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EXTRACTION OF NUTRACEUTICALS BY USING BIOCHEMICAL METHODS FROM WILD LEAFY VEGETABLES

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ABSTRACT

In this article, Nutraceuticals was estimated from three rarely used vegetables in our daily diet, *Amaranthus viridis*, *Portulaca oleracea*, *Carthamus tinctorius.* In the analysis significant amount of Nutraceuticals, Vitamins, Beta carotene, Fiber, Nitrogen, Protein and Chlorophyll content was found. The leaves materials was collected and shade dried then the powder of selected plant systems were analyzed for different parameters. The highest content of Calcium was estimated in *A. viridis* 2758.73 mg/100gm and lowest estimated in *P. oleracea* 364.9 mg/100gm, Copper was more in 6.1 mg/100gm *C. tinctorius*, Iron highest in *P. oleracea* 155.26 mg/100gm and lowest in *A. viridis.* Magnesium was highest estimated in *A. viridis* and lowest in *C. tinctorius.* Vitamin A was highest estimated in *A. viridis* and lowest in *C. tinctorius*, Vitamin C more in *P. oleracea* and low in *C. tinctorius.* Beta Carotene highest content was estimated in *A. viridis* 5749.38 mg/100gm and lowest in *C. tinctorius* 3932.29 mg/100gm. The highest percentage of Carbohydrate content was observed in *A. viridis.* The highest percentage of Fiber content was observed in *C. tinctorius* 9.85 mg/100gm. The Lycopene content was only estimated in *P. oleracea* 1.89 mg/100gm. The highest content of Nitrogen percentage was estimated in 6.42 mg/100gm and not estimated in *A. viridis* and *C. tinctorius* respectively. The highest content of Protein was estimated in *P. oleracea* and *C. tinctorius.* The Total Chlorophyll highest content was estimated in *C. tinctorius* and lowest in *P. oleracea*. Chlorophyll a, Chlorophyll b and Carotenoids content were analyzed.

KEYWORDS: Nutraceuticals, Minerals, Vitamins, Amaranthus *viridis*, *Portulaca oleracea*, *Carthamus tinctorius.*

INTRODUCTION

The Nutraceuticals from vegetable has great importance in our life as well as daily diet. Vegetable plays a key role in health maintenance. India is the country with great cultural diversity and biodiversity, with many people still using a wide variety of plants in daily lives for food, water, shelter, fuel, medicines and other necessities of life. These plants often referred to as traditional vegetables agricultural crops and forages etc. various plant sources provide supplement nutrient like protein, vitamin, minerals such as iron, calcium, magnesium, zinc, prospers and other important nutrients are widely distributed in plant food for human health. The Nutraceuticals are substance which is a part or a food provides medical as well as health benefits, it helps in prevention and treatment of diseases. The term "Nutraceutical" was coined by combining the terms ‘Nutrition’ and ‘Pharmaceutical’ in 1989 by Dr. Stephen De-Felice, Chairman of the Foundation for Innovation in Medicine. The product is isolated or purified from foods. A Nutraceuticals is having physiological benefit and provide protection against number of chronic disease.[1][2] The Vegetables are functional foods Nutraceuticals and they provide mainly minerals and nutrients which are health promoting. It plays an important role in the human diet as well as a major source of biologically active Nutraceuticals. Recently the Nutraceuticals having the considerable attention because of them are safe, efficacious and have potential nutritional value as well as therapeutic effects. The vegetables have natural dietary supplements (nutrients), specific diets, the other nutrients present in and processed foods such as cereals, soups, and beverages have low in calories as well as fulfill with vitamins, minerals, antioxidants and number of phytochemicals.[3] The Nutraceuticals mainly classified in two groups.[4]

i) Potential Nutraceuticals

ii) Established Nutraceuticals

The potential Nutraceutical can be established one only after efficient clinical data of its health and medical benefits are obtained. It is to be noted that much of the Nutraceutical products are still lays in the ‘potential’ category.

