OBSERVATIONS ON NITRITE CONTENT OF SOME FRUITS AND VEGETABLES DURING DIFFERENT STORAGE CONDITIONS

OBSERVAȚII ASUPRA CONȚINUTULUI ÎN AZOTIȚI LA UNELE FRUCTE ŞI LEGUME LA PĂSTRAREA ÎN DIFERITE CONDIȚII

EPERJESSY Diana Beatrice[2], TROFIN Alina[1]*, UNGUREANU Elena[1], TRINCĂ Lucia Carmen[1], SANDU Tatiana[1]
*Corresponding author e-mail: atrofin@uaiasi.ro

Abstract. *Due to the low caloric intake, correlated with the high content of vitamins, fiber and mineral salts, plant foods are essential for a healthy diet. On the other hand, plant products can also be an important source of potentially harmful compounds, such as nitrogen, residues from fertilizer treatments and soil conditioners. The problem has become particularly relevant since frequent acute and chronic intoxications have been reported in young children who have consumed these substances in water or food, becoming even more complex after highlighting the cumulative effect of nitrates and the possibility of carcinogenic nitrosamines. This study was performed using 5 samples of fruits: red apple, golden apple, grapefruit, pears, lemons and 5 samples of vegetables: green peppers, cucumbers, squash, onions, cabbage. The nitrate content was analyzed and compared during storage for 7 days at different temperatures.*
Key words: vegetables, fruits, nitrites, storage

Rezumat. *Datorită aportului caloric redus, corelat cu conținutul ridicat de vitamine, fibre şi săruri minerale, alimentele de origine vegetală sunt esenşiale pentru o dietă sănătoasă. Pe de altă parte, produsele vegetale pot fi, de asemenea, o sursă importantă de compuşi potențial dăunători, aşa cum este cazul azotiților, reziduurilor de tratamente efectuate cu îngrăşăminte şi agenți de condiționare a solului. Problema a devenit deosebit de actuală de când s-au semnalat frecvente intoxicații acute şi cronice la copii mici care au consumat aceste substanțe din apă sau hrană, devenind şi mai complexă în urma evidențierii efectului cumulativ al azotaților şi al posibilității formării nitrozaminelor cancerigene. Prezentul studiu s-a efectuat folosind 5 probe de fructe: măr roşu, măr golden, grapefruit, pere, lămâi şi 5 probe de legume: ardei verde, castravete, dovlecei, ceapă, varză. A fost analizat şi comparat conținutul în azotiți pe durata păstrării timp de 7 zile la diferite temperaturi.*
Cuvinte cheie: legume, fructe, azotiți, păstrare

INTRODUCTION

The contribution of vegetables and fruits to the accumulation of daily intake of nitrates is considerable, however, nitrates have a low toxicity, but the

[1]University of Agricultural Sciences and Veterinary Medicine Iasi, Romania
[2] Saint Mary Emergency Children Hospital Iasi, Romania

reaction products resulting from their reduction (nitrites and N-nitroso compounds) are considered among the factors responsible for methemoglobinemia in children and of gastric cancer in adults (EFSA, 2008).

Numerous genetic, environmental and cultural factors influence the absorption and accumulation of nitrates in vegetables, including: species, fertilizer treatment and climatic conditions such as temperature, intensity and duration of light exposure, amount of water and the physical - chemical nature of soil.

Inorganic nitrates/nitrites are naturally occurring compounds in foods, especially plant foods and vegetables, and are also used as additives in industrially processed foods. Major sources of exogenous nitrate exposure are vegetables and drinking water, whereas processed meat and animal food products are major nitrite-containing foods; more than 80-95 percent of dietary intake of nitrate is attributed to vegetables especially green leafy vegetables including lettuce and spinach, cabbage, rocket, red beetroot, and radish (Hord *et. al*, 2009; Reinik *et. al*, 2009). A wide range of nitrate in vegetables from <1 to >1000 mg 100 g^{-1} has been reported (Hord *et. al*, 2009; Reinik *et. al*, 2009), whereas most levels of nitrate determined in fresh meats have been low (~10–50 mg kg^{-1}) (Iammarino *et. al*, 2012; Walters, 1996).

Due to many biological and environmental factors, nitrate/nitrite concentrations of foods and especially vegetables, reported in several studies, were extremely variable and also varied from country to country and region to region (Santamaria, 2006; Correia *et al,* 2010).

The main concern regarding nitrate is its potential endogenous conversion to nitrites and nitrosamines, and some acute/chronic toxicities such as methemoglobinemia, thyroid disorders or carcinogenesis. On the other hand, several potential therapeutic properties of nitrate/nitrite have been reported, sparking a growing interest in its clinical applications in several pathological conditions such as cardiovascular disease, hypertension, diabetes, metabolic syndrome and insulin resistance (Ghasemi *et. al*, 2013; Kevil *et. al*, 2011).

This paper aims to compare the nitrite content of different vegetable and fruit samples during storage for seven days at room, refrigeration and freezing temperature.

