

## Estimation of biochemical constituents in different vegetables

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**Abstract :** The right foundation to good health is to choose food product that are rich in nutrients and have a balanced amount of nutrient like carbohydrates, proteins, minerals, vitamins and little bit of fat as well. If you choose your food wisely, you will be able to enjoy the experience of eating, as the right foods will help you remain healthy. In this present study, the estimation of biochemical constituents such as carbohydrates, proteins and lipids present in following vegetables such as *Solanum tuberosum* L. (Potato), *Raphanus sativus* (Radish), *Solanum lycopersicum* L. (Tomato), *Cucumis sativus* (Cucumber) and *Allium cepa* (Onion) were carried out. The results of the amount of carbohydrates present in vegetables showed that *Raphanus sativus* (Radish) has the high content of carbohydrates followed by *Solanum tuberosum* L. (Potato), *Cucumis sativus* (Cucumber), *Allium cepa* (Onion) and *Solanum lycopersicum* L. (Tomato). The results of the amount of proteins present in vegetables showed that *Allium cepa* (Onion) has large amount of proteins followed by *Solanum lycopersicum* L. (Tomato), *Raphanus sativus* (Radish), *Cucumis sativus* (Cucumber) and *Solanum tuberosum* L. (Potato) and the results of the amount of lipids present in vegetables showed that *Raphanus sativus* (Radish) has the high content of lipids followed by *Solanum lycopersicum* L. (Tomato), *Solanum tuberosum* L. (Potato), *Cucumis sativus* (Cucumber) and *Allium cepa* (Onion).

**Key words :** Vegetables, Carbohydrates, Proteins, Lipids

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## INTRODUCTION

Food is any substance consumed to provide nutritional support for an organism. It is usually of plant or animal origin and contains essential nutrients, such as carbohydrates, fats, proteins, vitamins or minerals. The substance is ingested by an organism and assimilated by the organism's cells to provide energy, maintain life or stimulate growth (Diet Health Club, 2014). Hippocrates (c.460-c.370) rightly pointed out that "Let food be thy medicine and medicine be thy food". Food is the basic necessity for all of us and we all earn money to get this basic necessity. We need to eat three meals a day to keep our body running so that we can manage our daily functions. Many of us "Eat food to live" while there are others who "Live to eat food". In fact, nutrition assumes a special important in each and

everyone's life (Mike, 2011).

There are basically two kinds of food sources such as plants and animals. Most food has its origin in plants. Some food is obtained directly from plants but even animals that are used as food sources are raised by feeding them food derived from plants. Many plants and plant parts are eaten as food and around 2,000 plant species are cultivated for food. Seeds, fruits and vegetables are most common plant parts which are consumed by an organism (Diet Health Club, 2014).

Among the plants, vegetables are consumed as a second type of plant matter that is commonly eaten as food. These include root vegetables (Potato and carrots), bulbs (onion family), leaf vegetables (spinach and lettuce), stem vegetables (bamboo shoots and asparagus) and inflorescence vegetables (globe artichokes and broccoli and other veggies such as cabbage or cauliflower. Vegetables are the fresh and edible parts of herbaceous plant. It may include roots, stem, leaves, fruits or seeds of plants that can be eaten as raw and/or cooked form. Vegetables are a major part of daily food intake by human with their main dishes all over the world. It is the cheapest and most readily available sources of foods that can contribute significantly to human nutrition and health. It is known for their essential biochemical and nutritional importance as they contain good amounts of proteins, fats, carbohydrates, vitamins and minerals (Miah Mohammed Abdus Satter *et al.*, 2016). Besides these, moisture, fibre and energy provided by individual vegetable are important for good health and prevention of diseases. It plays an important role in the balanced diet and advised to intake more that may reduce the risk of diseases like cancer, coronary heart attack, diabetes etc. The traditional wild vegetables have also some medicinal value like antibacterial and anticancer activity, which makes it a valuable addition to the diet (Miah Mohammed Abdus Satter *et al.*, 2016).

Nutrients in food grouped into several categories. Macronutrients such as fats, proteins and carbohydrates. Micronutrients are the minerals and vitamins. Additionally food contains water and dietary fibre (USDA, 2016).

