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Short Communication

Effects of Cooking on Nutritional value of *Abelmoschus esculentus* L. and *Cucumis sativus* L.

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Abstract

We examine the effects of different cooking methods (conventional cooking, and microwave cooking) on proximate chemical composition, mineral contents, and fatty acids profiles of fresh Lady's finger (Abelmoschus esculentus L.*) and Cucumber (Cucumis sativus* L.*) grown in Bangladesh. The moisture and ash content in raw Lady's finger were 92.80% and 0.65%, respectively, for Cucumber they were 93.30% and 0.50%, respectively. After conventional cooking moisture and ash content were 93.37% and 0.29%, respectively, for Lady's finger whereas 94.50% and 0.50%, respectively, for Cucumber. On the other hand, microwave cooking food showed the values were 93.32% and 0.47%, respectively, for Lady's finger, whereas 93.60% and 0.50%, respectively, for Cucumber. Total crude protein, fat and carbohydrate were significantly modified by both cooking methods. In both cases, microwave cooking decreased the vitamin-C content to some extent but the conventional cooking completely destroyed the vitamin-C contents.*

Keywords: Microwave cooking, nutritional value, fresh vegetables, *abelmoschus esculentus* L., *cucumis sativus* L.

Introduction

Maximum vegetables are usually cooked before being consumed. In general, vegetables are prepared at home on the basis of convenience and taste preference rather than retention of nutrient and health-promoting compounds[1]. It is known that cooking can significant changes in chemical composition, affecting the bioavailability and content of chemopreventive compounds in vegetables. Previous studies showed that cooking were affect to the contents of nutrient and health-promoting compounds (vitamin C, carotenoids, polyphenols, and glucosinolates, etc.)[2-5]. The cooking methods such as boiling and microwaving were used in these studies on the basis of dietary habit of peoples in Bangladesh.

Lady's finger (*A. esculentus* L.) is a flowering plant in the mallow family. It is valued for its edible green seed pods. Originating in Africa, the plant is cultivated in tropical, subtropical and warm temperate regions around the world[6]. Lady's finger is often known as "Okra" in the United States and in Hindi/Urdu it is called bhindi or bhendi. Greenish-yellow edible okra oil is pressed from okra seeds; it has a pleasant taste and odor, and is high in unsaturated fats such as oleic acid and linoleic acid[7].

The cucumber (*C. sativus* L.) is a widely cultivated plant in the gourd. The plant is a creeping vine which bears cylindrical edible fruit when ripe. There are three main varieties of cucumber such as slicing, pickling and burpless. Cucumbers grown to eat fresh are called slicing cucumbers. The main varieties of slicers mature on vines with large leaves that provide shading[8].

Nutritional science investigates the metabolic and physiological responses of the body to diet. The study of nutrition is increasingly concerned with metabolism and metabolic pathways with advances in the fields of molecular biology, biochemistry and genetics.

This study tried to reveal a suitable cooking method which will help to provide us more nutrient rich cooked food by comprising conventional cooking and microwave cooking method so that it is possible to overcome the nutrient lacking problems.

Materials and Methods

Preparation of sample: Fresh vegetables Lady's finger (*Abelmoschus esculentus* L.) and Cucumber (*Cucumis sativus* L.) were collected from local market (Sheikh Para, Kushtia, Bangladesh). Samples were washed properly and cut into small pieces from the edible part of the green vegetables.

Conventional cooking: Among various methods of conventional cooking, boiling method was applied in the study for the cooking of the selected sample. In this case, the sample to be cooked was just immersed in water at 100°C and maintained at that temperature till the sample was tendered.

Microwave cooking: A weighed, chopped sample was placed in a 250 ml beaker. The sample in the microwave oven was

cooked until it is tender (about 45 s in a 700 W oven). Remove the sample from the oven and the nutrition values were estimated.

