

# Effect of Cooking on the Phytonutrient Content of Selected Edible Flowers

M. Velvizhi<sup>1\*</sup>, T. Sujatha<sup>2</sup> and Jemima Beryl Mohankumar<sup>3</sup>

<sup>1</sup>Research Scholar, Department of Nutrition and Dietetics, PSG Arts and Science College, Coimbatore-641014, India; velvizhi.nima@gmail.com

<sup>2</sup>Department of Nutrition and Dietetics, Muslim Arts College, Thiruvithancode, India;

<sup>3</sup>Associate Professor, Department of Nutrition and Dietetics, PSG Arts and Science College, Coimbatore-641014, India

## Abstract

Phytonutrients are active compounds in plants that have been shown to provide benefit to humans when consumed. The phytonutrient content of two edible flowers were analyzed. Two matured edible flowers namely banana flower and neem flower were selected and studied. The flowers are seasonally available and are being used as natural food. The present study is involved in finding out the effect of different cooking process on phytonutrient content of the selected edible flowers. Cooking methods play a major role in altering the amount and nature of these phytonutrients. Maximum loss of the phytonutrients occurred in the selected edible flowers due to pressure cooking.

**Keywords:** Cooking Process, Edible Flowers, Phytonutrients

## 1. Introduction

Phytonutrients are rich in antioxidants and possess anti-carcinogenic properties. Phytonutrients show special promise for lowering the risk of health problems [1]. Globalization has contributed not only to a better awareness of consumers but also to the comeback of earlier lifestyles and food habits in which edible flowers play an important role.

The main sources of phytonutrients are edible flowers, vegetables as well as fruit, medicinal and ornamental plants [2]. The antioxidant activities could be obtained from leaf, roots, rhizome, flowers, fruits, seeds and bark as well [3].

## 2. Materials and Methods

The edible flowers namely banana flower (*Musa Paradisiaca*) and neem flower (*Azadirachta Indica*) were

selected for the study. Different heating methods like boiling, steaming and pressure cooking were applied and three different phytonutrient such as carotene, lycopene and polyphenol were analyzed in the raw and thermally treated edible flowers.

### 2.1 Sample Procurement

The flowers selected for the study, namely banana flower (*Musa Paradisiaca*) and neem flowers (*Azadirachta Indica*) were plucked from the trees grown locally at Panankarai and Arumanai area of Kanyakumari district of Tamil Nadu in the Southern part of India. Care was taken to accurately identify the flowers with the help of the local residents who used these flowers. The flowers were picked on dry mornings, before the sun becomes too strong, so the colour and flavours will be intense. The flowers were used immediately for best results or refrigerated in a plastic bag for a couple of days for analysis.

\*Author for correspondence

Samples were selected on the basis of frequency of consumption by the local population.

## 2.2 Processing of Sample

The flowers were checked for extraneous matters and insects. The flowers were washed in running water and drained. Ten grams of whole edible flower was weighed and chopped finely. From this sample two grams was taken and thermally processed for two minutes using different methods such as boiling, steaming and pressure cooking.

## 2.3 Carotene Content

The raw flower was taken in a mortar and pestle and ground well with 95% ethanol and the ground mass was transferred into a conical flask and refluxed for half an hour. After half an hour it was filtered into a beaker. Added 20ml ethanol and filtered it twice or thrice and taken in a separating funnel. The solutions get separated into two layers. The top layer was collected separately into a 100ml standard flask. To the bottom layer again added petroleum ether and again extracted the carotene. The intensity of the colour of the extract was compared with that of standard solution using colorimeter at 540nm. The same procedure was repeated for the processed sample [4]. The amount of carotene present in the sample is calculated as:

$$\frac{ODT}{ODS} \times \text{concentration of standard}$$

## 2.4 Lycopene Content

The sample was pulped to a smooth consistency in a waring blender. Weighed 5-10 g of this pulp. Extracted the pulp repeatedly with acetone using mortar and pestle or a waring blender until the residue was colourless. Pooled the acetone extracts and transferred to a separating funnel containing about 20 ml petroleum ether and mixed gently. Added about 20 ml of 30% sodium sulphate solution and shake the separating funnel gently. Added solvent as required to replace the losses and for the clear separation of the two layers. Separated the two phases and extracted the lower aqueous phase again with additional 20 ml petroleum ether until the aqueous phase was colourless. Pooled the petroleum ether extracts into a 100ml volumetric flask through a funnel containing cotton wool. Made up the volume and measured the absorbance in a spectrophotometer at 503 nm using petroleum ether as blank [5]. The standard in a one centimeter light path

gives an absorbance of  $17.2 \times 10^4$ . The amount of lycopene present in the sample is calculated as:

$$\text{Lycopene (mg/100g sample)} = \frac{31.206 \times \text{Absorbance}}{\text{Wt of sample (gm)}}$$

