

Original Research Article

<https://doi.org/10.20546/ijcmas.2017.609.293>

Effect of Microwave and Pressure Cooking on Stability of Vitamin C in Some Selected Vegetables

Shobham, Karukonda Raju, Mudhavath Mounica and M.K. Sukumaran*

Department of Biochemistry, Bhavan's Vivekananda College, Sainikpuri,
Secunderabad, Telangana, India

*Corresponding author

ABSTRACT

Keywords

Vitamin C,
Microwave
cooking, Pressure
cooking, Vegetables

Article Info

Accepted:
23 July 2017
Available Online:
10 September 2017

This investigation was carried out to evaluate and compare the effect of microwave and pressure cooking methods on the contents of vitamin C in selected vegetables. Total vitamin C contents of raw vegetables ranged between 3.55 to 91.27 mg/100g respectively. Microwave and pressure cooking for 2 to 3 min resulted in considerable loss of vitamin C. However, the loss was higher in the case of pressure cooking when compared to microwave cooking. Therefore, microwave cooking can be preferred over pressure cooking.

Introduction

Human body has evolved to process cooked foods more efficiently. This may be mainly due to the fact that raw foods are much harder to digest, taking longer time and burning more calories. Therefore, cooking plays a major role to minimize energy consumption and simple digesting of food. Some of these cooking methods have been shown to affect nutrient and health-promoting compounds like vitamin C, carotenoids, polyphenols, and glucosinolates in broccoli (Cieslik *et al.*, 2007; Lin and Chang, 2005; Sikora *et al.*, 2008 and Vallejo *et al.*, 200). Micronutrients (e.g., vitamins) are an essential component of human nutrition. Some of these micronutrients are sensitive to processing and cooking, hence a significant amount may be

lost during these processes (Pearson, 1973; Leskova *et al.*, 2003 and Ball, 2006). Loss of micronutrient in cooked food may involve factors like; temperature and duration for which the food is cooked (Pearson, 1973) and method of cooking. It has been observed that water soluble vitamins tend to be more sensitive and unstable than fat soluble ones (Somogyi and Muller., 1989).

Vitamin C is water soluble and it is thought to be most susceptible vitamin among the other vitamins (Ottaway, 1993). Therefore, at times it is considered as an index of nutrient quality (Erentuk *et al.*, 2005) (e.g., losses of other less sensitive micronutrients like folates). Keeping in view the sensitivity of vitamin C

during the process of cooking, the present study was undertaken to evaluate the loss of vitamin C content in selected vegetables as affected by different cooking (microwave and pressure cooking) methods.

Materials and Methods

Vegetables (cabbage, bitter gourd, green chilli, cauliflower, brinjal, spinach, potato and carrot) used in the study were purchased from the local market in Hyderabad city.

Cooking procedure

Two different cooking methods were employed in our studies;

Microwave cooking

100 g of the vegetable was placed in a glass dish and 10 mL of distilled water was added to it. The dish was then covered with cooking bag, having holes and cooked in a LG Microwave oven on a high power level for 2 to 3 min. After cooking, the vegetable was drained off and cooled rapidly on plenty of ice. All the vegetables were similarly treated.

Pressure cooking

100 g of the vegetable (in 50 mL of distilled water) was pressure cooked (Prestige 3 L Pressure Cooker) for 2 to 3 min at 121°C and pressure of 15 'lb'. Immediately the vegetable was drained off and cooled rapidly on plenty of ice.

All the vegetables were similarly treated.

Determination of vitamin C in raw, microwave and pressure cooked vegetables

Vitamin C content in the raw, microwave and pressure cooked vegetables were determined by the protocol outlined by Deekshika *et al.*,

(2015) and Rao and Deshpande, (2006). Vitamin C content in the raw vegetables was considered as 100% and percentage loss of vitamin C in microwave and pressure cooked vegetables were calculated.

Results and Discussion

Determination of vitamin C content in raw vegetables

The vitamin C content among the different vegetables varied significantly (Table 1). In their raw state, vitamin C content was found to be highest in cabbage (91.27 mg/100g) and lowest in carrot (3.55 mg/100g) (Table 1 and Figure 1) among the different vegetables.