In this article three rarely used vegetable were selected i.e., *Amaranthus viridis*, *Portulaca oleracea* and *Carthamus tinctorius* and analyzed to find out the Nutraceuticals, protein, vitamin, minerals such as iron, calcium, magnesium, zinc, vitamins, fiber, nitrogen, beta carotene, etc.

Amaranthus viridis is a vigorous, erect, branched, annual plant growing up to 10 -100 cm tall. The plant may become a short-lived perennial. The plant is often harvested from the wild as a source of food and medicines for local use. It is sometimes cultivated in the Tropics for its edible leaves, and is often sold in local markets *A. viridis* revealed the presence of major phytochemical compounds, including flavonoids, alkaloids, phenolics, steroids, terpenoids, saponins, cardiac glycosides, and tannins.[5]

Portulaca oleracea L. or Purslane is an annual grassy plant and distributed in many parts of the world, especially the tropical and subtropical areas. The plant possess many bioactive compounds such as lavonoids, coumarins, monoterpene glycoside, phenolic compounds, fatty acids as well as alpha- linolenic acid (Omega-3), alkaloids, vitamins, minerals and some other compounds. Flavonoids are one of the most abundant and important active constituents of the plant. Kaempferol and apigenin have been mainly isolated from leaf and stem. The plant is also source of Luteolin, myricetin, quercetin, genistein and genistin have been derived from the whole plant. Portulacanones A, portulacanones B, portulacanones C, portulacanones D and 2, 2'-Dihydroxy- 4', 6'-dimethoxychalcone have been isolated from aerial parts of the plant. Number of alkaloids has been isolated from different parts of the plant. Dopamine, noradrenalin is major alkaloids found in stem, leaf and seeds of the plant. The plant also contains, Oleraceins A, oleraceins B, oleraceins C, oleraceins D, oleraceins E and adenosine have been derived from whole plant and oleracins I and oleracins II mainly found in the plant stem.[6]

The Safflower (*Carthamus tinctorius* L.), it is an oilseed crop and, a member of the family Compositae or Asteraceae, this is mainly grown for centuries in India. From the plant orange-red dye (carthamin) extracted and it's brilliantly colored flowers and for its quality oil rich in polyunsaturated fatty acids. The tender leaves, shoots, and thinning of safflower are used as pot herb, green leafy vegetable and salad. They are rich in vitamin A, iron, phosphorus, and calcium.[7] The plant has high nutritional value of its edible oil. It contains a high amount of polyunsaturated fatty acid linoleic acid (70%) and monounsaturated oleic acid (10%) with small amounts of stearic acid.[8] More than 200 compounds were isolated from C. tinctorius where chalcone flavonoids are the main compounds in the water extract. These natural pigments have achieved industrial significance in many fields. They are used in food, pharmaceutics, cosmetics and various other commodity preparations.[9] [10] [11] [12] [13]

Three different types of vegetables were selected for the present study and it was analyzed for different- different types of Nutraceuticals present in the selected experimental plants. So it was our aim to find out the Nutraceuticals from the selected vegetables. There are no previously reported studies on the selected vegetables. The goal of the present investigation was to find out the Nutraceuticals and to study its benefits especially on human health.

MATERIAL AND METHODS

Collection of three selected experimental plant systems

The selected leaves of plants were collected from Georai (Dist. Beed, Maharashtra, India) during the month of November, 2020 and all the plants were taxonomically identified. The plant material collected in bulk amount and it was shade dried. The fine powder was prepared using mortar and pestle for further analysis.

The experimental analysis of all the selected plants was carried out in research laboratories. All the details of experimental analysis and obtained results are described as follows.

