



Measuring nitrate and nitrite concentrations in vegetables, fruits in Shiraz

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ABSTRACT: Nitrosamine is derived from nitrate and it seems as one of the factors and causes of gastrointestinal cancer in adults and Methemoglobinemia (blue baby syndrome). Eighty percent of nitrate enters to the body through vegetables and fruits, so in this study nitrate concentration in available vegetables and fruits at Shiraz was determined and compared with standard limit. At first, Shiraz city was divided to several regions in geographical terms, then samples were purchased; these samples were used by citizens more during spring and winter, then samples were extracted. Nitrate reading was done using a spectrophotometer Palin test (Photometer 7100) and accuracy was measured by a conventional spectrophotometers. SAS and Excel were used to draw diagrams and statistical calculations. Statistical comparisons showed value of nitrate and nitrite in leafy vegetables is more than fruits and cucurbits. Average concentration of nitrate is more in potato and is low in onion among cucurbits. Among fruit and vegetables, highest concentration of nitrate is allocated to eggplant and lowest concentration of nitrate is allocated to tomato. Among leafy vegetables, highest concentration is allocated to mint and lowest concentration is allocated to savory. Generally, concentration of nitrate in all samples was lower than WHO limit. © JASEM

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Today, the role of nitrogen fertilizers on growth, performance and quality of products as well as demand for available products at agriculture is increased to achieve more productivity and this leads to overuse or abuse of nitrogen fertilizers. Overusing such fertilizers leads to nitrate aggregation in the plants in addition to surface and groundwater water pollution and creating environmental hazards. Nitrate aggregation in the plants cause to various diseases like Methemoglobinemia in children and gastrointestinal cancer in adults. Therefore, nitrate is considered as a chemical fertilizer and a treat to human health and environment (Dezfouli and Abdollahi 2009, Manavifard et al 2008, Nev 2013)

High level of nitrogen fertilizer is used to plan growth in the soil. This substance is composed of carcinogenic elements such as nitrosamine, especially in vegetables like lettuce and spinach leaves that are eaten, accumulation of nitrates and nitrites are harmful. Based on researches and studies, effect of chemical fertilizers in the soil is not revealed immediately. Because soil has powerful buffer strength due to its elements (Serpil 2012)

Naturally, nitrate is produced in human body and its value is approximately 62 mg daily. Nitrate naturally present in the food or is added as an additive to food. Nitrate enters to drinking water through different ways. Also, contacting to nitrate and nitrite in foods especially vegetable and contaminated water of fruits as well as dairy products and cereals enter nitrate and

nitrite to human body. Also, nitrate and nitrite salts have been used as preservative in meat products in many countries since ancient times. Such salts are used to prevent Clostridium botulinum growth, creating Red - pink color in the products, creating a unique taste and flavor of products and creating a unique taste and flavor at processed products (Kamkar et al 2004, Khoshtinat et al 2009, Manavifard et al 2008, Miranzadeh et al 2009, Tabatabaei et al 2005)

In the past years, nitrate level in foods has increased. Basically, potential reduce from nitrate to nitrite is known as harmful factors on human and animals. In fact, nitrite is able to reacts Amino Acids in toxic form and converts to carcinogenic nitrosamine. In addition, nitrite is known as Methemoglobinemia (Anoxia) factor in children. Nitrite and nitrate in water drinking and foods are environmental factor to lead upper gastrointestinal cancer (Pirsaheb et al 2012, Raghimi et al 2008, and Noorafkan et al 2008)

Met Hemoglobin causes oxygen delivery disorder (Khoshtinat et.al 2010). In severe state, this disease can cause brain damage and eventually lead to death due to suffocation caused by a lack of oxygen (Pirsaheb et.al 2012, Shariati Fezabadaï et.al 2007 and Jan Alexander et. al, 2008).

Methemoglobinemia can be congenital or acquired. Acquired form is more common and generally caused by the oxidation of drugs, diarrhea and available in

caused wells and certain types of vegetables. Compensatory palpitation, vomiting, drowsiness, lethargy and jaundice are the main symptoms of methemoglobin in children (Bryk et al. 2003)

In human-beings Nitrate is absorbed from stomach and beginning of small intestine rapidly and at least 25 percent of it is transferred to saliva. In adults, 5 to 7 percent of entered nitrate to the body is converted to nitrite and in the children and who are suffered from intestine diseases more nitrate is converted to nitrite due to lower PH of intestine. In adults, Met hemoglobin reductase enzyme is produced which convert this composition to oxy hemoglobin (Hashemimajd et al 2010). Hence, avoid to feed domestic food contains vegetables to three months infants or older (Chan 2010).

