Bioscience Discovery, 11(4):268-273, Oct - 2020

Open Access, Peer Reviewed, Referred Research Journal

Print & Online available on https://jbsd.in
ISSN: 2229-3469 (Print); ISSN: 2231-024X (Online)

Research Article

Retention of β-carotene from green leafy vegetables

Haribabu Narra

Department of Botany,
SPDM Arts, SBB and SHD Commerce and SMA Science College, Shirpur, Dist Dhule
Maharashtra-425405
haribabuspdm@gmail.com

Article Info

Received: 01-06-2020,
Revised: 22-08-2020,
Accepted: 02-09-2020

Keywords: Blanching, β-Carotene, Retention, Drying, Visible Spectrophotometer.

Abstract

In the present research work the effect of blanching treatments on β-Carotene retention from the green leafy vegetables is studied. Blanching is suitable technique for preservation of green leafy vegetables. The objective of the present study is to show the impact of chemical blanching treatment with Magnesium Oxide (MgO) and water blanching for β-Carotene stability to conditions of temperature, time and type of vegetables, for commonly consumed green leafy vegetables. Four leafy vegetables are selected for blanching treatment viz. Spinach (*Spinacia oleracea L.*), Fenugreek (*Trigonella foenum-graecum* L.), Shepu (*Anethum graveolens L.) and* Coriander (*Coriandrum sativum* L.). The retention of β-Carotene increases in chemical blanching rather than water blanching. At the same time moisture content of vegetable also maximum in chemical blanched samples compare with the water blanched sample. This study indicates that chemical blanching is effective method for the preservation of vegetables to maintain its physical properties like colour, texture and odour. Chemical blanching is also important for stabilize the nutritive quality, nutrient retention and inactivate the enzyme in vegetables. In the nutrition point of view chemical blanching is beneficial technique than water blanching.

INTRODUTION

β-carotene is a precursor of vitamin-A which is widely distributed in fruit and vegetables. The β-carotene is a valuable nutrient and performs many functions in the human body, antioxidant depending on its metabolization, essential nutrient known as pro-vitamin A (Strobel *et al.*, 2007). The human beings need various nutrients for their growth, development and to lead an active and healthy life. The nutrients include proteins, fats, carbohydrates, minerals and vitamins, which are present in the food we eat daily. Most foods contain almost all the nutrients in various proportions. The blanching includes heat treatment of the vegetables in different heating system like steam, hot water and microwave to different time periods. Blanching type regulate by many factors such as balancing media, temperature, time, physiological properties of vegetables (Patel *et al.*, 2016).

The blanching process is traditional and widely used method for preservation of leafy vegetable, these includes Spinach, Fenugreek, Shepu, Coriander, Cabbage etc. The main purpose of blanching is to inactivate the enzymes that cause quality loss in the vegetable product during frozen storage and to reduce microbial load on the surface of vegetable. Some enzymes are most heat stable in vegetables and their deteriorations have been widely used as indicators of sufficient heat treatment (Pimsiree, 2015). In green leafy vegetables have significant levels of nutrients that are essential for human health.

The blanching revealed that at 15, 25 and 45 min decreased considerably the nutritional value of these leafy vegetables. The losses in anti-nutrients like oxalates, phytates might show a beneficial effect on the bioavailability of minerals like calcium, iron and zinc. Thus, the study suggests that the recommended time of domestic blanching must be less than 15 min for the studied leafy vegetables in order to contribute efficiently to the nutritional requirement **(**Oulai *et al.,* 2015).

The quality of vegetable, dried in mechanical dehydrator is studied as an attempt to develop a dehydrated product from this vegetable. The effect of different blanching i.e water blanching and steam blanching, chemical blanching like MgO, NaCl, $NaHCO_3$ was also important for nutritional factors. Drying of fresh leaves without any pre-treatment and in the absence of blanching resulted in undesirable colour changes. Blanching of vegetables in water for 10 to 20 seconds with magnesium oxide resulted in superior product which unlike the steam blanched or unblanched leaves by showing minimal loss of green colour as reflected in chlorophyll content and nutritional characteristics (Kaushal *et al.,* 2013). The pre-cooking or blanching is done by fruits or vegetables dip in water at 90-95°C temperature. Exposing these to steam is also possible, at that time fruits and vegetables become somewhat soft and inactivation of enzymes. Leafy vegetables shrink in this process and some of the micro-organisms die. Blanching is done before a product is dried for prevent unwanted colour and odour changes and an excessive loss of vitamins (James, 2013).