## 2.5 Polyphenol Content

The extract (1.5ml) was diluted with water to 8.5ml in a 10 ml graduated test tube. Added 0.5 ml Folin – Denis reagent, to the tubes and mixed thoroughly. Exactly after three minutes, 1 ml of saturated sodium carbonate solution was added and the contents of the tubes were mixed thoroughly. After 1 hour the absorbance was read at 725 nm using a blank. If the solution appeared cloudy or with precipitates, it was centrifuged. The clear supernatant was read spectrometrically. A standard curve was plotted by taking 0.5 ml to 4.0 ml working standard solution containing 10 µg to 80 µg tannic acid. The OD value of 0.325 corresponded to 40 µg tannic acid [6]. The amount of polyphenol present in the sample is calculated as:

$$\frac{\text{Test OD}}{\text{STD OD}} \times \text{concentration of solution}$$

## 3. Result and Discussion

### 3.1 Phytonutrient Content

Phytonutrients may help prevent disease and keep the body's physiological functions working properly. There are more than 25,000 phytonutrients found in plant foods. In this study three phytonutrients were analysed in the raw and cooked form (Table 1).

**Table 1.** Phytonutrients content in 100gram of Banana flower (*Musa paradisiaca*)

Cooking process	Carotene (mg)	Lycopene (mg)	Polyphenol (mg)
Raw	40.0	2.57	15.5
Boiling	33.3	2.19	14.5
Steaming	20.0	2.44	17.7
Pressure cooking	33.3	2.14	12.3

**Table 2.** Phytonutrients content in 100 gram in Neem flower (*Azadirachta indica*)

Cooking process	Carotene (mg)	Lycopene (mg)	Polyphenol (mg)
Raw	40.03	01.96	30.05
Boiling	39.09	01.71	10.07
Steaming	33.03	01.68	25.02
Pressure cooking	33.03	01.45	28.05

**Table 3.** Percentage cooking loss of phytonutrient on thermal processing of the plantain flower (*Musa paradisiaca*)

Cooking process	Carotene (mg)	Lycopene (mg)	Polyphenol (mg)
Boiling	66.5	13.4	6.2
Steaming	20.0	16.6	5.3
Pressure cooking	66.5	26.7	9.7

**Table 4.** Percentage cooking loss of phytonutrient on thermal processing in Neem flower (*Azadirachta indica*)

Cooking process	Carotene (mg)	Lycopene (mg)	Polyphenol (mg)
Boiling	39.9	12.7	2.28
Steaming	33.3	14.2	13.4
Pressure cooking	33.3	29.0	16.5

The carotene content of raw banana flower was 40 mg/100gm (Table 2). Cooking caused a decrease in carotene in banana flower in all the three cooked forms (boiling, steaming and pressure cooking). The lycopene content of raw banana flower was 2.57mg/100gm and maximum loss is seen in steaming. Polyphenol content of raw banana flower was 15.5mg/100gm. Steaming of banana flower caused an increase in polyphenol value.

Plant-based components have increasingly been advocated as “safe and natural” antioxidants considering their existence in regular foods that are consumed [7].

Carotenoids are a class of more than 600 naturally occurring pigments synthesized by plants. Carotenoids are the pigments responsible for red, yellow and orange colored fruits and vegetables. And carotenoids are also found in dark green vegetables such as palak. These compounds convert to Vitamin A in the body, and studies have found that carotenoids have anti-oxidant activity which may help protect cells from damage caused by free radicals.

The carotene content of raw neem flower was 40.3mg/100gm. Reduction of carotene in neem flower was seen in boiling. In steaming and pressure cooking the reduction was greater. Lycopene content of raw neem flower was 1.96mg and polyphenol is about 30.5mg/100gm. Cooking processes were not always detrimental to the phytochemical properties. It depended in some cases on the method used and species considered for cooking [8]. Carotenoids exhibit their maximum AOA at low oxygen pressures and recent research hypothesized that carotenoids are not the major antioxidant for the players but an important part of the antioxidant system [9].

