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Nutrient Profiling of ten commonly used Vegetables

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ABSTRACT

The vegetables play a very important role as a source of nutrients to the human body. Fresh vegetables endowed with almost all of the nutrients that our body requires. They are good source of vitamins, minerals, antioxidants and dietary fibre. Vegetables are naturally low in fat, salt and sugar. In this study, an attempt was made to estimate the nutrients in ten commonly eaten vegetables namely *Lablab purpureus, Beta vulgaris, Phaseolus vulgaris, Solanum melongena, Momordica charantia, Daucus carota, Coccinia grandis, Cucumis sativus, Lycopersicon esculentum, and Trichosanthes anguina*. The nutrients selected for this investigation were Carbohydrate, Protein, Fat, Amino acid and Ascorbic acid. The results showed that highest amount of carbohydrate (3.26mg/100gm) and ascorbic acid (0.35mg/100gm) was found to be in *Cucumis sativus*. Among the ten selected vegetables the highest amount of protein was found in *Daucus carota* (29.066mg/100gm) and lowest amount in *Coccinia grandis* (14.133mg/100gm). The highest amount of fat (360mg/100gm) was found to be in *Phaseolus vulgaris*. The carbohydrates and protein content of *Solanum melongena* (3.160mg and 18.933mg) were significantly higher than those in *Lycopersicon esculentum*. In this study *Beta vulgaris* showed the highest concentration of amino acid (211.5mg/100gm). To reach a conclusion, vegetables play a significant role in human nutrition, especially as source of vitamins, minerals, dietary fibres and trace elements. So their consumption ensures a young look and healthy feeling to our body.

KEYWORDS: Carbohydrate, Protein, Fat, Amino acid and Ascorbic acid

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I. INTRODUCTION

Nutrients in vegetables are vital for health and maintenance of our body. They contain relatively few calories and small amount of fat. Some vegetables contain high mount of carbohydrate and are commonly called starchy vegetables. Other vegetables are called non-starchy vegetables. Non-starchy vegetables tend to have higher water content, and are lower in energy but often richer in vitamins and minerals. One of the most important nutrient the body requires is protein. Vegetables are rich in protein include bean, spinach etc. Carbohydrates are naturaly occurring sugars that provide fuel for the central nervous system and energy for working muscles. The vitamins present in vegetables make an important contribution to human nutrition. They are good for healthy vision, skin, bone and it also works as an antioxidant. A diet rich in vegetables can lower blood pressure, reduce the risk of cancers, heart disease and stroke. Eating non-starchy vegetables may even promote weight loss.

II. MATERIALS

The following materials are used for the study.

1. *Lablab purpureus*
2. *Beta vulgaris*
3. *Phaseolus vulgaris*
4. *Solanum melongena*
5. *Momordica charantia*
6. *Daucus carota*
7. *Coccinia grandis*
8. *Cucumis sativus*
9. *Lycopersicon esculentum*
10. *Trichosanthes anguina*

III. METHODS

The following methods are used for estimation of Carbohydrates, Protein, Fat, Amino acid and Ascorbic acid.

1. Estimation of Carbohydrate

Total carbohydrates content was determined by using Anthrone reagent Spectrophotometric method [11].

2. Estimation of Protein

Protein content was determined by using Folin-Ciocalteau Spectrophotometric method [17].

3. Estimation of Amino acids

Total amino acid content was determined by using Spectrophotometric method [19].

4. Estimation of Fat

The fat content of the extract was determined by centrifuge method [12].

5. Estimation of Ascorbic Acid

The ascorbic acid content was determined by the volumetric titration method [10].

IV. RESULTS AND DISCUSSION

1. Estimation of Carbohydrate

Carbohydrates are one of such group of carbon compound, which are essential to life. It is used as building blocks of cells. The carbohydrate content of the fresh vegetables was given in the figure 1. Among the ten selected vegetables, the highest amount of carbohydrate was found in *Cucumis sativus* (3.260mg/100gm) and lowest amount of carbohydrate was found in *Mommordica charantia* (2.280mg/100gm). It was followed by *Solanum melongena* (3.160mg/100gm), Lablab purpureus (3.150280mg/100gm), *Daucus carota* (3.120mg/100gm), *Phaseolus vulgaris* (3.070mg/100gm), *Lycopersicon esculentum* (2.930mg/100gm), *Trichosanthes anguina* (2.920mg/100gm), *Coccinia grandis* (2.880mg/100gm), and *Beta vulgaris* (2.860mg/100gm).

