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Nutritional Potential of Locally Available Micronutrient Rich Green Leafy Vegetables

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Abstract: ***This study was made to analyze the nutritional composition of some micronutrient rich green leafy vegetables. Proximate analysis was done by standard procedures of AOAC, (2005). β carotene was analyzed by standard procedure of (Ranganna 2001). Ascorbic acid was analyzed by (Gupta 2007). The data obtained during study were analyzed statistically using mean values and C.D techniques. Results shows that the highest β-carotene was found Carrot (Soy disambiguation) leaves i.e.5440 ±11.05µg / 100g, followed by Moringa (Moringa oleifera) leaves 4453 ±17.090 µg /100g, and Spinach (Spinchacia oleracea) lowest i.e. 2740 ±12.01µg /100g. Iron ranged from 3.05± 0.47 to7.05 ±1.78 mg /100g. It is concluded that nutritional composition in identified greens was found highest in iron and β carotene and other nutrients. Thus these locally available green leafy vegetables can be used as a key driver to combat micronutrient deficiency in vulnerable groups.***

Keywords: Green leaves vegetables, proximate composition, micronutrients, locally available

1. Introduction

In developing countries like India where maximum population is vegetarian, liberal amount of green leaves vegetables (GLV) Underutilized green leaves vegetables, which are available seasonally, they are rich sources of vitamins such as β -carotene, ascorbic acid, riboflavin and folic acid as well as minerals such as iron, calcium and phosphorus. Green leafy vegetables should be incorporated in the diet as an important source of several nutrients, especially iron, calcium and β -carotene. Green leaves vegetables, which are available seasonally; they are rich sources of vitamins such as β -carotene, ascorbic acid, riboflavin and folic acid as well as minerals such as iron, calcium and phosphorus. *Surwari* (*Celosia argentea*) or Lagos spinach is a vigorous, broadleaves annual belonging to the Amaranth family (*Amaranthaceae*). It is an important source of protein, minerals and vitamins, especially in areas where animal protein sources are scarce. The composition of *Celosia argentea* per 100 g edible portion is: 83.8 g water; 185 kj energy; 4.7 g protein; 0.7 g fat; 7.3 g carbohydrate; 1.8 g fibre; 260 mg Ca; 43 mg P and 7.8 mg Fe. **Sheela *et al.* (2004)** reported that there *C.argentea,* amaranth *(Amaranthus tricolor)* are many underutilized greens of promising nutrient values, which can nourish the ever increasing human population. Many of them are resilient-adaptive and tolerant to adverse climate condition. Although, they can be raised comparatively at lower management costs even on poor marginal lands, they have remained underutilized due to lack of awareness and population of technology for utilization. Now-a-day, underutilized foods are gaining importance as a mean to increase the per capita availability of foods.

C. argentea is a good warm-weather leaves vegetable. Even in temperate regions spinach does well only in the cooler months of the growing season, and will not produce in the heat. *C.argentea*, on the other hand, will grow robustly in tropical climates, and has leaves that taste very much like spinach when cooked. **Gopalan *et al.* (2004).**

In India, various types of underutilized foods are available seasonally but are not utilized to the extent they should be despite their high nutritive value. Looking into the high prevalence of over- and undernutrition, these underutilized foods can be explored to overcome nutritional disorders. In view of this, the underutilized green leafy vegetable *Celosia argentea* was analyzed for proximate composition, minerals, and vitamin content and anti-nutritional factors, using standard procedures. On the basis of nutritional analysis, *C.argentea* was utilized for the development of value added products. Moisture, ash, protein, fat, fibre, carbohydrate and energy content of underutilized *C. argentea* were found to be 84.39+or-0.13 g, 3.06+or-0.05 g, 1.45+or-0.23 g, 1.25+or-0.03 g, 0.68+or-0.04 g, 9.06+or-0.15 g, 53+or-0.45 g/100 g respectively. Values obtained for iron, calcium, vitamin C and beta -carotene content of C. argentea were 26.48+or-0.14 mg, 170.6+or-2.17 mg, 60.6+or-7.07 mg, 2166+or-136 micro g/100 g respectively. The mean haemoglobin levels of the experimental group and control group were 8.71 g/dl and 9.28 g/dl respectively after supplementation. Due to supplementation, there was significant rise in the weight and haemoglobin levels (14.3%) (P<=0.01) of the subjects in the experimental group, whereas the change in the control group was non-significant. This supplementation of *C.argentea* based product "*mathri*" can significantly improve the haemoglobin status of adolescent girls **Gupta *et al.* (2013)**