The vitamin C contents (mg/100g) of the investigated vegetables were in the order of cabbage (91.27) > bitter gourd (76.63) > green chilly (74.18) > cauliflower (67.08) > brinjal (26.12) > spinach (17.74) > potato (11.61) > carrot (3.55) (Table 1 and Figure 1).

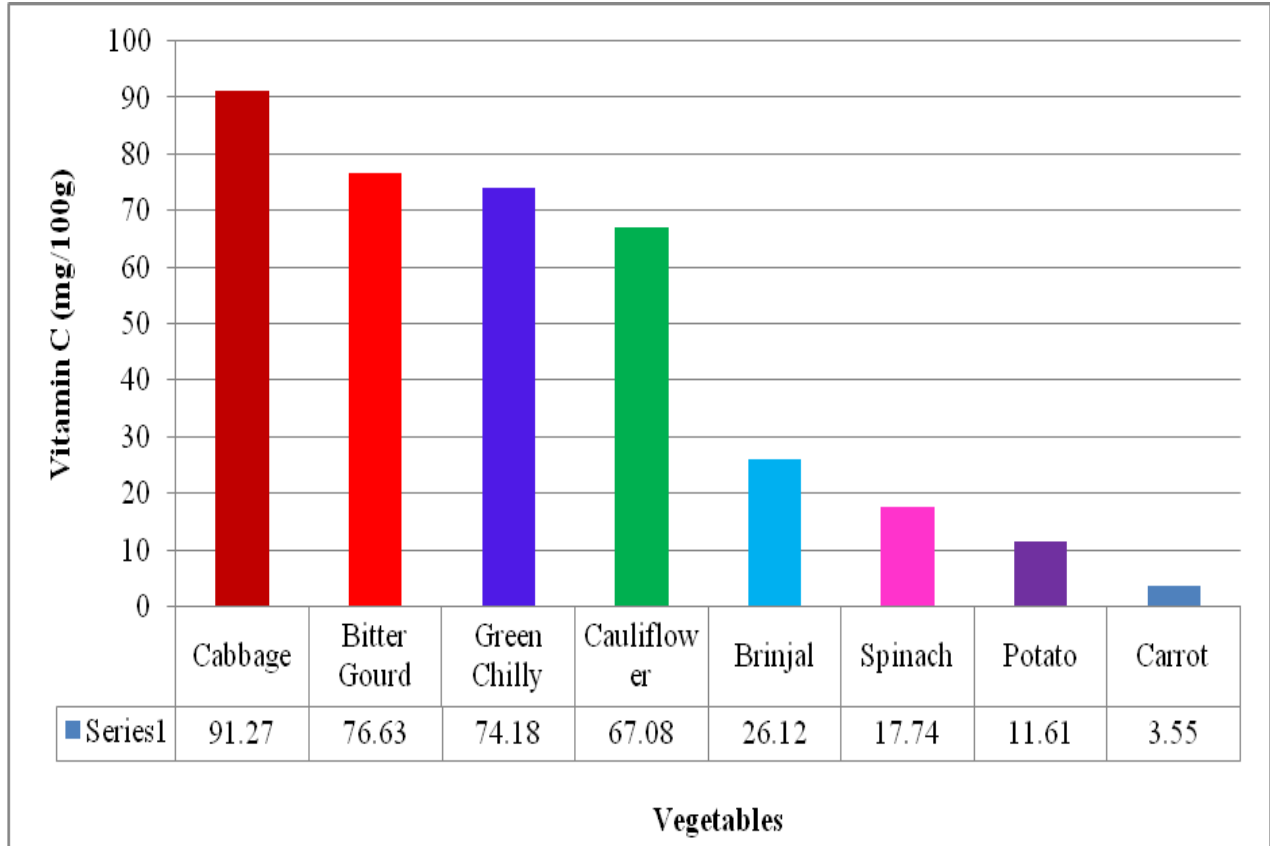
Effect of microwave and pressure cooking on vitamin C in some vegetables

Both microwave and pressure cooking resulted in the loss of vitamin C content among the different vegetables (Table 2).

