



## Comparative evaluation of the proximate analysis of some selected Capsicum species

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Received : January 2021

Accepted : February 2021

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**Abstract:** The quality of food depends upon the presence of a relative concentration of various nutrients such as protein, fat, carbohydrate, vitamins and minerals. The present investigation was aimed to generate baseline information on the proximate analysis of three colours of *Capsicum annum* (green, yellow and red). It was found that among the three colours of the *Capsicum annum*, yellow *Capsicum* contained highest fiber (9.6%), and vitamin C (159.43 mg/ 20 g) as compared to red *Capsicum* which contained 6.6% fiber, and 81.08 mg/ 20g of vitamin C content. The green *Capsicum* contained the least vitamin C content (16.54 mg/ 20 g). Green *Capsicum* contained highest carbohydrate content 27.21% as compared to yellow (16.13%) and red (13.79%). The protein

content of red *Capsicum* and yellow *Capsicum* was found to be equal (0.08%) and green *Capsicum* had the least protein content (0.065%). However, the fat content was highest in green *Capsicum* (19.83%) followed by red *Capsicum* (9.8%) and yellow *Capsicum* (8.1%). From the present investigation, it can be concluded that the yellow pepper contained higher nutrients compared to red and green *Capsicum*.

**Keywords:** *Capsicum annum*, nutrients, vitamins and minerals

### Introduction:

*Capsicum annum* (bell pepper) an autogamous plant, native to tropical America belongs to the family Solanaceae and is closely related to tomato, eggplant, potato and tobacco. The genus *Capsicum* represents a diverse plant group and includes twenty seven species; five domesticated and twenty two un-domesticated (Bosland, 1993).

*Capsicum* species are widely used as a source of nutrition and also for food flavoring (Zou et al., 2015) and consumed as an ingredient in many dishes, noodles, soup, and salads. The quality of food depends upon the presence of a relative concentration of various nutrients such as protein, fat, carbohydrates, vitamins and minerals. Various studies have shown that *Capsicums* are rich in protein, fat, and vitamins and are important for

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maintenance of health in terms of their essential amino acid and fatty acid ingredients (Ogunlade et al., 2012). Besides, the moisture; the dietary fiber and ash content have also been regarded as important for human health. Howard et al. (2000) also reported that bell peppers are good source of dietary fiber, protein, carbohydrate, vitamin C, and antioxidant compounds. This dietary supplement is low in saturated fat, and very low in cholesterol. Carbohydrates are the main source of energy for our body and they help in fueling up our brain, kidneys, heart muscles and central nervous system. It also helps in digestion and keeps our blood cholesterol levels in check.

Vitamin C, also known as ascorbic acid, can be found in nature in almost all plants, especially fresh vegetables and fresh fruits, so called fresh food vitamins (Singh and Kumari, 2015). Vitamin C has important roles in the body, such as collagen production, fat carrier, cholesterol regulator, and immune boosters (Pacier and Martirosyan, 2015). Bell pepper is rich in vitamin C. It has different levels of vitamin C which may be due to its varieties, growth conditions (temperature, soil, fertilizer), harvesting, post-harvest (storage, and processing) and maturity stages (Lee and Kader, 2000).

The overarching aim of the present study is to analyze and compare the nutritional contents in different varieties of *Capsicum* namely green, red and yellow in order to determine which variety of *Capsicum* should be consumed to get maximum benefits.

## **Materials And Method :**

### **Preparation of sample:**

Three samples of fresh *Capsicum annuum* i.e. green, red and yellow coloured, were purchased from the local market. The fruits of the *Capsicum* were washed, dried and thinly sliced. The samples were oven dried at 60°C for 24 h, grinded separately into powder with the help of mortar and pestle and stored in an air-tight container.

### **Determination of moisture content:**

The method of Association of Official Agricultural Chemists (AOAC, 1900) was used to determine the moisture content. Fresh fruits of *Capsicum* were washed, air dried for 30 min. They were chopped into

pieces and weighed separately. The weight was recorded as the initial (wet) weight. The samples were then dried in an oven at 70° C for 24 h. The difference between the wet and dried samples was considered as the moisture content for all the three samples.