1. Estimation / Determination of Copper, Manganese, Iron and Zinc content by ICP-OES method: (MIT- CARS/SOP/2018/F/08)
2. Test method: AOAC official method 985.01, 20th edition 2016. Chapter no.3 page no.6
3. Determination of Crude Fiber (MIT- CARS/SOP/2018/F/04)
   Test method: IS: AOAC method no.978.10
4. Determination of Potassium (K) and Sodium (NA) content by Flame Photometric method (MIT- CARS/SOP/2018/F/07)
   Test method: AOAC 20th edition 2016; Chapter no.3 method no. 956.01
5. Determination of Nitrogen (N) by Kjeldahl method (MIT- CARS/SOP/2018/F/06)
   Test method: AOAC official method 976.06
6. Determination of Crude protein (MIT- CARS/SOP/2018/F/01)
7. Determination of Vitamin A content (MIT- CARS/SOP/FOOD/V & VP/06)
8. Determination of Sugar
9. Determination of Chlorophyll content

Statistical analysis

All the experiments were performed in triplicate and the data represented as the mean ± standard deviation.

Table 1: Content of Minerals in experimental plants.

Plant Name	Calcium (Ca) (mg/100g)	Copper (Cu) (mg/100g)	Iron (Fe) (mg/100g)	Magnesium (Mg) (mg/100g)	Manganese (Mn) (mg/100g)	Phosphorous (P) (mg/100g)	Potassium (K) (mg/100g)	Sodium (Na) (mg/100g)	Zinc (Zn) (mg/100g)
Amaranthus viridis	2758.73	5.03	51.05	2034.81	4.81	643.92	3471.00	309.00	2.33
Portulaca oleracea	364.90	-	155.26	562.08	-	337.44	3517.00	403.50	1.93
Carthamus tinctorius	1777.79	6.10	115.15	521.72	6.10	399.10	3008.00	143.00	3.31

Table 2: Content of Vitamins in experimental plants.

Plant Name	Vit A (ug RE)	Vit B-1 (mg/100g)	Vit B-2 (mg/100g)	Vit B-5 (mg/100g)	Vit B-6 (mg/100g)	Vit B-9 (mg/100g)	Vit C (mg/100g)
Amaranthus viridis	937.00	-	0.16	-	-	0.12	4.64
Portulaca oleracea	806.28	-	-	0.05	-	-	5.80
Carthamus tinctorius	656.69	0.21	-	-	0.07	-	3.48

Table 3: Content of Nutrients in experimental plants.

Plant Name	Carbohydrate	Fiber	Nitrogen	Protein
Amaranthus viridis	13.28	8.87	5.89	36.81
Portulaca oleracea	13.33	12.53	3.00	18.75
Carthamus tinctorius	10.38	9.85	4.15	25.93

Table 4: Content of Pigments in experimental plants

Plant Name	Total Chlorophyll (mg/g)	Chlorophyll-A (mg/g)	Chlorophyll-B (mg/g)	Carotenoids (mg/g)
Amaranthus viridis	2.12	1.45	0.67	0.62
Portulaca oleracea	0.16	0.12	0.04	0.08
Carthamus tinctorius	2.86	1.57	1.29	0.71

Table 5: Content of Secondary Metabolites in experimental plants.

Plant Name	Isoflavones (%)	Anthocynins (mg/L)	Lycopene (mg/100g)
Amaranthus viridis	*4.11*	-	-
Portulaca oleracea	*2.49*	*1.33*	*1.89*
Carthamus tinctorius	*9.20*	-	-

RESULTS AND DISCUSSION

In the present analysis it is revealed that Estimation / Determination of Calcium, Copper, Manganese, Iron, Magnesium, Phosphorous, Sodium, and Zinc content showed prompt

results. The selected plant leaves materials proved the present of Crude Fiber. It is also observed that the Determination of Potassium (K) and Sodium (NA) content by Flame Photometric method gives the exciting results. The Determination of Nitrogen (N) by Kjeldahl method was also remarkable results. The Determination of Crude protein analysis was found in remarkable amount. In the Determination of Vitamins the vitamin A, Vitamin B-1, Vitamin B-2, Vitamin C, Beta Carotene, content was also estimated. Presence of carbohydrates (Sugar) also recorded in the present analysis. The obtained results describe in briefly as follows.