Carbohydrate metabolism in cucurbits fruits has been studied and the pathway has been elucidated [7,8,16]. It has been shown that in melon fruits as well as in cucumber the main free sugars in the pedicel and fruit tissue are sucrose and hexose [9]. Recently a study can be conducted on the estimation of the total carbohydrate content in *Daucus carota*. It was found to be 6.100 ± 0.346% [2]. The total carbohydrate content in fresh *Cucumis sativus* is about (32.27%). The observed value of carbohydrate content indicates that *Cucumis sativus* is good source of energy [28]. The proximate and phytochemical screening of *Cissus populnea* showed that spices contain 16/24% carbohydrate [25]. The proximate analysis in *Magnifera indica, Morinda lucida, Parquetina nigrescens, Oscmium gratissimum, Chenopodium ambrosioides* and *Veronia amygaldalina* were using standard reference methods. The study showed that *Veronia amygaldalina* had the highest amount of protein 30.02 and carbohydrate 54.00 while *Parquetina nigrescens* presenting the least amount of protein 25.06 and carbohydrate 40.23 [1].

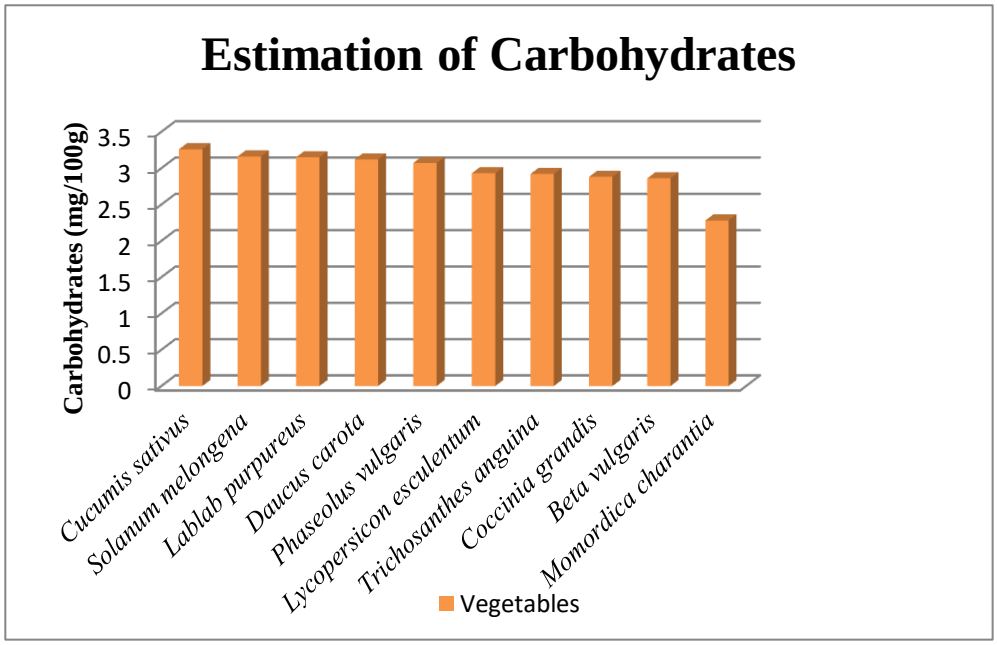

Figure 1: Estimation of Carbohydrate

2. *Estimation of Protein*

Proteins are essential for the growth and developments of the organisms. The protein content was significantly different among almost all the selected vegetables. The results of the study are given in figure 2. *Daucus carota* exhibiting the highest protein content (29.06 mg/100gm) when compared to remaining vegetables. *Coccinia grandis* showed the least value (14.13 mg/100gm). It was followed by *Cucumis sativus* (25.33mg/100gm), *Solanum melongena* (18.93mg/100gm), *Momordica charantia* (18.66mg/100gm), *Lablab purpureus* (17.33mg/100gm), *Beta vulgaris* (15.56mg/100gm), *Phaseolus vulgaris* (15.46mg/100gm), Lycopersicon *esculentum* (15.21mg/100gm), *and Trichosanthes anguina* (14.66mg/100gm). The protein content of *Coccinia grandis* and *Trichosanthes anguina* showed almost similar value.