### **Determination of ash content:**

AOAC (1900) method was used to determine ash content. 5g of each of the fruits of *Capsicum* was weighed and kept in a hot air oven for 6 h at 230°C.

Percentage ash was calculated by the following formula:

$$\% \text{ ash} = (\text{mass of ash} / \text{mass of sample}) \times 100$$

### **Determination of crude fiber content:**

The method of AOAC (1900) was used to determine the crude fiber content. 200 mL of 0.128M sulphuric acid was poured in a set of three 500mL capacity conical flasks. 2g of each of the fruit of *Capsicum* was taken and transferred into the conical flasks separately and mixed well with acid solution. Weight of the crucible containing ash was taken. Percentage crude fiber was calculated as follows:

$$\% \text{ crude fiber} = (\text{wt. of the crucible with fiber} - \text{wt. of the crucible with ash} / \text{wt. of sample}) \times 100$$

### **Determination of crude fat content:**

AOAC (1900) method was used to determine the crude fat content. 2g of each of the fruit of *Capsicum* was put into a thimble separately and cotton was placed to cover the sample and fold the end. 300 mL of petroleum ether was taken in the flask and setting of soxhlet apparatus was done. Water was run through a condenser and the apparatus was run between medium and high for 6 h. The flask was kept in the hot air oven at 110°C for 30 min. Final weight of the flask with fat was taken.

Percentage crude fat was calculated as follows:

$$\% \text{ crude fat} = (\text{wt. of the flask with fat} - \text{wt. of flask} / \text{wt. of sample}) \times 100$$

### **Determination of crude protein content:**

The Lowry assay method (1951) was used to determine crude protein content. 1 ml of each of the fruit

of *Capsicum* was taken separately in test tubes labeled as T1, T2 and T3. 5 mL of Lowry solution was added separately in all test tubes. 0.5 mL of Folin Reagent was added in all test tubes, shaken well and incubated at room temperature for 30 min. 1.3 mL samples were taken in semi-micro cuvettes and absorbance were taken at 650 nm. The absorbances of the samples were compared with the standard curve of protein and the concentration of protein of different *Capsicum* samples was determined.

$\% \text{ protein} = (\text{OD of test} / \text{OD of standard} \times \text{amount of standard} / \text{volume of test}) \times 100$

#### Determination of carbohydrate content:

The carbohydrate content was determined by difference = 100 - (% moisture + % ash + % crude fiber + % crude fat + % crude protein)

#### Determination of vitamin C:

All the three fruit samples of *Capsicum* were washed and air dried. 20g of each of the sample was blended separately until smooth. 20g of the blended samples were put into 100 mL of volumetric flask separately. 50mL of metaphosphoric acid solution was added in each flask and mixed well. 10mL of sample mixture was pipetted and put into conical flask. 5mL metaphosphoric acid was added and titrated with 2, 6-dichloroindophenol solution until the steady pink colour was obtained. The process was performed for all the three samples. Vitamin C content of the samples was calculated by the formula given by Horwitz (2003):

$\text{Vitamin C} = (\text{volume of sample titration} - \text{volume of blank titration}) \times \text{equality} \times \text{volume of volumetric flask} \times 100 / \text{volume of aliquot} \times \text{weight of sample}$

### Results and Discussion :

#### Preparation of sample:

500g of each sample of *Capsicum* i.e. red, yellow and green were dried, powdered separately and stored in air tight containers.

#### Determination of moisture content:

Moisture content is essential to determine because it affects the physical and chemical aspects of *Capsicum* and it is related to the freshness. It also affects its

storage longevity, higher the moisture content, higher is the microbial activity, thus reducing its shelf life.

The difference between the fresh and oven dried (at 70°C for 24h) samples were recorded for determination of moisture. The amount of moisture content in green, yellow and red coloured samples of *Capsicum* were found to be 5.63 %, 5.98% and 7.58%, respectively. A comparative account of the moisture contents of the samples is shown in Table 1.