MATERIAL AND METHOD

The following samples were analyzed, at an interval of 7 days of storage at different temperatures, in what regarded their nitrite content:

P 1 – “Golden Delicious” green apples;
P 2 –“Starkrimson” red apples;
P 3 – Grapefruit;
P 4 – Cureé pears;
P 5 – Lemons;
P 6 – Green peppers;
P 7 – Squash;
P 8 – Cornichon cucumbers;

P 9 – Yellow onions;

P 10 - White cabbage.

The fruits and vegetables under analysis were purchased fresh on the day of the analysis. Each sample was sectioned into 4 equal parts. The first part was analyzed the same day to determine the dry matter and the humidity of fresh vegetables and fruits, respectively. One of the remaining 3 parts of each sample was stored at room temperature in a place away from sunlight and moisture, for a period of 7 days in order to monitor the evolution of changes that may occur, the second was stored in the refrigerator at a temperature of 4^0C and the last part was stored at freezing temperature between -18 and -20^0C. The nitrites content was determined using the Griess reagent colorimetric method and a Spekol 1100 spectrophotometer.

RESULTS AND DISCUSSIONS

As regards the moisture and dry matter of the analyzed samples, the values are shown in table 1. They were determined in order to properly express the nitrite content in samples.

Table 1

Humidity and dry matter values for the analyzed fruit and vegetable samples

Sample	Humidity (%)	Dry matter (%)
P 1	84.038	15.962
P 2	83.072	16.928
P 3	82.144	17.856
P 4	85.78	14.22
P 5	89.572	10.428
P 6	93.86	6.14
P 7	94.65	5.35
P 8	96.133	3.867
P 9	91.22	8.78
P 10	93.972	6.028

According to Griess method, we prepared a series of known concentration solution and draw a calibration curve (fig. 1):

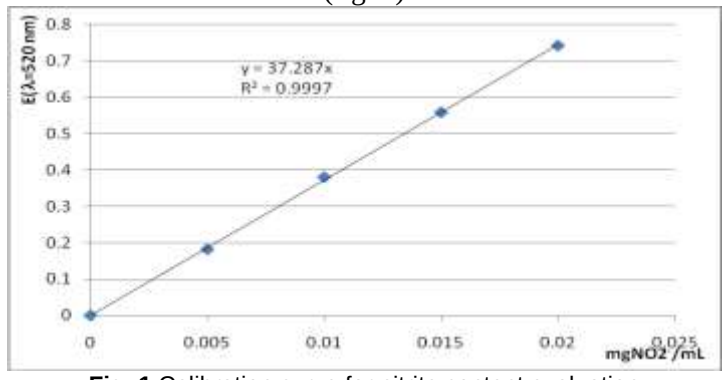
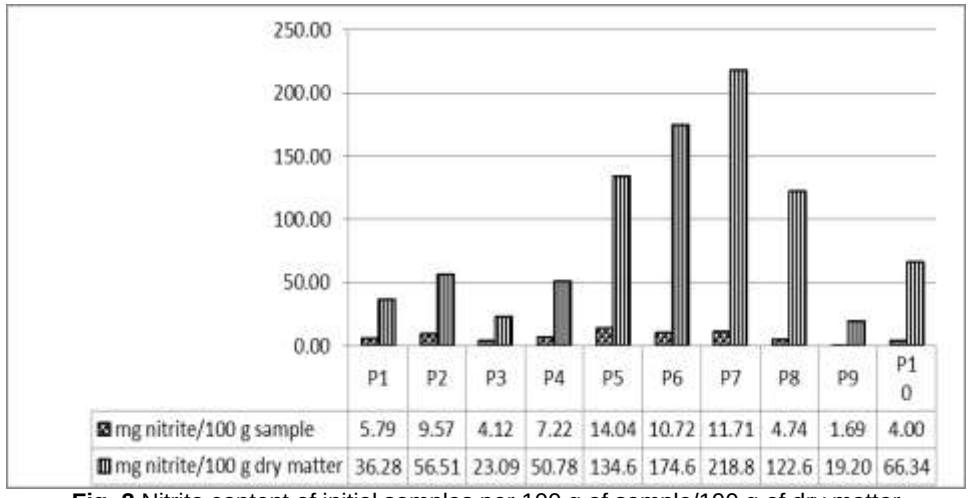


