout the India. It is an erect annual herb with tuberous root stocks. Beetroot leaves are used to reduce blood pressure, as a tool to fight against cancer, to regulate digestion and to fight against skin discomfort and dandruff. Beet leaves are rich source of potent nutrient, Potassium and Vitamin A, K and C, which are important for cardiovascular health.

2.4 Methodology

The biochemical analysis was analyzed by following standard methods. Carbohydrate – Anthrone method, Starch - Anthrone method, Proteins - Lowry's method, Amino acid - Ninhydrin method, Vitamins - AACC method (1976), Minerals – AOAC method (1975).

3. Results

The result of biochemical analysis (Table: 1, Chart: 1) showed the presence of Carbohydrate (5mg/100g), Starch (4.4mg/100g), Protein (14.8mg/100g) and Amino acid (34.4mg/100g) in very less amount. The young leaves (Plate: Table: 1, Chart: 2) showed the presence of high concentration of Vitamin A (3.93mg/100g), Vitamin K (280mg/100g) and minerals (Table: 1, Chart: 3) such as Calcium (2220mg/100g), Iron (16.90mg/100g), Magnesium (350.50mg/100g), Potassium (1400mg/100g) and Phosphorus (330mg/100g). When compared with RDA values (Table:2, Chart:4), the young leaves showed high amount of Vitamin A (3.93mg/100g), Vitamin K (280mg/100g), Calcium (2220mg/100g), iron (16.90mg/100g) and Magnesium (350.50mg/100g). Nutritive value of leaves and roots were compared (Table: 3, Chart: 5, 6) the results revealed the presence of Vitamin A, Calcium, Iron, Magnesium, Phosphorus and Potassium in higher amount in young leaves than the beetroots. Hence the young leaves can be taken as a part of our diet.

Table 1: Concentration of Macronutrients, Vitamins and Minerals present in *Beta vulgaris*, L. leaves

Sl. No	Nutrients	Concentration (Mg/100g)
1.	Carbohydrate	5
2.	Starch	4.5
3.	Protein	14.8
4.	Amino acid	34.4
5.	Vitamin - A	3.93
6.	Vitamin - K	280.0
7.	Calcium	2220.0
8.	Iron	16.90
9.	Magnesium	350.50
10.	Potassium	1400
11.	Phosphorus	330.0