2. Methodology

Experimental site- The present investigation was carried out in the Nutritional Research, Laboratory of the Department of Foods and Nutrition, Ethelind School of Home Science, SHIATS, Allahabad.

Identification of green leafy vegetables- Green leafy vegetables were identified from villages near by the Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad. Nine leafy vegetables such as Bathua *(Chenopdium album),* chaulai ki patti *(Amaranths caudatus L.),* methi ki patti *(Trigonellafoenumroaecum),* soya leaves *(Anethum graveolens),* phool gobhi leaves *(Barssica*

oleracea), gajar leaves *(Soy disambiguation),* shajan leaves *(Moringa oleilefera),* sarso ki patti *(Brassica Juncea),* palak leaves *(Spinchacia oleracea) were identified.*

Procurement of green leafy vegetables- Green leafy vegetables were procured from the field of village near by the Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad. Only the fresh leaves were be collected. These leaves were washed with the help of clean water so as to remove the dirt and other disease causing organisms.

Nutritional composition of prepared value added products- Nutritional composition of green leafy vegetables was done by standard procedures of **AOAC (2005).**

Statistical analysis- Mean and Critical Difference were used to analysis the data **(Gupta *et al*., 2002).**

3. Results and Discussion

Table-1 shows that nutritional composition of the micronutrient rich green leafy vegetable on the basis (Per 100g).

Moisture Spinach leaves had the highest moisture content of 92.05 percent followed by Moringa (*Moringa oleifera)* leaves (92%) and least was found in dill leaves (*Anethum graveolens)* i.e 77.05%. The high level of moisture in all the samples investigated suggested that the leafy vegetable would not stay stored for long without spoilage, since a higher water activity could enhance microbial action bringing about food spoilage.(**Saha *et al* ., 2014)** assessed nutritional composition for some underutilized green leafy vegetables and founded moisture content ranged from 71.74-98.20% wet basis, highest being in *Moringa oleifera* (98.20g/100g)and lowest in *Diplazium esculentum* (71.74g/100g).The moisture content obtained in leafy vegetable was close to the values (86.5 to 90.41 %) reported by **Gupta and Prakash ,(2011).**

Ash Fenugreek leaves (*Trigonella foenum-groaecum)* had the highest ash content of 4.25 ±0.77g/100g, followed by the Amaranthus (*Amaranths caudatus L)* leaves with a value of 1 .22 ±0.11g/100g. **Gafar *et al*.,(2011)** reported that the values of ash content of the sample was found to be 17.67%, the value obtained is higher compared to 5.55% obtained in *chancapiendra leaf* vegetable, but lower than 19.61% in *Amarentuhs hybrid* **(Nwaogu *et al*., 2011).**

Fat. Fat content leaves for the raw green leafy vegetable varied with species with the highest value of 3.15 ± 0.63g/100g observed in Fenugreek leaves (*Trigonella foenum-groaecum)* and lowest in Amaranths leaves (*Amaranths caudatus L)* i.e.1.04±0.5g/100g**. Ellis, (2010)** reported that the fat content of sweet potato leaves (0.38-1.91%) were lower when compared to that of the *Moringa oleifera* (2.23%). A diet including *Moringa oleifera* should be more palatable than that with sweet potato leaves because dietary fats function to increase food palatability by absorbing and retaining flavors **(Lindsay, 2008).** A diet providing 1 - 2% of its caloric energy as fat is said to be sufficient to human beings, as excess fat consumption yields to certain cardiovascular disorders such as atherosclerosis, cancer and aging **(Davidson et al., 2007; Kris-Etherton *et al.*, 2012).**