Moisture content determination: Moisture was determined by oven drying method. A crucible was cleaned and dried in air oven at 110°C. After cooling, it was weighed (W1). About two gram of sample was weighed into a crucible and reweighed (W2). Then the crucible was again dried in an oven and weighted (W3). The moisture content was determined by following equation:

$$\text{Moisture content (\%)} = \frac{(W2 - W3) \times 100}{W2 - W1}$$

Determination of Ash content: For the determination of ash, a crucible was cleaned and dried in an oven at 100°C. After cooling, it was weighed (W1). About two gram of the sample was weighed into crucible and reweighed (W2). After ignited it was then transferred into a furnace at 550°C. The sample was kept in the furnace for eight hours. The crucible containing ash was then removed. After cooling, it was weighed (W3). Then the ash content was calculated by the following equation:

$$\text{Ash content (\%)} = \frac{(W3 - W1) \times 100}{W2 - W1}$$

Determination of Protein content: Protein content was determined by Kjeldahl method[9]. The dried samples was weighted and taken in digestion flask. Then 10-15 ml conc. H_2SO_4 and 8 g of digestion mixture i.e. K_2SO_4:$CuSO_4$ was mixed with the sample. It was then swirled for mix the contents thoroughly. After that it was placed on heater to initiated digestion till the mixture become clear. This mixture was cooled and taken in a 100 ml volumetric flask and make diluted to 100ml.with distilled water. Then distillation of the solution was carried out by Markam Still Distillation Apparatus. 10ml of this sample was then taken in the distillation tube and 10 ml of 0.5N NaOH was added slowly. Then the distillation was continued for another 10min and NH_3 produced was collected as NH_4OH in a conical flask which contains 20 ml of 4% boric acid solution and few drops of methyl red indicator. The solution was titrated with standard HCl solution. A blank titration was also performed (without sample) in same way. Protein content of the sample was calculated by using the following equation:

$$\text{Protein (\%)} = 6.25X \frac{\text{(Sample Titration – Blank Titration) X Strength of HCl X 0.014 X Volume of digest Sample X } \frac{100}{\text{Wt. of the sample X Volume taken for Distillation}}}{}$$

Determination of Fat content: The amount of crude fat was determined by ether extract method using Soxhlet apparatus[10]. Since all the fat materials e.g. fats, phospholipids, sterols, fatty acids, carotenoids, pigments, chlorophyll etc. are extracted together therefore, the results are frequently referred to as crude fat. About one gram of moisture free sample was filtered with filter paper and it was kept in the extraction tube. After cleaning, drying and weighing, a beaker was filled with petroleum ether. Then the water heater was start for extraction. When ether was evaporated then disconnect beaker. After that extract was transferred into clean glass dish. Then the dish was placed in an oven at 105°C for 2 hrs. The percentage of crude fat was determined by using the following equation:

$$\text{\% Fat content} = \frac{\text{Wt. of Ether Extract X 100}}{\text{Wt. of Sample}}$$

Determination of Carbohydrate content: The total carbohydrate was determined by subtracting the sum of the percentage moisture, ash, crude protein and crude fat from 100[11].

Calculation: Total carbohydrate (%) = 100 - (% moisture + % ash + % Protein +% fat)

Determination of vitamin C: Vitamin C content was determined by the official method of the Association of Official Analytical Chemists (AOAC) Official Method 985.33 (2,6-dichloroindophenol titrimetric method)[12]. The content of Vitamin C is generally expressed as unit of mg/100g of sample.

Results and Discussion

Food preparation is an important step in meeting the nutritional needs of the family. Food has to be pleasing in appearance and taste in order to be consumed. Conventional cooking method has a great impact on food nutrients. Most foods are mainly consumed after being cooked. So, cooking method considerably affects their health-promoting compounds, minerals and vitamins. In this study we tried to picture the changes brought by cooking (microwave and conventional method) in the nutrient content of two fresh vegetables collected from local market named as Lady's finger and Cucumber.

Previous studied showed that raw samples of Lady's finger contained 87% moisture, 0.2% fat, 3% protein, 9% carbohydrate and Cucumber contained 93% moisture, 0.6% fat, 1.8% protein, 4.3% carbohydrate[13]. In this study, the moisture content in raw Lady's finger and Cucumber were 92.80% and 93.30%, respectively. After conventional cooking moisture content in Lady's finger and Cucumber were 93.37% and 94.50%, respectively, whereas after microwaving, 93.32% and 93.60%, respectively, were found for Lady's finger and Cucumber (Figure-1). Ash content in raw Lady's finger was 0.65%, but after conventional and microwave cooking it was found 0.29% and 0.47%, respectively. On the other hand, ash content in raw Cucumber was 0.50%, but after conventional and microwave cooking it was found 0.50% and 0.50%, respectively (Figure-2).