Nutritional analysis of *Daucus carota* juice showed that it contain 2.067±0.058% of protein [2]. Similar kind of studies carried out in some selected Nigerian vegetables. At this investigation vegetable samples have low protein content. But *Daucus carota* leaf possessed the highest amount of protein (2.40±0.01%) followed by *Vernonia amygdalina* (2.27±0.01%) and *Talinum triangulare* (1.58±0.01%) [24]. The estimation of primary and secondary metabolites in hot aqueous extract of *Pleurotus sajorcaju* can be conducted during 2015. In this investigation, the quantitative analysis of primary metabolites showed that protein content was found to high (7.593±0.238mg/gm) followed by amino acids (2.89±0.30mg/gm) and then carbohydrates (2.53±0.40mg/gm) [18]. The proximate and phytochemical screening of *Cissus populnea* showed that, spices contain 37-21% crude protein [25]. A study of protein and amino acids analysis in some

leafy vegetables can be conducted during 2017. The results showed that protein values in the leafy vegetables gave a range of 11.1726 ± 0.0232 to 25.036 ± 0.0078% with the highest mean protein content of 25.036 ± 0.0078% obtained in pumpkin leaf (*Telfairia occidentalis*) [5].

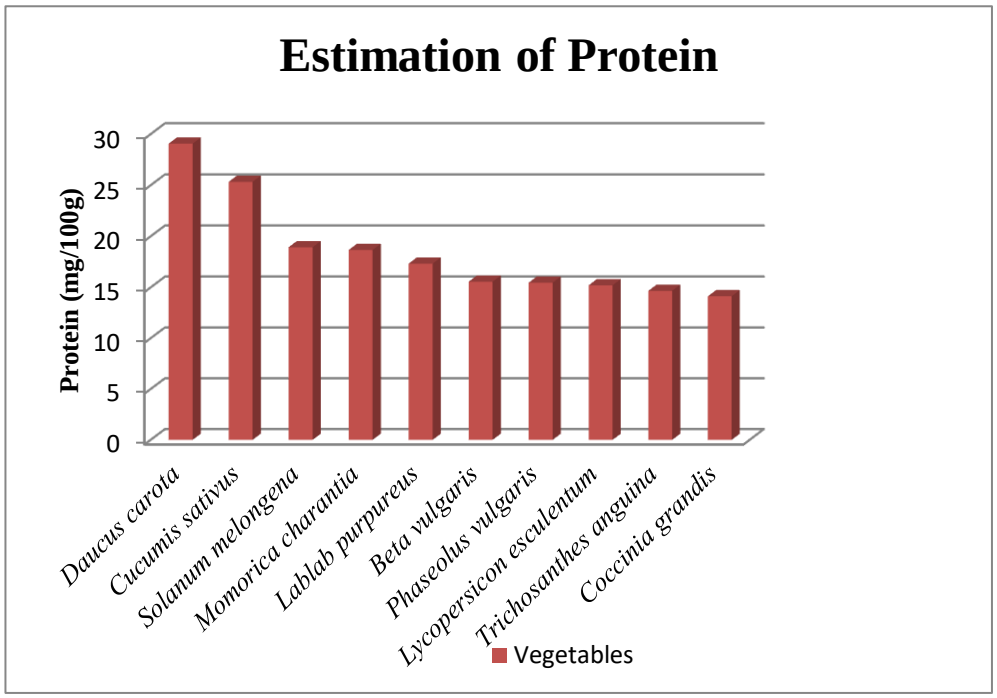

Figure 2: Estimation of Protein

3. *Estimation of Total free Amino acid*

Amino acids are commonly called building blocks of protein. There are tens of thousands of unique proteins in our body which are constructed from amino acids. The amino acids content was different among almost all the vegetables. The results of the study are shown in figure 3. Among the ten selected vegetables the highest cocentration of amino acid is found in *Beta vulgaris* (211.5mg/100gm) and the least value is found in *Daucus carota* (52.3mg/100gm). It was followed by *Lycopersicon esculentum* (147mg/100gm), *Phaseolus vulgaris* (124mg/100gm), *Coccinia grandis* (103mg/100gm), *Lablab purpureus* (76mg/100gm), *Momordica charantia* (71mg/100gm), *Cucumis sativas* (67.5mg/100gm), *Trichosanthes anguina* (62/mg/100gm) and *Solanum melongena* (58.5mg/100gm). The amino acids content of *Lycopersicon esculentum*, *Phaseolus vulgaris* and *Coccinia grandis* were significantly higher than in *Trichosanthes anguina*, *Solanum melongena* and *Daucus carota*.