Protein Protein content of selected micronutrient green leafy vegetable ranged between 2.0± 0.27 to 6.7 ±0.69g /100g.Protein content of the sample was high in Moringa (*Moringa oleifera)* leaves i.e. 6.7 ± 0.69 g/100g followed by spinach *(Spinchacia oleracea*) leaves i.e.2.0± 0.27g/ 100g . According to **Tag *et al* .,(2014)** *chenopodium album* and *Diplazium esculentum* revealed more or less some protein contents . *Amaranthus vidridis* was found to have low protein content of 2.29g/100g.

Crude fibre Crude fibre content varied from 1.99 ± 0.22 to 3.6 ± 0.55 g/100g being highest in spinach *(Spinchacia oleracea*) leaves i.e.3.6 ±0.55g /100g followed by Bathua (*Chenopdium album*) leaves i.e 1.99 ± 0.22g /100g. According to **Pillai *et al.*, (2013)** the *Basella rubra* showed the highest crude fibre value (8.61g/100g) and lowest was found to be in *Moringa oleifrea* (2.04g/100g) and *Amaranthus virdis* (0.25g /100g).

Carbohydrate Total carbohydrate content ranged between 4.9 ± 0.32 to 12.5± 1.88g /100g.Fresh leaves of Moringa (*Moringa olefiera)* leaves had the highest carbohydrate content i.e. 12.5± 1.88 g /100g,but lower than value of 52.85g /100g (dry weight) reported by **Reghuvashi *et al.*, (2011) .** Carbohydrate contents of all green leafy vegetables ranged between 11.16 g/100g to 5.45 g /100g. *Basella alba* had the highest i.e.11.16 g/100g and lowest in *Diplazium esculentum* i .e.5.45 g/ 100g. The similar values were reported for the carbohydrate contents of wild edible herbs used in Eastern Chattisgarh **(Vishwakarma and Dubey, 2011).**

Calcium
Leaves of *Moringa oleifera* was found to have high calcium content i.e. 440± 6.01mg /100g,when compared to the value was observed similar to values of calcium i.e. 42.65mg/100g) reported by the **Gopalan *et al.*, (2010) . Nayarko *et al*., (2012)** studied that the calcium content was found to be the range of 36.60 to 67.93mg/100g.*Moringa oleifera* had the maximum amount and *Barassica juncea* recorded the minimum amount. Calcium is an important mineral for human beings, which provides good strength of bones and teeth. It plays an important role in blood clotting, muscles contraction, and neurological function and also helps in enzymatic metabolic processes **(Senga *et al.*,2013).**

Iron In the leaves studied the iron ranged from 3.05± 0.47 to7.05 ±1.78 mg /100g .The highest iron content was found in cauliflower (*Barssica oleracea)* leaves i.e.7.05 ±1.78mg/100g, followed by dill leaves *(Anethum graveolens*) i.e.6.50± 0.90mg /100g, and least in Moringa (*Moringa olefiera)*) leaves i.e.3.04 ±0.47 mg /100g.

Iron content was found highest in the order *Brassica nigra* (241.20 mg / 100g), *Brassica juncea* (118.50mg / 100g), *Amaranthus viridis* (118.1 mg / 100g), *Basella alba* (90.80 mg /100g) and *Chenopodium album* (85.46 mg/ 100g) respectively. While the rest of the green leafy vegetables had iron content in the range of 29.40 to 57.37 mg / 100 g iron

content analyzed in the present study were similar to the values as reported by **Singh *et al.*, (2001**).