Total crude protein of raw Lady's finger was 2.21%. After conventional and microwave cooking it was found 1.56% and 1.94%, respectively. While crude protein content in raw

Cucumber was 1.99%, but after conventional and microwave cooking it was found 1.40% and 1.99%, respectively (Figure-3). As shown in Figure-4, crude fat in raw Lady's finger was 0.035%. After conventional and microwave cooking it was found 0.020% and 0.024%, respectively. On the other hand, crude fat content in raw Cucumber was 0.15%, but after conventional and microwave cooking it was found 0.16% and 0.10%, respectively.

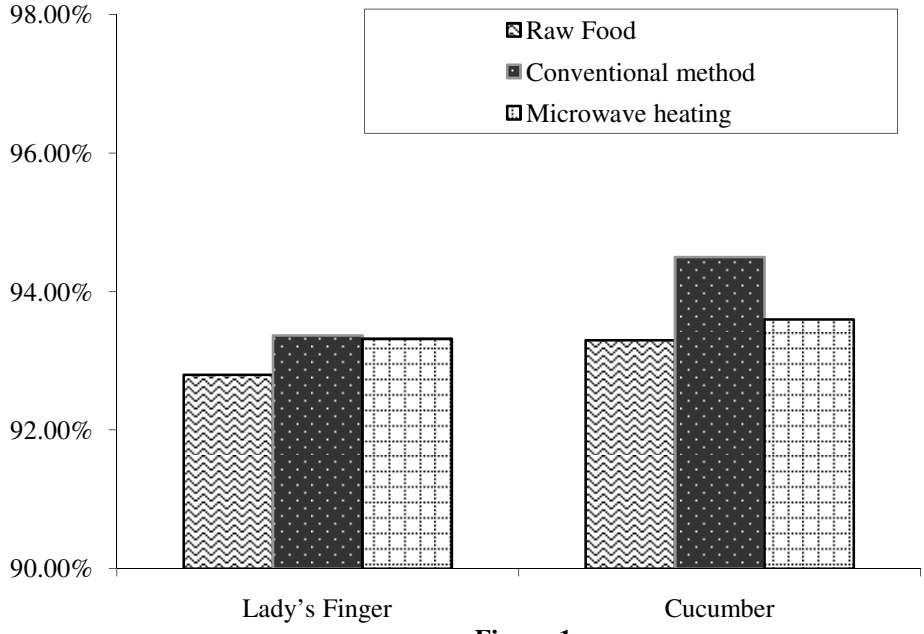

Figure-1
The moisture content inLady's finger and Cucumber cooked by different methods