Minerals, Vitamins, Nutrients, Pigments & Secondary metabolites content in the *Amaranthus viridis*

The amount Calcium content was estimated highest in *A. viridis* 2758.73 mg/100gm. The second highest content was estimated as Potassium 3471 mg/100gm and thirdly the Magnesium 2034.81 mg/100g. The other highest content revealed as Beta Carotene 5749.38 ug/100g. The Zinc was estimated as lowest content in *A. viridis* 2.33 mg/100g. In the analysis of Vitamins the Vitamin A was estimated highest and Vitamin B-2 found as lowest content. The Carbohydrate content was 13.28%. Nitrogen content was estimated 5.89% and the protein content was estimated 36.81% (Fig. 1 to 3 & Table 1 to 5).

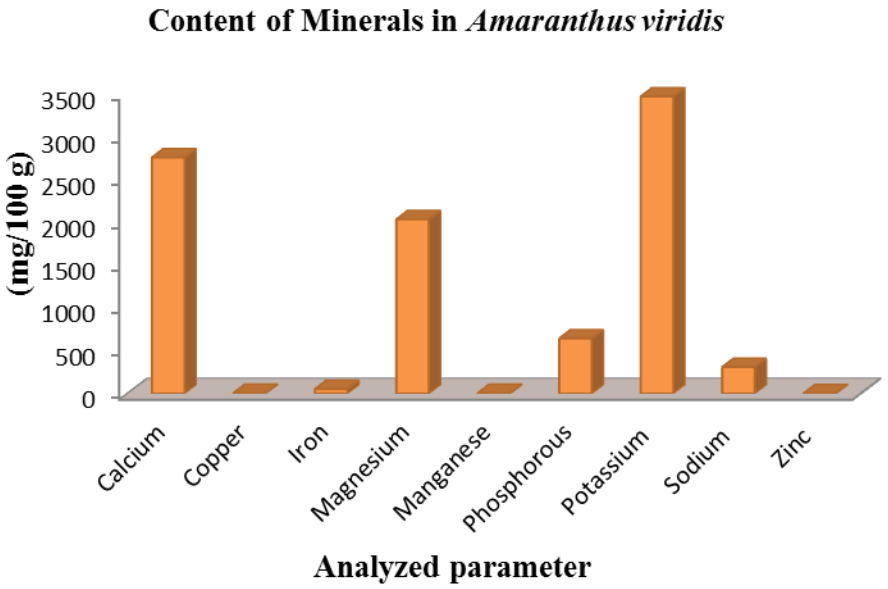

Fig.1: Content of Minerals in *Amaranthus viridis*.

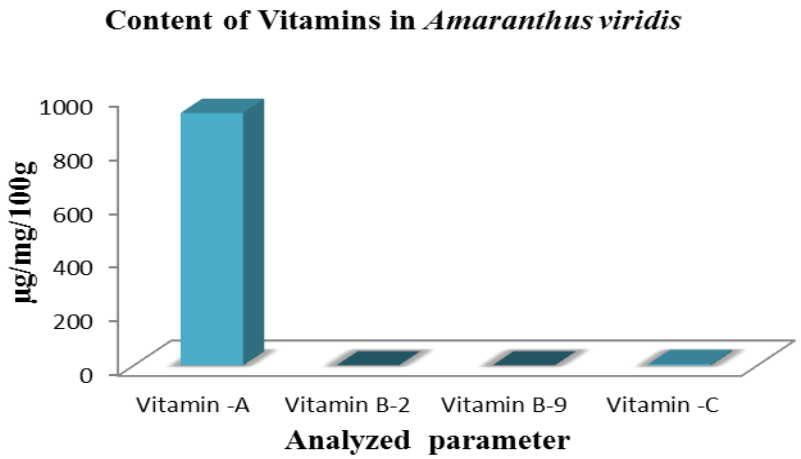

Fig.2: Content of Vitamins in *Amaranthus viridis*.

