STUDY ON STORAGE CONDITION INFLUENCE UPON THE NITRITE CONTENT IN PARSLEY

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Abstract
The pollution with the chemical products used in agriculture (fertilizers and pesticides) represent one of the most important but at the same time of the most controversial health problems for both of the mentioned products have as purpose the increase of harvests but they are also dangerous for the human health if they are not correctly used. According to FAO, the nitrite quantity daily tolerated by the organism is of 0.4-0.8 mg/kilo body. The lethal dosage for the adults may vary between 180 and 2500 mg. The persons with a reduced gastric secretion and an active micro flora in the superior part of the gastrointestinal tract (the aerobic part) can be easier intoxicated with nitrite. As a method of analysis for the nitrite it was used the spectrophotometric method with Griess reagent. In the work there were performed series of 20 determinations on different products so that it was determined the nitrite content in the fresh parsley leaves after a storage period in refrigerating conditions of 3 and respectively 7 days. It was also observed the variation of the nitrite content by drying and freezing for the parsley leaves as well as for the parsley roots. After the led determinations it was shown that the nitrite are found in low content in the fresh parsley whether when the conservation methods are used on the product the content increases.

Keywords: nitrite toxicity, vegetable quality, spectrophotometric method, refrigeration, freezing, drying.

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1. INTRODUCTION

The massive introduction of nitrogen fertilisers, necessary to maximise the global food production, has brought about an increase of the residual amounts of nitrites and nitrates in the products. Notoriously, these compounds may exercise toxic effects (Iammarino et al, 2013). The content of nitrates (NO_3^-) and nitrites (NO_2^-) in agricultural products is an important indicator of the quality of products and it has an important influence on the health of people (Sušin et al, 2006).
In fresh, undamaged vegetables, the nitrite concentrations are usually very low. Under adverse post-harvest storage conditions, nitrite concentrations in vegetables increase as a result of bacterial contamination and endogenous nitrate reductase action. Nitrite accumulation in vegetables is inhibited under frozen storage because endogenous nitrate reductase is inactivated. Pureeing releases endogenous nitrate reductase, increasing nitrite concentrations in vegetables (Chan et al, 2011). Vegetables, an important component of the human diet and a major source of nitrate and nitrite, constitute nearly 72 to 94% of the average daily human dietary intake (Dich et al, 1996).
The nitrite is more toxic having the following consequences (Banu, 2002):

- They produce methemoglobinemia reacting with hemoglobin the degree of methemoglobinemia being according to the nitrite quantity passed into the blood so on the nitrite/ nitrate quantities ingested with the foods and endogenous formed.
- They produce the cancer of the lymphatic system fact proved experimentally on the Sprague-Dawley rat species, they inhibit the action of the triode gland and the transformation of the A provitamins in A vitamins, of reduction of the A vitamins content producing the absorption and reduction of proteins.
- They have a strong vasodilatation action which in the case of severe intoxications determines the collapse. High dietary nitrate and nitrite intake may increase the risk of gastro-intestinal cancers due to the in vivo

formation of carcinogenic chemicals known as N-nitroso compounds (Hsu et al, 2009).
In the case of the toxic dosage the nitrite action is manifested at the level of the digestive and kidneys systems causing cramps, diarrhea, polyurea, collapse.
Nitrite has been proven to have adverse effects on health, including changing the normal form of haemoglobin and the formation of carcinogenic nitrosamines (Jun Cai Hou et al, 2013). The nitrosamines can be formed in different food products but not in the body on endogenous way. The nitrosamines apparition is possible for foods only if the sodium nitrite is over 1 mg/100 g of product.
Nitrate and nitrite are widely consumed by animals and humans, and are also formed endogenously. Nitrate is metabolized to nitrite, which is approximately 10-fold more toxic. Recently, the European Food Safety Authority performed risk assessments for nitrate in food and nitrite in feed and concluded that, at current levels of exposure, no concerns for human or animal health are raised. A risk–benefit assessment relating nitrate toxicity and benefits of vegetable consumption as part of a healthy diet, concluded that the beneficial effects prevail. Future needs include an extension of risk-assessment approaches for a scientific evaluation of health benefits (Cockburn et al, 2014).