MATERIALS AND METHODS:

Materials: Spinach (*Spinacia oleracea L.*), Fenugreek (*Trigonella foenum-graecum* L.), Shepu (*Anethum graveolens L.) and* Coriander (*Coriandrum sativum* L.). These Four leafy vegetables are selected for the study.

Preparation of Sample: The selected green leafy vegetables are washed with tap water. These vegetables thoroughly drained, weighted by digital balance. These vegetables blanched in hot water with of 0.1 % Magnesium Oxide (MgO) solution at 95 to 98 ˚C for 1 minute in distilled water, at same time all vegetables blanched by in distilled water.

Drying Vegetables: These blanched vegetables dried in cabinet tray drying method, the blanching leaves of vegetables spread on aluminum tray and placed into the cabinet tray drier at 45°C to 50°C upto the drying vegetables (Satwase *et al.,* 2013).

Moisture content: Moisture content of all the vegetables was determined, the fresh weight of each vegetable 100 gm. These vegetables blanched and it was placed in cabinet drier. After drying the weight was taken and then calculated moisture content of vegetables by using following formula (Samuel, 2013).

$$\text{Moisture content} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \text{ X } 100$$

Analysis of β-Carotene: Blanched leaf vegetables used for extraction of β-Carotene by column chromatography technique using alumina powder, acetone and petroleum ether as solvent. After the extraction of β-carotene optical density was measured by single beam systronics spectrophotometer at 450 nm. These all vegetables preserved for 30 days, after one month again β-carotene was estimated from these preserved vegetables. Amount of β-Carotene calculate by using following formula.

Beta -Carotene: X/0.25=Y

Where X= Optical density, Y= Amount of β-Carotene

Statistical analysis: All the data is analyzed by using Microsoft office excel. The main analysis includes means and standard deviation in each sample, calculates by three replicates.

RESULTS AND DISCUSSION:

Effect of blanching treatment on retention of β-carotene

The present research work shows the effect of chemical blanching and water blanching for retention of β-carotene and moisture content of selected leafy vegetables- Spinach (*Spinacia oleracea L.*), Fenugreek (*Trigonella foenum-graecum* L.), Shepu (*Anethum graveolens L.) and* Coriander (*Coriandrum sativum* L.). In chemical blanched vegetables retention of β-carotene is higher compare with water blanched vegetables. Magnesium oxide (MgO) is the pre-eminent preservatives for retention of nutrient and colour, texture and odour of vegetables. Effect of blanching time and temperature of water also affect quality of vegetables and loss of nutrient in vegetables. In fresh vegetable there is less β-carotene, For calculating moisture content of vegetables

this retention increase after blanching vegetable with Magnesium oxide (MgO).

100 gm each fresh vegetable used for drying by using cabinet drier. Spinach has 94.69 % moisture content in chemical blanching and 93.37 % in water blanching. Trigonella shows more in chemical blanching i.e 87.57 % and less 84.97% in water blanching. Shepu contain 89.61% in chemical blanching and 93.70% water blanching. Lastly in Coriander, chemical blanching shows 89.66% and water blanching shows 93.80% of moisture content (Table 1).