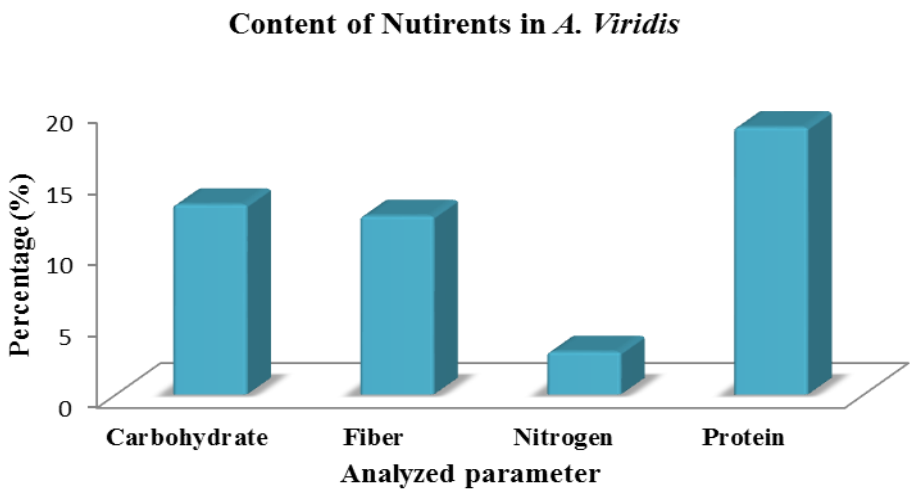

Fig.3: Content of Nutrients *A. viridis.*

Minerals, Vitamins, Nutrients, Pigments & Secondary metabolites content in the *Portulaca oleracea*

In this plant the highest content of Calcium was estimated 364.9 mg/100gm. Copper was not detected in *P. oleracea*. The content of Iron was 155.26 mg/100gm. Magnesium content is 562.08 mg/100gm. Phosphorous content revealed 337.44 mg/100g. Potassium (3517 mg/100g), Sodium (403.5 mg/100g). The content of Vitamin A 806.28µg, Vitamin B-5- 0.05 mg/100g, Vitamin C 5.8 mg/100g. The Beta Carotene content was 4828.07µg/100g. The Carbohydrate content was found 13.33%, Fiber content 12.53%, Nitrogen 3%, Protein content 18.75% (Fig.4 to 6 & Table 1 to 5).

