



EFFECT OF PROCESSING ON THE NUTRIENT COMPOSITION OF SELECTED GREEN LEAFY VEGETABLES

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ABSTRACT

People from all around the world have an increased level of interest as a direct result of the many health benefits offered by green leafy vegetables. This study investigates the nutritional worth of a wide variety of dark green vegetables that are ingested on a regular basis. It is possible that the prevention of major diseases may be aided by eating a sufficient amount of green leafy vegetables every day. Consuming a diet that is abundant in these vegetables may be able to assist individuals, particularly those who are already at a nutritional disadvantage, in meeting their requirements for the various nutrients they need on a daily basis. Vegetables are an inexpensive and abundant source of dietary fiber, vitamins, minerals, essential amino acids, and compounds that prevent illness. These nutrients may be found in vegetables in large quantities. Since different leafy greens originate from different plant families, their nutritional profiles might vary quite a bit from one another. The objective of this research is to evaluate the nutritional value of various plant kinds and to determine the extent to which these differences may affect nutritional status. If you want to keep your weight in a healthy range and maintain a good body composition, you can consider eating more green leafy vegetables. These vegetables are low in calories but high in essential nutrients such as folic acid, vitamin C, vitamin K, magnesium, potassium, and dietary fiber. As a major source of nutrition, leafy greens are preferable than grains because they contain a greater quantity of the mineral components iron and calcium than grains do. In addition, plants that come from spinach, asparagus, lettuce, mustard green, colocasia green leaf, and turnip green have a much higher concentration of folic acid than other leafy vegetables and vegetables that do not have leaves. As a consequence of this, there has to be more of an emphasis placed on boosting both the demand for and supply of these greens.

Keywords: *nutritional components, green leafy vegetables, proteins, vitamins, minerals*

INTRODUCTION

Green leafy vegetables have a significant place among food crops due to the high levels of vitamins and minerals that are included inside them. They have a plethora of nutrients, including vital vitamins and minerals like as calcium, iron, phosphorus, and folic acid, amongst others. There are several types of healthy greens that are now going to waste since



their use is not very widespread. People who live in countries with a lower standard of life particularly benefit from include more dark green leafy vegetables in their diets. India is home to a diverse array of leafy greens due to the fact that the country's terrain, climate, and seasons are all quite distinct from one another. Huge amounts of the leaves of annuals, perennials, and aquatic plants are consumed. The plants may be either land or water-based. Examples of popular green vegetables include spinach (*Spinacia oleracea*), amaranth (*Amaranthus gangeticus*), fenugreek (*Trigonella foenum graecum*), drumstick (*Moringa oleifera*), cabbage (*Brassica oleracea* var. *capitata*), bathua (*Chenopodium album*), and so on. These veggies are not only inexpensive but also productive, fundamental to the regional cuisine, and not hard to get by. The leaves of many plants, such as the curry plant (*Murraya koenigii*), the coriander plant (*Coriandrum sativum*), the mint plant (*Mentha spicata*), the bay plant (*Laurus nobilis*), and the basil plant (*Ocimum basilicum*), are harvested and used as spices. Because of the high levels of vitamins, essential fatty acids, minerals, amino acids, dietary fiber, and other bioactive components that are found in vegetables, they are sometimes referred to as "protective foods." Vegetables provide a wide range of health benefits and are frequently referred to in this context. More and more individuals, particularly younger people, are becoming ignorant of the fact that these nutrient-dense food plants are readily available. They are fantastic for maintaining your health and protecting you from becoming sick, which is why they should be included in the diet of everyone. Not only are they a pleasant addition to the menu, but they are also a significant source of minerals, vitamins, fibers, proteins, and other nutrients that may be absent in the diet of a normal rural resident. Greens are often recommended for dieters due to the low number of calories contained in each serving. One of the many different vitamins, vitamin C is an essential component for the human body to have in order to keep its metabolic processes in a healthy state. Vitamin C is an essential component for the enzymes that are responsible for the production of collagens and carnitine. Vitamin C, an antioxidant that is water-soluble, plays a significant role in the human body. There are several different vital elements that may be found in green leafy vegetables, some of which are iron (Fe), calcium (Ca), phosphorus (P), copper (Cu), zinc (Zn), sodium (Na), and chloride (Cl) (table 1). Green leafy vegetables are an excellent source of several nutrients and elements, including iron (Fe), calcium (Ca), potassium (K), and sodium (Na), amongst others. The use of dark lettuces on a consistent basis, which are rich in vitamins A, C, and K, has been related to improved visual acuity, bone and skin health, and the ability to properly coagulate blood. To put it another way, spinach is one of the foods that has the highest concentration of nutrients since it has a low calorie count but yet manages to provide a significant amount of important vitamins and minerals. Folic acid, vitamin A, and vitamin C are all abundant in this food item's supply. Because heat breaks down the oxalate in the green, spinach is more nutritious when cooked than when ingested raw. This is because cooking spinach makes the calcium in the green's diet more easily accessible. Beneficial secondary metabolites, such as antioxidants and phenolic compounds, may be found in plants. In a report that was published in 2003, the World Health Organization and the Food and Agriculture Organization of the United Nations recommended eating a minimum of 400g of fruit and vegetables every day (with the exception of potatoes and other starchy tubers). This was done for the purpose of preventing chronic diseases such as heart disease, cancer, diabetes, and obesity, as well as the prevention and alleviation of several micronutrient deficiencies. In addition, this was recommended for the purpose of preventing and alleviating several other deficiencies. According to HHS and

