## CHAPTER 10

# GREEN LEAFY VEGETABLES: A POTENT FOOD SOURCE

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## INTRODUCTION

India, endowed with climatic conditions provides opportunities for growing an array of green leafy vegetable, which form second important category of vegetables. These green leafy vegetables are mostly rich in essential minerals, vitamins and dietary fibre and have therapeutic properties. A number of greens are cultivated in India throughout the year. Some are suitable for growing during winter eg. Palak, spinach, fenugreek and mustard and others such as amaranthus, portulaca and poi are suitable for growing during summer. The ten most popular green leafy vegetables are spinach, amaranthus, fenugreek, agathi, mustard, mint, gogu, alternanthera, drumstick leaves and coriander. Besides these, great variety of less familiar green leafy vegetables are also used locally in different parts of the country. GLVs (Green Leafy Vegetables) are vegetables whose young shoots, leaves and flowers are edible. They have excellent nutritional value and can be used for medicinal benefits. Concentration of functional compounds varies according to the climate season, their growth phase and their existence in particular plant.

Dark green leafy vegetables are good sources of minerals like iron, calcium, potassium, and magnesium and vitamins including K, C, E, and many of the B vitamins. They also provide a variety of phytonutrients including beta-carotene, lutein, zeaxanthin, and Omega- 3 fatty acid which protect cells from damage and age-related problems (Sreenivasa Rao, 2017).

## PHYTOCHEMICALS IN GREEN LEAFY VEGETABLES:

The phytochemicals present in green leafy vegetables includes phenolic acids, flavonoids, carotenoids, polyphenols, glucosinolates, isothiocyanate, allylic sulfides, phytosterols, and monoterpenes .

## COMPONENTS OF GREEN LEAFY VEGETABLES:

Green leafy vegetables mostly contain antioxidants, dietary fibers, minerals, α-linoleic acid, and vitamins. Antioxidants reduce ferric ions and mitigate oxidative stress. Dietary fiber delay absorption of carbohydrates and improve insulin secretion. Minerals such as magnesium and phosphorous protect against gestational diabetes. α linoleic acid determines composition of phospholipid bilayer and insulin sensitivity within skeleton muscles. Vitamins such as α-tocopherol(Vit. E), β-carotene (Vit. A), ascorbic acid (Vit. C) Reduces oxidative stress.

## HEALTH BENEFITS:

Green leafy vegetables with phytochemicals and enormous antioxidants have potential to work as: anti-diabetic prevents CVD,anti-hypertensive, anti-carcinogenic, anti-anemic, improves gut health.

## GREEN LEAFY VEGETABLES AND ANTI-DIABETIC PROPERTIES:

Diabetes Mellitus is spreading everywhere in the world and it is categorized as a non-communicable disease. By 2025, it has been proposed that approximately 300,000,000 people would be affected by this disease. GLVs (Green leafy vegetables) contain decent quantity of minerals, alpha tocopherols, vitamins, flavonoids, α-linoleic acid, phytochemicals.

It has been seen in one of the studies that females who consume leafy green vegetables are at low risk to develop type 2 diabetes. Green leafy vegetables can decrease the chance of developing type 2 diabetes because of magnesium present in these vegetables as one of the researches has proved that magnesium can decrease the risk of type 2 diabetes development.

## GREEN LEAFY VEGETABLES AND ITS CARDIO PROTECTIVE EFFECTS:

CVD includes the diseases related to heart and blood vessels 12 like stroke hemorrhage, heart failure.13It has been reported that about 80% of males and 75% of females died annually due to cardio vascular diseases.12 In Pakistan, 30 to 40 per cent of all deaths.The risk factors for CVD includes smoking, age, physical inactivity, alcohol consumption, obesity, family

history, diabetes mellitus, high blood cholesterol level, poverty and inadequate vegetables and fruits consumption. There is very low data available on the effect of vegetables and fruits in lowering the risk of heart diseases. One of the researches conducted to observe the effect of consumption of fruits and vegetables in lowering risk of heart diseases. It was observed that people who consume fruits and vegetables especially leafy green vegetables have low risk to develop CVD as compare to those who does not consume them.