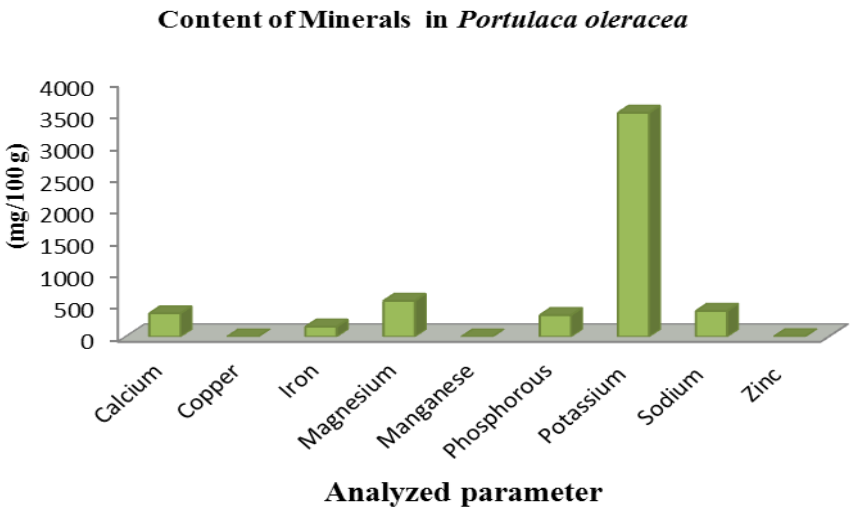

Fig. 4: Content of Minerals in *Portulaca oleracea.*

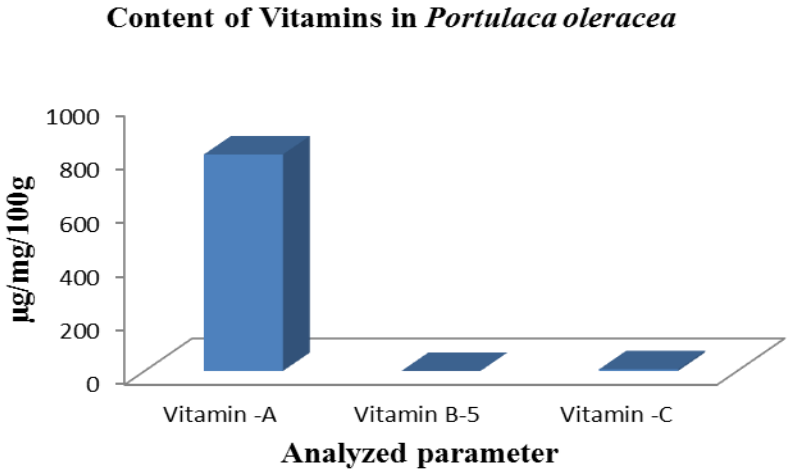

Fig. 5: Content of Vitamins in *Portulaca oleracea.*

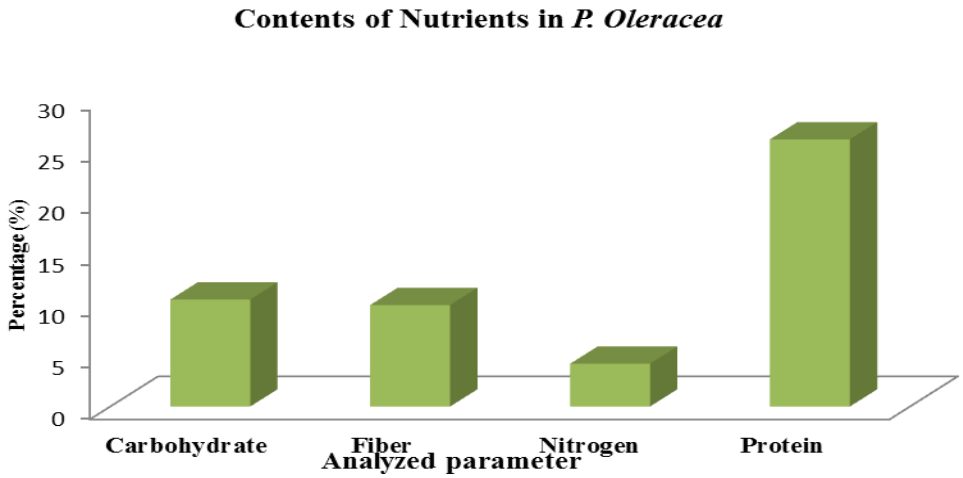

Fig. 6: Content of Nutients in *P. Oleracea.*

Minerals, Vitamins, Nutrients, Pigments & Secondary metabolites content in the *Carthamus tinctorius* (Safflower)

The highest Calcium content estimated as 1777.79 mg/100gm, Copper content 6.1 mg/100gm, Iron content 115.15 mg/100gm, Magnesium content 521.72 mg/100gm, Manganese content 6.1 mg/100gm, Phosphorous content 399.1 mg/100gm, Potassium Content 3008 mg/100gm, Sodium Content 143 mg/100gm, Zinc content 3.31 mg/100gm. The Vitamin - A was revealed 656.69 µg, Vitamin B-1 mg/100gm, Vitamin B-6 mg/100gm, Vitamin C 3.48 mg/100gm. The content of Beta Carotene was estimated 3932.29 µg. The content of Carbohydrate was found in the *C. tinctorius* as 10.38%, Fiber content 9.85%, Nitrogen 4.15%, Protein content 25.93% (Fig.7 to 9 & Table -1 to 5).

