



## Nitrite and Nitrate in Some of Syrian Vegetables Roots

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### ABSTRACT

Vegetables are one of the essential sources of vitamins, minerals and other vital compounds which are important for the body. They considered the major source of nitrogenous compounds contained to the human body, which they constitute 80-92% of acceptable daily intake (ADI). In addition to that, good crops requirement using a huge amount of nitrogenous fertilizers, but add them at random and thoughtful lead to accumulation significantly in alimental vegetables. So the goal of study was to determine the concentrations of nitrite and nitrate in the most alimental tuberous "potato, carrot and radish" in different parts of Syria and compared with the allowable globally concentrations. It has been observed a high concentrations of nitrite and nitrate in most of the studied samples and this concentrations is varies by the region. According to the obtained results we suggest that encouraging farmers to reduce the random use of nitrogen fertilizer and orientation to use the organic fertilizer as well as the need to take serious steps to reduce the pollution of nitrite and nitrate in general.

**Keywords:** Vegetables roots, nitrite, nitrate, potato, carrot, radish.

### INTRODUCTION

Syria as a developing country, agriculture plays a very important role in its economics and is considered the main source of nitrite and nitrate in the environment.<sup>1,2</sup>

The toxicity of nitrate ion is considered weak itself, but it turns into nitrite in the live membership, which it is considered more toxic than nitrate<sup>3</sup>.

These nitrogen compounds play a significant role in the appearance of many toxicity symptoms for whom partakers these vegetables in the case of they contain toxic concentrations.

The presence of nitrite in food is responsible for many of main health problems, because it may lead to increased methemoglobin in the child's body, which in may cause methemoglobinemia or which is known as Blue Baby Syndrome<sup>4</sup>.

In addition to, it leads to the formation of nitrosamines which is scientifically proven that they have carcinogenic effects, so they are insert in the list of hazardous substances carcinogens which cause a variety of different cancers such as cancer of the stomach, pancreas, liver and lungs<sup>5</sup>.

As the "European Commission's Scientific Committee For Food 1995(ECSCF)"<sup>6</sup> the acceptable daily intake (ADI) is 0-3.7mg/kg nitrate of body weight and is 0-0.06mg/kg nitrite of bodyweight.

According to Santamaria (2006), the Plants are divided by nitrate containing into 5 categories:

1- plants with very low content of nitrate (200 >) mg/kg of weight - potato, tomato, mushrooms, green bean, onion, garlic and asparagus.

2- plants with low content of nitrate (200-500) mg/kg of weight - carrot, cauliflower, broccoli, cucumber and pumpkin.

3- plants with medium content of nitrate (500-1000) mg/kg of weight - Cabbage and turnip.

4- plants with high content of nitrate (1000-2500) mg/kg of weight - Parsley and leek.

5- plants with very high content of nitrate (2500 <) mg/kg of weight - radish, lettuce, red beets and spinach.<sup>7,8</sup>

Usually the presence of nitrite in fresh vegetables is much less compared with nitrate. It should be noted that Potato, carrot and Radish are from the root vegetables which stored nitrate in their tissues.<sup>8</sup>

According to the recent studies, the nitrate levels present in these vegetables are as follow<sup>9</sup>:

Plant	concentrations of nitrite (NO <sub>2</sub> ) mg\kg	concentrations of nitrate (NO <sub>3</sub> ) mg\kg
potato	n.d.-19	35-200
carrot	n.d.-2	115-271
radish	n.d.- 4	1100-1510

n.d. (not detected)

Often farmers use large quantities of nitrogen fertilizer greater than the assumed amounts for their willingness to increase production quickly, especially when prices of these products are very high in the market. As the plant



does not benefit from the all fertilizer additive, so the excess amount of fertilizer is drifted from soil with water to reach groundwater and may reach streams and rivers to be re-used to irrigate crops<sup>10</sup>.

