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Identification of the nitrate and nitrite content in leafy vegetables from the city of Zliten

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Abstract: The study identifies the nitrate (NO3) and nitrite (NO2) content in leafy vegetables (parsley, chard, coriander) in three agricultural areas in Zliten (Azdo, Dafniya, Madjer) using the colorimeter dr / 980 device, and assesses whether the content is within the comparatively with allowable concentrations. The results obtained from this study show that the nitrate concentrations in all samples examined are within the global standards, with the highest level of 5.5 ppm found in chard samples collected from the area of Azdo. As for nitrite, the concentrations found in the studied samples are higher than nitrate concentrations. Overall, the nitrate and nitrite content are found to be within the permitted concentrations based on international standards, where the highest concentration of nitrite of 60 ppm is recorded in parsley samples from the Dafniya area.

Keywords: leafy vegetables, Nitrite, Parsley, Zliten.

تحديد محتوى النترات والنتريت في الخضار الورقية من مدينة زليتن

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المستخلص: تقدر الدراسة محتوى النترات (3NO) والنتريت (2NO) في الخضار الورقية (البقدونس، السلق، الكزبرة) في ثلاث مناطق زراعية في زليتن (أزدو، الدفنية، ماجر))، باستخدام جهاز colorimeter dr / 980، وتقييم ما إذا كان المحتوى ضمن التركيزات المسموح بها نسبيًا. تظهر النتائج التي تم الحصول عليها من هذه الدراسة أن تركيزات النترات في جميع العينات التي تم فحصها ضمن المعايير

العالمية، مع أعلى مستوى من 5.5 جزء في المليون وجدت في عينات السلق التي تم جمعها من منطقة أزدو. أما بالنسبة للنتريت فالتركيزات الموجودة في العينات المدروسة أعلى من تركيزات النترات. بشكل عام، وجد أن محتوى النترات والنتريت ضمن التركيزات المسموح بها بناءً على المعايير الدولية، حيث يتم تسجيل أعلى تركيز من النتريت 60 جزء في المليون في عينات البقدونس من منطقة الدفنية.

الكلمات المفتاحية: الخضار الورقية، النتريت، البقدونس، زليتن.

1. Introduction.

Environmental pollution has attracted the attention of many scientists and research institutions concerned with the environment since the beginning of civil movements accompanied by industrialisation and agricultural development. This led to the emergence of great environmental challenges as a direct consequence of such an unprecedented growth in the history of mankind. The most crucial pollution arises from the contamination of the environment surrounding humans with a multitude of contaminants, such as soil pollution which transfers pollutants to vegetables and fruits consumed by humans and animals alike. Nitrates and nitrite are the most common contaminants among these pollutants (Parvizishad et al., 2017).

Plant absorb nitrogen from the soil either in the form of ammonium or nitrate ions. Nitrogen is also absorbed in its gaseous by leaves. Nitrate is quickly reduced to ammonium ions within the plant which, after bonding with certain extent carboxylic acids, is transformed into amino acids. Therefore, changes in carbohydrates and nitrogen reserves in plants are closely related. When nitrogen reserves are low, carbohydrates are deposited in cells, resulting in the formation of small cells with thick walls. The plant leaves become of a pale green to yellowish colour owing to the lack of chlorophyll (Uddin et al., 2021).

The real risk of nitrate ions is borne in their potential conversion, under certain circumstances, to toxic nitrite ions, known for their ability to interact and bond with many of the materials. The presence of nitrate in food is due to its natural containment, its use in preservatives as live microbes require nitrogen, and the use of nitrogen fertilisers. Despite the limited number of studies on nitrogen absorption and its use in the ocean, nitrogen in agricultural fertilisers is considered the main source of nitrates in food and water (Youssef, 2003). A study to determine the effect of a waste of nitrogen fertilisers on the concentrations of nitrate and nitrite in vegetables grown locally found the concentrations to be within the globally allowable levels by the World Health Organization (WHO, 2004). Similar results were reported by Sulaiman, and Salman (2013), who examined the significance of increasing the concentrations of nitrate and nitrite on cultivated in greenhouses in Tartus, Syria. Using samples from Slovenia during, Susin et al. (2006) estimated the content of nitrates and nitrite in agricultural products during the period 1996-2000. They reported the highest concentrations of 881, 264, and 298 to be found in lettuce, beans, and cabbage, respectively. These results are higher than the permissible European limits. Zhou et al. (2000) tested the

pollution by nitrates and vegetables in China and found that the level of pollution is proportional to the use of a nitrogen fertilisers. Fakhreddin and Elahi (2014) measured the concentrations of nitrate and nitrite in vegetables and fruits in the city of Shiraz and found that the concentrations in leafy vegetables were higher than those in fruits, cucurbits, and potatoes. The lowest concentrations were recorded in onions and tomatoes. In general, all levels were within the limits set by the World Health Organisation. A study conducted in Romania estimated the concentrations of nitrate and nitrite in vegetable cultivated for human consumption using the HPLC and UV radioactive rays methods. The results indicated that nitrate levels in most of the samples were within 0.6 - 5.5 mg/kg, while nitrite concentrations were not detectible by the material used (2015).