A study determined the amino acid composition of ten commonly eaten indigenous leafy vegetables of South-West Nigeria. The average percentage distribution of different group of amino acids includes: essential (30.23%); non-essential (52.64%); neutral (56.36%); acidic

(28.56%); basic (15.00%) and aromatic (10.12%). The result revealed that vegetables are rich in different groups of amino acids and good sources of quality protein and amino acids [23]. Similar type study was conducted to determine the amino acids composition of brocoli cabbage protein. They selected four varieties of broccoli such as Parthenon, Belstar F1, Quinta F1 and Monaco F1. The investigaion identified and quantified 8 indispensable and 8 dispensable amino acids in the sample and the greatest content of indispensable amino acids is characteristic for cabbage varieties Parthenon (41.95 mg/100 mg protein) and Belstar F1 (42.26 mg/100 mg protein) [26]. The main free amino acids present in Malus domestica Borkh cv. Annurca were asparagine (>70 mg/100gm), aspartic acid, glutamic acid and o-phosphoserine (about 1-5 mg/100 g each) [4]. Another kind of study determines the amino acids content in some leafy vegetables. The results showed that 1.035±0.0071-5.415±0.0071g/100g in *Amaranthus hybridus*, 1.14 ± 0.0071 - 7.83 ± 0.0141 g/100 g in *Vernonia amygdalina*, 1.26 ± 0.0141-8.745±0.0071g/100g in *T.occidentalis* and 0.985 ± 0.0071 - 4.96 ± 0.014 g/100 g in *T. triangulare* [5].

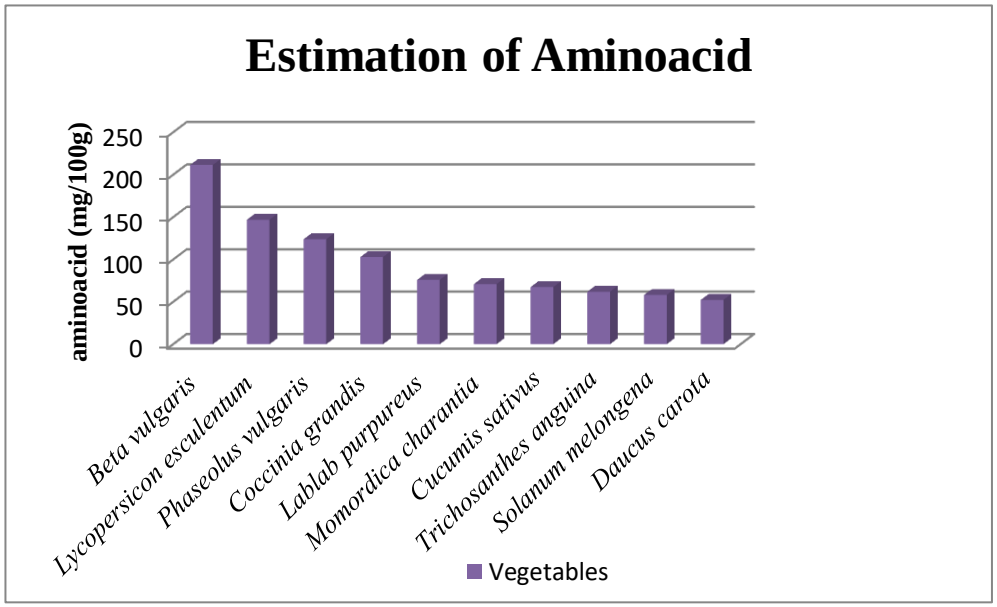

Figure 3: Estimation of Total Free Amino acids

4. *Estimation of Fat*

The nutritional content of vegetables varies considerably; most of the vegetables contain low level of fat. Certain vegetables contain relatively high levels of fat. The most of the fat seen in these foods is monounsaturated or polyunsaturated fat, which are healthy forms. The results of the study are given in the figure 4. Among the ten selected vegetables, it was determined that *Phaseolus vulgaris* had the highest amount of fat (360mg/100gm) and *Cucumis sativus* had the lowest amount (98mg/100gm). It was observed that the amount of fats in *Lablab purpureus* was estimated as (310mg/100gm). It was followed by *Daucus carota* (257mg/100gm), *Solanum*

melongena (220mg/100gm), *Beta vulgaris* (190mg/100gm), *Momordica charantia* (163mg/100gm), *Lycopersicon esculentum* (145mg/100gm), *Coccinia grandis* (112mg/100gm) and *Trichosanthes anguina* (125mg/100gm).