As evident from the data presented in table 2, pressure cooking resulted in a higher loss of vitamin C as compared to microwave cooking,

Percentage loss of vitamin C content in microwave and pressure cooked vegetables were as follows; cabbage (9.89 and 49.47), bitter gourd (19.20 and 55.80), green chilly (11.31 and 49.57), cauliflower (20.68 and 46.15), brinjal (19.75 and 54.06), spinach (30.89 and 70.91), potato (27.73 and 72.18) and carrot (27.32 and 67.32) respectively (figures 2 to 9).

Fig.1 Determination of vitamin C content in raw vegetables



Loss of Vitamin C (mg/100g) content during the process of microwave and pressure cooking

Fig.2

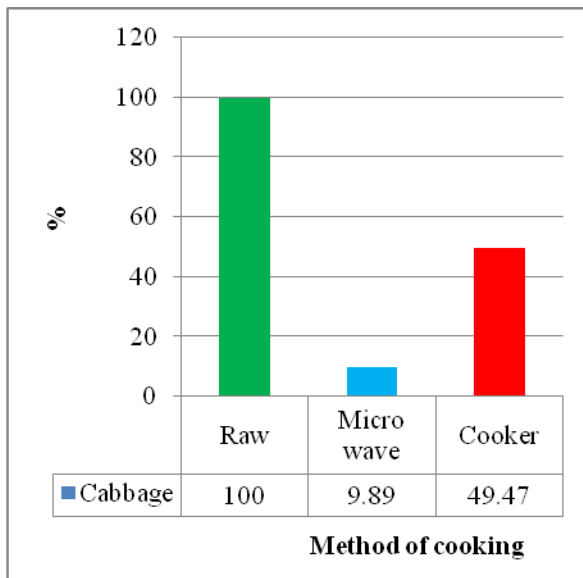


Fig.3

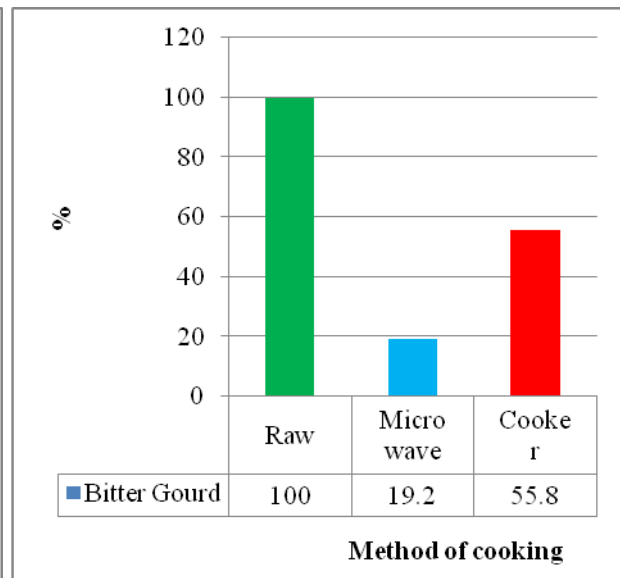


Fig.4

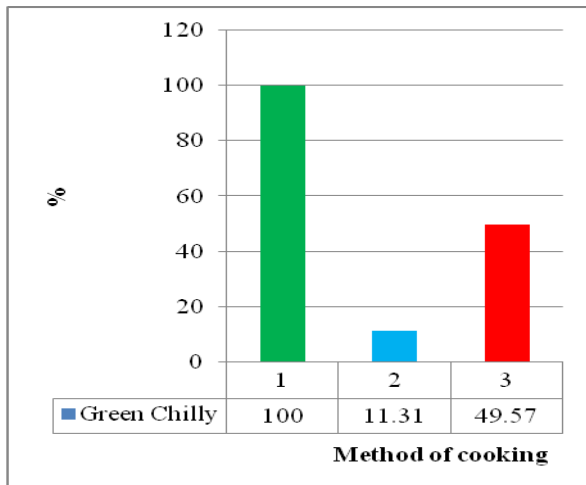


Fig.5

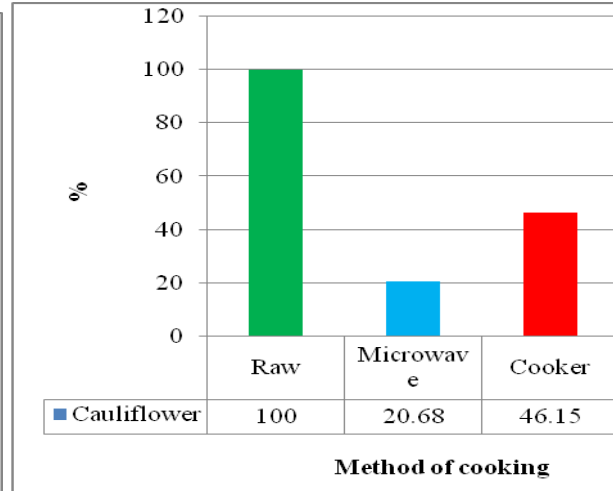


Fig.6

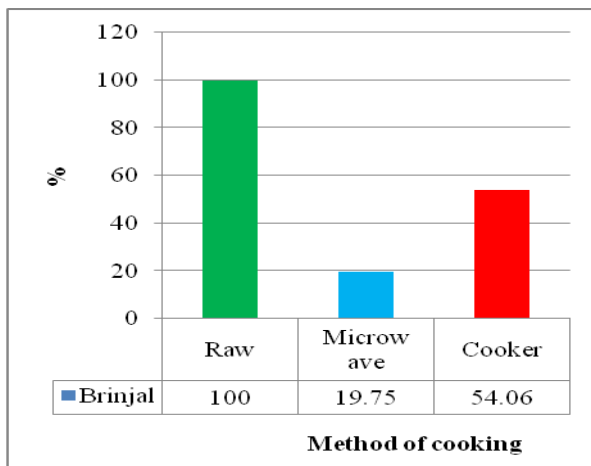


Fig.7

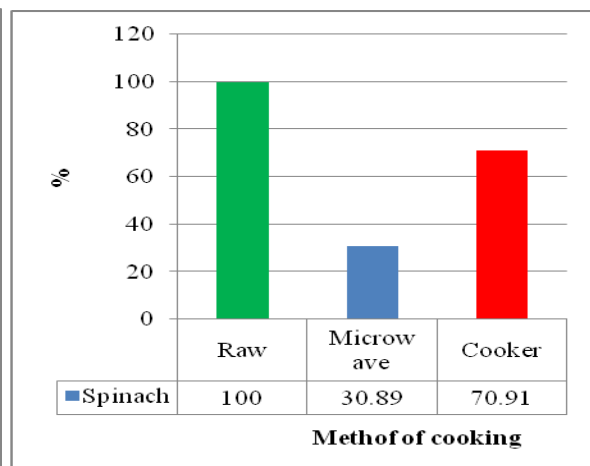


Fig.8

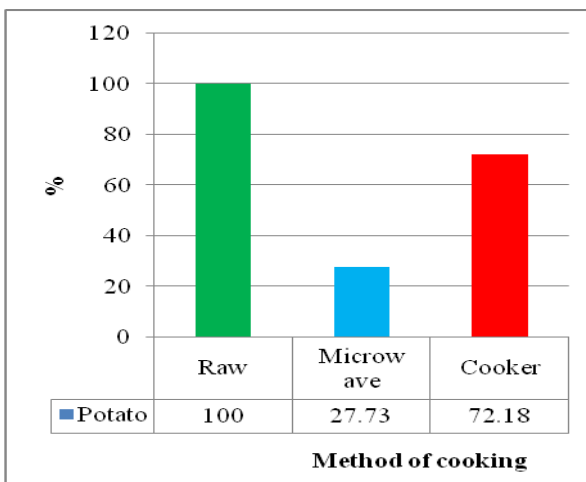


Fig.9

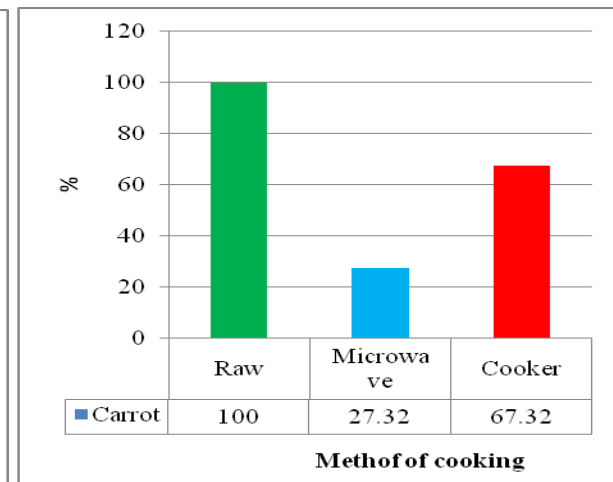


Table.1 Determination of vitamin C content in raw vegetables

S. No	Vegetable	Raw
1	Cabbage	91.27
2	Bitter Gourd	76.63
3	Green Chilly	74.18
4	Cauliflower	67.08
5	Brinjal	26.12
6	Spinach	17.74
7	Potato	11.61
8.	Carrot	3.55

Table.2 Loss of vitamin C (mg/100g) content during the process of microwave and pressure cooking