Table 1: Effect of blanching treatment on moisture content in vegetables

Name of Vegetables	Moisture content of 100 gm sample				
	Fresh weight	Chemical blanching		Water blanching	
		Weight in gm	% loss in wt.	Weight in gm	% loss in wt.
Spinach	100	05.31 ± 0.05	94.69	06.63 ± 0.22	93.37
Fenugreek	100	12.43 ± 1.03	87.57	15.03 ± 2.01	84.97
Shepu	100	10.39 ± 0.34	89.61	06.30 ± 0.20	93.70
Coriander	100	10.34 ± 0.31	89.66	06.20 ± 0.10	93.80

Values are represented as Mean ± Standard deviation by each three replicates

In fresh vegetable, highest β-carotene content in Coriander 3.460 µg followed by Trigonella 3.404 µg, Spinach 3.260 µg and least in Shepu i.e. 2.928 µg. In β-carotene retention the chemical blanching is more effective than the water blanching treatment. During the chemical blanching with MgO shows highest retention in Spinach 8.128 µg followed by Coriander 7.968 µg, Trigonella 7.968 µg and least 7.696 µg. Water blanching shows maximum β-carotene in Trigonella contain 7.860 µg, Coriander 7.636 µg, Spinach contain 7.628 µg and Shepu 7.584 µg of β-carotene (Table 2).

Table 2: Effect of blanching treatment on β-carotene retention in vegetables

Name of Vegetables	Fresh Sample		Chemical blanching		Water blanching	
	O.D. at 450 nm	β carotene µg/ gm	O.D. at 450 nm	β carotene µg/ gm	O.D. at 450 nm	β carotene µg/ gm
Spinach	0.815	3.260 ± 0.03	2.032	8.128 ± 3.00	1.907	7.628 ± 1.30
Fenugreek	0.851	3.404 ± 0.10	1.991	7.964 ± 2.03	1.965	7.860 ± 2.11
Shepu	0.732	2.928 ± 0.01	1.924	7.696 ± 2.10	1.896	7.584 ± 1.41
Coriander	0.865	3.460 ± 0.11	1.992	7.968 ± 2.02	1.909	7.636 ± 1.20

Values are represented as mean ± standard deviation by each three replicates

The result indicates effect of blanching treatment for retention of β carotene content in green leafy vegetables. During research leafy vegetables blanched with different method i.e chemical and water blanching, vegetables dry in cabinet drier. These blanched vegetables preserve one month and comparison in between chemical blanched, water blanched and fresh sample. In chemical blanching Trigonella shows more retention i.e 7.988 µg followed by Coriander 7.800 µg, Spinach 7.528 µg and less in Shepu contains 7.448 µg. At the same time in water blanching treatment Trigonella has maximum β carotene content 7.720 µg followed by Coriander contain 7.572 µg, Shepu 7.300 µg and Spinach contains 7.232 µg of β carotene (Table 3). The cabinet tray drier is the best method of dehydration of fruit and vegetables. There is better retention of valuable nutrients i.e. vitamins, protein, carbohydrates, crude fibre and minerals and dehydrated characteristics as compared to the oven, shade and sun drying methods.

Table 3: Effect of blanching treatment on β-carotene retention after 01 month

Name of Vegetables	Fresh Sample		Chemical blanching After 01 month		Water blanching After 01 month	
	O.D. at 450 nm	β carotene µg/ gm	O.D. at 450 nm	β carotene µg/ gm	O.D. at 450 nm	β carotene µg/ gm
Spinach	0.815	3.260 ± 0.03	1.882	7.528 ± 2.21	1.808	7.232 ± 2.11
Fenugreek	0.851	3.404 ± 0.10	1.997	7.988 ± 2.01	1.930	7.720 ± 2.20
Shepu	0.732	2.928 ± 0.01	1.862	7.448 ± 2.23	1.825	7.300 ± 1.20
Coriander	0.865	3.460 ± 0.11	1.950	7.800 ± 2.10	1.893	7.572 ± 2.02

Values are represented as mean ± standard deviation by each three replicates

Dehydration technique resulted in concentration of nutrients. Dehydration was one of the most possible strategies for preservation of green leafy vegetables. The abundantly available inexpensive leaves of *Moringa oleifira* Lam. can serve as a pool house of nutrients and can be used in the developing countries to reduce micronutrient deficiencies (Satwase *et al.,* 2013).

