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## Green leafy vegetables source of nutrients: A review

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**Abstract**

Vegetables make up a major portion of the diet of humans in many parts of the world and are considered essential for well-balanced diets. Leafy vegetables crops are one group of vegetable crops which used mainly for their leaves whether eaten raw or cooked. They provide adequate amount of dietary fibres, minerals, vitamins and other nutrients to people in developing countries. They also contain an immense variety of bioactive non-nutritive health promoting compounds such as antioxidants and phytochemicals, which provide health benefits beyond basic nutrition. These are highly essential for developing resistance by allowing the immune system to function in a systematic manner.

**Keywords:** Green leafy vegetables, nutrients, antioxidants

**Introduction**

Generally, vegetables are widely designated as “protective foods” in human diet due to their varied health benefits attributable to the richness in vitamins, essential fatty acids, minerals, amino acids and dietary fibre (Shukla *et al.*, 2016) [20] and various essential bioactive compounds (Da *et al.*, 2017, Hemmige *et al.*, 2017) [5, 10] Green leafy vegetables are a blessing for a safe and healthier life and have been in use for centuries. They provide adequate amounts of many vitamins and minerals for humans (Randhawa, 2015) [17]. They are rich sources of oil, carbohydrates, carotene, ascorbic acid, retinol, riboflavin, folic acid and minerals like calcium, iron, zinc, magnesium, manganese and selenium depending on the vegetable consumed (Fasuyi, 2006; Ihekoronye and Ngoddy, 1985) [7, 11]. Ononugbu (2002) [15] reported that vegetable fats and oil lower blood lipids thereby reducing occurrence of disease associated with damage of coronary artery. It is worthwhile to note that consumption of numerous types of edible plants as sources of food could be beneficial to nutritionally marginal population especially in developing countries where poverty and climate is causing havoc to rural populace. However, low consumption of green leafy vegetables in diet is one of the major factors which lead to deficiency of vitamins and iron. Minerals and vitamins cannot be synthesized by animals and must be provided from plants or vitamins and mineral-rich water. Therefore leafy vegetables are essential for human health.

**Green leafy vegetables source of nutrients**

**Antioxidant:** Green leafy vegetables have been recognized most abundant sources of protein, vitamins and minerals (Aletor *et al.*, 2002; Shukla *et al.*, 2006) [1]. Green leafy vegetables have been traditionally recognized as good sources of antioxidant. Antioxidants are molecules that fight with free radicals in your body. Free radicals are compounds that can cause harm if their levels become too high in your body. They are linked to multiple illnesses, including diabetes, heart disease, and cancer. Antioxidants vitamins like ascorbic acids, phenols etc. are important in human food since they function as an anticancer agent (Shibata *et al.*, 1992, Yadav *et al.*, 2013) [19, 21]. Antioxidant rich green leafy vegetable like garden spinach leaf, water spinach leaf, Indian spinach leaf, and green leaved amaranth. It has been found that the total antioxidant activity was highest in *Murraya koenigii* (2,691.78 µmol of ascorbic acid/g sample) and least in *Centella asiatica* (623.78 µmol of ascorbic acid/g sample (Gupta and prakash 2009) [9]. Amagloh *et al.*, 2017 studied that moringa had the highest levels of β-carotene and ascorbic acid. Priya *et al.*, 2019 [16] found that total antioxidant activity was found to be high in spinach with value of 0.60mg/100grams among the samples analyzed. Yadav *et al.*, 2013 [21] concluded that the amaranth, chenopod, spinach had the high antioxidant activity and could be utilized for improving the efficiency of different nutraceutical and pharmacological products. The consumption of these may play a role in preventing human diseases in which free radicals are involved such as cancer, cardiovascular diseases and aging.