In another study researchers studied the mechanism of green leafy vegetables related to the protection against heart diseases. Researchers noticed that inorganic nitrate present in green leafy vegetables was converted to nitric oxide and nitrite in oral cavity which were seen to have vasodilation property and tissue protective effect, thus lowers the risk of CVD. In different Indian areas, a clear difference has been seen in the prevalence and mortality due to cardiovascular disease. An investigation was done to examine the importance and numerous dietary factors and other variables in everyday life to describe the variation death rate of cardiovascular disease. Survey results showed that death due to cardiovascular disease was linked with literacy level, smoking, prevalence of overweight and obesity, prevalence of stunted growth at 3-years, dietary consumption of calories, adult mean body mass index, green leafy vegetables, cereals and pulses, roots, milk and milk products, tubers and other vegetables, sugar, jaggery and fats and oils. A noteworthy negative link of cardiovascular disease mortality with green leafy vegetable intake was seen. On the contrary, a positive link between cardiovascular disease mortality with intake of milk and milk products, sugar and prevalence of obesity was observed. A meta-analysis was done to see that intake of GLVs (green leafy vegetables) as well as cruciferous vegetables considerably decreases the incidence of CVD

(cardiovascular disease). Studies examined the positive correlation between the intake of GLVs (green leafy vegetables) and occurrence of CVD (cardiovascular disease) and met the encompassing criteria. With different constituents of minerals, vitamins, dietary fiber, bio-active phytochemicals and carotenoids, vegetables and fruits make a heterogeneous food group.

A research was done to study the association between stroke risk in Swedish men and women and specific intake of fruits and vegetables subdivisions. This study was restricted to persons without High blood pressure (hypertension). Results concluded that risk of stroke is negatively associated with intake of fruits and vegetables especially intake of green leafy vegetables and pears and apples was negatively linked with stroke. Leafy vegetables produce reactive oxygen species and decrease the LDL oxidation and also low the monocyte adhesion to endothelial cell which lowers the chances of atherosclerosis Green Leafy vegetables and anti- hypertension effect:

Bioactive component of green leafy vegetables that prevent from hypertension includes alpha-tocopherol, Carotenoids, coumarins , omega-3-fatty acids. The antioxidants present in green leafy vegetables helps in protection against cardiovascular diseases by free radical scavenger, Induction response element, and helps in lowering oxidize LDL, lowering blood pressure, and lowering blood glucose level.

Green leafy vegetable, that are rich source of dietary nitrate and defensive against stroke and cardiovascular diseases are suggested by Epidemiological studies. The major risk factor of stroke is High blood pressure (BP) and the use of inorganic nitrate has shown to lessen the blood reassure. Analysis of the theory that vegetables containing high nitrate diets would enhance plasma nitrate and concentrations of nitrate whereas in healthy women reduce blood pressure was aim of the study. The high omega-6: omega-3 fatty acid ratio (FAR) in typical Western dietary pattern may aggravate the possibility of chronic disease. Contrarily, disease risk has been reducing by the intake of green leafy vegetable (GLVs).

The limited use of spinach has been assumed; a high dietary nitrate content containing vegetables can influence the central and peripheral blood pressure (BP) and arterial waveform analytical of arterial stiffness. Healthy candidate were erratically allocate to obtain either a low-nitrate or high-nitrate soup, by using a placebo-controlled, crossover design. The result shows that vegetable-rich diet may contribute beneficial hemodynamic effects of dietary nitrate from spinach and underline the elevated BP the management.

## GREEN LEAFY VEGETABLES AND ANTI-CANCEROUS PROPERTIES

Crucified family members are planted and consumed worldwide on regular bases. The main vegetables include banana, broccoli, radish, cauliflower, cabbage, Brussels sprouts and watercress which can be fresh (salad), steamed or cooked. In addition to nutrients, these vegetables also have health-beneficial secondary metabolites, including S-methylcysteine sulfoxide and sulfurcontaining flavonoids, glucosinolates, anthocyanin, coumarin, carotenoids, and other antioxidant enzymes. Some specific mechanisms of cancer prevention include NRF2, anti-inflammatory, polymorphism, inhibition of histone deacetylase activity, and effects on estrogen metabolism. "Bioactive compounds" are extra-nutritional components that usually happen in minor amounts in food. Their benefits on health are studied comprehensively. The epidemiology of this scientific research has resulted in numerous epidemiological studies showing the heart healthy benefits of a plant based diet on cancer and heart disease.