The dehydration of green peas solar dehydrated green peas pre-treated with 0.1% magnesium oxide is the best dehydration technique based of sensory evaluation colour, taste, and overall acceptability compared to the other pre-treatment and the dehydration techniques. The moisture content was found to be increasing as the shelf life increasing, the nutrient retention was found to be higher in those vegetables pre-treated with magnesium oxide. Where chlorophyll retention was superior compared to the untreated green peas. The solar dehydrated green peas pre-treated with magnesium oxide packed in aluminium pouches had shown the better chlorophyll retention and less nutritional losses as compared to the untreated green peas and these nutritional values remain stable for a period of 6 months (Jangabelli *et al.,* 2017). Drying is cheapest method for preservation of vegetables in drying removing moisture and prevent to spoilage and decay. When drying vegetables, the key is to remove moisture as quickly as possible at a temperature that does not affect the flavor, texture and color of the vegetables (Kendall *et al.,* 1998).

The curry leaves blanched in hot water containing 0.1 percent magnesium oxide. The treated leaves were then dried in different drying conditions like sun drying, shade drying and cabinet tray drying. The dried leaves were analyzed for their nutritional and organoleptic qualities. The highest percent of nutrients retention show in cabinet tray drier than sun and shade drying technique (Sakhale *et al.,* 2007). The blanching shows the effects of different storage conditions on textural quality and microbiological qualities of vegetables. The durations of blanching and refrigerated storage significantly influenced green colour intensity and hardness of edamame beans. Green colour intensity peaked as blanching time increased to 5 min, while the hardness of the beans decreased during blanching and cold storage. Blanching reduced the activity of Yeast, Mold, and Coliform bacteria (Xu *et al.,* 2012). The frozen vegetables are used for analyze riboflavin, vitamin E, β-carotene and ascorbic acid, these nutrients not only preserved in quantities equivalent to those of fresh samples, but in many cases nutrients are found in much higher quantities than those of the fresh vegetables (Bouzari *et al.,* 2014). Vegetables and fruits are loss their quality, due to enzymatic browning, to reduce the browning fruit and vegetable are prevent from oxidation. For preservation of vegetables use chemical, physical blanching and freezing, for controlled atmosphere and coating methods, to prevent enzymatic browning (Ioannou and Ghoul 2013).

The retention of total antioxidant activity, total phenols and ascorbic acid in broccoli, carrots and green beans was strongly influenced by the different pre-treatment and preservation methods. Blanching treatments subjected to vegetables had better retention of nutrient and total colour of vegetables (Patras *et al.,* 2010). In Ambat chukka shows maximum retention of ascorbic acid followed by Shepu in all blanching treatments for time and temperature. Chemically blanched samples showed better retention of ascorbic acid than their respective unblanched samples. This retention depends on blanching method, time, media and temperature for processing the commonly consumed green leafy vegetables (Gupta *et al.,* 2008). In chemical blanching natural colour of

green leafy vegetables is retained, the green vegetables to preserve the colour of the blanched vegetable during processing and storage. In the conventional method of blanching and drying green vegetables such as green beans, peas and spinach, the vegetable after being washed, is subjected to a blanching operation of 3 to 5 minutes duration. After the blanching the retention of green colour in vegetables generally requires a mixture to gain the colour retention (Segner *et al*., 1984).

Leafy vegetables play an important role in balanced diet. The blanching technique provides nutritious food to consumers. The blanching dry vegetables are stored for long period; dehydration is one of the techniques which preserve vegetables for longer period. In cabinet tray drying method, retention of nutrient values is more compared to other drying methods. It can be concluded that the cabinet tray drying is the cheapest method of dehydration of blanched and unblanched vegetables. The retention of β-carotene in chemical blanched vegetables is more than that of water blanched vegetables. Blanching is also important for stabilize the sensory quality of preserved vegetables. In chemical blanching Magnesium Oxide (MgO) is effective preservatives for retention of nutrient content in vegetables and these vegetables can be preserve for long duration.

Acknowledgement:
Author is thankful to Head, Department of Botany and Head, Dept of Chemical Technology Dr. Babasaheb Ambedkar Marathwada University, Aurangabad for providing necessary laboratory facilities.

