THE INFLUENCE OF FREEZING ON THE CONTENT OF VITAMIN C, CHLOROPHYLLS AND CAROTENOIDS IN CHIVES (*ALLIUM SCHOENOPRASUM* L.)

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Abstract: *In this paper we analyzed the influence of freezing at -18°C for 4 months, for blanched and non-blanched chives (Allium schoenoprasum* L.*) on the content of ascorbic acid, chlorophylls and carotenoids. In the case of fresh chives, the vitamin C content (determined by iodometric method) was 56.48 mg/100g; for frozen non-blanched chives, were determined losses of 49.91% and for frozen blanched chives, losses of 15.88%. The total chlorophylls concentration (determined by spectrophotometry) in fresh chives was 268.15 µg/g, of which 205.00 µg/g chlorophyll "a" and 63.15 µg/g chlorophyll "b", respectively. After the freezing treatment on the fresh chives there were determined losses of 18.95% from total chlorophylls, 18.27% chlorophyll "a" and 21.14% chlorophyll "b". Freezing of the blanched chives has caused less loss of chlorophylls (9.58% loss of total chlorophylls) compared with the same treatment applied to fresh chives. The content of carotenoids determined by using spectrophotometric methods, revealed that fresh chives had 36.41 µg/g, and losses were of 31.86% for frozen non-blanched chives and of 16.97% for frozen blanched chives.*

Keywords: chives, freezing, vitamin C, chlorophylls, carotenoids.

INTRODUCTION

Chives (*Allium schoenoprasum* L.) *Alliaceae* family, is a perennial aromatic plant, widespread in nature mostly in Europe, Asia and North America. This plant has been used for centuries to flavor food, for medicinal qualities, and has been used in some parts of the world for some religious rituals (Parvu *et al*., 2014; Rattanachaikunsopon and Phumkhachorn, 2008; Stajner *et al*., 2011).

Chives contains vitamins A, B as well as iron, sulfur, phosphorus, potassium, iodine, sodium, etc. It also contains chlorophylls, carotenoids and a lot of vitamin C that helps to absorb and fix the iron in the body, so the anemic can consume it with confidence at every meal. It is a safe source of vitamin B6, E, magnesium, iron, calcium, selenium, zinc, protein, but also water, carbohydrates, fibers and fats (Poulsen, 1990). Chives has been found to have similar medicinal properties to garlic, but weaker. The plant is used to reduce blood pressure, but also as antimicrobial and antifungal agent (Rattanachaikunsopon and Phumkhachorn, 2008). Chives are used in many dishes. Only the leaves are of interest for consumption, the bulbs being too small.

Industrially, chives leaves are processed by freezing, by hot air drying or by freeze-drying (Poulsen, 1990). Freezing is one of the most widespread methods of food preservation. As a result of the development of freezing technologies, nowadays we can get frozen products that keep almost all the qualities of fresh products (Evans, 2008) from the market.

The purpose of this paper is to study the influence of freezing with and without preliminary blanching on the content of ascorbic acid, chlorophylls and carotenoids from the chives.

MATERIALS AND METHODS

Leaves of chives (*Allium schoenoprasum* L.) were purchased fresh from the local market in Timisoara (supermarket) in May, 2016.

From the raw material were used both fresh samples as well as samples after freezing, with or without preliminary blanching treatment. In both cases, freezing was achieved

at -18°C for 4 months. Blanching was done on steam for 5 minutes.

Determination of vitamin C content in fresh and frozen samples was performed according to the methodology presented by Dumbravă *et al*. (2016). The chlorophylls and carotenoids pigments levels were assessed spectrophotometrically (Dumbravă *et al*., 2012), using an UV-VIS Perkin Elmer - Lambda 25 spectrophotometer. All determinations were made in triplicates, their mean being calculating.

RESULTS AND DISCUSSIONS

Vitamin C content

The ascorbic acid content (mg/100g fresh weight) of the fresh and frozen chives samples is shown in Figure 1.