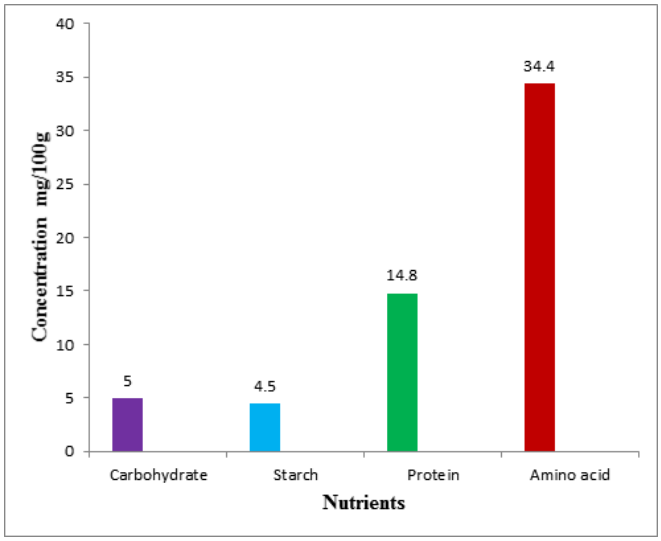

Fig 1: Concentration of Macronutrients present in *Beta vulgaris*, L. leaves

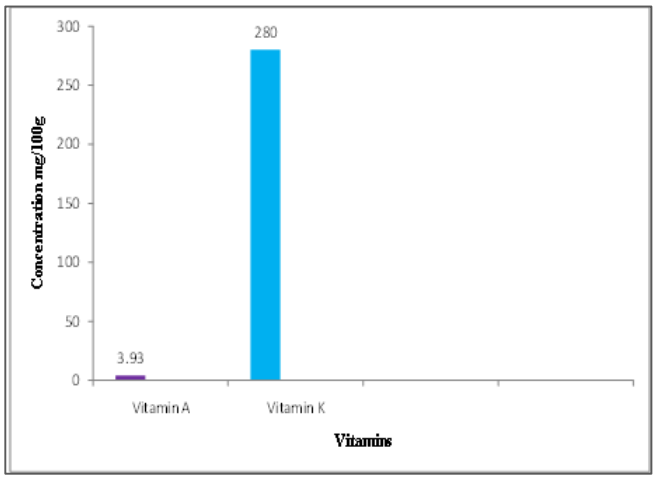

Fig 2: Concentration of Vitamins present in *Beta vulgaris*, L. leaves

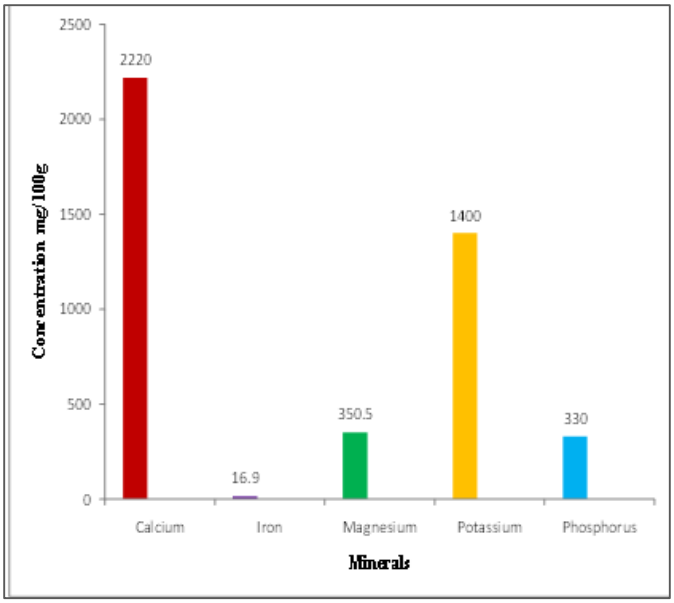

Fig 3: Concentration of the Minerals present in *Beta vulgaris*, L. leaves

Table 2: Comparison of Macronutrient, Vitamins and Minerals present in *Beta vulgaris*, L. leaves with RDA values

Sl. No	Nutrients	Composition of nutrient present in the sample mg/100gm	Recommended Daily Allowances of Macronutrients, Vitamins and Minerals/day			
			(1-3years) Infants and children	Older children	Adult man and women	Pregnant women and lactating mother
1.	Carbohydrate	5	95 g	130 g	130 g	210 g
2.	Protein	14.8	11.0 g	19 g	46-56 g	71 g
3.	Amino acid	34.4	714 mg	214 mg	84 mg	-
4.	Vitamin - A	3.93	0.3 mg	0.6 mg	0.9 mg	0.77 mg
5.	Vitamin - K	280.0	0.5 mg	0.9 mg	1.3 mg	1.4 mg
6.	Calcium	2220.0	500 mg	1300 mg	1000 mg	1000 mg
7.	Iron	16.90	7 mg	8 mg	8 mg	27 mg
8.	Magnesium	350.50	80 mg	240 mg	400 mg	360 mg
9.	Potassium	330.0	460 mg	1250 mg	700 mg	700 mg
10.	Phosphorus	1400.0	3.0 g	4.5 g	4.7 g	4.7 g

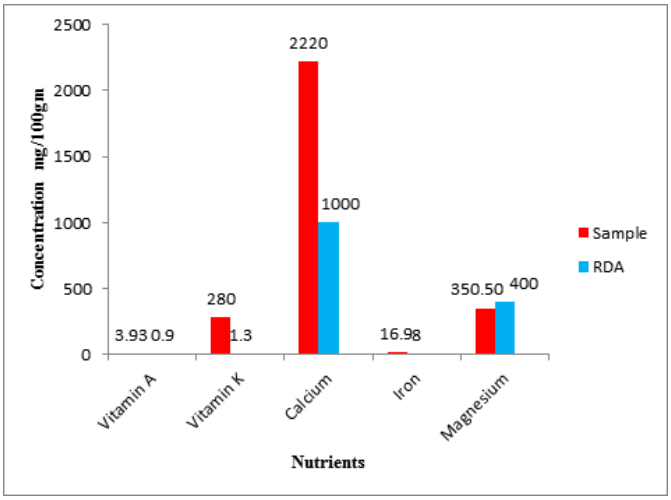

Fig 4: Suggested Nutrients from *Beta vulgaris*, L. leaves

Table 3: Concentration of Macronutrients, Vitamins and Minerals present in *Beta vulgaris*, L. leaves with beetroot