**Vitamines:** Green leafy vegetables are abundant sources of vitamins (Arasaretnam *et al.* 2018) [2]. Vitamin C is an antioxidant and an important part of the immune system, which defends against viruses, bacteria, and other pathogens. Studies show that low levels of vitamin C lead to problems with the immune system and other illnesses (Berry, 2019) [4]. For instance, any species of Amaranths are excellent source of vitamin C (Jiménez *et al.*, 2017) [12]. The data obtained from USDA national nutrient database (Edelman and Colt 2016) [6] clearly shows that vitamin A and K1 (Phylloquinone) in leafy vegetables are exceptionally high for kale and spinach than the cereals and pulses. In addition, cereals and pulses are devoid of vitamin C whereas, leafy vegetables are the potential sources of vitamin C with good amount in kale (1014mg/100g). Adebayo, 2019 investigated four green leafy vegetables from the two different zones show that all the investigated vegetables are good source of vitamins with vitamin C being highest. Settaluri *et al.* 2015 found that among the five green leafy vegetables the ascorbic acid content was highest in lettuce. Asparagus had been reported to contain up to 262 µg of folic acid additionally it fulfills the need of vitamin K, vitamin C, vitamin A, and manganese (Bansal *et al.* 2018) [3]

**Dietary fibre:** Green leafy vegetables have been traditionally recognized as good sources of dietary fiber (Gopalan *et al.* 2000). Literature information showed that Indian Green leafy vegetables such as basella (*Basella rubra*), fenugreek (*Trigonella foenum graecum*), hibiscus (*Hibiscus cannabinus*), coriander (*Coriandrum sativum*), cabbage (*Brassica oleracea*) and spinach (*Spinacia oleracea*) are good sources of soluble dietary fiber content. Arasaretnam, 2018 [2] found that dietary fiber content of green leafy vegetables is the highest in *P. latifolia* (15.30%)

**Proteins:** Green leafy vegetables are the richest and cheapest sources of proteins. Protein is a nutrient needed by the human body for growth and maintenance. Next to water, proteins are the most abundant kind of molecules in the body. Protein can be found in all cells of the body and is the major structural component of all cells in the body, especially muscle. Settaluri found that among the five green leafy vegetables the protein content was highest in parsley. Recent evidence showed that green leafy vegetables such as spinach (*Spinacia oleracea*), broccoli (*Brassica oleracea var. Italic*) and duckweed (*Lemna perpusilla*) provide all the essential amino acids that meet the FAO nutrition standards (Edelman and Colt 2016) [6].

**Minerals:** Minerals are inorganic chemicals that your body needs to function properly. There are millions of tiny cells in our body that require essential nutrients to grow. These nutrients like iron, calcium, zinc, selenium are derived from various sources. These minerals can help in maintaining fluid balance, building bones, hormonal balance, carbohydrate metabolism, muscle contraction and secreting hormones. Many of the diseases that we have occur due to misbalance of minerals in our body. Minerals cannot be synthesized by humans and animals thus they must be provided through food and water (Mohammed and Sharif, 2011) [13]. Dark leafy greens are source of essential minerals. The predominant elements found in green leafy vegetables calcium, copper, iron, potassium, magnesium, and zinc. Dark leafy greens are a great low-calorie addition to any meal. High

mineral dark leafy greens include spinach, kale, swiss chard, and turnip greens. Dulce *et al.* 2017 *Amaranthus acanthochiton* had the highest concentrations of Ca, Mg, Ni, Zn, and A. *deflexus* and A. *viridis* had the highest concentrations of Fe. Singh, 2001 analyzed six green leafy vegetables and herbs- spinach, amaranth, bengal gram, cauliflower, mint, coriander and carrots – were for moisture, protein, ascorbic acid, β-carotene, total iron, ionizable iron (as % of total iron) in vitro iron (% of total iron), copper, manganese and zinc. Moisture content of the leaves and carrots varied from 75.1 percent (bengal gram) to 95.4 percent (carrot) and protein from 9.83 percent (carrots) to 30.9 (mint) percent. Ascorbic acid, β-carotene, total iron and ionizable iron contents were at a maximum in case of bengal gram leaves whereas level of ionizable iron and in vitro iron as a percent of total iron was highest in carrots. Copper, manganese and zinc contents were maximum in spinach.

### Conclusion

Green leafy vegetables are considered to be one of the cheapest vegetables in the market and it could be rightly described as ‘poor man’s vegetables’. Seeing the potential of Green leafy vegetables as a cheap source of antioxidants and other nutrients. Green leafy vegetables have plenty of vitamins, minerals and disease-fighting chemicals. Vegetables that contain beta-carotene, such as spinach, help in the growth and repair of body tissues. Green leafy vegetables are good sources of folate, which can reduce your risk of cardiovascular disease and memory loss as well as warding off depression. Hence, consumption of green leafy vegetables benefits human health by improving nutritional status and reducing risks of specific diseases like diabetes, cancer and hepatotoxicity.

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