### Aim of study

In this research, it was determined the levels of nitrite and nitrate in a number of root vegetables, which were used as a food on a large scale in Syria (potato, carrot, radish) which were collected from several areas included: (Damascus Countryside, Homs, Idlib, Daraa and Aleppo) in order to see how they conform with the levels of nitrite and nitrate which are globally permitted, because the high concentrations of them in those vegetables that cause high concentrations of nitrosamines in the body which is considered as carcinogen. It should be noted that the concentrations of nitrite and nitrate are often associated with the amount of fertilizer used by farmers and the sources of water to irrigate crops.

### MATERIALS AND METHODS

Samples were collected from number of Syrian regions, namely: Homs, Idlib, Daraa, Aleppo and Damascus countryside (Keswa, Rankous, Daraya, Assal- Alwarded, Beit- jenn and Alteba). Nitrite and nitrate are extracted from vegetables with hot water, this is because all salts of nitrite and nitrate are dissolved in water and this solubility is increasing with rising temperature, in case that PH = 9-10 during the extraction process, because the

nitrite compounds are not stable in PH less than 5 and can be oxidized to nitrate. This process is followed by divestiture from proteins using potassium ferrocyanide, zinc acetate with Borax<sup>11</sup>. By this way, the Extraction rate for each nitrite and nitrate are ranged between 98-100%. Sulfanilamide with NED (N-1-naphthyl-ethylenediamide de hydrochloride) has been chosen as a method to determination the concentration of nitrite and nitrate in root vegetables studied, it being a simple and easy method which availability in laboratory and relatively low-cost, as it do not require a long time and give reliable results in terms of accuracy and sensitivity. This way giving the Azoia derivative with red color which is measured by spectrophotometer at a wave length of 538 nm<sup>11</sup>. (spectrophotometer type P48800UVVIS company of Philip) is used.

### RESULTS AND DISCUSSION

There were 90 samples collected from the Syrian regions in the different periods of the year between January 2011 - April 2012. The different samples of each area were taking at the same time then transported in cool boxes to the laboratories of Pharmacy Collage, Department of Pharmacology and Toxicology in Damascus University where be analyzed.

Results were expressed as Mean  $\pm$  STDEV, n = number of samples. STDEV: standard deviation.

The results are as follow:

**Table 1:** The concentration of nitrite and nitrate in potato samples

Potato	Idlib (n=5)	Damascus countryside (Assal -AlWared) (n=5)	Damascus countryside (Beit- jenn) (n=5)
Nitrite (NO <sub>2</sub> <sup>-</sup> ) mg/kg	1.10 $\pm$ 0.03	0.82 $\pm$ 0.46	1.15 $\pm$ 0.02
Nitrate (NO <sub>3</sub> <sup>-</sup> ) mg/kg	846.81 $\pm$ 9.68	366.1 $\pm$ 42.50	698.44 $\pm$ 13.01

Potato	Daraa (n=5)	Homs (n=5)	Aleppo (n=5)
Nitrite (NO <sub>2</sub> <sup>-</sup> ) mg/kg	0.47 $\pm$ 0.02	1.08 $\pm$ 0.61	$\pm$ 0.110.2
Nitrate (NO <sub>3</sub> <sup>-</sup> ) mg/kg	152.97 $\pm$ 7.09	1572.62 $\pm$ 10.94	80.7 $\pm$ 602.9

**Table 2:** The concentration of nitrite and nitrate in carrot samples

Carrot	Idlib (n=5)	Damascus countryside (Alteba) (n=5)	Damascus countryside (Keswa) (n=5)
Nitrite (NO <sub>2</sub> <sup>-</sup> ) mg/kg	1.18 $\pm$ 0.22	1.90 $\pm$ 1.06	0.32 $\pm$ 0.01
Nitrate (NO <sub>3</sub> <sup>-</sup> ) mg/kg	583.6 $\pm$ 38.60	526.96 $\pm$ 29.75	1056.6 $\pm$ 4.64