USDA guidelines (2015), an individual should consume at least five of the necessary nine daily pieces of fruits and grains in the form of vegetables. Additionally, one of the five pieces of veggies should consist of green leafy vegetables. Folate is abundant in liver, as well as in other organ meats, vegetables, fruits, Brewer's yeast, legumes, and green leafy vegetables like spinach. Folate is also found in high concentrations in green leafy vegetables like spinach. Consuming a broad range of meals is recommended by nutritionists and dietitians since no one vegetable can provide all of the body's requirements for the nutrients essential to good health and well-being. Increasing the diversity of vegetable crops that are grown as well as the nutritional value of those crops has the potential to improve food and nutrition security on a global scale.

Folic acid is required for the development and proliferation of red blood cells, and you could obtain enough of it by eating a lot of fresh green vegetables. Folic acid is essential for the development and proliferation of red blood cells. Cabbage delivers more than 20% of the daily value for both vitamin C and vitamin K in a single serving, making it an excellent source of both nutrients. Cabbage does not include any other major levels of nutrients per 100 gram serving in addition to fiber, vitamin B6, and folate, which are the only nutrients that cabbage does contain. Dark green lettuces include varieties such as romaine lettuce (*Lactuca sativa* L. var. *longifolia*), arugula or tara mira (*Eruca vesicaria*), and butter head lettuce (*Lactuca sativa* L. var. *capitata*). The most typical method to eat these nutritious leaves, which are dry and have a little astringency, is to prepare them in the form of a raw salad. Many people believe that phytochemicals, which is a catchall term for a large range of bioactive molecules that are produced from plants, are crucial to maintaining good health. Similar to essential fatty acids, proteins, vitamins, minerals, and phenolic compounds, phytochemicals are a kind of nutrient that may be found in plants. Unutilized food sources are gaining in importance as a potential means of increasing the amount of food available on a per-person basis.

Table 1: Nutritional composition of some green leafy vegetables (per 100 g edible portion)

Vegetables	Macronutrients					Vitamins				Minerals		
	Energy	Moisture	Protein	Fat	Carbohydrate	Thiamine	Riboflavin	Niacin	Ascorbic	Calcium	Phosphorus	Iron
Spinach	26.0	92.1	2.0	0.7	2.90	30	260	500	28	73	21	1140
Coriander	44.0	86.3	3.3	0.6	6.3	50	60	800	135	184	71	1420
Mint leaves	48.0	84.9	4.8	0.6	5.8	50	260	1000	27	200	62	1560
Fenugreek	49.0	86.1	4.4	0.9	6.0	40	310	800	82	395	51	1930
Bathua	30.0	89.6	3.7	0.4	2.9	10	140	600	35	150	80	4200
Cabbage	27.0	91.9	1.8	0.1	4.6	60	90	400	124	39	44	800
Amaranth	45.0	85.7	4.0	0.5	6.1	30	30	1200	99.0	397	83	3490
Drumstick	38.0	75.9	6.7	1.7	4.1	60	50	800	52	440	70	850

Source: Gopalan *et al.*, (2004).