Fig. 1 Calibration curve for nitrite content evaluation

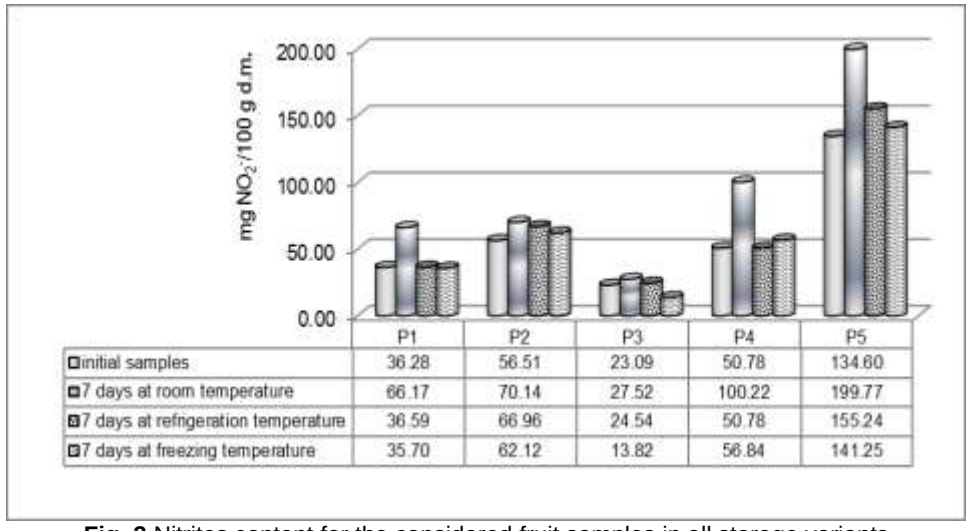


	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
mg nitrite/100 g sample	5.79	9.57	4.12	7.22	14.04	10.72	11.71	4.74	1.69	4.00
mg nitrite/100 g dry matter	36.28	56.51	23.09	50.78	134.6	174.6	218.8	122.6	19.20	66.34

Fig. 2 Nitrite content of initial samples per 100 g of sample/100 g of dry matter

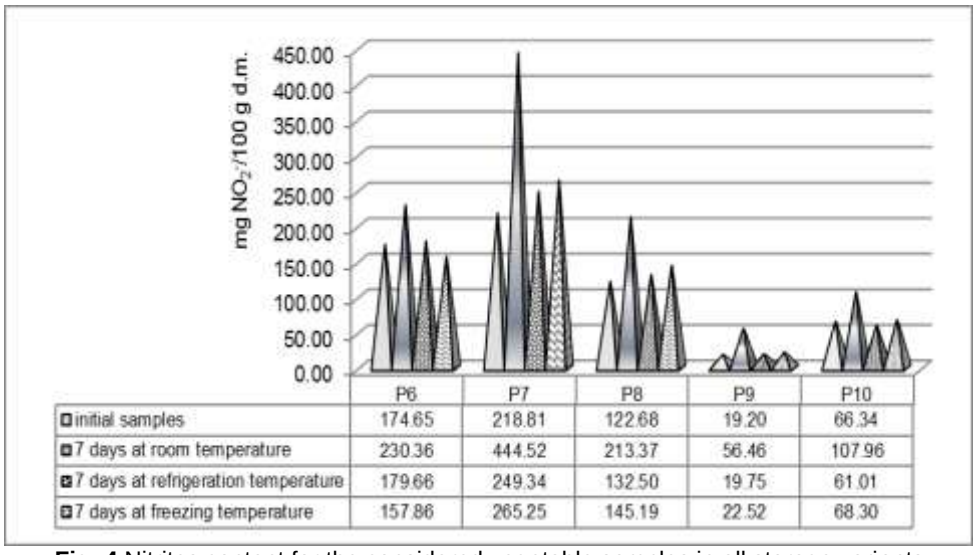
As shown in figure 2, in what regards the fruit samples, the highest value for nitrite content was registered for lemons (P_5) in 100 g dry matter and in normal sample and for the vegetables, the highest value appeared for squash sample (P_7).

We analyzed by comparison the nitrite content of initial samples to those of the samples maintained for 7 days at different storage temperatures (fig. 3 and 4). For all samples, the variant maintained at room temperature showed an increased content of nitrites, while the refrigerated and especially the frozen variants showed very small variations from the initial values.



	P1	P2	P3	P4	P5
initial samples	36.28	56.51	23.09	50.78	134.60
7 days at room temperature	66.17	70.14	27.52	100.22	199.77
7 days at refrigeration temperature	36.59	66.96	24.54	50.78	155.24
7 days at freezing temperature	35.70	62.12	13.82	56.84	141.25

Fig. 3 Nitrites content for the considered fruit samples in all storage variants



	P6	P7	P8	P9	P10
initial samples	174.65	218.81	122.68	19.20	66.34
7 days at room temperature	230.36	444.52	213.37	56.46	107.96
7 days at refrigeration temperature	179.66	249.34	132.50	19.75	61.01
7 days at freezing temperature	157.86	265.25	145.19	22.52	68.30

Fig. 4 Nitrites content for the considered vegetable samples in all storage variants

CONCLUSIONS

1. Dry matter content of the considered fruit samples varied between 10.43 – 17.86% and between 3.87 – 6.14% for the vegetable samples;

2. Observing the samples of fruits initially analyzed, the highest content in nitrites per 100 g dry matter was registered for lemons and the lowest for grapefruits;

3. In what regards the samples of vegetables initially analyzed, the highest content in nitrites per 100 g dry matter was registered for squash and the lowest for yellow onions

4. In the case of both fruit and vegetables, the highest concentrations of nitrites were observed in the case of samples kept at room temperature for 7 days.

5. Both fruits and vegetables are best consumed fresh, of course, but if storage is required, it is preferred to do that in the freezer, at least from the nitrites accumulation point of view.

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