2. MATERIAL AND METHODS

As an object of study it was used the parsley (Petroselinum Hortense) both the leaves and the roots cultivated on a soil treated with natural fertilizer in Suceava area.
In this study it was observed the variation of the nitrite content in the following storage conditions: fresh parsley leaves, fresh parsley leaves refrigerated for 3 days, fresh parsley leaves refrigerated for 7 days, fresh parsley roots, dry parsley leaves and roots, frozen parsley leaves and roots. For each series of determinations there were used 20 samples from different areas of Suceava County. For the determination of the nitrite content it was used the spectrophotometric method with Griess reagent.
The nitrite in an acidic medium can combine with a primary aromatic amine forming a diazonium salt. If this salt is condensed or coupled with another primary aromatic amine a colored complex is formed that is subdued to Beer law. The intensity of the colour of the analyzed solution is compared to that of a standard solution that contains a known quantity of nitrite. The reading can be done directly visually using a comparison scale, or with the aid of a photocolorimeter or spectrophotometer using a standard curve. For a precise evaluation it's good for the proteins in the water extract to be withdrawn by precipitation (ISO 6635:1984).
For the analysis there were used Sigma Aldrich reagents and the Jenway 6400 molecular absorption spectrophotmeter.
The spectrophotometric Greiss reagent method was used to determine the content of nitrites. The standard curve was obtained by determining extinctions of a standard solution containing 1,2,3,4,5,6,7 ml $NaNO_2$ solution (1ml of working solution contains 0.003 mg $NaNO_2$) which is completed to volume of 10 ml with bidistilled water. To which 10 ml of Griess reagent is added. The coloration intensity is read after 20 minutes at wavelength of 530 nm (Gutt et al, 2006).
The calibration curve used for the determination of the nitrite content from the studied samples is presented in figure 1.

3. RESULTS AND DISCUSSIONS

The nitrite content in the fresh parsley lot varied between 1.7-2.2 mg/kg. The variation of nitrite content in fresh parsley leaves is presented in figure 2. The average value of the nitrite content is of 1.88 mg/kg, value that is within the admitted limit of nitrite content.
The nitrite content in the 3 days refrigerated parsley leaves lot varied between 1.8-2.5 mg/kg.

