

Determining the quantity of nitrates in green leafy vegetable on Croatian market

Sanja Miloš¹, Jasna Bošnjir², Dario Lasić², Andrea Gross-Bošković¹

¹Croatian Food Agency, Osijek, Croatia (agros-boskovic@hah.hr)

²Institute of Public Health "Andrija Štampar", Zagreb, Croatia

Abstract

Nitrates are compounds that occur in nature as part of the nitrogen cycle in the soil-plant-atmosphere system, and as approved dietary supplements. They play an important role in the diet and functionality of plants. Part of the nitrogen enters in the soil by the application of fertilizers, and it is involved in many biological processes. It can be assimilated and immobilized by edaphic microorganisms, forming nitrogen that is available for the following cultures only after the process of mineralization of organic matter.

The main sources of nitrate in foods are fruits and vegetables. Nitrates and nitrites are very water soluble and mobile in the environment. On nitrate accumulation in vegetables affects a number of factors, such as type and amount of nitrogen fertilizer, geographic location and time of ripening as well as the and conditions, such as temperature and light. The amount of nitrate is different in different parts of the plant, and there are the highest in the petiole and stem plants, slightly less in the leaves and roots, and at least in flower and fruit. Microbial conversion of nitrate to nitrite may take place during storage of fresh vegetables, especially at room temperature, when the concentration of nitrite can reach a very high level of 3600 mg / kg dry matter. Like nitrates, nitrites themselves are not particularly toxic to the human body, however, products that may arise from them, such as nitrosoamines showed carcinogenic effect on animals.

Human exposure to nitrates is largely exogenous origin, through the consumption of vegetables and to a lesser extent, water and other supplies. Exposure to its metabolite nitrite is endogenous origin due to the conversion of nitrate and reduction of nitrate to nitrite formed body. Nitrate *per se* showed little toxic effects (oral lethal dose for humans is 330 mg / kg body weight (Walker, 1990). Metabolites of nitrate and reaction products (nitrite, nitric oxide, nitrite compounds and secondary amines) are a matter of concern for adverse effects health as methaemoglobinemia and carcinogenesis.

On the other hand, scientific studies emphasize the positive effect of nitrite in antimicrobial activity and nitric oxide in the physiological effects on the regulation of blood pressure (Ahluwalia et al. 2010). While the vegetables are a major source of nitrates, increased intake of vegetables greatly recommended due to the generally accepted views on the health benefits of vegetables WHO (2003b.) recommended daily intake of vegetables together with fruits of at least 400g.

Based on the above, research goal was to determine the level of nitrates in leafy green vegetables on the Croatian market. In this way, the conformity with national legislation harmonized with the EU that determines the maximum level (MRL) of nitrite in vegetables will be checked. As samples for the analysis green leafy vegetables were selected: lettuce, spinach, kale, chard, cabbage and arugula. Samples were collected during the two seasons -

spring and autumn, and at four locations: Osijek, Zagreb, Split and Rijeka, in order to achieve regional representation in terms of sampling. Each sample was prepared for chromatographic analysis in atomic sampler for HPLC.

The results of this study concluded that the analyzed samples of spinach and lettuce meet the requirements of the Ordinance on maximum levels for certain contaminants in food, because all individual values, and all the mean values in these samples were lower than allowed, regardless of the period were sampled. It is worth to mention that the maximum levels for the other samples of leafy green vegetables are not regulated with the mentioned Regulations. Commission Regulation from 2011. determine the maximum levels of nitrates in the arugula, which provides for the proposal for a new Regulation on maximum amounts of contaminants in food. Precisely for this reason, in this project were sampled and samples arugula in the autumn period, and the results indicate that the specified leafy vegetables contain the highest amounts of nitrate in relation to other types of analyzes, but these values do not exceed those prescribed by the Regulation. For other types analyzed green leafy vegetables (kale, cabbage and chard), there is no maximum permitted levels, so the results in this study cannot be compared in this way. From the available literature data it can be seen that the individual member states of the European Union have prescribed maximum values of nitrate in certain types of vegetables that are determined based on the results obtained by extensive research of certain types of products and an assessment of their daily intake in the human body.

Given the results of the analyzed samples depending on the sampling period, it is evident that the amount of nitrate in the samples analyzed from the autumn period is much higher than of those sampled in the spring. Differences in the amounts are expected, since the maximum permitted levels of nitrates laid down in the Regulation vary depending on the period of maturation and harvesting.

Key words: nitrates, vegetables, Croatian market