REFERENCES:

Bouzari A, Holstege D and Barrett DM, 2014. Vitamin retention in eight fruits and vegetables: a comparison of refrigerated and frozen storage. *Journal of Agricultural and Food Chemistry,* DOI: 10.1021/jf5058793.

Gupta S, Lakshmi J and Prakash J, 2008. Effect of different blanching treatments on ascorbic acid retention in green leafy vegetables. *Natural Product Radiance,* **7**(2): 111-116.

Ioannou I and Ghoul M, 2013. Prevention of enzymatic browning in fruit and vegetables. *European Scientific Journal,* ISSN: 1857 – 7881, **9** (30): 310-341.

James IF, 2003. Preservation of fruit and vegetables. *Agromisa Foundation, Wageningen,* ISBN: 90 77073 302:17.

Jangabelli M, Rao M, Bhasker V, Waghray K and Maloo S, 2017. Process standardization and evaluation of green peas (*pisum sativum*) using solar dehydration technology. *International journal of innovative technology and research,* **5**(2):5673-5680.

Kaushal M, Sharma K and Attri S, 2013. Effect of blanching on nutritional quality of dehydrated colocasia, Colocasia esculenta (L.) Schott leaves. *Indian Journal of Natural Products and Resources*, **4**(2):161-164.

Kendall P, DiPersio P and Sofos J, 1998. Preparation drying vegetables, *Food and nutrition series, Colorado State University Cooperative Extension,* No. 9.308.

Oulai PD, Zoué LT and Niamké SL, 2015. Evaluation of nutritive and antioxidant properties of blanched leafy vegetables consumed in northern côte d'ivoire, *Pol. J. Food Nutr. Sci*, **65** (1): 31–38.

Patel PB, Patel PV, Joshi SB, Pandya DD, Chaudhary MK, Patel BG and Joshi AB, 2016. Effect of different blanching treatments on ascorbic acid retention in green leafy vegetables. *International Journal of Agriculture Sciences,* ISSN: 0975-3710&E-ISSN: 0975-9107, **8**(51): 2353-2355.

Patras A, Tiwari BK and Brunton NP, 2010. Influence of blanching and low temperature preservation strategies on antioxidant activity and phytochemical content of carrots, green beans and broccoli. *LWT - Food Science and Technology,* **44:** 299-306.

Pimsiree S, 2015. Effects of blanching on color, texture and sodium chloride content during storage time of frozen vegetable soybean modeling for commercial scale. *Dissertations & Theses in Food Science and Technology,* pp. 54.

Sakhale BK, Nandane AS, Tapre AR and Ranveer RC, 2007. Studies on dehydration of curry leaves. *ADIT J. of Engineering,* **4**(1): 62-64.

Samuel NN, 2013. Determination of selected trace elements and beta-carotene in fresh and dried indigenous vegetables as potential food supplement from Kiambu, Kenya. *ir-library.ku.ac.ke/.../Determination%20of%20selected%20trace%20elements%20:43-44.*

Satwase AN, Pandhre GR, Sirsat PG and Wade YR, 2013. Studies on drying characteristic and nutritional composition of drumstick leaves by using sun, shadow, cabinet and oven drying methods. *Open Access Scientific Reports,* **2**(1):1-4.

Segner WP, Ragusa TJ, Nank WK and Hoyle WC, 1984. Process for the preservation of green colour in canned vegetables. *United States Patent*, Patent Number: 4,473,591. Application NO: 449,914.

Strobel M, Tinz J and Biesalski H, 2007. The importance of β-carotene as a source of vitamin A with special regards to pregnant and breastfeeding women. *European Journal of Nutrition*, **46**:(1):1-20.

Xu Y, Sismour E, Pao S, Rutto L, Grizzard C and Ren S, 2012. Textural and microbiological qualities of vegetable soybean (Edamame) affected by blanching and storage conditions. *J Food Process Technol*, **3** (6):1-6.

How to cite this article

Haribabu Narra, 2020. Retention of β-carotene from green leafy vegetables. *Bioscience Discovery*, **11**(4):268-273.

Google Scholar citation: https://scholar.google.co.in/citations?user=vPzEyC8AAAAJ&hl=en