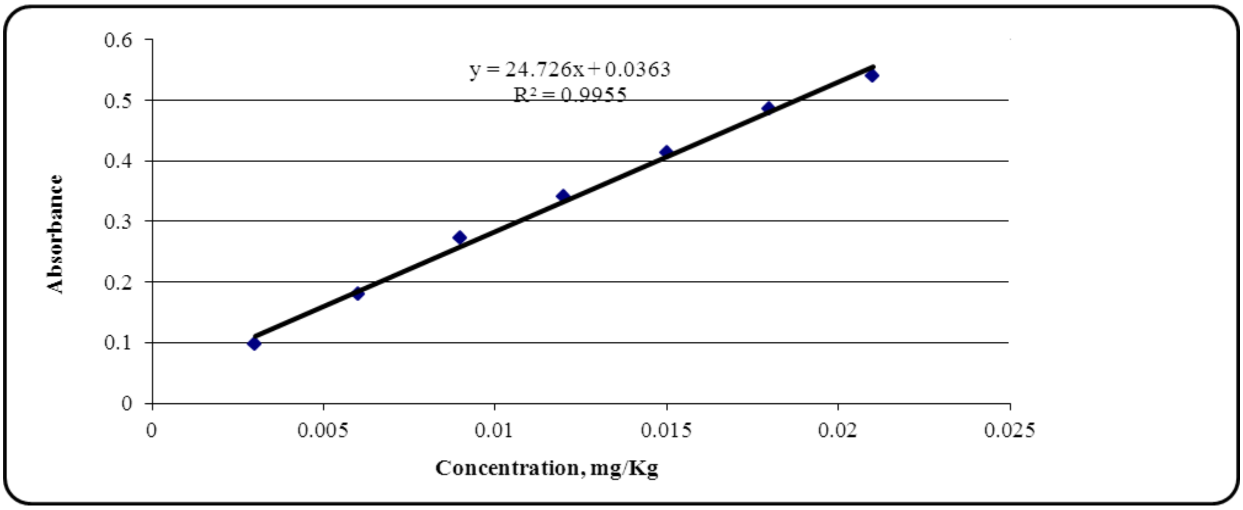

Fig. 1. The calibration curve used for the determination of the nitrite content

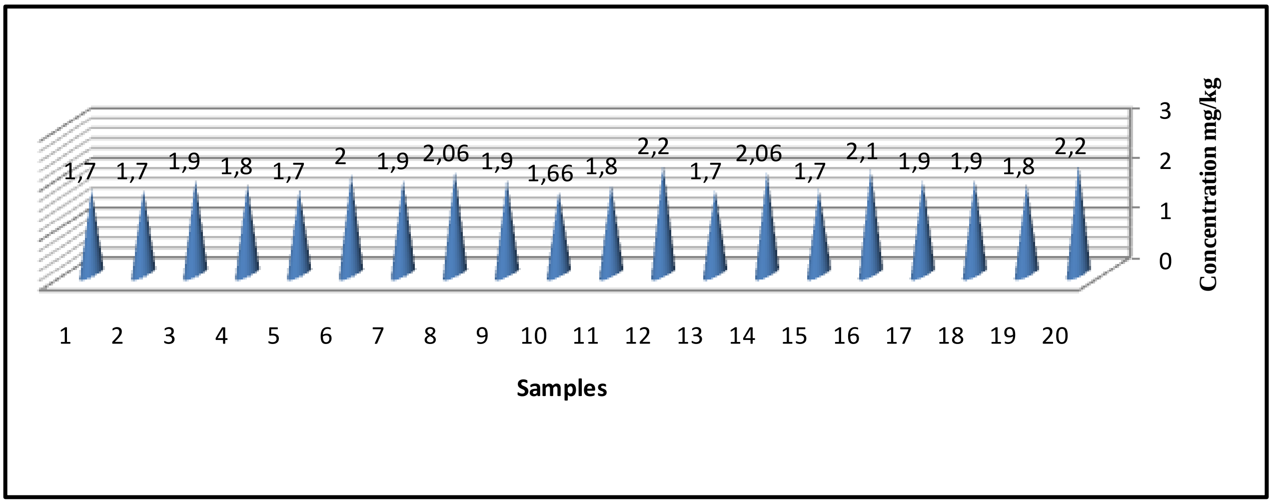

Fig.2. The variation of the nitrite content in the fresh parsley leaves