Nutritional components in green leafy vegetables Dietary fiber

According to the common understanding, eating green leafy vegetables is one of the most effective methods to get the recommended amount of fiber each day. According to the findings of epidemiological studies, consuming enough amounts of dietary fiber, especially the fiber that can be found in green leafy vegetables like celery, cabbage, spinach, and lettuce, is critical for lowering one's risk of developing a variety of diseases. It has been hypothesized that the capacity of fiber to decrease the absorption of cholesterol generated by the body to assist in fat breakdown is responsible for the cholesterol-lowering benefits of fiber. Compounds present in vegetables belonging to the cabbage family, such as cabbage, cauliflower, turnips, and brussels sprouts, have the potential to be useful in the prevention of cancer. Both spinach and cabbage are excellent sources of the dietary fiber that your body needs. According to the aforementioned body of research, green leafy vegetables indigenous to India, such as cabbage, spinach, fenugreek, coriander, and basella, may contain a significant amount of soluble dietary fiber. A diet that is high in vegetable fiber is beneficial for the digestive system, the body weight, the risk of cardiovascular disease, and maybe colon cancer as well. Most significantly, it assisted those who were struggling with problems such as obesity, diabetes, diverticulitis, and constipation.

Vitamins

The nutritional value of spinach is comparable to that of other dark leafy greens. Boiled spinach has a vitamin A level that is equivalent to 229% of the daily value per half-cup serving (573 mcg). Consuming spinach may improve one's cardiovascular health and lead to a drop in blood pressure, according to some available research. The amounts of vitamin C are greatest in recently produced leaves and gradually decrease in more mature plants. When it comes to their nutritional value, the inner white leaves of lettuce and cabbage are not nearly as beneficial as the outside green leaves. Less calories and a greater concentration of nutrients are often found in leaves that are larger but thinner. Carotenoids, such as beta-carotene, are found in plant-based diets, and the body is responsible for converting these carotenoids into vitamin A [49]. Beta-carotene is a powerful antioxidant that may be found in abundance in green leafy vegetables. In leaves, vitamin-A can be found in the form of provitamin-A carotenoids such as beta-carotene (ca. 25-30%), alpha-carotene, beta-cryptoxanthin, and gamma-carotene, as well as non-provitamin-A carotenoids such as lutein (ca. 45%), violaxanthin (ca. 15%), and neoxanthin (ca. 15%). The content of carotenoids in green leafy vegetables is greatly affected by preparation techniques such as heating, boiling, and steaming [40]. A study that looked at the nutritional value of 30 different green leafy vegetables revealed that several of them had a significant amount of the pigment lutein (37), as well as a wealth of various vitamins. For example, there is evidence that all types of amaranth plants contain significant amounts of vitamin C [26]. In addition, the vitamin



content of seeds and leafy plants may be compared to one another.

For instance, evidence obtained from the USDA's national nutrition database [50, 52] reveals that kale and spinach contain much greater quantities of vitamin A and K1 (Phylloquinone) compared to grains and pulses. In comparison to the vitamin E content of other green vegetables and seeds, the amount of vitamin E found in duck weed is rather high at 45.7 micrograms per 100 grams. Folate is a molecule that can be dissolved in water and is classified as vitamin B9. The ramifications of not getting enough folate on both the metabolic and clinical fronts are catastrophic. Folate is mostly derived by humans via the consumption of plant-based foods, namely dark green leafy vegetables. A diet that is mostly composed of cereal grains and tubers often has a low foliate content, which may be remedied by the consumption of green leafy vegetables. Folic acid is often supplemented with colocasia leaves (*Colocasia esculenta*), which are native to India. However, it has been noticed that the foliate content of food is reduced by about half or more when it is heated. Cooking vegetables for a lengthy amount of time in a significant quantity of water is one of the primary contributors to this issue. Because it has a high concentration of minerals and nutrients, the water used to boil vegetables should be drunk [30]. Using a high-performance liquid chromatography (HPLC)-DAD-MS/MS based approach that was developed by Santos et al. [46] (Table 2), water-soluble vitamins (B1, B2, B3, B5, B6, B9, and C) and fat-soluble vitamins (pro-vitamin A, and vitamin E) may be readily extracted and monitored in a sequential way. This is possible both for the vitamins themselves as well as for their precursors.