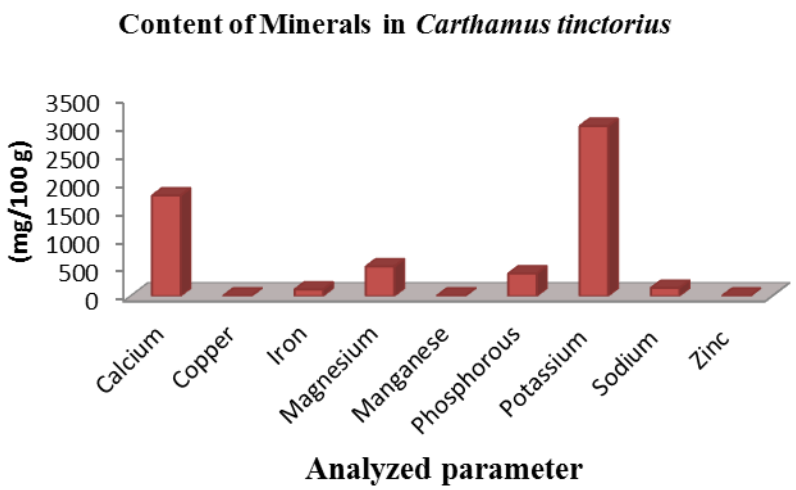

Fig. 7: Content of Minerals in *Carthamus tinctorius.*

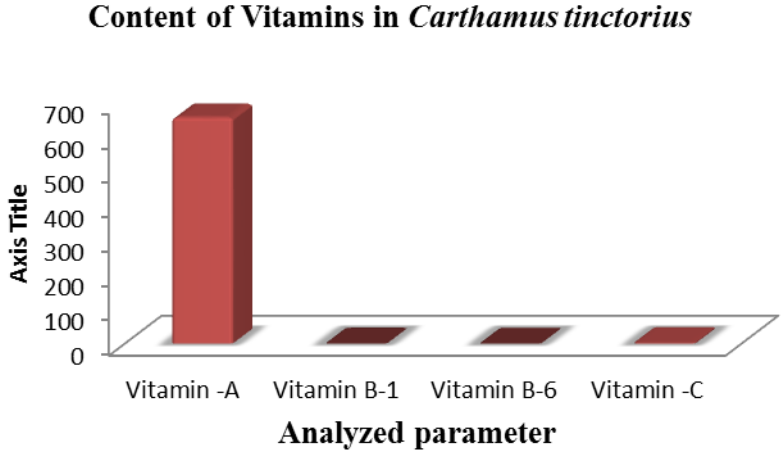

Fig. 8: Content of Vitamins in *Carthamus tinctorius.*

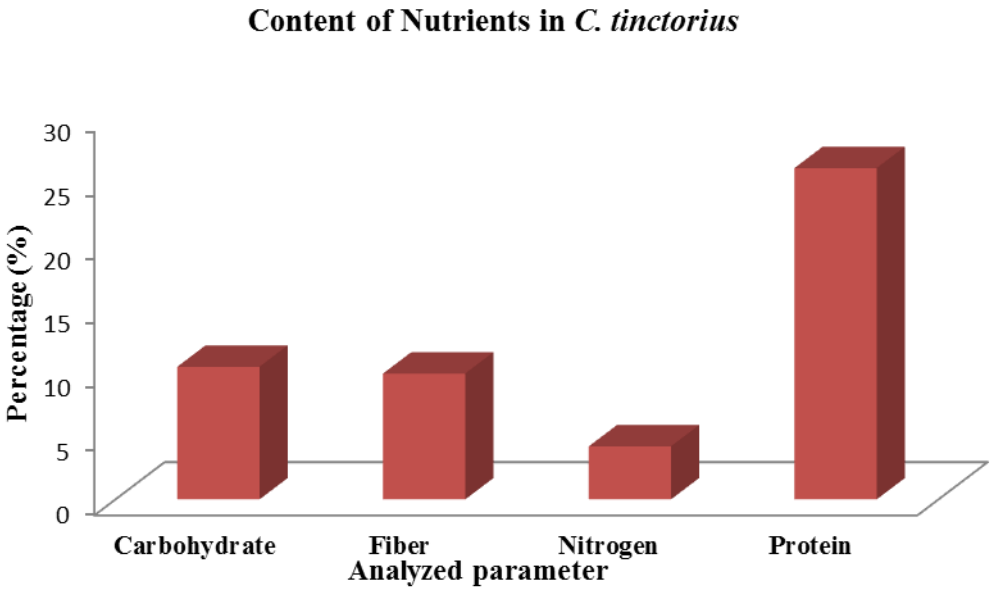

Fig. 9: Content of Nutrients in *C.tinctorius.*

Minerals, Vitamins, Nutrients, Pigments, Secondary metabolites & Determination of Chlorophyll content

One another parameter i.e. Determination of Chlorophyll content was also done in the present work. The Total Chlorophyll highest content was estimated in *Carthamus tinctorius* 2.86 (mg/g) tissues; in the *Amaranthus viridis* it was revealed as 2.12 (mg/g) tissues and lowest in *Portulaca oleracea* 0.16 (mg/g) tissues. Chlorophyll a was highest in *Carthamus tinctorius* as 1.57 (mg/g) and the lowest in *Portulaca oleracea* as 0.12 (mg/g) tissues (Fig. 10 & Table 4).

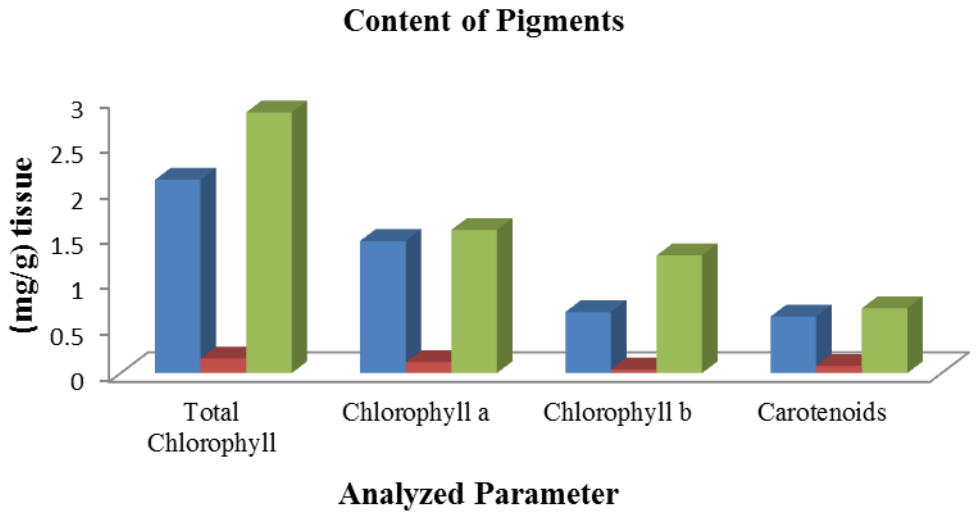

Fig.11: Estimation of Pigments content in selected experimental plants.

CONCLUSION

From the obtained results**,** it is concluded that the content of Nutraceuticals was revealed in the present analysis. In the experimental plants, it was revealed that the content of calcium, potassium, and magnesium found in remarkable amount, as well as the content of vitamin A and beta-carotene also found high level, carbohydrate, fiber, nitrogen and protein percentage also got in significant amount. Nutraceuticals are already becoming part of dietary Supplements; nowadays Nutraceuticals are the most rapidly growing segments of the industry & the global Nutraceutical market. Nutraceuticals have important health benefits it plays a key role to cure the diseases like cardiovascular diseases, Diabetes, Obesity, Cancer, Anti-inflammatory activities, Vision improving agents, Osteoarthritis and Alzheimer's disease, etc. It is a future need to find out the Nutraceuticals in the plant systems, which is used for the food and feed purpose.

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