### 3.2 Cooking Loss

Heat treatment is the most common method of processing vegetables to inactivate the contaminating micro-organisms and endogenous enzymes for improved quality and shelf life. Therefore it is necessary to optimize food processing operations to minimize degradation of phytochemicals.

After two minutes of cooking the carotene content of plantain flower had maximum loss of 66.5 percent in boiling and pressure cooking gave lower loss of 20% and 10% (Table 3). Percentage of lycopene content is reduced in pressure cooking which is upto 26.7%. The extent of loss is dependent on the type of cooking treatment [10]. Polyphenol quality and quantity depends on the plant genetics, cultivator, soil composition, growing conditions, maturity and post-harvest condition [11].

After two minutes of cooking the carotene content of Neem flower had maximum loss of 39.9 percent in boiling while the minimum loss was 33.3 in steaming. Percentage of lycopene content is reduced in pressure cooking upto 29.0% (Table 4).

Available data on a number of edible flowers show that petals also contain an array of vitamins and minerals, particularly vitamins A and C, various B vitamins, folic acid, and minerals including calcium, magnesium, potassium, iron and phosphorus. Flower colour is determined by many chemical compounds but carotenoids and flavonoids are the most important. The flavonoids in particular have been shown to give flowers the high antioxidant capacity [12].

Post-harvest treatment of vegetables alter the phytochemical levels. Domestic pretreatment like washing, peeling and cutting and conventional thermal treatments degrade phytochemicals.

## 4. Conclusion

Cooking makes a difference in the phytonutrient content of the selected flowers. In banana flower steaming had the least loss of the analysed phytonutrient. Comparing the three thermal methods pressure cooking caused the most reduction of phytonutrient in both Banana flower and Neem flower. Boiling and steaming were the most preferred method of cooking to obtain maximum phytonutrients. Such studies are of immense importance since fruits and vegetables provide most of the carotenoids, lycopenes and polyphenols in the human diet.

## 5. References

1. Craig W. J., "Phytochemicals: guardians of our health", *J Am Diet Assoc*, vol. 97(suppl), p. S199–204, 1997.
2. Kelley K. M., Behe B. K., Biernbaum J. A., and Poff K. L. "Consumer and professional chef perceptions of three edible species", *Hortscience*, vol. 36, p. 162–166, 2001.
3. Balange A., and Benjakul S., "Use of kiam wood extract as gel enhancer for mackerel (*Rastrelligerkanagurta*) surimi", *International Journal of Food Science and Technology*, vol. 44, p. 1661–1669, 2009.
4. Sadasivam S., and Theymoli B., "Inpractical manual in Biochemistry". *Tamilnadu Agricultural University*, Coimbatore, 1987. p. 14.
5. Ranganna S., *In manual of analysis of fruits and vegetables products*, McGraw Hill, New Delhi, 1976. p. 77.
6. Swain T., and Hillis W. E., "The Phenolic Constituents of *Prunus domestica*. I-The Quantitative Analysis of Phenolic Constituents", *Journal of the Science of Food and Agriculture*, vol. 10(1), p. 63–68, 1959.
7. Wanasundara and shahidi F., *Antioxidants: Science, technology and applications*, *Bailey's Industrial Oil and Fat products*, 6th Edition. John Wiley & sons, Inc., 2005. p. 431–483.
8. Boari F., Cefola M., Gioia F. D., Pace B., Serio F., and Cantore V., "Effect of cooking methods on antioxidant activity and nitrate content of selected wild Mediterranean plants", *Int J Food Sci Nutr*, p. 1–7, 2013. DOI: 10.3109/09637486.2013.799125.
9. Surai P. F., *Natural Antioxidants in Avian Nutrition and Reproduction*, Nottingham University Press. Nottingham, 2002.
10. Lin Ch-H., and Chang Ch-Y., "Textural change and antioxidant properties of broccoli under different cooking treatments", *Food Chem*, vol. 90, p. 9–15, 2005.
11. Jeffery E. H., Brown A. F., Kulich A. C., Keek A. S., Matusheki N., and B. P. "Variation in content of bioactive components in broccoli", *Journal of food Composition and Analysis*, vol. 16, p. 323–330, 2003.
12. Otakar R., Jiri M., Tunde J., Jarmila N., and Jindriska V., "Edible Flowers - A New Promising Source of Mineral Elements in Human Nutrition", *Molecules*, vol. 17, p. 6672–6683, 2012. Doi: 10.3390/molecules1706667