Table 2: Vitamins composition for some green leafy vegetables

Vitamins concentrations	Leaf	
	Kale	Spinach
Vitamin A, IU	130,000	85,500
Vitamin-B1, mg	0.9	0.9
Vitamin-B2, mg	0.9	1.8
Vitamin-B5, mg	0.9	0.9
Vitamin-B6, mg	2.5	1.8
Vitamin-C, mg	1014	256



Vitamin-E, mg	9.3	18.2
Vitamin-K1, mg	6900	4400

Source: (Edelman and Colt, 2016)

Proteins:

Green leafy vegetables are a good source of protein since they are inexpensive and have a high concentration of the nutrient. The nutritional value of a protein may be evaluated based on its content of essential amino acids, which humans are unable to manufacture on their own and must instead get from their diet. If only one of these amino acids is in short supply, it might lead to poor growth in both animals and humans, as well as a loss of nitrogen from the meal. The 10 essential amino acids are lysine, isoleucine, leucine, phenylalanine, tyrosine, threonine, tryptophan, valine, histidine, and methionine. C. album has all of these amino acids in their natural forms. Growing C. album has a number of advantages, one of which is that the plant's vegetative matter is an excellent source of protein. Proteins are necessary for all forms of life because they play a role in the activities that occur inside cells, the construction of cells, and the regulation of metabolic processes. As a result, eating sufficient amounts of proteins need to be a priority for everyone. This is due to the fact that they are able to make use of the abundant sunlight, water, oxygen, and nitrogen that is available in the air in order to synthesize and store amino acids. The nutritional value of a protein may be evaluated based on its content of essential amino acids, which humans are unable to manufacture on their own and must instead get from their diet. If only one of these amino acids is in short supply, it might lead to poor growth in both animals and humans, as well as a loss of nitrogen from the meal. Proteins are large, intricate molecules that are made up of a diverse array of amino acid sequences in a certain order. An enzyme known as ribulose-1,5-bisphosphate carboxylase/oxygenase (RUBISCO), which is found in the chloroplasts of leaves, is responsible for almost half of the total cell protein found in a leaf.

It plays a critical role in the process of photosynthesis, which fixes atmospheric carbon. The RUBISCO protein is found in all green leafy plants; the only difference between them is in the tiny amino acid clusters that make up their individual clusters. It was recently discovered that green leafy vegetables, such as spinach (*Spinacia oleracea*), broccoli (*Brassica oleracea* var. *italica*), and duckweed (*Lemna perpusilla*), have adequate quantities of all nine necessary amino acids to meet the FAO dietary requirements [9]. Evidence indicating that the amino acid profile of cassava (*Manihot esculenta*) leaves is comparable to that of pulses and dairy products provides support for the use of cassava (*Manihot esculenta*) leaves as a green leafy vegetable [14]. Both the green leaves of septic weed (*Senna occidentalis*) and the green leaves of cassava (*Manihot esculenta*) are examples of leafy vegetables that provide 7 grams of protein for every 100 grams of fresh weight. This is higher than the quantity of protein that



is found in typical leafy greens such as cabbage (*Brassica oleracea Capitata*), which is 1 g of protein for every 100 g of fresh weight. The amount of protein that is included in greens may vary greatly depending on the conditions under which they were produced and the temperature at the time.

Minerals

The greens that fall under this group are very high in a wide range of minerals, including calcium, iron, vitamins A, B2, and C, as well as fiber. This meal also contains a large amount of magnesium and iron, representing respectively 17% and 20% of the recommended requirement for each nutrient. Magnesium is essential for around 300 separate chemical processes that take place in the human body. Vitamin K-1, also known as phyloquinone, may be found in green leafy vegetables and other types of plants. The zinc content of *C. album* is much greater than the bulk of the values that have been reported for green leafy vegetables. Zinc is essential for the healthy functioning of the immune system. Shahi (1977) spent two years gathering data from the field and discovered that *C. album* contained very high quantities of the minerals nitrogen, phosphorus, potassium, magnesium, and manganese. As the plant matured, the amount of nutrients it contained became less. According to study conducted by Guerrero and Isasa (1997), the mineral content of kale is much greater than that of the majority of other types of greens.

According to the World Health Organization (1996), the status of micronutrients is now an essential component of the equation used to determine overall malnutrition. It is impossible to attain optimal growth and function if vitamin deficiencies are not treated alongside attempts to raise the status of the body's protein and energy stores. Because metal ions play critical roles as cofactors in the activities of enzymes and in the maintenance of protein structures, human health and well-being are dependent on the presence of metal ions. A lack of iron in the diet is a potential cause of anemia in both females and young children. When zinc levels are low, both the digestive and immune systems have difficulty performing their normal functions. The mineral composition of seeds and fresh green leaves are compared in Table 2, which may be found below. The figures demonstrate that green leafy vegetables contain a significant amount of mineral elements. Some foods that are high in zinc include duck weed (15 mg/100g), spinach (1036 mg/100g), magnesium (827 mg/100g), iron (28.4 mg/100g), and sodium (827 mg/100g). Spinach is also high in calcium (1036 mg/100g). Cooking does not have nearly the same detrimental effect on minerals as it does on vitamins and proteins.