Fat is an important organic acid with an important place in human nutrition. The fat content of *Phaseolus vulgaris L.* was found to be 2.20% - 5.03% [27]. The Lowest amount of fat content in *Cucumis sativus* L. was reported in 2018 [22]. The proximate composition of three varieties of *Lablab purpureus* showed that, fat content of the three varieties of *L. purpureus* seed where moderately high. Rongai brown variety has the highest fat content having 9.74% followed by high worth black 9.63% and Rongai white 9.56% [14]. The proximate analysis of *Lablab purpureus* seed flour showed 4.57 ± 0.02% of fat [21]. Ripe fruits of *Trichosanthes anguina* were subjected to proximate analysis. The results of the study showed that fruit of *T. anguina* had lowest amount of fat (0.23 ± 0.04%) [20].

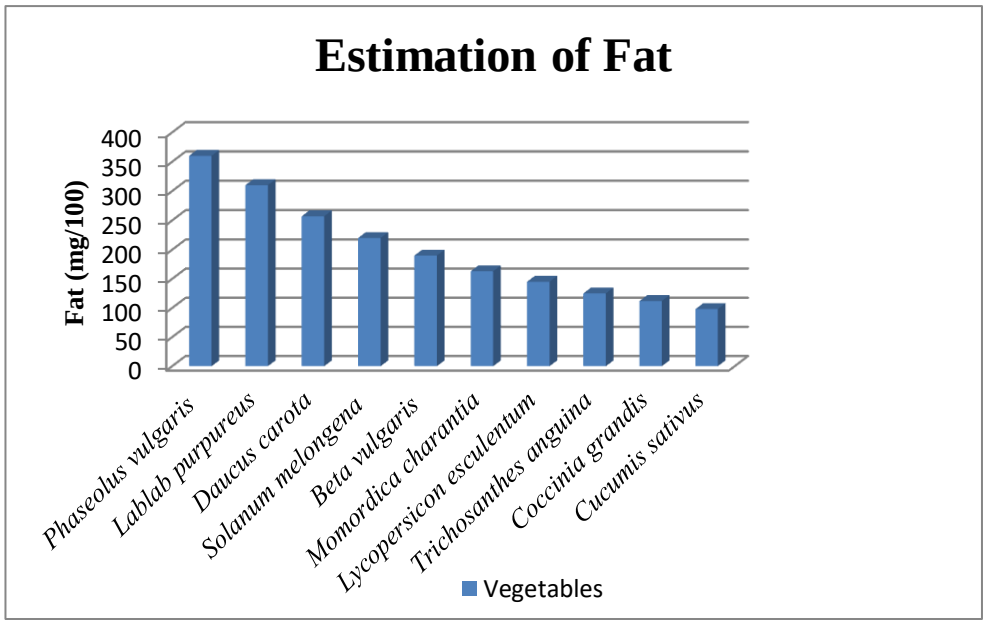

Figure 4: Estimation of Fat

5. *Estimation of Ascorbic Acid*

Ascorbic acid is widely seen in vegetables, berries and fruits. It also known as vitamin C. Ascorbic acid is soluble in water. It cannot be produced or stored by humans and must be obtained in the diet. The results of the study are shown in figure 5. The results showed that *Cucumis sativus* has highest amount of Vitamin C (0.35mg/100gm) content and *Daucus carota* have lowest amount of vitamin C (0.02mg/100gm) content. It was followed by *Coccinia grandis* (0.31mg/100gm), *Lycopersicon esculentum* (0.28mg/100gm), *Momordica charantia* (0.31mg/100gm), *Lablab purpureus* (0.18mg/100gm), *Phaseolus vulgaris* (0.15mg/100gm), *Beta*

vulgaris (0.06mg/100gm), *Trichosanthes anguina* (0.05mg/100gm) and *Solanum melongena* (0.04mg/100gm).