2. Materials and methods

2.1. Geographic area

This study aims to estimate nitrates and nitrite contents in certain leafy vegetables grown in areas of Zliten: Azdo, Dafniya, Madjer.

2.2. Sampling

The samples used in this study were collected between January and May, 2016, for the purpose of determining concentrations of nitrates and nitrite for three types of leafy vegetables.

2.2.1. Samples studied

Parsley: Petroselinum in the Apiaceae family., Chard: Beta vulgaris in the Amaranthaceae family., Coriander: Coriandrum sativum in the Apiaceae family.

2.3. Analysis Device

Nitrate and nitrite contents were estimated using a German-made a colorimeter (DR 980).

2.4. Nitrate and nitrite measurement

The contents of nitrate and nitrite were estimated following Gaya (2006), which consists on corresponding the intensity of the colour to the concentration of both nitrates and nitrite, where different colours depend on the type of vegetable and the detector used.

Statistical analysis

All analytical determinations were performed in triplicate (n = 3). The results were statistically analyzed was performed using the Student's t-test (Hill, 1971). Data obtained was analyzed using analysis of variances to determine the significance ($p<0.05$).

3. Results and discussion

An analysis of nitrates in vegetables is necessary to assess exposure to nitrates for adverse effects (Tzu-Hsien Yu et al., 20018). The toxicity of nitrate is mainly due to its reduction to nitrite after ingestion. Nitrite, which stimulates methemoglobin which interferes with hemoglobin's ability to carry oxygen, and causes methemoglobin to be present to which infants under 3 months are particularly susceptible (Chan 2011). The results of the analysis showed various concentrations of nitrate and nitrite in the samples studied. These concentrations were compared to the allowable limits to establish their degree of safety for human consumption. Nitrite contents were found to be negligible whereas nitrates concentrations ranged between 5.5-6 ppm. It should be noted that concentrations of value 00 ppm signify that the content was lesser than the sensitivity of the device could detect. The device is able to capture a minimum concentration of 0.2 ppm. A zero concentration was accepted to draw graphs. Following is a detailed discussion of the concentrations detected in the studied samples.

3.1. Parsley samples

The results reported in Figure 1 show that the highest average concentration of nitrate in the studied samples of parsley was 3.4 ppm found in samples collected in the Madjar area, and that the lowest concentration was 0.2 ppm found in samples collected in the Dafniya region. As for nitrite, the highest average concentration was 60 ppm recorded in samples collected in Dafniya, while the lowest concentration was 22 ppm recorded in samples collected in the Azdo region. Samples collected in Madjar showed a nitrite concentration of 22 ppm.

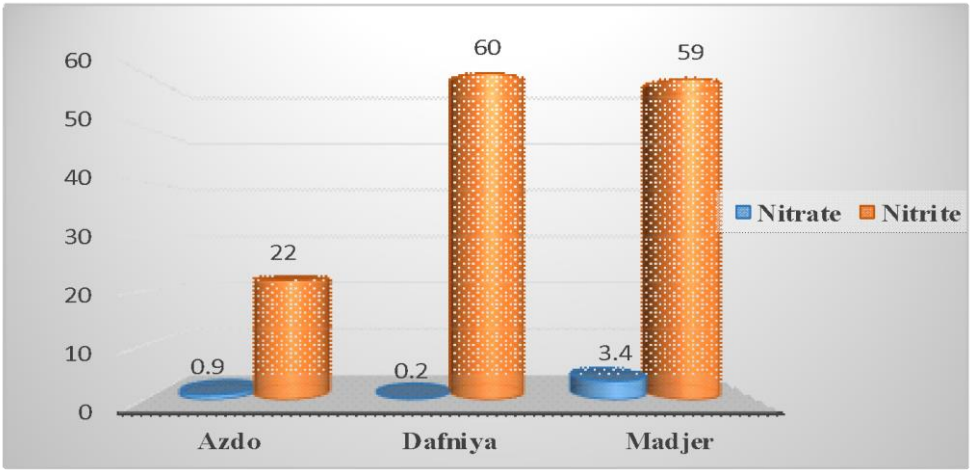

Figure (1) The concentrations of nitrate and nitrite in parsley samples.