Table 3: Minerals composition of some green leafy vegetables (mg per 100 g)

Minerals	Green Leafy Vegetables	
	Kale	Spinach
Magnesium	265	827
Phosphorus	519	513
Potassium	2769	5840
Calcium	846	1036
Sodium	214	827
Iron	8.3	28.4
Zinc	-	3.2

Source: (Edelman and Colt, 2016).

Essential fatty acids

Because the human body is unable to produce omega3 on its own, we must get it from the consumption of food or nutritional supplements. Because of the many positive effects it has on your body, this medication is sometimes referred to as a "wonder drug." The possibility of developing cardiovascular illness is reduced, cognitive capacities are improved, memory is fortified, blood pressure is brought back to normal, and diabetes may be brought under control. Vegetables with green leafy parts include alpha-linolenic acid, which is the precursor of omega-3 fatty acid. Omega-3 fatty acid has been demonstrated to have beneficial benefits on human health. Omega-3 fatty acids are necessary for regular growth and development, and they also play a vital part in the prevention and treatment of cardiovascular disease, high blood pressure, diabetes, arthritis, cancer, and other inflammatory and autoimmune illnesses. Omega-3 fatty acids are required for normal growth and development. It is common knowledge that essential fatty acids have a part in both the prevention and treatment of a variety of chronic diseases. According to the research that is now available, omega-3 fatty acids are found in higher concentrations in wild plants than in farm-raised ones. According to the same study, one gram of butter crunch lettuce had 0.6 milligrams of alpha-linolenic acid, while one gram of red leaf lettuce contained 0.7 milligrams, and one gram of mustard greens included 1.1 milligrams. Spinach contained 1.7 milligrams per gram of alpha-linolenic acid, whereas mustard greens contained 1.1 milligrams per gram. The presence of fatty acids in leaf samples may be determined with the use of gas chromatography. Research has indicated



that eating spinach may have a beneficial impact on a person's cognitive function, memory, cardiovascular health, blood pressure, and energy levels. Additionally, spinach has a rather high concentration of omega-3 fatty acids. Omega-3 may be found in spaghetti spinach at a rate of 370 milligrams per 100 grams.

CONCLUSION

Green leafy vegetables are a good source of several nutrients that are necessary for human health and well-being. Foods that are deficient in this area may be improved by adding green leafy vegetables, which are rich in important micronutrients and can be found in plenty in green leafy vegetables. There are many examples of nutrients, some of which include fiber, vitamins, minerals, amino acids, and essential fatty acids. Green vegetables that are traditionally grown are available throughout the year in rural areas, which makes them an important source of various nutrients. Additionally, it has significant beneficial benefits on both the economy and society. Green leafy vegetables are often suggested as the nutritional supplement that provides the most value for the money in order to address nutritional deficiencies. The applications of herbs and medicinal plants encompass a broad spectrum of illnesses and settings, including those encountered in conventional Western medicine. There is the potential for the edible leaves of native and underused plants to be used in food and medicine, as well as for possible incorporation into traditional agricultural practices. If more research is conducted on the varieties of green leafy vegetables that are now accessible and the viability of applying suitable agronomic practices, it is possible that the nutritional value of these vegetables might be enhanced. Before consuming green leafy vegetables, it is recommended to first subject them to thermal processing such boiling, heating, or blanching to reduce the amount of anti-nutrients present. The results suggest that if vegetables were consumed in the proper proportions, they may give great protection against diseases that are caused by malnutrition and help significantly to completing the nutritional requirements for healthy growth. The results of this study provide credence to the hypothesis that leafy greens are high in water content. It is well known that these kinds of meals generally have a low lipid content, and it is true that the fat content of all green leafy vegetables is rather low. These results suggest that a diet that is high in vegetables may be protective against diseases that are caused by undernourishment and may aid greatly in addressing the nutritional demands of children who are growing.