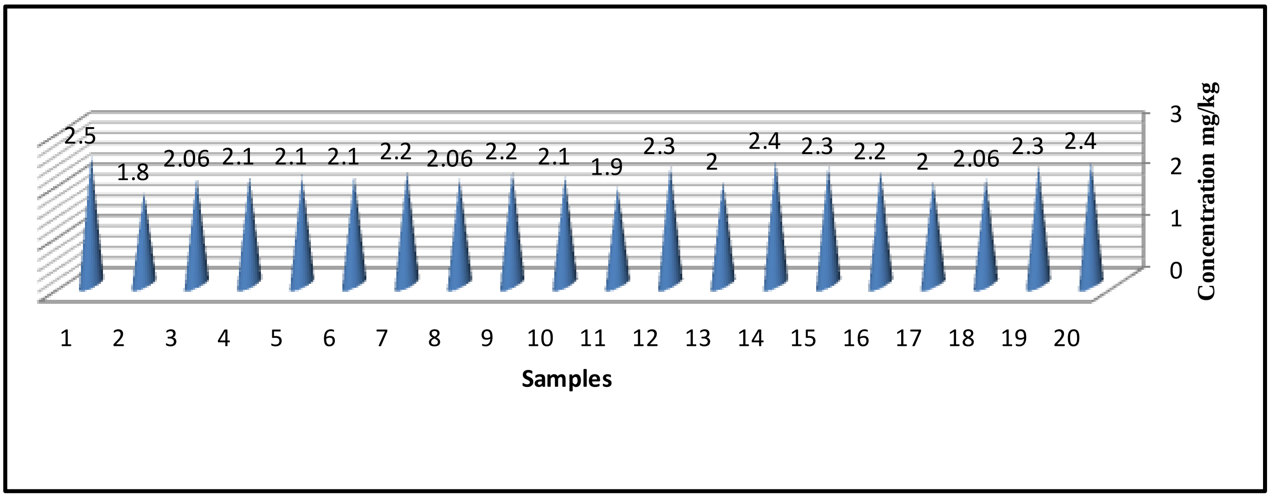

Fig. 3. The variation of the nitrite content in the 3 days refrigerated parsley leaves

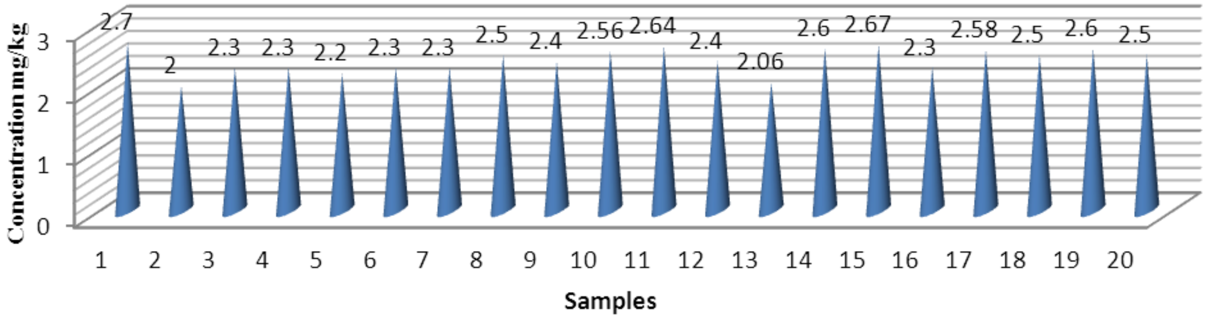

Fig.4. The variation of the nitrite content in the 7 days refrigerated parsley leaves