Conducted researches about measuring nitrate and nitrite in vegetables and fruits are limited in Iran, so it is required to regard this issue because vegetables and foods are important nutritional composition in food diet and nitrate resource. In this study, nitrate concentration in available vegetables, cucurbits and fruits at Shiraz City were investigated.

MATERIAL AND METHODS

In this study, first Shiraz city have divided to several geographical regions, then samples which were most consumed vegetables during spring and summer were purchased. Vegetables are listed in table 1. Samples were washed by distilled water and 100 gram of each sample was selected and placed in specific packets, then samples were placed in oven with 70 centigrade degree and were kept for 48 hours in this temperature. Samples were powdered after parching and extracted by 0.2 percent acid citric solution. 1 gram was selected per sample and 100 CC of solution was added to samples and placed in shaker device for 20-30 minutes to combine samples and solutions. Then extraction was done by filter paper and juice kept in a specific bottle. Then, nitrate reading was done by spectrophotometer and Palin test (photometer 7100) to compare nitrate values in different devices and nitrate of some samples were read randomly. Standard limit of nitrate in each sample is adopted from world health organization site (Table 1)

Standard of nitrate usage for human dairy is determined as 3.7 Milligram per kilogram weight according world health organization and average of nitrate in vegetable according to FAO site for Islamic Republic of Iran is 3.7 Milligram /Kilogram dairy. Since population of Iran is 75 million and weight average of an Iranian is 75 Kilogram, so according to world health organization, nitrate dairy consumption is 3.7 Milligram per kilogram of body weight and dairy consumption is estimated for each person (Table 2)

DISCUSSION AND RESULTS

According to comparison, nitrate concentration in all samples was lower than standard limit of World Health Organization (Table 1) and are consistent to Hashmimajd et al studies 2010 (Hashmimajd et al 2010).

Average of nitrate concentration in leafy vegetables is more than fruits and cucurbits. Average of nitrate concentration in leafy vegetable, cucurbits and fruits are respectively 53.81 milligram /kilogram, 52.17 milligram/kilogram and 48.74 milligram/kilogram (Table 3), these findings are consistent to Khoshtinat et al studies (Khoshtinat et al 2010). Also, Tabatabaei et.al determined nitrate values in all kinds of vegetables in Tabriz city by spectrophotometer method and founded nitrate aggregation in leafy vegetables is more than cucurbit and value of nitrate in cucurbits are more than bushes vegetables (Tabatabaei et al 2005). Nitrate concentration in mint is more and its value is 74.8 milligram/ kilogram and in tomato is less and its value is 33.6 milligram/kilogram. These findings are consistent to Ardekani, Shayesteh, Afyouni and Sofiani studies (Sobhan Ardekani et.al 2005). Also, these findings are consistent to Pasdar et.al 2009 studies (Pasdar et.al 2009). Totally, major nitrate enter to the body through mint, potato and eggplant and there is low nitrate in vegetables like savory, onion and tomato.

Among leafy vegetables, nitrate concentration in mint (74.8 milligram / kilogram) is more than other (figure1) and among cucurbit, nitrate concentration in potato (73.4 milligram / kilogram) is more than others (Figure 2), among fruit vegetables, nitrate concentration in eggplant (66.93 milligram / kilogram) is more than other (Figure 3)

Values which are considered at nitrate concentration in each material should be healthy (Milligram / Kilogram) and is estimated in table 2.

Nitrate aggregation value in different organs of vegetables is from highest to lowest including leaflets> leaves> stems> roots> inflorescence> bulb> Onion> fruits> seeds (Santamaria 2006). In Hashemimajd study in 2007 in Ardebil, share of vegetables and fruits to enter nitrate to body is approximately 60 percent (Hashemimajd 2009). Higher level of nitrate tend to find in leaves, while lower level are placed in seeds or bulbs (Jan Alexander et al. 2006)

Due to standard limit for nitrate value in vegetables, standard limit per weight kilogram is less than 3.65 Milligram (Tabatabaei et al 2005). If an individual use leafy vegetables in diet, average nitrate in this group (2020.5 Milligram / Kilogram) should not be more than 120 Gram dairy, because using 120 Gram

of vegetable supply nitrate value in the body and overusing leads to some disorders in the body, it should be mentioned this issue is important in the children. For example consumed value of vegetable is reduced to 45 Gram for a child with 25 Kilogram