**Table 1. Moisture contents of green, yellow and red *Capsicum annum***

| Samples                | Initial Weight (in g) | Final Weight (in g) | Percentage (%) |
|------------------------|-----------------------|---------------------|----------------|
| <i>Green Capsicum</i>  | 97.94                 | 5.52                | 5.63%          |
| <i>Yellow Capsicum</i> | 197.36                | 11.81               | 5.98%          |
| <i>Red Capsicum</i>    | 133.41                | 10.12               | 7.58%          |

#### Determination of ash content:

Amount of ash content is directly proportional to the amount of minerals present in *Capsicum*. AOAC (1900) method was used to determine ash content. The dried samples were kept in the oven and ash was obtained.

*Yellow Capsicum* had the highest amount of ash content (5.14%) as compared to the red (4.9%) and the green (4.96%) ones. Thus, *yellow Capsicum* has the highest amount of minerals present among the three samples. A comparative account of ash contents of the samples is shown in Table 2.

**Table 2. Ash contents of green, yellow and red *Capsicum annum***

| Samples                | Percentage (%) |
|------------------------|----------------|
| <i>Green Capsicum</i>  | 4.96           |
| <i>Yellow Capsicum</i> | 5.14           |
| <i>Red Capsicum</i>    | 4.9            |

#### Determination of crude fiber content:

The crude fiber is used to determine the undigested amount of cellulose, lignin and other components present in *Capsicum*. Specified chemical solutions were mixed with the samples and crude fiber content was determined. The amount of crude fiber in

green, yellow and red *Capsicum* was recorded as 8%, 9.6% and 6.6%, respectively. The data are presented in Table 3.

**Table 3. Crude fiber contents of green, yellow and red *Capsicum annum***

| Samples                       | %Fibre |
|-------------------------------|--------|
| <b>Green <i>Capsicum</i></b>  | 8      |
| <b>Yellow <i>Capsicum</i></b> | 9.6    |
| <b>Red <i>Capsicum</i></b>    | 6.6    |

#### Determination of crude fat content:

The amount of crude fat in green, yellow and red *Capsicum* was determined by AOAC (1900) method. The crude fat content of green, yellow and red *Capsicum* were found to be 19.83%, 8.1%, and 9.8%, respectively. So, yellow *Capsicum* has the lowest crude fat and it is best in the context of weight loss.

A comparative account of the crude fat contents of the three samples of *Capsicum* studied in the present research work is shown in Table 4.

**Table 4. Crude fat contents of green, yellow and red *Capsicum annum***

| Samples                       | % Fat |
|-------------------------------|-------|
| <b>Green <i>Capsicum</i></b>  | 19.83 |
| <b>Yellow <i>Capsicum</i></b> | 8.1   |
| <b>Red <i>Capsicum</i></b>    | 9.8   |

#### Determination of protein content:

Protein was determined in *Capsicum* samples by Lowry assay (1951) method. It was found that the yellow and the red *Capsicum* contained equal amounts of protein which was 0.08% while the green *Capsicum* contained the least amount of protein (0.065%). A comparative account of the protein contents of all the three samples of *Capsicum* is shown in Table 5.

**Table 5. Protein contents of green, yellow and red *Capsicum annum***

| Samples                       | Protein% |
|-------------------------------|----------|
| <b>Green <i>Capsicum</i></b>  | 0.065    |
| <b>Yellow <i>Capsicum</i></b> | 0.08     |
| <b>Red <i>Capsicum</i></b>    | 0.08     |

#### Determination of carbohydrate content:

The amount of carbohydrate content in green, red and yellow *Capsicum* was found to be 27.21%, 13.79% and 16.13%, respectively. A comparative account of the carbohydrate contents of all the three samples of *Capsicum* studied in the present research work is shown in Table 6.