Energy Energy content of the sample ranged between 10.45 ±0.99 to 92 ±3.01 kcal /100g.The highest value in Moringa (*Moringa oleifera)* leaves 92 ±3.01 kcal /100g, followed by Fenugreek leaves (*Trigonella foenum-groaecum)* i.e. 57.4 ±1.08 kcal /100g and minimum energy content was found in Mustard (*Barssica oleracea*) leaves i.e. 10.45 ± 0.42 kcal /100g. **Gordon and Kessel, (2002); Yisa *et al*., (2010)** suggested that the high carbohydrate content in food means high energy content, which helps in digestion and assimilation of other foods. They are also responsible for carrying out daily activities in day to day life **.**The calorific value of green leafy vegetable ranged between 195.00 to 541.33 Kcal/100g, and highest being in *Amaranthus viridis* and lowest in *Diplazium esculentum*. Similar values were found in *Vitex doniane* (194.03 Kcal/100g), *Limosella aquatic* (152.00 Kcal/100g) and *Corchorus olitorius (*184.00 Kcal/100g) **(Gladys Oguche., 2012)**

β-carotene The highest β-carotene was found Carrot *(Soy disambiguation)* leaves i.e.5440 ±11.05µg / 100g, followed by Moringa (*Moringa oleifera*) leaves 4453 ±17.090 µg /100g, and Spinach (*Spinchacia oleracea)* lowest i.e. 2740 ±12.01µg /100g. *β*-carotene content was highest in bengal gram leaves (11.8 mg/100 g) and lowest in carrots (2.2 mg/100 g) on fresh weight basis . Significant ($p < 0.05$) differences were observed in all other vegetables and herbs except for mint and spinach reported by **Bawa *et al.,(* 2013)** .Similar values for *β*-carotene in spinach and amaranth have been higher values of *β*-carotene in spinach (5.10 mg/100 g) have also been reported by **Bhattacharjee (2011).**

4. Conclusion

Result obtained from the present study revealed that the green leafy vegetables are rich in macro and micronutrients. The abundantly available inexpensive green *leafy vegetables* can serve nutrients and can be used in the developing countries to combat micronutrient deficiencie

References

[1] **AOAC. 1990**. Official method of Analysis. 15thedn., Association of Official Analytical Chemists, Washington, DC.

[2] **Bawa SF, Yadav SP (1986)** Protein and mineral content of green leafy vegetable consumed by sokota population. J Sci Food Agric 37: 504-506.

[3] **Bhattacharjee LL, Mudanbi SR, Bhushan B, Patanakar MV (1994)** Pro-vitamin A content of selected Indian foods, J Food SciTechnol 31: 249-251.

[4] **Davidson ,N. Gropper, J. I. Smith and J. I. Groff,(2007)** "The antioxidant nutrients, reactive oxygen species and disease in advanced nutrition and human metabolism," 4th edition, Thomson Wadsworth, Belmont, pp.368 – 377, .

[5] **Gladys ogauche H. E. 2012**. The effect of sun and shade drying on chemical composition of Vitexdoniana Ipomoea aquatic and chorcorusolitorious and theirs soups. International journal of Nutrition and Metabolism 4 (9): 121-129.

[6] **Gopalan C. (1996)** Combating Vitamin A Deficiency and Micronutrient Malnutrition through Dietary Improvement. Media workshop for the nutrition foundation of India, New Delhi, India.Vol 11. pp. 5-1114

[7] **Gordon, M. N. and Kessel, M. 2002.**Perspective in Nutrition. 5thedn., P. 257-281. Ohio, New-York McGraw Hill company.

[8] **Gupta, S. and Prakesh, J. 2011.** Nutritional and sensory quality of micronutrient-rich traditional products incorporated with green leafy vegetable. International food Research Journal 18: 667-675.

[9] **Nwaogu, M. S., thabet, A. H. and Algadi, A. E. 2013.** Influence of drying process and functional properties of some plants. Chemistry and Material research 3 (7): 1-8.

[10] **Raghuvanshi, R.S., Singh, R. and Singh, R. 2001**.Nutritional composition of uncommon foodsandtheirrole in meeting micronutrient needs. International Journal of Food Sciences and Nutrition 52: 331 -335.