Sl. No	Nutrients	Composition of *Beta vulgaris*, L. leaves mg/100gm	Composition of *Beta vulgaris*, L. roots mg/100gm
1.	Carbohydrate	5	9960
2.	Starch	4.5	7960
3.	Protein	14.8	1680
4	Vitamin A	3.93	2
5	Calcium	2220	16
6	Iron	16.90	0.79
7	Magnesium	350.50	23
8	Phosphorus	1400	38
9	Potassium	330	305

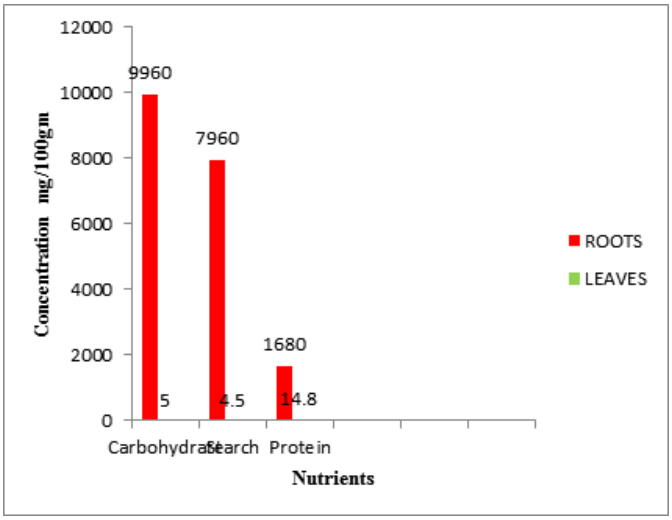

Fig 5: Comparison of Macronutrients present in *Beta vulgaris* (L) leaves with beetroots

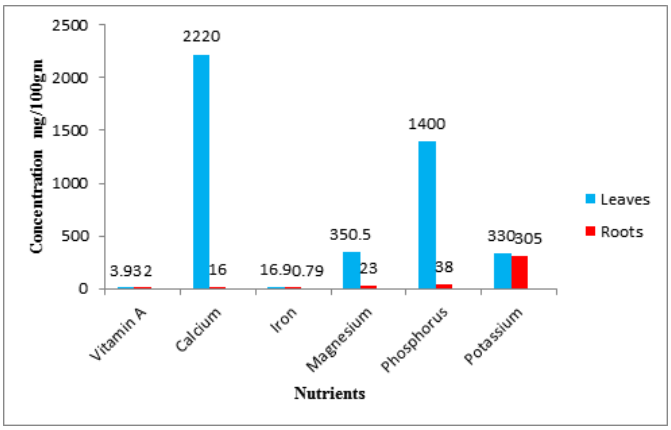

Fig 6: Comparison of Vitamins and Minerals present in *Beta vulgaris*, L. with beetroots

4. Conclusion

The analyzed of *Beta vulgaris*, L. leaves contains more amount of Vitamin A, Vitamin K, Calcium, Iron and Magnesium. Vitamins are the main function of number of coagulation factors. The calcium is required for blood clotting and for the muscles and many enzymatic activities. The results were tabulated and compared with RDA value. The green leafy vegetable of *Beta vulgaris*, L. leaves were compared to the results with *Beta vulgaris*, L. roots. Here the leaves contain a higher amount of Vitamin A, Calcium, Iron, Magnesium, Phosphorus and Potassium. So the diabetes patients can avoid to beet root because it contains higher amount of carbohydrate, starch and protein, the leaves contains less amount of macronutrients. In day today life the young leaves of beetroot is good for health, it is rich with high amount of nutrients and minerals, when compared with matured leaf. The leaves can be boiled and taken to substitute the nutrients. Hence the present study ensures that *Beta vulgaris*, L. leaves can be suggested to children, adults, pregnant women's and diabetes patients.

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