**Table 6. Carbohydrate contents of green, yellow and red *Capsicum annum***

| Samples                       | % Carbohydrate |
|-------------------------------|----------------|
| <b>Green <i>Capsicum</i></b>  | 27.21          |
| <b>Yellow <i>Capsicum</i></b> | 16.13          |
| <b>Red <i>Capsicum</i></b>    | 13.79          |

#### Determination of Vitamin C content:

Our body needs vitamin C to improve the immune system. Bell pepper is one of the vegetables that is rich in vitamin C. Different colours of *Capsicum* have different vitamin C content. Pulp of samples were prepared and mixed with metaphosphoric acid, separately. 10mL of this solution was titrated with 2, 6-dichloroindophenol solution until the steady pink colour was obtained. Yellow *Capsicum* contained more vitamin C content (159.43 mg/ 20 g) than the red (81.08 mg/ 20 g) and the green (16.54 mg/ 20 g) *Capsicum*. The data are presented in Table 7.

**Table 7. Levels of vitamin C in different colours of *Capsicum annum***

|                | <b>Green <i>Capsicum</i><br/>(mg/ 20 g)</b> | <b>Yellow <i>Capsicum</i><br/>(mg/ 20 g)</b> | <b>Red <i>Capsicum</i><br/>(mg/ 20 g)</b> |
|----------------|---|--|---|
| 1.             | 16.57                                       | 158.99                                       | 80.88                                     |
| 2.             | 16.49                                       | 159.66                                       | 81.02                                     |
| 3.             | 16.56                                       | 159.64                                       | 81.34                                     |
| <b>Average</b> | 16.54                                       | 159.43                                       | 81.08                                     |

#### Summary :

In the present investigation, the nutrient contents present in different colours of *Capsicum* were estimated. The presence of important nutrients like carbohydrate, protein and fibers makes the yellow coloured *Capsicum annum* a nutritionally valuable and healthy ingredient



to promote health. Compared to some conventional sources of carbohydrate, such as cereals, *Capsicum annum* can be considered as a potential source of carbohydrate. The percentage ash represents the inorganic content of the vegetable. Moreover, low fat and high dietary fiber content of *Capsicum* makes it a promising food recommended as part of the weight-reducing diet for obese people. High food fiber aids absorption of trace elements in the gut and reduces absorption of cholesterol. Thus, fiber reduces the risk of coronary heart disease, hypertension, constipation, diabetes, colon and breast cancer. Red *Capsicum* contained highest moisture content of 7.58% followed by the yellow *Capsicum* with a value of 5.98% while the green *Capsicum* had the least moisture content of 5.63% showing significant difference ( $p < 2.0$ ) from the rest. The high levels of moisture in all the samples investigated suggest that the pepper cannot be stored for long. Since high water content could enhance microbial action bringing about food spoilage, hence, the storage-life or shelf-life of peppers can be increased by dehydrating peppers. The ash contents of all the pepper colours are relatively high with the yellow *Capsicum* having the highest value of ash content (5.14%) and the red *Capsicum* having the least value of 4.9%. Insoluble fiber is essential in enhancing digestion and bowel movement (Papas et al., 2004). The carbohydrate content was highest (27.21%) in the green bell pepper as compared to the yellow pepper (16.13%) and the red bell pepper (13.79%). Vitamin C content was found to be highest in the yellow *Capsicum* (159.43 mg/20 g) followed by the red *Capsicum* (81.08 mg/20 g) and the green *Capsicum* (16.54 mg/20 g).

From the above findings, it was concluded that the yellow pepper contained higher nutrients as compared to the red and the green coloured *Capsicum*.

#### Conclusion :

In the present study, comparative evaluation of the proximate analysis of three different coloured *Capsicum annum* i.e. red, green and yellow was conducted. The findings suggest that all three colours of *Capsicum* are good source of nutrients and vitamins with slight variation in quantity. It can be concluded that the yellow

pepper contains higher nutrients (crude fiber, crude fat, protein & carbohydrate) as compared to the red and the green coloured *Capsicum*. Vitamin C was also highest in yellow *Capsicum* compared to the green and the red samples.

#### Acknowledgement:

We express our sense of great respect and gratitude to Dr. Sister M. Rashmi A.C., Principal, Patna Women's College, Autonomous, Patna University for giving us the opportunity to do this research work.

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