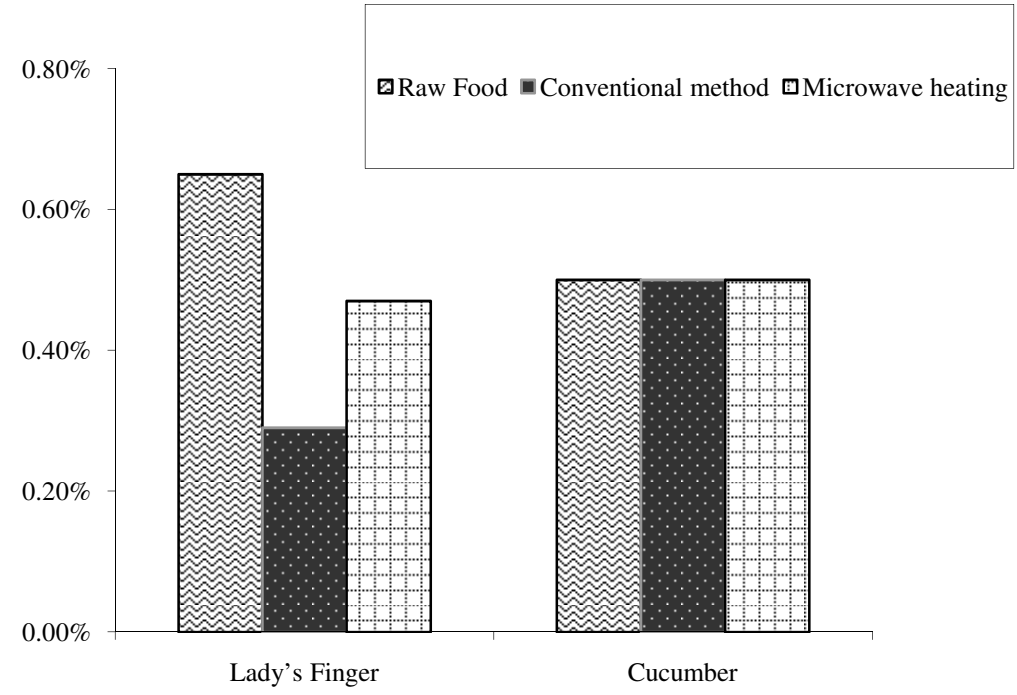

Figure-2
The ash content inLady's finger and Cucumber cooked by different methods

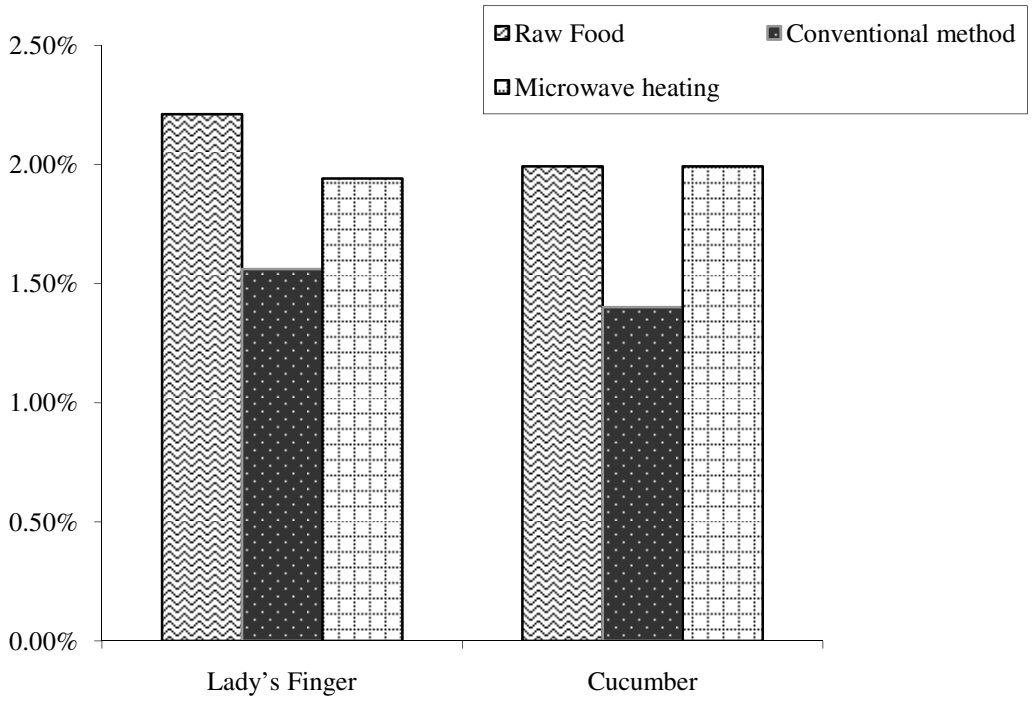

Figure-3
The protein content inLady's finger and Cucumber cooked by different methods

Figure-4
The fat content inLady's finger and Cucumber cooked by different methods

The carbohydrate content in raw Lady's finger and Cucumber was 4.31% and 4.06%, respectively. 4.76% carbohydrate was found in Lady's finger after conventional cooking while 4.25% carbohydrate was found after microwave cooking. On the other hand, 3.40% carbohydrate was found in Cucumber after conventional cooking while 3.81% carbohydrate was found after microwave cooking (Figure-5).