[11] **Senga, K. P., Opota, O. D., Tamba V. A. Tona, L. G., Kambu, K. O., Covaci, A., Apers, S., Pieters, L., and Cimanga, K, 2013**. Chemical compositional and nutritive value study of the seed oil of Adenantherapavonina L. (Fabaceae) growing in Democratic Republic of Congo. International journal of Pharma Tech Research 5(1): 205-216.

[12] **Tag, H., Tsering, J., Hui, P.K., gogoi, B. J. and Veer, V. 2014**.nutritional potential and traditional uses of high altitude wild edible plants in eastern Himalayas, India. International journal of Biological, Veterinary, Agricultural and Food Engineering 8(3): 226-231.

Table: Nutritional composition of the micronutrient rich green leafy vegetables (Fresh) *Per* 100g

Local name	English name	Botanical name	Moisture (g)	Ash (g)	Protein (g)	Fat (g)	CH0 (g)	Energy (Kcal)	Crude fibre (g)	Iron (mg)	Calcium (mg)	β. Carotene (µg)	Vitamin C (mg)
Bathua	Fat hen	*Chenopdium album*	89.6± 1.24	2.01± 0.11	4.8± 0.23	2.06± 0.43	7.01± 0.52	49.0± 1.64	1.9.9± 0.27	5.0± 0.84	145± 4.02	1760± 7.03	27.09± 2.54
Chaulai ki Ptti	Amaranth leaves	*Amaranths caudatus L.*	81.83± 1.9	1.22± 0.11	3.01± 0.45	0.7± 0.22	4.9± 0.32	26± 0.83	2.09±0. 56	4.44± 0.45	200± 11.04	2124.28± 17.03	26.43± 1.98
Methi ke patti	Fenugreek Leaves	*Trigonella foenumroaec um*	90.1± 2.90	4.25± 0.77	5.5±0.5 6	3.15± 0.63	7.5± 0.65	57.4± 1.08	2.2± 011	4.01± 0.83	390± 14.91	11782± 19.04	50± 1.43
Soya leaves	Dill leaves	*Anethum graveolens*	88.5± 0.89	2.08± 0.34	3.45±0. 11	2.10±0. 23	6± 0.93	40± 0.32	2.10± 0.32	6.50± 0.90	200± 8.78	2690± 16.01	80± 2.54
Phool Gobhi	Cauliflowe r leaves	*Barssica oleracea*	91.62± 3.05	0.67± 0.56	6.02± 0.76	2.23± 0.62	5.06± 0.76	16± 0.63	2.03± 0.24	7.05± 1.78	44.17 ±0.23	2.0±0.08	55± 1.99
Gajar leaf	Carrot leaves	*Soy disambiguati on*	84.0± 1.01	3.97± 076	2.07 ± 0.32	3.02± 0.66	9.6± 0.54	44± 2.09	2.01± 0.78	4.08± 0.87	77.34± 1.00	5440± 11.05	10± 0.33
Shijan, Munaga	Moringa leaves	*Moringa oleilefera*	92.05 ±3.97	2.47± 0.23	6.70± 0.90	2.70±0. 21	12.5± 1.88	92± 3.01	2.90± 0.86	3.04± 0.47	49.32± 6.01	8990±13. 01	149± 1.75
Sarso ki ptti	Mustard leaves	*Brassica Juncea*	87.05± 1.09	3.98± 0.65	7.7± 69	2.03±0. 1	4.69± 0.67	10.5± 0.42	2.8± 0.11	3.05± 0.55	104± 3.01	4453± 17.09	35.4± 0.88
Palak	Spinach eaves	*Spinchacia oleracea*	80.05± 3.01	3.09± 0.87	2.0± 0.11	2.16±0. 13	7.62± 1.04	28± 1.06	3.6± 0.55	3.64± 0.56	77± 1.00	2740± 12.01	27± 1.54