

# Nutritional and Antioxidant Potential of Common Vegetables in Pakistan

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## ABSTRACT

Vegetables contain many important antioxidants and nutrients. *Daucus carota L* (carrot) is rich in hydrophilic and lipophilic antioxidants and is a good source of carbohydrates, vitamins, and minerals such as Ca, Mg, P, and Fe. It shows anti-carcinogenic, antioxidant, and immune boosting properties. It also provides protection against muscular degradation and development of senile cataract and reduces the risk of many diseases in humans. The nutritional value of *Cucurbita pepo Linn* (pumpkin) is attributed to the high level of carotenoids, carbohydrates, vitamins, other minerals. Pumpkin due to the presence of vitamin B complex, Ca and P, provides protection against many acute and chronic diseases. Pumpkin peel and pulp are the good source of antioxidants, polyphenols, carotenoids, dietary fiber and minerals such as P and Fe. Pumpkin extract shows antioxidant, antimicrobial and other activities. *Spinacia oleracea* (spinach) is a good source of essential nutrients such as carotenoids, vitamins, and minerals (P, K, Mg). Its leaves contain carotenoids, polyphenols, flavonoids, and ascorbic acid. Fresh spinach extract shows antioxidant and antimicrobial activity. *Solanum tuberosum* (potato) is rich in starch, alkaloids, flavonoids, dietary fiber, and some other minerals (K, Mg, Fe). Potato helps to overcome chronic and acute diseases and has an impact on blood pressure and gut health.

### Keywords

Carrot, pumpkin, spinach, potato, nutrients, antioxidant, vitamins.

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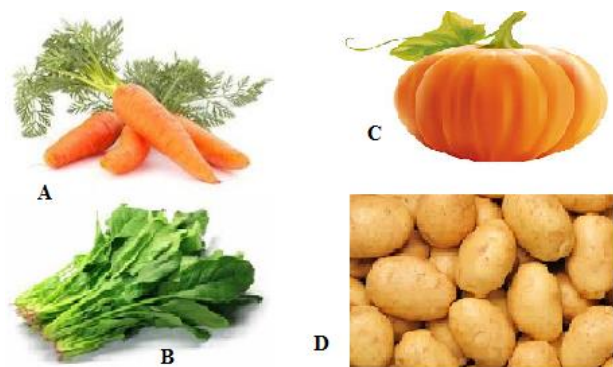
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## INTRODUCTION

Vegetables and fruits are not only the source of nutrition for human beings but also very important for maintaining health. Due to the presence of essential minerals and vitamins, the vegetables play a vital role in a diet of mankind<sup>1</sup>. They are an important source of vitamins, minerals, and fibers for human lives. However, vegetables are different from fruits due to their antioxidant activities as well as their fiber and vitamin contents. Vegetables are bioavailable because of the presence of antioxidants. Different vegetables show different antioxidant activities and provide protection against oxidative stress<sup>1</sup>. Vegetables and fruits contain a high concentration of antioxidants that help to treat many diseases such as aging, brain dysfunction, inflammation, heart disease, arteriosclerosis, arthritis, and cancer etc. The substance

which has the capacity to prevent oxidative damage to fats, proteins and nucleic acid with the help of reactive oxygen species are known as antioxidants. These reactive oxygen species primarily are reactive free radicals including alkoxyl, peroxy, hydroxyl, superoxide, and non-radicals, for example, hypochlorous, hydrogen peroxide<sup>2</sup>. Vegetables contain no of antioxidants such as vitamins A, C, and E as well as carotene all of which play a vital role in good health. They also play a significant role in different mechanisms including co-factors for certain enzymes, involvement in oxidation and reduction reaction<sup>3</sup>. In fruits and vegetables, three major groups are present which are ascorbic acid, phenolic compounds, and carotenoids. Beta carotenoids are responsible for the antioxidant defensive system. Ascorbic acid and phenolic

compounds are also called hydrophilic antioxidants and carotenoids are called lipophilic antioxidants<sup>4</sup>. In the present review, a focus has been made on the nutritional and antioxidant value of four common vegetables i.e., *Daucus carota* (carrot), *Cucurbita pepo* Linn (pumpkin), *Spinacia oleracea* (spinach) and *Solanum tuberosum* (potato) (Figure 1).



**Figure 1.** A: *Daucus carota* (carrot); B: *Cucurbita pepo* Linn (pumpkin); C: *Spinacia oleracea* (spinach); D: *Solanum tuberosum* (potato).