Vitamin C is one of the most important horticultural crops which content a large amount of nutrient and has many biological functions in the human body[14]. The concentration of ascorbic acid (the predominant form of vitamin C) in fresh vegetables generally decreased after cooking[15]. Both cooking treatments caused a dramatic loss of vitamin C. 28.10% and 0.20% of vitamin C was observed in raw Lady's finger and Cucumber, respectively. After microwaving 8.51% and 0.10% of vitamin C was observed in Lady's finger and Cucumber, respectively, while conventional cooking completely destroyed the vitamin-C in both vegetables (Figure-6).

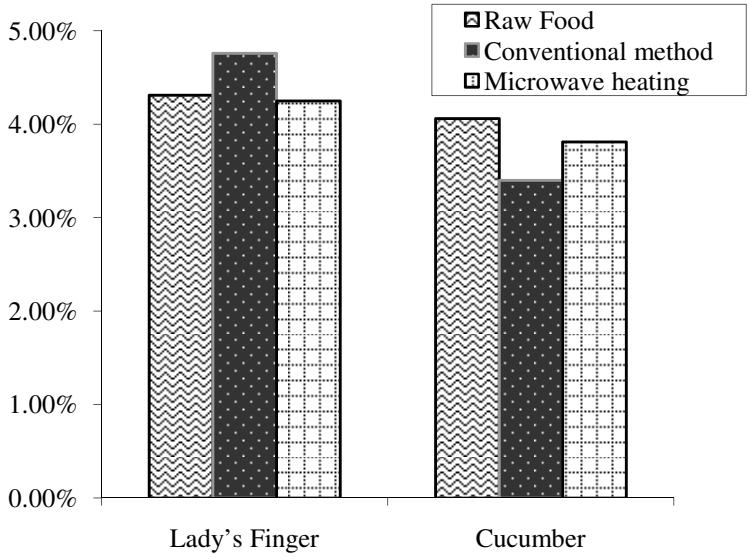

Figure-5
Thecarbohydrate content in Lady's finger and Cucumber cooked by different methods

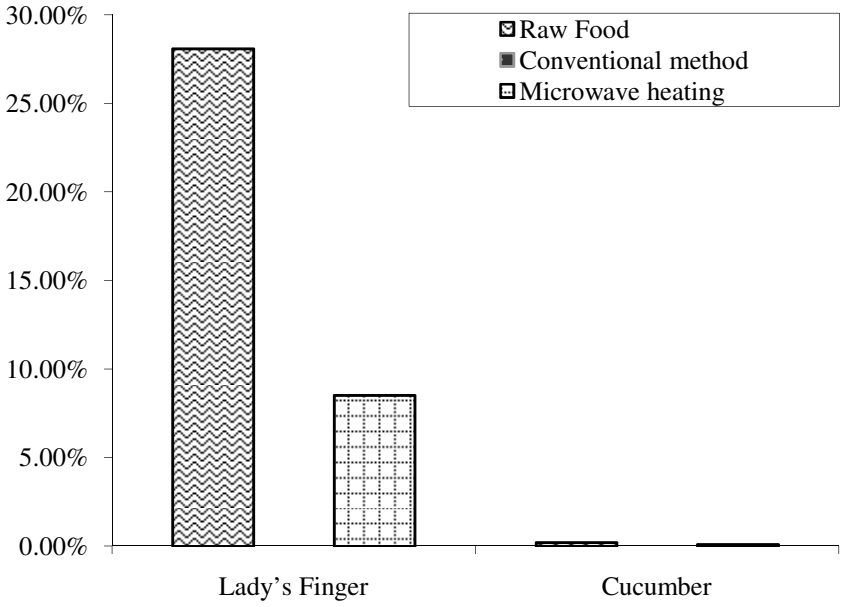

Figure-6
C content in-The Vitamin Lady's finger and Cucumber cooked by different methods

Conclusion

Bangladesh is an under developing country and many people of this country are suffering from nutritional problem. For this reason people should choice the best method of cooking by which nutrient content are present in high amount. Results of this study suggested that microwave cooking method is better than other methods because microwave cooked food contains high amount of nutrients.

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