The considerable amount of Vitamin C present in this vegetables showed that when they are consumed in large amount they will improve the health and thereby reducing cardiovascular diseases, eye diseases and diabetes. A study was conducted to evaluate the nutritional composition of different varieties of locally available cucumbers. The study reported that organic Zucchini variety had the highest vitamin content. As Vitamin C content is higher, it posses high anti oxidant activity [15]. Similar type of study was conducted in four *Lycopersicon esculentum* varieties. The result showed that ascorbic acid was the most abundant antioxidant in all the sample and highest concentration was found in the sample of the heart tomato (18.56mg/100gm) [13]. The nutritional analysis of fresh and fresh cut carrot (*Daucus carota*) showed that Vitamin C content in fresh cut carrot was same as that found in fresh carrot ($P>0.05$) [3]. Another type of amino acid estimation was conducted in some medicinal plants from Southern Sonora, Mexico. The results revealed that Tatachinole samples showed the greater amino acid concentration (7.83 to 58.17 nM). Fifteen amino acids were detected in plant samples. From this results aspartic acid (Asp), glutamic acid (Glu), serine (Ser), glycine (Gly), alanine (Ala) and leucine (Leu) (43.55, 44.84, 29.60, 58.17, 43.05 and 38.73 nM, respectively) showed the highest concentrations [6].

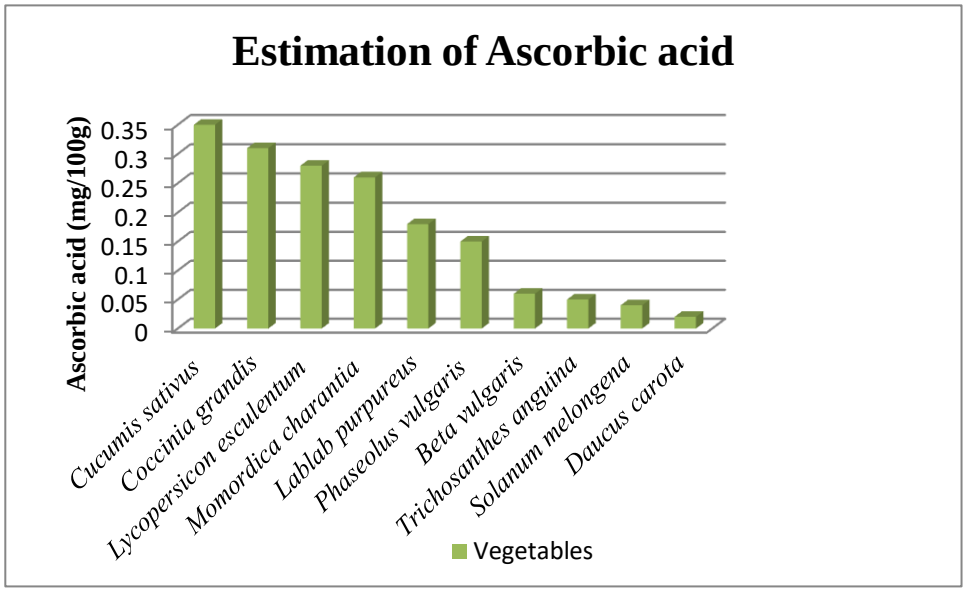

Figure 5: Estimation of Ascorbic acid

V. SUMMARY & CONCLUSION

Vegetables are the best food for our body. They have all the essential nutriets namely vitamins, minerals, fibres and phytochemicals that form resistance to diseases naturally. Including vegetables in the daily diet have been found to reduce the risk for cancers, stroke, heart diseases and many other serious complications. The present study revealed that, *Cucumis sativus* (3.26 mg/100 gm) have the highest amount of carbohydrate and lowest amount was found to be in *Momordica charantia* (2.28 mg/100 gm). *Solanum melongena* and *Lablab purpureus* have almost similar quantity of carbohydrates. The highest amount of protein was found in *Daucus carota* (29.066 mg/100 gm). But it has small amounts of amino acid and ascorbic acid (52.3 mg and 0.02 mg). *Cucumis sativus* has the highest amount of ascorbic acid (0.35 mg/100 gm). In the case of free amino acid, the highest amount was found to be in *Beta vulgaris* (211.5 mg/100 gm). The present study also reported that *Phaseolus vulgaris* has highest amount of fat (360 mg/100 gm) and *Lablab purpureus* has the second highest amount of fat (0.18 mg/100 gm). To reach a conclusion, most of the vegetables selected for this study are important to human nutrition. They play a vital role in human health, which cannot be replaced by any other nutrient factors.

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