### **Macronutrients:**

Carbohydrates are one of main components of our daily diet. Carbohydrates are the body's main source of energy. There are two types of carbohydrates: Simple and complex. Simple carbohydrates are composed of one or two sugar units. There are two types of simple carbohydrates: Monosaccharides and disaccharides and complex carbohydrates are composed of long chains of simple carbohydrate units because of their longer size, they can be broken down into simple carbohydrates. Complex carbohydrates are found in breads, cereals, pasta, rice, beans, peas and starchy vegetables such as potatoes, green peas and corn. Many carbohydrates also supply fibre. Fibre is a type of complex carbohydrate found in foods that come from plants- fruits, vegetables, nuts, seeds, beans and whole grains. Eating food with fibre can prevent stomach or intestinal problems, such as constipation. It might also help to lower cholesterol and blood sugar (USDA, 2016).

Proteins are large biological molecules made up of large number of amino acid units. Because of the complex nature of protein, our body takes a longer time to break down protein molecules. Proteins are a much slower and longer -lasting source of energy compared to carbohydrates. Proteins are often called as body's building blocks. They are used to build and repair tissues. They fight against infections. Body uses extra protein for energy. Good sources of protein are sea food, eggs, beans and peas. Protein from plants sources tends to be lower in fat and cholesterol and provides fibre and other health- promoting nutrients (USDA, 2016).

### **Lipids :**

Body needs fat to grow and to process vitamins. There are many different kinds of fats. Polyunsaturated and monounsaturated fats are good for the body. These fats include nuts and fish, as well as olive, peanut, safflower and canola oil. Other kinds of fat, including saturated and trans fat also called as hydrogenated oils can increase the risk of certain diseases. Saturated and trans fats are found in butter, fried foods, baked goods, whole milk and in meat from animals and peanut, eggplant and red pepper are good source of lipids found in vegetables (USDA, 2016).

Angela *et al.* (2010) investigated the nutrient content of different types of leafy vegetables and in their study they concluded that leafy vegetables are generally good sources of nutrients. They are important protective foods and highly beneficial for the maintenance of health and prevention of diseases as they contain valuable food ingredients

which can be utilized to build up and repair the body. Mike (2011) discussed the importance of food in our life and concluded that all fat diets may work to some extent. However, each has its own possible side effects that could affect overall health. Michaela Suchankova *et al.* (2015) carried out a comparative study between the nutritional value of selected fruits and vegetables and in their study they concluded that nutrient density scores for vegetables were found significantly higher than the fruits. Miah Mohammed Abdus Satter *et al.* (2016) investigated the nutritional quality and safety aspects of wild vegetables consumed in Bangladesh and they suggested that wild vegetables have very good nutritional potential to meet the recommended dietary allowances.

### Objectives:

To estimate the amount of carbohydrates, proteins and lipids present in the following vegetables:

- *Solanum tuberosum* L. (Potato)
- *Raphanus sativus* (Radish)
- *Solanum lycopersicum* L. (Tomato)
- *Cucumis sativus* (Cucumber)
- *Allium cepa* (Onion).

## RESEARCH METHODOLOGY

Commonly consumed vegetables were collected from different locations of city markets, Chennai. The inedible portions of the vegetables were removed prior to analysis and a composite sample was prepared.

### Biochemical estimation:

Vegetable samples such as *Solanum tuberosum* (Potato), *Raphanus sativus* (Radish), *Solanum lycopersicum* (Tomato), *Cucumis sativus* (Cucumber) and *Allium cepa* (Onion) were taken for the biochemical estimation of carbohydrates, proteins and lipids.

### Estimation of carbohydrates:

Different vegetable samples were taken for the estimation of carbohydrates and estimated by following the procedure of Roe (1955).

### Estimation of proteins:

Different types of vegetable samples were taken for the estimation of proteins and estimated by following the procedure of Lowry *et al.* (1951) using folin phenol reagent.

### Estimation of lipids:

Different types of vegetable was taken for the estimation of lipids and estimated by following the procedure of Barnes and Blackstock (1973).

## RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

### Biochemical estimation:

Biochemical constituents (*i.e.*) the carbohydrates, proteins and lipids was carried out in the different types of vegetables such as *Solanum tuberosum* (Potato), *Raphanus sativus* (Radish), *Solanum lycopersicum* (Tomato), *Cucumis sativus* (Cucumber) and *Allium cepa* (Onion). The results of carbohydrates, proteins and lipids estimation

are presented in Table 1.

### Carbohydrates:

The results of estimation of carbohydrates, shows that the carbohydrates content in *Raphanum sativus* (Radish) is high ( $0.341\pm 0.00115$ ) and low in *Solanum lycopersicum* (Tomato) ( $0.159\pm 0.002$ ).

### Proteins:

The results of estimation of proteins reveals that the protein content in *Allium cepa* (Onion) is high ( $0.959\pm 0.0015$ ) and low in *Solanum tuberosum* (Potato) ( $0.183\pm 0.001$ ).

