# Effect of Cooking on Carotene Content of Some Leafy Vegetables

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## Introduction

Vitamin A has been recognised to be a very important nutrient required for multiple physiological functions especially for vision and epithelial cell formation 1,2,3. Vitamin A deficiency is one of the major nutritional catastrophe in all developing countries as well as Bangladesh4. Vitamin A may be obtained from two sources-animal and plant sources. Animal foods contain mostly preformed vitamin A and plant sources contain carotene, (precursor of vitamin A) which is converted into vitamin A mainly in the intestinal wall.

For Bangladeshi people carotene plays a very important role as a source of vitamin A. Most of the requirement of vitamin A are meet up by carotene. In our diet 92% of vitamin A is supplied by carotene 4. The important source of provitamin A (carotene) in our usual diet is mainly green leafy vegetables, where as vitamin A from animal source is negligible 4.5. In our country almost all of the vegetables are consumed after cooking. Different methods of cooking are practiced in different parts of the country6. In some area the water come out during boiling is discarded, whereas in other area no water is discarded during cooking.

Since both vitamin A and carotene are insoluble in water and generally under ordinary cooking temperature it is believed that little could be lost during cooking. Wood7 and Munsell8 studied the loss of carotene in cabbage at high temperature. Munsell and coworkers found 15% loss of carotene in cabbage at high temperature. Malek9 reported that there is some loss of carotene after boiling. Sweeny 10 observed the loss of carotene during cooking green leafy vegetables ranging from 15-20% and for yellow vegetables it was 30-35%.

Recognising the importance of green leafy vegetables (GLV) in our diet as a source of vitamin A, a systematic study on cooking loss of carotene by different processes from locally available green leafy vegetables has become inevitable for our country. The present study was designed to provide an overview of losses of carotene during cooking and identify conditions under which these losses occur more.

## Materials and Methods

Green leafy vegetables were collected from the nearest local market during winter season and only edible portions were taken for cooking and analysis.

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### *Cooking Procedure:*

Informations about the cooking practices of green leafy vegetables were collected from people of different district.

It was reported that three traditional methods are generally practiced. Accordingly three cooking process (i.e. process I, Process II and process III) were used in the laboratory. In all the processes the vegetables were cooked for 15-20 minutes in gas burner.

***Process I*** This process is very simple one by which the vegetables were washed with water and kept in a porous container to drain away the water. The vegetables were then cut into small pieces, mixed them with spices (e.g. onion, garlic, chilly, salt) and poured in hot oil in a pan of convenient size. The pan was covered for sometime untill vegetables were tender, then removed the cover and fried untill most of the water dried up.

***Process II*** All the vegetables were washed and cut into very small pieces as practiced in most of the families. The vegetables were then boiled for some time in a covered pan until water come out from vegetables. The water was then drained away and the vegetables including spices were poured in hot oil. The vegetables were then fried unitil most of the water evaporated.

***Process III*** The vegetables were washed, cut and all the spices were mixed and boiled without Oil. The frying pan containing the vegetables were covered for sometimes and cooked smoothly until most of the water dried up.

For the estimation of carotene from raw samples a sizeable portion of vegetables were cut into small pieces and an aliquot was taken. Weight of the pan including vegetables with all ingredients was taken before and after cooking to know the loss of weight due to cooking.

### *Analytical methods*

Reference beta-Carotene was obtained from sigma Chemical Company, USA. All solvents used in the experiment were redistilled and were of analytical grade. The carotene estimation of vegetables before and after cooking was done according to the standard methods 11, 12.

## Results

Effect of cooking in different traditional methods on carotene content of nine green leafy vegetables is shown in Table 1.

The extent of loss of carotene was highest in Khesari Sak (35-39%). In case of other two vegetables, Motor Sak and Helencha Sak, the percentage of loss was near to Khesari Sak i.e. (33-39% and (31-36%), resectively.

But if we compare among the different cooking processes it is evident that in case of Khesari and Helencha Sak the extent of loss was lowest in process I and highest in prosess III.

**Table I :** Loss of carotene during cooking by different methods

| Sl. No. | Local Name | Scientific Name | Carotene conent of Raw samples (mg/100 gm edible portion) | Percent losses of carotene | | |
|---|---|---|---|---|---|---|
| | | | | Process I | Process II | Process III |
| 1 | Khesari Sak | *Lathyrus sativa* | 9.26 | 35.00 | 37.00 | 39.00 |
| 2. | Helencha Sak | *Enhydra fluctuan* | 11.38 | 31.00 | 33.00 | 36.00 |
| 3. | Lal Sak | *Amaranthus gangeticus* | 10.20 | 16.66 | 27.45 | 22.54 |
| 4. | Pui Sak | *Basella rubra* | 8.11 | 20.71 | 29.71 | 24.00 |
| 5. | Mula Sak | *Raphanus sativus* | 7.20 | 17.35 | 25.16 | 19.00 |
| 6. | Kalmi Sak | *Ipomoea retans* | 10.15 | 12.80 | 19.20 | 17.57 |
| 7. | Data Sak | *Amaranthus gangeticus* | 9.12 | 16.00 | 12.06 | 25.00 |
| 8. | Motor Sak | *Pisum sativum* | 10.50 | 36.00 | 33.00 | 39.00 |
| 9. | Pat Sak | *Corchorus capsularis* | 11.65 | 19.00 | 23.00 | 17.00 |

However, in case of Lal Sak, Pui Sak, Mula Sak and Kalmi Sak, the percentage of loss of carotene was lowest in process I followed by process III and II.

