GENERAL ISSUES CONCERNING CONTENT OF ASCORBIC ACID IN PROCESSED HORTICULTURAL PRODUCTS

ASPECTE GENERALE PRIVIND CONȚINUTUL ÎN ACID ASCORBIC LA PRODUSELE HORTICOLE PRELUCRATE

BARCAN (BĂETU) Alina-Loredana[1], BĂETU M.[1]
e-mail: alina_brcn@yahoo.fr

Abstract. *Product processing causes loss of C vitamin, depending on the methods used. Prolonged washing, air and lighting exposure, fragmentation, boiling, drying, freezing of the products lead to a significant decrease in C vitamin content. The lactic fermentation stores the C vitamin in the product, but 50% goes into the liquid coating. The losses can be lowered by scalding steam, shortened high-temperature sterilization, vacuum closure or by using different preservatives. The usage as a food additive (ascorbic acid - E300) is due to its antioxidant properties. It exhibits as acicular colorless crystals, foils or white crystalline powder. It is used in beverages, canned food, oils and non-emulsified fats, as stabilizing agent etc. Ascorbic acid has many derivatives are also used as antioxidants: sodium ascorbate, ascorbyl palmitate, iso-ascorbic acid and iso-ascorbats.*

Key words: processing, loss, use

Rezumat. *Prelucrarea produselor determină pierderi de vitamină C, în funcție de metodele utilizate. Spălarea îndelungată, expunerea la aer și lumină, fragmentarea, fierberea, deshidratarea, congelarea duc la diminuarea semnificativă a conținutului în vitamină C. Fermentația lactică păstrează vitamina C, dar în proporție de 50 % trece în lichidul de acoperire. Pierderile pot fi micșorate prin opărire cu abur, termosterilizare la temperaturi înalte pe durată redusă, închiderea sub vid, folosirea diferiților conservanți. Utilizarea ca aditiv alimentar (acidul ascorbic – E300) se datorează proprietăților sale antioxidative. Se utilizează în băuturi, conserve, uleiuri, grăsimi neemulsionate, ca agent de stabilizare etc. Prezintă mai mulți derivați utilizați tot ca antioxidanți: ascorbatul de sodiu, ascorbil palmitatul, acidul izoascorbic și izoascorbații.*

Cuvinte cheie: prelucrare, pierderi, utilizare

MATERIAL AND METHOD

Besides the study of specialized literature represented by scientific work, treatises, and books, I consulted various websites of foreign non-governmental agencies dealing with research in the public nutrition field.

RESULTS AND DISCUSSIONS

Food preservation represents the way in which human beings intervene to maintain unchanged the organoleptic properties and nutritive value of food as long as possible.

[1] University of Agricultural Sciences and Veterinary Medicine Iaşi, România

Influence of technological phases on ascorbic acid content of processed products:

- *prolonged washing, thick skin peeling, boiling in uncovered vessels and in a large quantity of water or repeated heating* determine the significant diminution of ascorbic acid from the horticultural raw materials;

- *cutting into fragments, chopping, mincing* affect tissues, releases specific enzymes and increase the contact surface with atmospheric oxygen; the size and shape of fragments, besides their exposure to air, directly influence the loss level through oxidization of some useful substances (table 1);

Table 1

Losses of vitamin C of peeled peaches, depending on the duration of exposure to air and during fragmentation (as Maria Olaru, 1976)

Time of exposure to air	Losses in vitamin C (%)	
	Peach halves	Peach slices
30 minutes	29	42
60 minutes	34	52
90 minutes (max)	45 (max)	58 max)

- *boiling (bleaching)* – the loss level of ascorbic acid depends on the type and duration of treatment; losses may be obtained by dissolution and oxidization; these losses may be limited by the inactivation of oxidases;

Smaller losses are registered through steaming rather than by water boiling. High temperature thermal sterilization and for a short time protects the ascorbic acid content of canned food and so does the vacuuming of containers (Beceanu D. 2009).

- water bleaching of fruits and vegetables leads to the decrease of vitamin C content by 10 ÷ 50% (table 2);

- steam bleaching has losses of only 10 ÷ 30%.

Table 2

Loss of water soluble vitamin content of vegetables, after scalding
(as Maria Olaru, 1976)

Product	Percentage loss in water soluble vitamins			
	Vitamin C	Vitamin B_1	Vitamin B_2	Vitamin PP
Garden Beans	10-50	0-18	0-30	0-40
Peas	10-30	0-37	13-33	4-41
Spinach	1-94	0-33	0-22	0-37

Potatoes that may bring in the human nutrition a significant share of vitamin C may lose up to 50% of vitamin after peeling and water boiling; the loss is two times smaller by baking them into the oven without peeling (Cuciureanu Rodica, 2002).