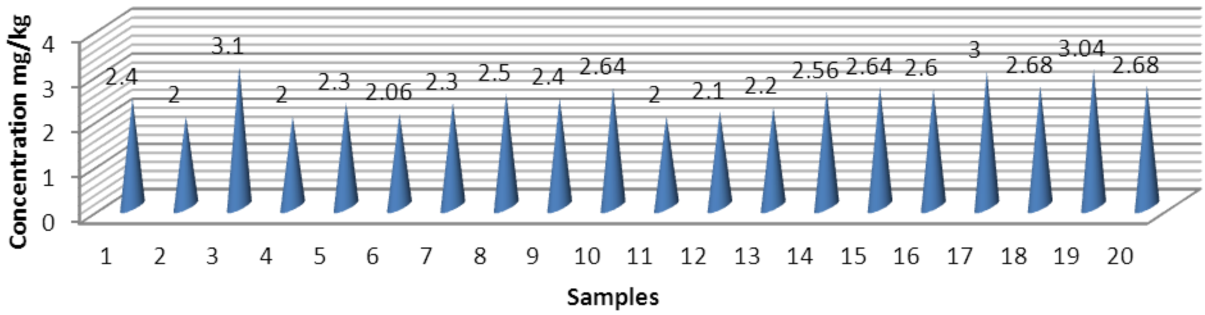

Fig. 5. The variation of the nitrite content in 1 month frozen parsley leaves

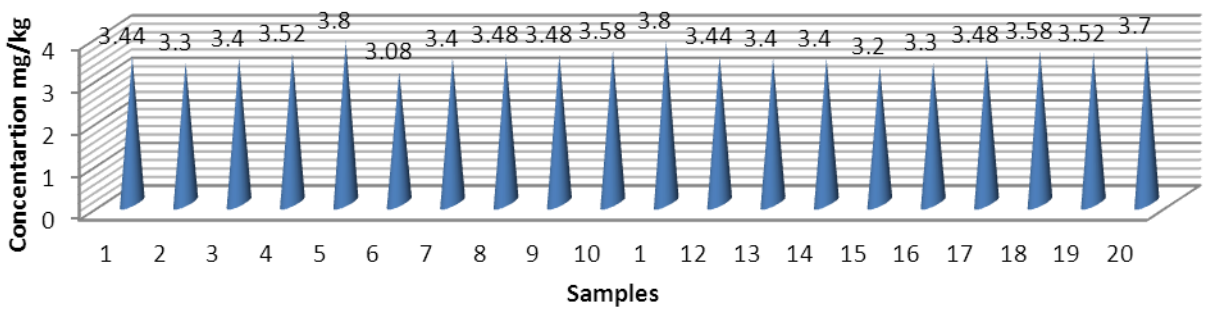

Fig. 6. The variation of the nitrite content in 1 month dried parsley leaves

The variation of the nitrite content in the 3 days refrigerated parsley is presented in figure 3. The average value of the nitrite content is of 2.15 mg/kg

The nitrite content in the 7 days refrigerated parsley leaves samples varied between 2.06-2.7 mg/kg. The variation of the nitrite content in the 7 days refrigerated parsley leaves is presented in figure 4. The average value of the nitrite content is of 2.42 mg/kg. It was observed a slight increasing of the nitrite content from 1.88 mg/kg in the fresh up to 2.42 mg/kg for the 7 days stored product at refrigeration temperature.

The nitrite content in the 1 month frozen parsley leaves samples varied between 2-3.1 mg/kg, the average value being of 2.46 mg/kg. The variation of the nitrite content in 1 month frozen parsley leaves is presented in figure 5. The values are between the admitted limits. It is observed an increasing of the nitrite content with 0.58 mg/kg reported to the fresh product.

The nitrite content in the in 1 month dried parsley leaves samples varied between 3.08-3.8 mg/kg, the average value being of 3.46 mg/kg. The variation of the nitrite content in 1 month dried parsley leaves is presented in figure 6. It is observed an increasing of the nitrite content with 1.58 mg/kg reported to the fresh product and with 1 mg/kg reported to the frozen product.

The nitrite content in the parsley root samples varied between 1.66-2.2 mg/kg. The nitrite average value was of 1.81 mg/kg. The variation of the nitrite content in the parsley root is presented in figure 7. The nitrite quantity in the parsley root is approximately equal to hat in the parsley leaves.