S. No	Vegetables	Method of Cooking		
		Raw	Microwave (%) Loss	Pressure Cooking (%) Loss
1	Cabbage	100	9.89	49.47
2	Bitter Gourd	100	19.20	55.80
3	Green Chilly	100	11.31	49.57
4	Cauliflower	100	20.68	46.15
5	Brinjal	100	19.75	54.06
6	Spinach	100	30.89	70.91
7	Potato	100	27.73	72.18
8	Carrot	100	27.32	67.32
Minimum % loss			9.89	46.15
Maximum % loss			30.89	72.18
Average % loss			20.85	58.18

Vallejo *et al.*, in 2002 examined the effect of under and reduced pressure and microwave cooking on the ascorbic acid content of broccoli and suggested that there was a 40% loss in ascorbic acid content of broccoli that were cooked in microwave (Vallejo *et al.*, 2002).

Khatoon and Prakash compared the effect of under pressure and microwave cooking on ascorbic content and concluded that there was a loss of 29-62% that was higher than the effect of pressure cooking (Khatoon and Prakash, 2006).

Studies by Yahyaei *et al.*, in 2013, indicated that the ascorbic acid content of vegetables that were cooked for 10 min by conventional cooking preserves higher concentrations of ascorbic acid as compared to 10 min of pressure or microwave cooking. He also reported that the higher ascorbic acid concentration was preserved when 20 min of pressure cooking was applied at the same time, highest losses were observed in the carrot that were cooked for 20 min in microwave. The losses that accounted for 45.4% of the ascorbic acid originally present.

Boiling had a greater effect on vitamin C losses compared with microwaving,

especially boiling for 6 min. Boiling for 6 min caused a 64.45% decrease in broccoli, 70.74% in white cabbage and 66.82% in cauliflower (Shams El-Din *et al.*, 2013).

India is the home of diverse cultures, languages, food habits. This diversity is evident in prevailing cooking methods in the different regions of our country. Cooking methods generally employed are boiling, steaming, pressure cooking, microwave cooking, frying (stir and deep frying) and baking, etc. Some of these cooking methods may deplete the essential nutrients that may be required for a healthy life. This work is being conducted to identify a cooking method that would cause minimal loss of the essential nutrients. Minimum, maximum and average loss of vitamin C content in microwave cooked vegetables was found out to be 9.89, 30.89 and 20.85 mg/100g and that in pressure cooked vegetables was found out to be 46.15, 72.18 and 58.18 mg/100g as compared to raw vegetables (Table 2). Though our studies indicate that there is a considerable loss of vitamin C in both microwave and pressure cooked vegetables the extent of loss was more in pressure cooked vegetables.