Influence of different preservation methods of horticultural products:

- *dehydration* – the factors influencing the destruction of vitamin C in dehydrated products are the nature of the horticultural product, the level of dehydration, the storage temperature and the chemical composition of the environment where storage occurs (table 3).

For example, dehydrated cabbage kept at 32˚C for 16 weeks loses 33% of vitamin C if it is stored after dehydration in a moist atmosphere of 3.6% and 90% if air moisture is 8.2% (Cuciureanu Rodica, 2010).

Table 3

Vitamin content (mg%) of dehydrated products (after Mincu, 1976-1984)

Dehydrated product name	Vitamins				
	A (β – carotene)	B_1 (thiamine)	B_2 (riboflavin)	PP (nicotinamide)	C (ascorbic acid)
apricots	5	0,01	0,16	3,3	-
apples	0,06	0,05	0,08	0,5	1
pears	0,07	0,04	0,06	0,3	1
peaches	2	0,12	0,11	1,6	1
plums	1,25	0,18	0,5	1,7	2
paprika	17-350,01	0,1-0,3	0,08	1-5	95-180

- *lacto fermentation* – allows the preservation of vitamin C but this passes into the fermentation liquid in proportion of 50% (Jamba A., Carabulea B., 2002);

- *microwaves* – the use of microwaves in food technology does not trigger specific modifications;

- *ionizing treatment* – the reduction of the ascorbic acid content of a freshly irradiated fruit with 2kGy is smaller than that of the untreated product after the same storage period in identical conditions (Cuciureanu Rodica, 2002);

- *freezing* –ascorbic acid is preserved relatively well, although there may occur important losses by oxidization if the freezing speed favors the destruction of the vegetal tissues favoring the contact of oxidizing cellular enzymes with ascorbic acid (fig.1, table 4).

Important losses may be found in an incorrect de-freezing; the frozen fruit diminish their ascorbic acid content depending on the temperature and period of preservation; at -8.5ºC losses reach 70 ÷ 80% within 6÷8 months (Beceanu D. et al., 2011).

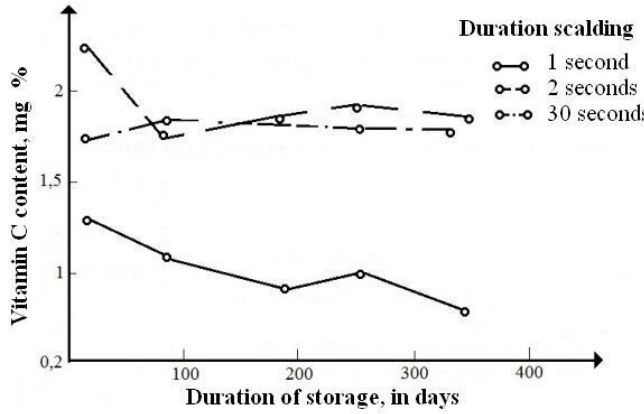

Fig. 1 - The decrease in vitamin C content of frozen peas in conjunction with technological parameters (mode and duration of storage scalding)

Table 4

Losses of vitamin C recorded in several species of vegetables, depending on the duration and temperature of freezing (after Maria Olaru, 1976)

Product	Baseline (mg%)	Freezing (months)	Losses%		
			-12°	-18°	-30°
cauliflower	78	4	30	5	-
		8	70	45	20
		12	80	50	20
beans	14	4	55	15	-
		8	70	18	-
		12	95	30	-
peas	17	4	25	-	-
		8	42	5	-
		12	79	11	2
spinach	31	4	55	15	-
		8	85	50	10
		12	90	55	15

According to Dumitrescu C. (1987), following the processing by *thermal sterilization,* vegetables diminish their vitamin C content, but preserve better the quantity of vitamins A and B.

The industrial preparation of sterilized cans carried out in the absence of air keeps a quite high level of C vitamin (tables 5 and 6).