### ***Daucus carota* L**

The most important crop of Apiaceae Family is *Daucus carota* commonly called carrot. Carrot is a root vegetable and has the worldwide distribution. Carrot shows different colors such as white, red, orange, yellow, purple and dark purple; yellow and purple colors carrot are the first cultivation of this family. Carrot is one of the most important vegetables all over the world and its phytochemicals and polynutrients are beneficial for mankind<sup>5</sup>. Carrots are rich in lipophilic and hydrophilic antioxidants and a good source of carbohydrates, vitamins, and minerals such as Mg, Ca, P and Fe<sup>6</sup>. It is also rich in carotenoids especially beta carotenoids. Due to the presence of vitamins and antioxidants carrot shows beneficial health effects on mankind as it possesses immune boosting, antioxidant and anti-carcinogenic properties. The chemical structure of carrot contains a polyene chain having 11 conjugated double bonds and a  $\beta$ -ring at each end of the chain<sup>7</sup>. Carrots on the basis of their nutrition are ranked on 38 number<sup>1</sup>. Nitrogen balance in our body and the quantity of urine can also be controlled by carrot<sup>8</sup>. Sometimes eyes photoreceptors start to deteriorate which is an eye vision problem due to the deficiency of Vitamin A. Beta carotenoid (the major

source of vitamin A) in carrots helps to protect the vision and also provides protection against muscular degradation and the development of senile cataract, the leading cause of blindness in aged people. Carrots one of the richest sources of provitamin A and its high intake is associated with a significant decrease in post-menopausal breast cancer due to the presence of carotenoids. Carrot plays a *vital* role in human health because of enrichment of carotenoids and phenolic compounds which also reduce the risk of many diseases<sup>5</sup>.

### ***Cucurbita pepo* Linn**

Pumpkin is the common name of *Cucurbita pepo* Linn which belongs to the cucurbitaceae family. Pumpkin is also called Elegege in Southwest and Nigeria regions. The word pumpkin is derived from a Greek word pepon which means a large melon. In the plant kingdom, this family is one of the largest families which consist of a large number of edible plant species<sup>9</sup>. In pumpkin family melon, cucumber, gourds and summer winter squash also included<sup>10</sup>. Pumpkin is used as food due to its high nutritional value as it contains a high level of carotenoids. Pumpkins have many varieties which are grown in Brazil<sup>11</sup>. Pumpkins are a good source of carotenoids, carbohydrates, vitamins, and other minerals<sup>12</sup>; they provide protection against many acute and chronic diseases due to the presence of B complex, calcium, and phosphorous<sup>13</sup>. After the nutritional analysis, it has been noted that pumpkin wastes (both peel and pulp) are the richest source of antioxidants, nutrients, polyphenol compounds, carotenoids dietary fiber, and minerals such as P and Fe. The pulp of pumpkin is comprised of the high level of beta carotenoids as well as many other vitamins. Pumpkin extract shows antioxidant activity, antimicrobial activity, as well as various other activities. This extract consists of active compounds having the ability to scavenge different free radicals<sup>12</sup>.

### ***Spinacia oleracea***

*Spinacia oleracea* (spinach) belongs to the family Amaranthaceae which has about 102 genera and 1400 species worldwide. It also belongs to the leafy green family. The word spinach has been derived from the Persian word ispanai which means the "green hand". In Latin, it is called spanachia and in English, it is called as

spinach. The range of color of spinach is from light green to dark green. Spinach can be classified into two categories: spinach with crinkle leaf and the spinach with smooth leaf. Although there are a lot of varieties, however, all of these have many characters which are similar to each other<sup>14</sup>. Spinach is a leafy green vegetable and is a rich source of vitamins and antioxidants. It is not only a common raw material in the food processing industry but also finds importance as a dietary vegetable. Spinach is a good source of essential nutrients for example carotenoids, vitamins (vitamin A, C) and minerals (P, K, Mg). It also shows antioxidant and various activities but it does not exhibit hypolipidemic activity<sup>15</sup>. The leaf of this vegetable contains carotenoids, polyphenol, flavonoids, and ascorbic acid. Fresh spinach extract shows antioxidant and antimicrobial activities<sup>16</sup>.