### Lipids :

The results of estimation of lipids shows that the lipid content in *Raphanus sativus* (Radish) is high ( $0.337\pm 0.00057$ ) and low in *Allium cepa* (Onion) ( $0.112\pm 0.0015$ ).

Food is important for both physical and mental well being, the importance of the food in life is huge. Proper nutrition means that all the requirements are obtained for healthy functioning of the body through the diet. These essential nutrients can only be obtained in the diet. If the body is in shortage of these nutrients it can have adverse effect on overall functioning of the body. The body needs the right amount of nutrients and this can be only done through the diet. Importance of food nutrition can also be understood by the fact that even if a single micronutrient is missing or is in short supply, it can cause serious implications for the functioning of the body (Diet Health Club, 2014).

There are many different nutrients that need to be consumed in order to maintain healthy functioning of the body. These nutrients include vitamins and minerals, fats, carbohydrates and proteins. Each of these nutrients has a vital role to play in the functioning of the body. Therefore, the deficiency of any one of them can cause an organ system to fail. For instance, potassium deficiency causes muscle cramps and calcium deficiency can cause heart and bone diseases (USDA, 2016).

Thus, in the present investigation the biochemical estimation of carbohydrates, proteins and lipids present in different types of vegetables such as *Solanum tuberosum* (Potato), *Raphanus sativus* (Radish), *Solanum lycopersicum* (Tomato), *Cucumis sativus* (Cucumber) and *Allium cepa* (Onion) were studied.

The results of the present study showed that in potato, carbohydrates ( $0.274\pm 0.004$ ) and lipids ( $0.261\pm 0.001$ ) contents were higher than the proteins ( $0.183\pm 0.001$ ). Potato contains protein, fat, minerals, fibre, carbohydrates, calcium, phosphorus, iron and it gives 97 kcal energy. It also contains carotene, thiamine, riboflavin, niacin, folic acid, vitamin C, magnesium, sodium, potassium, copper, manganese, molybdenum, zinc, chromium, sulphur, chlorine and wide range of amino acids like arginine, histidine, lysine, tryptophan, phenyl-alanine, methionine, cysteine, threonine, leucine, isoleucine and valine.

The results of the present study revealed that in radish, proteins ( $0.588\pm 0.001$ ) content was found high and low in carbohydrates ( $0.341\pm 0.00115$ ) and lipids ( $0.337\pm 0.00057$ ). Radish contains fats, fibre, protein and carbohydrates. This also gives an energy value of 347.12kcal/10mg. It also contains iron, copper, manganese, chromium, cadmium, magnesium and sodium.

In tomato, the results of the biochemical estimation showed that proteins ( $0.595\pm 0.0015$ ) content was high in

**Table 1 : Estimation of biochemical constituents in different vegetables**

Vegetables	Carbohydrates	Protein	Lipids
Control	$0.118\pm 0.0030$	$0.411\pm 0.00057$	$0.256\pm 0.001$
<i>Solanum tuberosum</i> L. (Potato)	$0.274\pm 0.004$	$0.183\pm 0.001$	$0.261\pm 0.001$
<i>Raphanus sativus</i> (Radish)	$0.341\pm 0.00115$	$0.588\pm 0.001$	$0.337\pm 0.00057$
<i>Solanum lycopersicum</i> L. (Tomato)	$0.159\pm 0.002$	$0.595\pm 0.0015$	$0.289\pm 0.001$
<i>Cucumis sativus</i> (Cucumber)	$0.244\pm 0.0023$	$0.257\pm 0.00152$	$0.212\pm 0.0015$
<i>Allium cepa</i> (Onion)	$0.241\pm 0.002$	$0.959\pm 0.0015$	$0.112\pm 0.0015$

± Standard deviation

tomato than lipids ( $0.289 \pm 0.001$ ) and carbohydrates ( $0.159 \pm 0.002$ ). The tomato contains protein, fat, carbohydrate, minerals such as calcium, phosphorus and iron, carotene, thiamine, nicotinic acid, riboflavin and ascorbic acid. It also contains vitamins A and C, adinine, carotenoids, lycopene, tomatine, tomatidine, solanine, solanidine and trigonelline. Carotinoids in tomatoes can reduce risk of breast cancer and prostate cancer. Tomato is ranked 2<sup>nd</sup> among the top five vegetables in antioxidant activity assays (Stephen and Suresh, 2015).