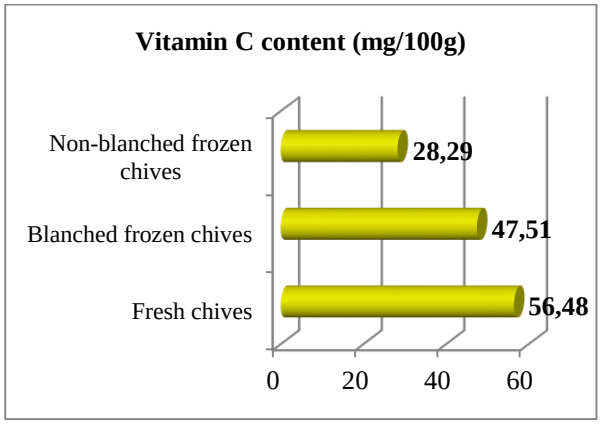

Figure 1. Ascorbic acid content in fresh and frozen chives samples.

Experimental data show that freezing causes drops in ascorbic acid concentrations in chives. In frozen chives without prior blanching, vitamin C content dropped to nearly half (28.29 mg/100g) of the value found for fresh chives leaves (56.48 mg/100g), whereas in chives blanched on steam and then frozen, the content of ascorbic acid was closer (47.51 mg/100g) to fresh chives.

The loss (%) of vitamin C in samples of non-blanched frozen chives were 49.91%, while in the case of blanched frozen chives, the losses were only 15.88%.

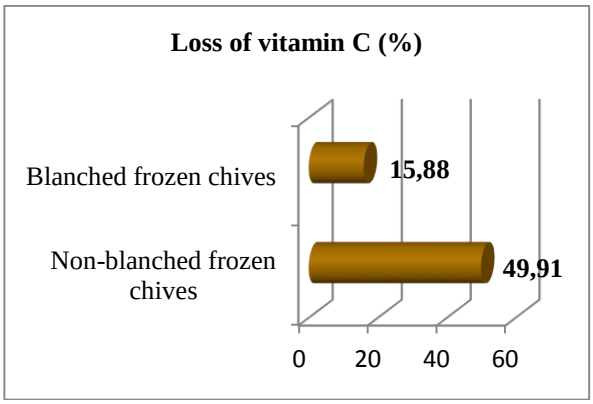

Figure 2. Loss of vitamin C as a result of chives freezing.

Chlorophyll content

Calculated values for chlorophyll "a", chlorophyll "b" and total chlorophylls (µg/g fresh weight) of the analyzed samples are shown in Figure 3.

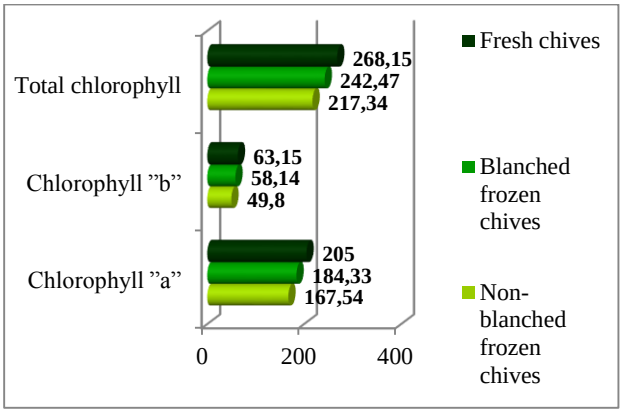

Figure 3. Chlorophyll content (µg/g fresh weight) of fresh and frozen chives.

It can be noticed that freezing causes a decrease in chlorophylls concentration compared to fresh chives, the most significant decrease being in samples of frozen chives without preliminary blanching. For non-blanched frozen chives, the biggest losses of chlorophylls were in the case of chlorophyll “b” (21.14% loss of chlorophyll “a” being of 18.27%), while for blanched frozen chives, the highest losses were in the case of chlorophyll “a” (10.08%, loss of chlorophyl “b” being of 7.93%), as is depicted in Figure 4.

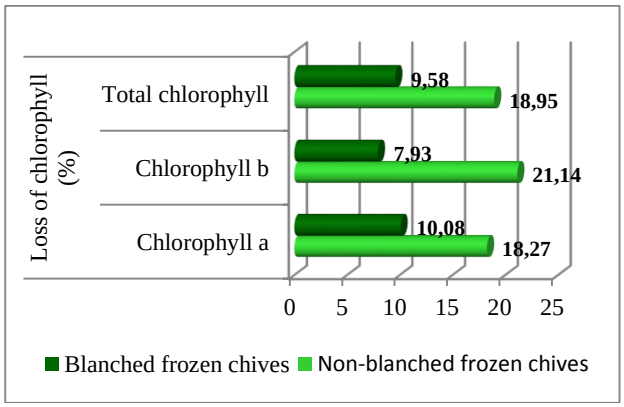

Figure 4. Chlorophyll loss in frozen chives.