### ***Solanum tuberosum***

The word potato is derived from Spanish word patatas and in English, it is called potato which grows down the earth about 6 cm. It is the third most important crop in the United States. The production of potato crop is more than 300 million metric tons<sup>17</sup>. According to their shapes and color, it is categorized into many varieties which include round whites, yellow flesh, long whites, round red etc<sup>18</sup>. There are 5000 varieties of potatoes present in all over the world. The major variety of potato is *solanum tuberosum* which is a starchy vegetable and consist of alkaloids and flavonoids in a large amount. Potatoes are polynutrients and contain carbohydrates, dietary fiber, and some other minerals (K, Mg, and Fe etc). It is used for allergic reactions as well as it plays a *vital* role in the production of the antioxidant defense system due to the presence of essential nutrients (vitamins, polyphenol, beta carotene, and minerals). Polynutrients in potatoes help in chronic and acute diseases<sup>18</sup>. One of the most important vitamins C (Ascorbic acid) in potatoes tuber has a significant role in human nutrition. The highest content of ascorbic acid (about 20.75 mg/kg) is present in marble potato (a variety of potato)<sup>19</sup>. Potato nutrients also show a favorable impact on satiety, blood pressure, gut health and other acute and chronic diseases in children teen adults<sup>18</sup>.

### **Comparative Studies**

Studies investigate that vegetables, such as pumpkin, spinach, shallots, potato, carrots, and cabbage, have high antioxidant activities. Beside antioxidant nutrients such as ascorbic acid, tocopherols, and carotenoids, these vegetables are also a good source of polyphenol components<sup>20</sup>. Among these vegetables, carrots show highest antioxidant activity followed by pumpkin, spinach, and potatoes. Carrot peel and juice are rich in pro-healthy antioxidants both of lipophilic (carotenoids) and hydrophilic (phenolic compounds) characters<sup>21</sup>. Pumpkin seeds have a high content of vitamin E (tocopherol)<sup>22</sup> and the pulp was found to be a rich source of  $\beta$ -carotene (142.38 mg/100 gm). The peel and pulp samples present almost similar values of polyphenols and antioxidants<sup>23</sup>. Spinach is rich in antioxidants such as beta-carotene and lutein. These have antioxidant and anticancer properties<sup>24</sup>. Spinach is a rich source of polyphenols. It contains high levels of flavonols unique to spinach. They are mainly quercetagenin derivatives. Other compounds in spinach were scarcely studied, although some like *p*-coumaric acid contribute significantly to its antioxidant activity<sup>25</sup>. Potato is not only a source of antioxidants source such as ascorbic acid, tropocool, phenolic acid and flavonoids in human diet but it consists of high amount of polyphenolic compounds. Potatoes are good sources of phenolic compounds, with total phenolic content higher than other widespread fruits and vegetables like carrots, pumpkin, or tomatoes because of their high consumption rates<sup>26</sup>. The aqueous and methanolic extracts of spinach (*Spinacea oleracia*), pumpkin (*Cucurbita pepo*), carrots and potatoes were evaluated for antimicrobial activity against bacterial strains<sup>27</sup>.

Potatoes exhibits well-known antimicrobial activity against different microbes. The methanolic and aqueous extracts of carrot (leaves, stems, and roots) on four microorganism species showed that the root, leaf, and stem were active against *B. cereus*, *S. aureus*, and *E. coli*; it shows that carrot shows maximum antimicrobial activity<sup>28</sup>. Leaves of Spinach was extracted with methanol extract. the extract of spinach (20mg/ml) showed maximum activity against the *Escherichia coli* (32mm), *Staphylococcus aureus* (29mm) zone of inhibition respectively whereas the minimum activity is reported against the *Bacillus subtilis*

(12mm) and *Penicillium chrysogenum* (15mm). Antimicrobial Activity of Pumpkin: The fruity body of *Cucurbita pepo* (pumpkin) was extracted with methanol extract. Methanolic extract of pumpkin shows the sufficient zone of inhibition against the microorganisms as 23 mm in *Escherichia coli*, 22 mm in *Staphylococcus aureus*<sup>29</sup>.

## CONCLUSIONS

Vegetables contain many important antioxidants and nutrients. These antioxidants provide protection against diseases and reduce the rate of risk in mankind. The use of these vegetables helps to maintain the health of human being. *Daucus carota L* is a good source of antioxidants, carbohydrates, vitamins, and minerals such as Ca, Mg, P, and Fe. It shows anti-carcinogenic, immune boosting properties and protection against muscular degradation. The *Cucurbita pepo Linn* (pumpkin) contains carotenoids, carbohydrates, vitamins, antioxidants, polyphenols, carotenoids, dietary fiber and minerals such as P and Fe. *Spinacia oleracea* (spinach) is a good source of carotenoids, vitamins, and minerals (P, K, Mg). Its leaves contain carotenoids, polyphenols, flavonoids, and ascorbic acid. *Solanum tuberosum* (potato) is rich in starch, alkaloids, flavonoids, dietary fiber, and some other minerals (K, Mg, Fe). Potato helps to overcome chronic and acute diseases and has an impact on blood pressure and gut health.

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