REFERENCES

1. Aletor O, Oshodi A, Ipinmoroti K. Chemical composition of common leafy vegetables and functional properties of their leaf protein concentrates. *Food Chemistry*. 2002; 78(1):63-68.
2. Asaolu SS, Adefemi OS, Oyakilome IG, Ajibulu KE, Asaolu MF. Proximate and



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- Mineral Composition of Nigerian Leafy Vegetables. *Journal of Food Research*. 2012; 1(3):214-218.
3. Britton G. Carotenoids. In: Hendry GAF, *et al*, editors. *Natural food colorants*, Springer, USA, 1996, 197-243.
 4. Baudoin WO, Louise Fresco O. Food and nutrition security towards human security. *ICV Souvenir Paper*, Italy, 2002, 1-19.
 5. Colonna E, Roupheal Y, Barbieri G *et al.*, Nutritional quality of ten leafy vegetables harvested at two light intensities. *Food Chem*. 2016; 199:702-710.
 6. Dias JS, Major classes of phytonutrients in vegetables and health benefits: A review. *Journal of Nutritional Therapeutics*. 2012; 1(1):31-62.
 7. *Dietary Guidelines for Americans 2015–2020*. 8th ed. USA; 2015, 1-144.
 8. Da Silva Dias Joao Carlos, Imai S. Vegetables consumption and its benefits on diabetes. *Journal of Nutritional Therapeutics*. 2017; 6(1):1-10.
 9. Edelman M, Colt M. Nutrient value of leaf vs. seed. *Front Chem*. 2016; 4:1-32.
 10. FAO W. Human vitamin and mineral requirements Report of a Joint FAO/WHO Expert Consultation, Bangkok, Thailand. Food and Nutrition Division, FAO, Rome, Italy, 2001, 1-303.
 11. Fathima Begum K, Rajalakshmi D. “Microwave Drying of selected greens and their sensory characteristics,” *Plant food for human nutrition*. 2001; 56:303-311.
 12. Fresco Louise O, Baudoin Wilfried O. Food and Nutrition Security towards Human Security, Food Security and Vegetables–A Global Perspective, P.N. Agricultural Science Foundation, Bangalore, India, 2004, 7-42.
 13. Judith Shaber t K. in *Encyclopedia of Gastroenterology*, 2004.
 14. Fasuyi AO. Nutrient composition and processing effects on cassava leaf (*Manihot esculenta crantz*) anti nutrients. *Pakistan Journal of Nutrition*. 2005; 4(1):37-42.
 15. Grusak MA, Della Penna D. Improving the nutrient composition of plants to enhance human nutrition and health. *Annu Rev Plant Physiol Plant Mol Biol*. 1999; 50(1):133-161.
 16. Gopalan C, Ramasastri B, Balasubramanian S. *Proximate principles: Common foods*.
-



Nutritive Value of Indian Foods (Revised and Updated Edition). Hyderabad, India: National Institute of Nutrition, ICMR, India, 2000, 53-55.

17. Galloway R. Anemia prevention and control: What works part I: Program guidance, USA, 2003, 1-77.
18. Gopalan C, Sastri R, Balasubramanian SC. Nutritive value of Indian foods. National Institute of Nutrition, ICMR, Hyderabad, 2004, 52.
19. Gibson RS, Perlas L, Hotz C. Improving the bioavailability of nutrients in plant foods at the household level. Proc Nutr Soc. 2006; 65(2):160-168.
20. Guil Guerrero JL, Torija Isasa ME. Fatty acid profiles of Mediterranean wild edible plants. In: Sánchez Mata M, *et al*, editors. Mediterranean wild edible plants, Springer, USA, 2016, 173-186.
21. Guerrero JLG, Isasa MET. Nutritional composition of leaves of *Chenopodium* species (*C. album* L., *C. murale* L. and *C. opulifolium*. Int J Food Sci Nut. 19
22. Hamazaki T, Okuyama H. Fatty acids and lipids–New findings. Karger Medical and Scientific Publishers, Japan, 2001, 1-53.
23. Hassan LG, Umar KJ. Nutritional value of Balsam apple (*Momordica balsamina* L.) leaves. Pakistan Journal of Nutrition. 2006; 5:522-529.
24. Iheshiulo EM, Abbey L, Asiedu SK. Response of kale to single–dose application of K humate, dry vermicasts, and volcanic minerals. International Journal of Vegetable Science. 2017; 23(2):135-144.
25. Jenkins DJ, Kendall CW, Popovich DG *et al.*, Effect of a very–high–fiber vegetable, fruit, and nut diet on serum lipids and Colonic function. Metabolism. 2001; 50(4):494-503.
26. Jiménez Aguilar DM, Grusak MA. Minerals, vitamin C, phenolics, flavonoids and antioxidant activity of Amaranthus leafy vegetables. Journal of Food Composition and Analysis. 2017; 58:33-39.