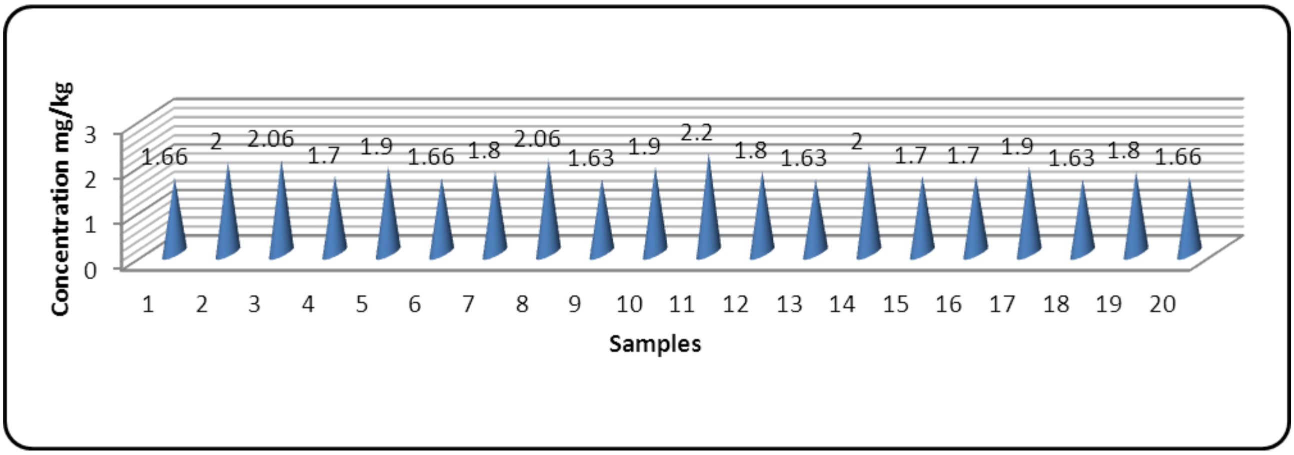

Fig. 7. The variation of the nitrite content in the parsley root

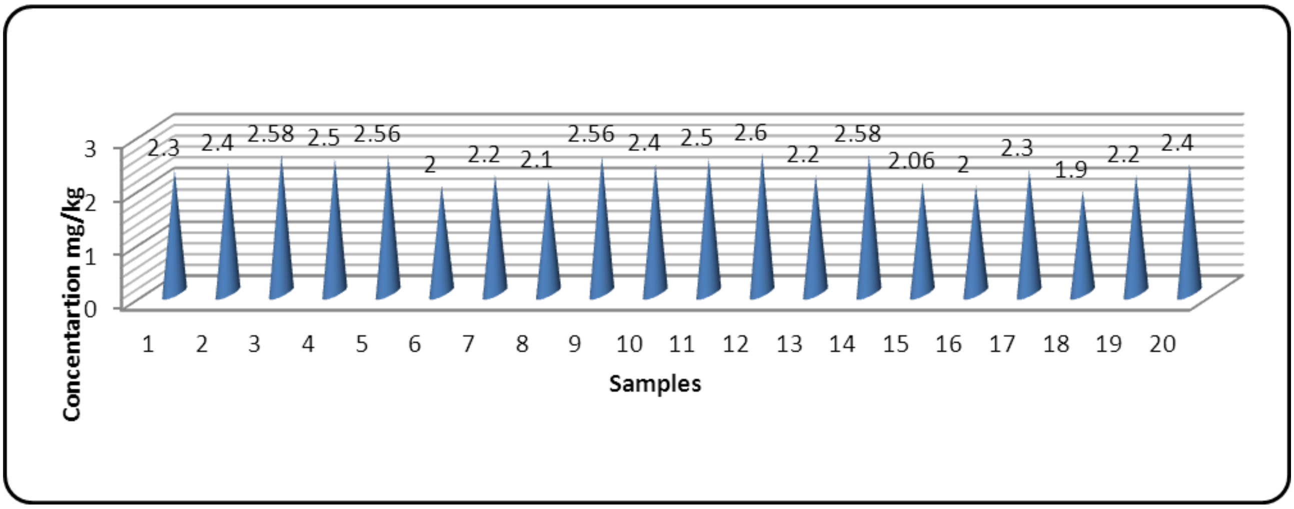

Fig. 8. The variation of the nitrite content in the 1 month frozen parsley root

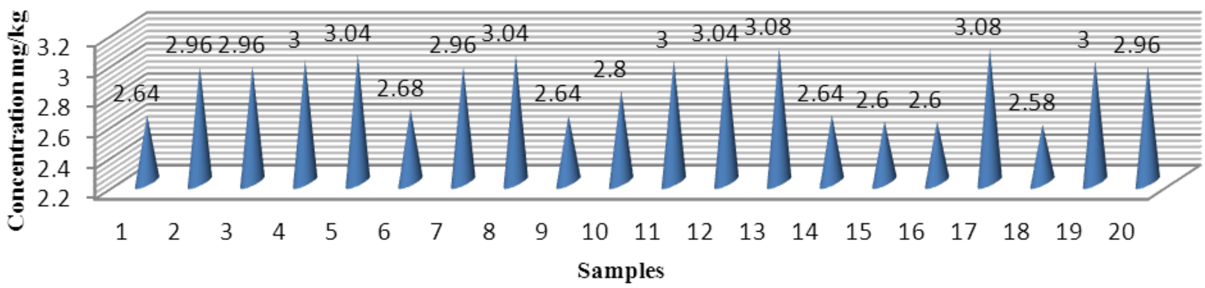

Fig. 9. The variation of the nitrite content in the 1 month dried parsley root

The nitrite content in the 1 month frozen parsley root samples varied between1.9-2.6 mg/kg, the average value of the determinations being of 2.317mg/kg. The variation of the nitrite content in the 1 month frozen parsley root is presented in figure 8. It is observed only a slight increasing of the nitrite content with 0.507 mg/kg reported to the fresh product.
The nitrite content in the 1 month dried and store parsley root varied between 2.58-3.08 mg/kg. The variation of the nitrite content in the 1 month dried parsley root is presented in figure 9. The average value of the determinations was of 2.865 mg/kg. It is observed only an increasing of the nitrite content with 1.055 mg/kg reported to the fresh product.

4. CONCLUSIONS

The nitrite content in the fresh parsley lot varied between 1.7-2.2 mg/kg. It was observed an increasing of the nitrite content in the product after 3 days of refrigeration with 13.46 % in comparison to the fresh product. It was observed an increasing of the nitrite content in the product after 7 days of refrigeration with 28.7 % in comparison to the fresh product.
It was observed an increasing of the nitrite content in the product after 1 month of frozen with 30.85 % in comparison to the fresh product.
It was observed an increasing of the nitrite content in the product, after 1 month dried with 84% in comparison to the fresh product and with 40.65 % in comparison to frozen product.
The nitrite content in the parsley root lot varied between 1.66-2.2 mg/kg. It was observed an increasing of the nitrite content after 1 month frozen with 28% in comparison to the fresh product. It was observed an increasing of the nitrite content after 1 month dried with 58% in comparison to the fresh product and with 23.65 % in comparison to the frozen product.