Conflict of interest statement

Author declares that there is no conflict of interest.

Acknowledgment

Authors are thankful to Management and Principal Prof. Y. Ashok, Bhavan's Vivekananda College for providing necessary facilities and constant encouragement.

References

Ball, G., 2006. *Vitamins in Foods, Analysis, Bioavailability and Stability*. CRC Press.

Cieslik, E., Leszczynska, T., Filipiak-Florkiewicz, A., Sikora, E., Pisulewski, P.M., 2007. Effects of some technological processes on glucosinolate contents in cruciferous vegetables. *Food Chem.*, 105(3):976-981. [doi:10.1016/j.foodchem.2007.04.047].

Deekshika, B., Praveena Lakshmi, B., Hemanth Singuluri and. Sukumaran, M.K., 2015. Estimation of ascorbic acid content in fruits and vegetables from Hyderabad, India – A theoretical assessment of Vitamin C activity *Int.J.Curr.Microbiol.App.Sci*, 4(1): 96-99.

Erentuk, S., Gualaboglu M.S. and S. Gultekin., 2005. The effects of cutting and drying medium on the vitamin C content of rosehip during drying. *Journal of Food Engineering* 68, 513-518.

Khatoon, N., and Prakash, J. 2006. Nutrient retention in microwave cooked germinated legumes. *Journal of Food Chemistry*. 115–121.

Les4kova, E., Kova', J., Ikova', E., Kos4icka', M., Porubská', J. and Holc4Q'kova, K. 2003. Vitamin losses: Retention during heat treatment and continual changes expressed by mathematical models, *Journal of Food Composition and Analysis*, 252–276.

Lin, C.H., Chang, C.Y., 2005. Textural change and antioxidant properties of broccoli under different cooking treatments. *Food Chem.*, 90(1-2):9-15. [doi:10.1016/j.foodchem.2004. 02.053].

Ottaway, P. B., 1993. *The Technology of Vitamins in Food*. Published by Blackie Academic and Professional, an important of Chapman and Hall.

Pearson, D., 1973. *Laboratory Techniques in Food Analysis*. Fric, First Published.

- Rao, B., and Deshpande, V., 2006. *Experimental biochemistry*. Tunbridge Wells, Kent: Anshan.
- Shams El-Din, M.H.A., Madiha M. Abdel-Kader, Makhoulf, S.K., and Ola S.S. Mohamed., 2013. Effect of Some Cooking Methods on Natural Antioxidants and Their Activities in Some *Brassica* Vegetables, *World Applied Sciences Journal* 26 (6): 697-703.
- Sikora, E., Cieslik, E., Leszczynska, T., Filipiak-Florkiewicz, A., Pisulewski, P.M., 2008. The antioxidant activity of selected cruciferous vegetables subjected to aquathermal processing. *Food Chem.*, 107(1):55-59. [doi:10.1016/j.foodchem.2007.07.023].
- Somogyi, J. C., and Muller, H. R. 1989. *Nutritional Impact of Food Processing*. Published by The Group of European Nutritionists.
- Vallejo, F., Tomas-Barberan, F.A., Garcia-Viguera, C., 2002. Glucosinolates and vitamin C content in edible parts of broccoli florets after domestic cooking. *Eur. Food Res. Technol.*, 215 (4):310-316. [doi:10.1007/s00217-002-0560-8].
- Yahyaee, M., Ghavami, A., Gharachorloo, M., Larijani, K., Mazhari, S. Z., 2013. The Effect of Different Methods of Heat Treatments on the Retention of Ascorbic Acid in Carrot and Corn, *J. FBT, IAU*, 3, 23-28.

How to cite this article:

Shobham, Karukonda Raju, Mudhavath Mounica and Sukumaran, M.K. 2017. Effect of Microwave and Pressure Cooking on Stability of Vitamin C in Some Selected Vegetables. *Int.J.Curr.Microbiol.App.Sci*. 6(9): 2391-2397. doi: <https://doi.org/10.20546/ijcmas.2017.609.293>