The results of the present study showed that in cucumber, proteins ( $0.257 \pm 0.00152$ ) content was high followed by carbohydrates ( $0.244 \pm 0.0023$ ) and lipids ( $0.212 \pm 0.0015$ ). Cucumber is a stomachic and contains urease, peptidase, protease and vitamins B and C. It can also be used to treat skin problems, swelling and wrinkles. A cucumber soup relieves retention of urine. A salve made from cucumber is recommended for skin disorder, scalds and to treat beriberi. Fruit and leaves are used for anti-inflammatory and diuretic purposes and they promote salivary secretion and thirst quenching. They can be used to treat heat and thirst, sore throat, sore eye, high blood pressure and burns and scalds. It contains cucurbitacins A, B, C and D, oleic acid, linoleic acid, palmitic acid and stearic acid (Pandey *et al.*, 2014).

In onion, the result of the biochemical estimation revealed that the proteins ( $0.959 \pm 0.0015$ ) content was high followed by carbohydrates ( $0.241 \pm 0.002$ ) and lipids ( $0.112 \pm 0.0015$ ). Onion has bacchic, emmenagogue and diuretic properties. The fresh juice has been found to contain hypoglycemic agent. It is used to treat chest colds, shortness of breath, headache, stomach and digestive problems. Onion contains throb, methyl disulphide, allyl disulphide, trisulfide, thiosulfinates, citrate, malate, o-coumaric, caffeic, ferulic, sinapic, p-coumaric and protocatechuic acids, polysaccharide A and B, quercetin, thymine, kaempferol and carotenes (Stephen and Suresh, 2015). High consumption of fruits and vegetables is associated with a lower incidence of cancer, heart diseases, inflammation, arthritis, immune related diseases, neuro-degenerative diseases, diabetes and anti oxidant components, such as vitamin C, vitamin E, carotenoids and plant polyphenols appear to play important role in decreasing the development of such diseases (Pandey *et al.*, 2014). It is recognized that consumption of 400g of fruits and vegetables per day may prevent obesity and chronic diseases in children (Delgado-Noguera and Hernandez, 2012). Increased intake of vegetables is associated with the lower risk of dementia and slower rates of cognitive decline in older age (Loef and Walach, 2012). Increased fruits and vegetables intake in the range commonly consumed is associated with the reduced risk of stroke (He *et al.*, 2006). Today, dietitians agree that plant foods should comprise the major part of the healthy human diet (Beceanu, 2008). Carbohydrates, proteins and lipids which constitutes the major biochemical constituents of the body play an important role in the body construction and energy metabolism (Palaniswamy *et al.*, 1986). Carbohydrates is much essential for the oxidation requirement of the body because the body generates chemical energy through the breakdown of glucose by the operation of citric acid cycle (Quastel, 1969). The principle and immediate energy resource is the carbohydrates, which normally comes to the rescue. The reduction in the carbohydrates may probably be due to the glycolysis and utilization of glucose to meet the increased metabolic rate as suggested by Revathy (1995). Lipids forms an important fuel reserve stored in large quantities and it is an essential component of protoplasm and even during extreme starvation, considerable amount would be extracted from the tissue (Hoar, 1984). Thus, the results of biochemical estimation indicates that the amount of carbohydrates content present in *Raphanum sativus* (Radish) was high and low in *Solanum lycopersicum* (Tomato), the amount of proteins content present in *Allium cepa* (Onion) was high and low in *Solanum tuberosum* (Potato) and the amount of lipids content present in *Raphanus sativus* (Radish) was high and low in *Allium cepa* (Onion).

### Conclusion:

Thus, it can be concluded from the present study that vegetables are known for their essential biochemical and nutritional importance as they contain good amount of proteins, fats, carbohydrates, vitamins and minerals. Biochemical estimation of carbohydrates, proteins and lipids in the following vegetables, *Solanum tuberosum* (Potato), *Raphanus sativus* (Radish), *Solanum lycopersicum* (Tomato), *Cucumis sativus* (Cucumber) and *Allium cepa* (Onion) were carried out and the results of the present study revealed that the highest amount of carbohydrates was recorded in the radish followed by potato, cucumber, onion and the least amount was found in the tomato. Whereas the highest content of protein was found in the onion followed by tomato, radish, cucumber and the lowest amount was found in

the potato and with regard to estimation of lipids, the highest content of lipids was found in the radish followed by the tomato, potato, cucumber and the lowest amount of lipids was found in the onion. Thus, to conclude from the results of the present study that the nutrient density scores for vegetables were found significantly higher than the fruits.

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