3.2. Chard samples

The results presented in Figure 2 show that the highest mean concentration of nitrate was in the chard samples was 5.5 ppm recorded in samples collected in the Azdo region, while the lowest

concentration was, on average, 0.3 ppm found in samples found in samples collected in the Dafniya area. As for nitrite, the highest mean concentration was 30 ppm reported in samples collected in Azdu, and the lowest concentration was 2 ppm found in samples obtained from the Dafniya area.

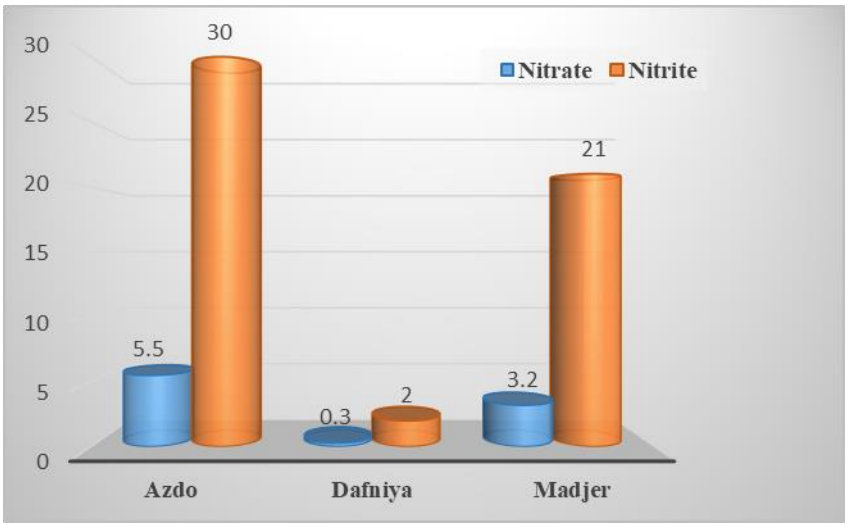

Figure (2) The concentrations of nitrate and nitrite in chard samples.

3.3. Coriander samples

The results reported in Table 3 show that the highest average concentration of nitrate in coriander samples was 19 ppm recorded in samples obtained in the Madjer area, and the lowest average concentration was 0.0 ppm in samples obtained from the area of Dafniya. As for nitrite, the highest mean concentration was 40 ppm found in samples collected Azdu while the lowest concentration was 0.0 ppm reported in samples collected in Dafniya. A similar study of the coriander in Kermanshah found that the concentrations of nitrate and nitrite in coriander were 128.17, 115.32 mg/kg respectively (Sadeghi et al. 2013).

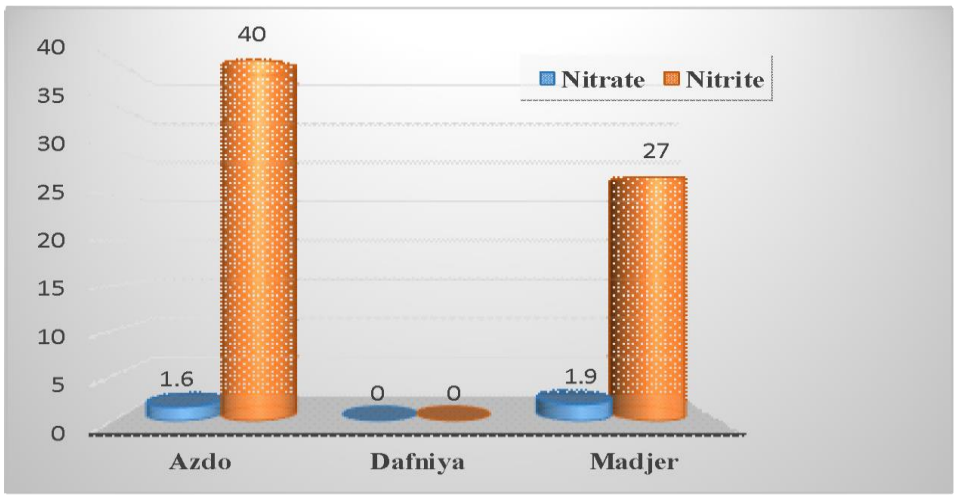

Figure (3) The concentration of nitrates and nitrite in coriander samples.

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