Carrot	Daraa (n=5)	Homs (n=5)	Aleppo (n=5)
Nitrite (NO <sub>2</sub> <sup>-</sup> ) mg/kg	0.44 $\pm$ 0.02	0.19 $\pm$ 0.11	$\pm$ 0.130.15
Nitrate (NO <sub>3</sub> <sup>-</sup> ) mg/kg	297.41 $\pm$ 82.37	4622.62 $\pm$ 23	71.30 $\pm$ .5809



**Table 3:** The concentration of nitrite and nitrate in radish samples

Radish	Idlib (n=5)	Damascus countryside Daraa (n=5)	Damascus countryside (Rankous) (n=5)
Nitrite (NO <sub>2</sub> <sup>-</sup> ) mg/kg	0.70±0.42	0.38±0.21	0.41±0.23
Nitrate (NO <sub>3</sub> <sup>-</sup> ) mg/kg	3226.69±31.71	1995.56±43.54	741.12±30.73

  

Radish	Daraa (n=5)	Homs (n=5)	Aleppo (n=5)
Nitrite (NO <sub>2</sub> <sup>-</sup> ) mg/kg	0.22±0.12	0.35±0.14	±0.120.18
Nitrate (NO <sub>3</sub> <sup>-</sup> ) mg/kg	1025.33±22.88	4398.48±4.91	74.68±1661.1

In this study, all nitrite concentrations in the samples were within the permissible limits in fresh vegetables based on the limits listed by European Commission, Food Science and Techniques and Reports of the scientific Committee for Food, Thirty Eighth Series<sup>9</sup>.

The concentrations of nitrate compared with the limits listed by European Commission<sup>9</sup> have varied values depending on the region and the type of vegetables which studied. The results were as follow:

#### Damascus countryside:

Potato: The concentrations of nitrate increased in potato samples which taken from the areas of Beit Jenn and Assal- Alwared.

Carrot: The nitrate levels were remarkably high in Keswa samples, while it was within normal limits in Alteba samples.

Radish: The samples taken from Daraya have amounts of nitrate higher than those taken from Rankous. Generally the radish tissues save large amounts of nitrate.

Aleppo: Nitrate concentrations increased significantly in potato and carrot samples, while slight height of nitrate levels was noted in radish samples.

Homs: All samples (potato, carrot, and radish) are containing the highest concentrations of nitrate from all samples studies, which exceeded the normal amounts of nitrate many times.

Daraa: All samples studied have the amounts of nitrate within normal limits, and this indicates that this area was less nitrate pollution.

Idlib: The nitrate levels in each potato and radish samples were increased significantly while the height in nitrate levels were less in the carrot samples.

It should be noted that the high concentrations of nitrate in root vegetables in general and particularly in Homs, may be due for using farmers large amounts of fertilizer. In addition to the height levels of nitrate in the groundwater and irrigation water as a result of leak nitrate to it from agricultural land where the farmers used the nitrogen fertilizer in exaggerated way, so it was observed a significant increase of nitrate levels in well water used for drinking about allowable limits, especially

in Homs and Damascus<sup>12</sup>. According to the World specification; the levels are determined with 10 mg nitrate per liter of water and 1 mg nitrite per liter of water<sup>12</sup>. In Damascus countryside the irrigation of crops with sewage is one of the important reasons for nitrate pollution. Besides, the wastewater resulting from population centers are using to irrigate crops in immersion way. In addition to the foregoing, The highest concentrations in Homs may be due to spread the factories of dairies and ice creams and others which use Nitric acid, as well as the presence of the nitrogen fertilizer factory in Homs, which is important source of nitrate pollution<sup>12</sup>.

#### CONCLUSION

Generally the nitrate levels in samples which taken from most of the areas is high, especially on Homs where was the more polluted areas, followed by Damascus countryside while Daraa was marked as the least polluted area.

Research indicates that the inability of the plant to take advantage from excess amounts of fertilizer in terms of the strength of growth and production, so the process becomes a losing economically in many cases. In addition, the damage to the complex bio is found in soil and water nearby. As a result, the soil is poisoned with nitrate and lack of suitability for the production of agricultural, add to the contamination of groundwater with nitrate.

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