Table 5

Vitamin C content of some sterilized products (after Mincu, 1974 - 1984**)**

Product name	Vitamin C (mg/100g produs)
Courgettes in water	10
Okra in tomato sauce	5,5
Pot in broth	7
Tomato broth	18
Eggplant in tomato sauce	4
Vegetable stew	30
Okra in Oil	3,5
Oil Pot	7

Table 6

Vitamin C content of fruit products concentrated with sugar (after Mincu, 1976-1984**)**

Product name	Vitamin C (mg/100g produs)
syrup cherry / raspberry	5,2
apricot jam	4,2
peach jam	3,1
plum jam	4,2
cherry jam	2,1
strawberry jam	15,4
quince jam	2,2
walnut jam	181
rose jam	3,6
marmalade	4,7
extra marmalade	5,8

The sterilization process causes variable losses of vitamin C content; they reach 20 ÷ 50% if we take into account the entire content of the container in which sterilization is made and 50 ÷ 70% if we take into account only the solid content of the container; if we also consume the liquid part of the food, the level of maintenance of vitamin C is superior to that retained by culinary processing of the product (table 7) (Beceanu D., 2009).

Table 7

Vitamin C content in juices prepared of several species of fruit
(after Mincu, 1976-1984)

Product name	Ascorbic Acid (mg/100g product)
Cranberry juice	6,8
Apple juice	7
Prune juice	3,5
Grape juice	4

By storing sterilized cans, the losses of vitamin C depend more on temperature than on the period of storage. The vitamin C losses especially occur in the first days of storage and are due to its oxidization by the oxygen existing in the residual air from the container. Tinned metal containers protect vitamin C.

Reheating of sterilized cans for consumption may produce new losses of vitamin C; to reduce the vitamin C losses in the products consumed after heating, we recommend:

- first to concentrate the liquid part and heat the solid part of the food, thus the vitamin C losses are minimal;

- if one eats the solid part of the food, this will be heated entirely by removing then the liquid part; this way the losses are quite significant since the liquid contains between 33 – 54% of vitamin C present in the initial product.

Other factors influencing the ascorbic acid content in the processed products

The ascorbic acid content of vegetables and fruits transformed may be destroyed by:

- *oxidization or solubilization in water*. Oxidization is favored by the neutral or alkaline pH being catalyzed by light and the copper cations.

- *ascorbatoxidase and peroxidases* intensify the level of these losses.

-*preservation in* SO_2 or the presence of sulphur amino acids provides the antioxidant protection of vitamin C.

- *processing equipment* enameled or made from stainless materials prevents the inactivation of this vitamin in the presence of iron or copper ions (Cuciureanu Rodica, 2010).

Vitamin C as a food additive used in the food industry

Food additives are substances added to the food products to prevent the appearance of undesired processes: antioxidants, antiseptic, acidulants) and to give superior qualities to the finished product (colour, colorants, and flavor enhancers). The names of the relevant European food additives are: E300 acid

ascorbic, E301 sodium ascorbate, E302 calcium ascorbate, E303 potassium ascorbate, E304 esters of ascorbic acid with fat acids: ascorbyl palmitate and ascorbyl stearate.

According legislative act OMS/2002, in our country the ascorbic acid is used in doses "qs" for the following products: in fruit juices and nectars in extra jams and extra jellies, raw fruits and vegetables, chilled, frozen and packed, unprocessed and peeled potatoes, processed; in emulsified oils and fats (except virgin oils and olive) for boiling, roasting, or for preparing sauces, canned vegetables and fruit, bread prepared exclusively from wheat flour, water, yeast or leaven, salt, in specialties "Pain courant français", the fresh pasta and beer.

In pineapple juice and nectar and passion fruit is added 3g / L ascorbic acid. It is also added to foods for infants and young children, healthy, such as drinks, juices, baby foods from fruit and vegetables (separately or in combination with L-ascorbate and sodium ascorbate Calcium L-) in the dose 0.3 g / kg expressed as ascorbic acid, in cereal-based foods containing fat, including biscuits and rusks, a dose of 0.2 g / kg (expressed as ascorbic acid) (Elena Orănescu, 2008).

CONCLUSIONS

Different treatments of horticultural products cause greater losses or lower after the application as follows:

- steam bleaching produce minimal los;
- water bleaching leads to significant loss of vitamin C;
- sulfitation ensure the maintenance of a larger amount of vitamin C;
- lactic fermentation preserves the biological activity of ascorbic acid.

Technological flow of production phases of canned fruit and vegetables may influence both the upside (added ascorbic acid - food additive) and the decrease in ascorbic acid content of the finished product (technological stages: washing, fragmentation, cleaning layer thick, bleaching and technological processes: concentration, dehydration, freezing, sterilization).

By treating horticultural products with X-ray and microwave, did not reveal specific effects on vitamin C. The ascorbic acid is used as an antioxidant to obtain: beverage cans, oils, fats emulsified, as stabilizing agents.

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