Figure 5 shows the ratio of the chlorophyll "a" and chlorophyll "b" content in fresh and frozen chives.

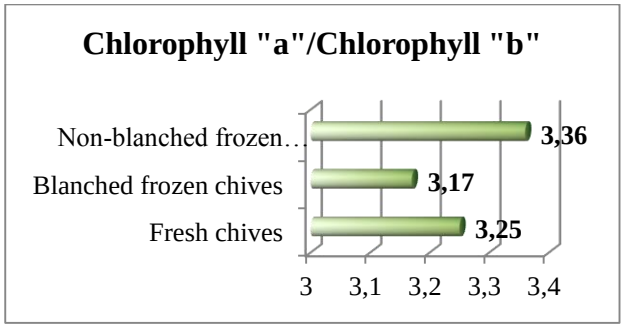

Figure 5. The ratio of chlorophyll "a" and Chlorophyll "b" in fresh and frozen chives.

Analyzing the ratio of chlorophyll "a" and chlorophyll "b", were observed close values for the analyzed samples. Compared to fresh chives, the ratio is slightly higher in the case of non-blanched frozen chives, and in blanched frozen chives the ratio is slightly lower.

Carotenoids content

The content of carotenoids (carotenes and xanthophylls) from fresh and frozen chives, determined spectrophotometrically, is shown in Figure 6.

Also with regard to carotenoids, the freezing preservation of chives leaves led to a decrease in the concentration of these compounds, the most important decrease being in the case of non-blanched frozen chives leaves.

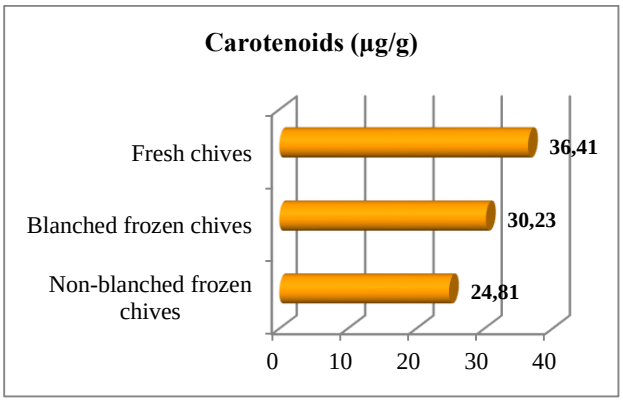

Figure 6. Carotenoids content in fresh and frozen chives (µg/g fresh weight)

For blanched frozen chives the carotenoids losses were almost two times lower (16.97%) than for non-blanched frozen ones (31.86%) (Figure 7.).

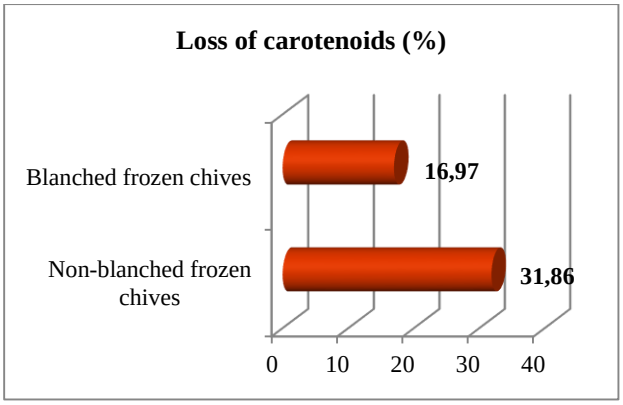

Figure 7. Carotenoids loss in frozen chives.

Kmiecik and Lisiewska (1999) also found that in chives blanched and then frozen, vitamin C, chlorophylls and carotenoids are better preserved than in non- blanched frozen chives.

CONCLUSIONS

Fresh chives are a rich source of vitamin C, chlorophylls and carotenoids, compounds that can be largely conserved by freezing chives at -18°C for 4 months, preceded by 5 minutes of blanching on steam. If the chives are frozen without pre-blanching, the losses of these compounds are higher: in this case, the highest losses were recorded for vitamin C (49.91%), then for carotenoids compounds (31.86%). More studies are needed to evaluate how other conditions and times of freezing affect the content of bioactive principles in chives leaves.

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