The percentage of losses in process I. III. II for Lal Sak were 16.66%, 22.54%, and 27.45%, Pui Sak 20.71%, 24.00% and 29.71%, Mula Sak 17.35%, 19.00%, and 25.16% and Kalmi Sak 12.8%, 17.57% and 19.20%, respectively. So process I is preferable for these four leafy vegetables and also for Khesari and Helencha Sak mentioned above.

The table also indicates that Data Sak and Motor Sak lost their carotene content in lowest extent in process II. then process I and highest in process III. But for Pat Sak the loss was lowest in process III and highest in process II.

On average, the percentage of loss in process I (22.73%) was slightly lower in comparison with process II (26.62%) and process III (26.57%).

## Discussion

Sweeny 10 reported that carotene values of cooked green leafy vegetables were decreased by 15-20% and for yellow vegetables 30-35%. The loss of carotene is due to some chemical changes (i.e. rearrangement) in carotene molecule during cooking10. Some trans-forms are changed to other isomers resulting in carotenes of lower vitamin A value. Drying and dehydration also produce a considerable loss by oxidation13. Various factors may be responsible for the

loss of carotene due to cooking. Variations in the maturity of samples, size of whole vegetables or cut into pieces,time and temperature required for cooking, exposure to sunlight and the method of preparation are the known factors affecting the extent of loss of carotene during cooking14.

It can be conclude from the present findings that amongst the three home cooking prodedure, process I is preferable to prevent loss of carotene. That means during cooking of vegetables water should not be discarded and oil should be used.

In process II, water was discarded. Some carotene may be lost with water. On the otherhand in process III, although water was retained, the loss may be due to oxidation in absence of oil. Comparing process II and III, average loss of carotene was almost same. But it is likely that loss should be more in process II. The explanation in support of this may likely be that addition of oil prevents some loss of carotene. The presence of vitamin E in cooking oil may play a role as antioxidant, whcih prevents loss of carotene during cooking.

## Summary

Nine varieties of green leafy vegetables were studied to investigate the extent of loss of carotene in three traditional home cooking methods. The three methods of cooking (e.g. process I, II, III) were practiced for each vegetable. In process I, oil was used and no water discarded during cooking, whereas in process II, water was discarded after boiling the vegetables and fried in oil. On the otherhand, in process III, vegetables including spieces were boiled together without oil and no water discarded during cooking. The extent of loss of carotene was highest in Khesari Sak (35-39%) followed by Motor Sak (33-39%) and Helencha Sak (31-36%). Comparing among the different cooking methods, on average the percentage of loss of all the vegetables in process I (22.73%) was slightly lower in comparison with process II (26.62%) and process III (26.57%). Khesari, Helencha, Mula, Kalmi, Pui and Lal Sak suffered lowest lost in process I, whereas Data Sak and Motor Sak suffered lowest lost in process II an Pat Sak in process III.

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## References

1. David, W. Martin, Jr. Mayes, Victor, W. Redwell. Harper's Review of Biochemistry. Lange Medical publications 20th ed., 1985; p. 118.
2. IVACG. Guidelines for the Eradication of Vitamin A Deficiency and Xeropthalmia, 1977; p. 4-5.
3. Eastman EJ. Vitamin A deficiency and xerophthalmia. Recent findings and some programme implication.

Assignment Children Series. UNICEF, NeW York, 1987; p.5.

4. Ahmad, K., Hassan, N., Nutrition Survey of Rural Bangladesh. Institute of Nutrition and Food Science, University of Dhaka, 1981-82.
5. UNROD (United Nations Relief Operation- Dhaka), Nutrition Problems in Bangladesh, 1973; p. 58.
6. Nahar, B., C.P. Banu, A. Banu and K. Ahmad. Loss of Nutritional Values of Food Stuff on Cooking. Bang. J. Agro., 1982; 7: 9.
7. Wood, M.A., Collings, A.R., Stodola, V., Burgoin, A.H., Fention, F. Effect of large scale food preparation on vitamin retention: Cabbage. J. Am. Diet. Assoc., 1946; 22: 677
8. Munsell, H.E., Streight off, F. Bendor, B., Orr, M.L., Ezekiel, S.R., Leonard M.H., Richardson, M.E., Koch, F.G. Effect of lafge scale methods of preparation on the vitamin context of food 3. Cabbage: J. Am. Diet. Assoc., 1949; 25:420.
9. Malek, A., A.R. Begum and K. Ahmed. Analysis of some food stuffs of East pakistan. Pak. j. Biol. and Agr. Sc., 1966; 9(1)
10. Sweeny, J.P. and Marsh, A.C. Effect of processing on provitamin A in vegetables. J. Am. Diet. Assoc., 1971; 59; 238.
11. Glick, D., Methods of Biochemical Analysis, Interscience Publishers, Inc., New York, 1957; 4; 362.
12. The Association of Vitamin Chemists: Methods of vitamin Assay. Interscience publishers., Inc., New York. 3rd Edition. 1966; p. 98.
13. Gordon, J. and Noble, I., Waterless vs Boiling water Cooking of Vegetables. J. Am. Diet. Assoc., 1964; 44: 348.
14. Osee Hughes and Marion Bennion. Introductory Foods. 5th ed. published by Macmilan Publishing Co. Inc., 1970; 87.