After the analysis of the variation of nitrite content in the parsley it is recommended its use in fresh state for by its conservation by different methods the nitrites content increases more or less according to the ways of preservation previously presented.

5. REFERENCES

[1] Iammarino, M, Di Taranto, A, Cristino, M, Endogenous levels of nitrites and nitrates in wide consumption foodstuffs: Results of five years of official controls and monitoring, Food Chemistry, **140**, Issue 4, 2013, 763-771.
[2] Sušin, J, Kmecl, V, Gregorčic, A. A survey of nitrate and nitrite content of fruit and vegetables grown in Slovenia during 1996–2002, Food Additives and Contaminants, **23**, Issue 4, 2006, 385–390.
[3] Chan Thomas, Y.K. Vegetable-borne nitrate and nitrite and the risk of methaemoglobinaemia. Toxicology Letters, **200**, Issues 1-2, 2011, 107-108.
[4] Dich, J., Jarvinen, R., Knekt, P, Penttila, P.L. Dietary intakes of nitrate, nitrite and NDMA in the Finnish mobile clinic health examination survey. Food Additives and Contaminants, **13**, Issue 1, 1996, 541–552.

[5] Banu, C. Treaty of food chemistry, Agir Publishing, Bucharest, 2002.
[6] Hsu, J, Arcot, J, Lee, A. Nitrate and nitrite quantification from cured meat and vegetables and their estimated dietary intake in Australians, Food Chemistry, **115**, Issue 1, 2009, 334–339.
[7] Jun Cai Hou, Cheng Gang Jiang, Zhong Chen Long. Nitrite level of pickled vegetables in Northeast china. Food Control, **29**, Issue 1, 2013, 7-10.
[8] Cockburn, A, Heppner, C. W., Dorne, J.L.C.M. Environmental Contaminants: Nitrate and Nitrite, Encyclopedia of Food Safety, **2**, Issue 1, 2014, 332-336.
[9] ISO 6635: 1984. Fruits, vegetables and derived products – determination of nitrite and nitrate content – molecular absorption spectrometric method.
[10] Gutt, S, Niga, E. Study of the storage condition influence upon the nitrite content in vegetables, Annals of the Suceava University, Food engineering, **5**, Issue 1, 2006, 5-12.