A powerful carotenoid, lycopene which is present in tomatoes and other fruits inhibits the growth of tumor cells in animals and also protect from prostate and other cancers. In experimental models, onion and garlic contain organo sulfur compounds, monoterpes in citrus fruits, isothiocyanates in cruciferous vegetables, cherries and monoterpes have cardio protective effects as well as anti-cancer activity.

In order to make science-based dietary recommendations many scientific researches needs to be conducted. However, there is ample proof that bioactive compounds are rich in dietary sources. So it is best to recommend whole grains, legumes, oils, nuts, fruits and vegetables rich diets.

The minimum carcinogen threat and low toxins levels of fruits and vegetables recommended that precise amount of antioxidants agents from these food sources can cause anticancerous effects without producing significant toxins. This review provides a comprehensive overview on major findings from studies on the effects of dietary antioxidants on lungs, skin, breast, prostate, and liver cancers for example curcumin, resveratrol, tea polyphenols, lycopene, genistein, lupole and pomegranate. Green leafy vegetables as anti-anemic. In anemia body have not the adequate amount of healthy red blood cells which carry appropriate amount of oxygen to the tissues of body.The very common or induced types of anaemia are included megaloblastic anaemia and Iron deficient anaemia.

## IRON DEFICIENCY ANEMIA AND GREEN LEAFY VEGETABLES:

### Folate and prevention of anemia:

The risk of chronic disease increases due to the deficiency of folate, megaloblastic anemia. A study that is conducted in China shows the link between the green leafy vegetables and their contribution in the intake of folate. Similar results show that population that consume green leafy vegetables have better source of folate than those who consumes fruits and root vegetables.

### Megaloblastic Anemia and green leafy vegetables:

70 out of 100 patients with megaloblastic anemia significantly were delivered with green leafy vegetables in the 6 months more than in the other half of the year. So the study showed that the higher incidence of onset in winter and spring may be related to an inadequate intake of folic acid due to seasonal low consumption of fresh green vegetable.

### Green leafy vegetables and gut health:

Dietary fiber is a major component of vegetables, coming in the form of cellulose (polysaccharides and lignin).Two types of dietary fibers are soluble and insoluble.

### Insoluble dietary fiber and Constipation:

Insoluble fiber does not dissolve in water and is left intact as food moves through the gastrointestinal tract. The insoluble dietary fiber has long been known to relieve constipation. Insoluble fiber adds bulk to the diet and performs the role of cleansing the digestive tract

### Soluble dietary fiber:

Soluble dietary fibre absorbs water from the digestive tract and become viscous and gelatinous in nature, thereby improves stool consistency .Because of these properties of GLV helps to relief constipation and hemorrhoids. Inulin is now also included in this class. 30-40% dietary fibers come from green leafy vegetables.

### Green leafy vegetables and dietary fiber:

Gut health has been influenced by the dietary fiber comes from green leafy vegetables, effecting the spread of disease causing bacteria. GLV can protect against or else improve

enteric infections, balance and upheld with the metabolism and immune system and fermentation of non-digestible dietary components in the large intestine.

**Benefits of dietary fibers:**

A good intake of dietary fibers provides us benefits such as improves the serum lipid concentration, blood glucose control, regularity gets promote, lower the blood pressure, helps in losing the weight moreover improves the immunity.

## CONCLUSION

The dark-green leafy vegetables made a significant contribution towards total nutrient intake of two-to five year-old children for several of the micronutrients. This contribution can potentially be increased and these vegetables be consumed more frequently and by a larger proportion of the children. This can be achieved through appropriate promotion and nutrition education programmes, e.g. promote as nutritionally rich traditional green leafy vegetables. Promotion of kitchen garden / nutrition garden for more intake of greens India is the richest source for vegetables and greens. A survey can be taken up to identify the non-traditional green leaves and their nutrient contents. The crops which are rich in nutrients can be commercially exploited.

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