Weight and this shows importance of vegetable in children compared to adults. Therefore, nitrate concentration in vegetables should be reduced especially for whom use of vegetables in their diet (Tabatabaei et al 2005)

Table 1: Average Concentration of Nitrate in the Samples and Standard Limit of Sample According To World Health Organization

Kind Of Vegetable	Nitrate (Milligram / Kilogram)	Standard Limit (Milligram/ Kilogram)
Onion	36.9	(5) 80
Potato	73.40	(5)250
Carrot	60.60	(1)800-30
Turnip	37.80	-
Green Bean	50.88	(1)822-80
Eggplant	66.93333	(1)400
Cucumber	56.06667	(5)150
Tomato	33.6	5(300)
Green Pepper	42.4	5(200)
Pepper	42.6	5(200)
Cress	74.4	-
Savory	37.2	-
Celery	46.08	-
Mint	74.8	3000
Parsley	46.4	(5)2000
Lettuce	54.7	(5)2000
Spinach	44	(5)3000-2000
Dill	54	(5)2000
Basil	55.8	(5)2000
Tarragon	50.4	-
Leek	37.2	(5) 2500-2000
White Cabbage	56.4	(5)500-900
Purple Cabbage	48.2	(5)500-900

❖ The numbers in the bracket are used resource number.

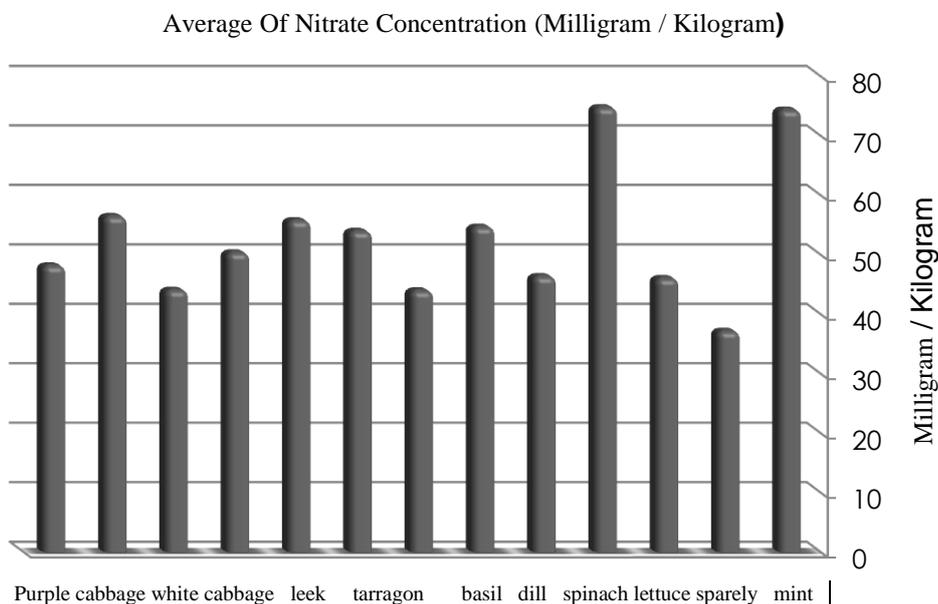


Fig 1: Comparison of Nitrate Concentration in Leafy Vegetables

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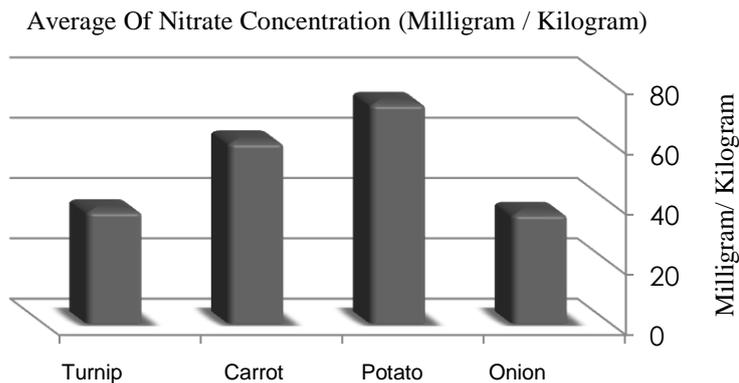


Fig 2: Comparison of Nitrate Concentration in cucurbits

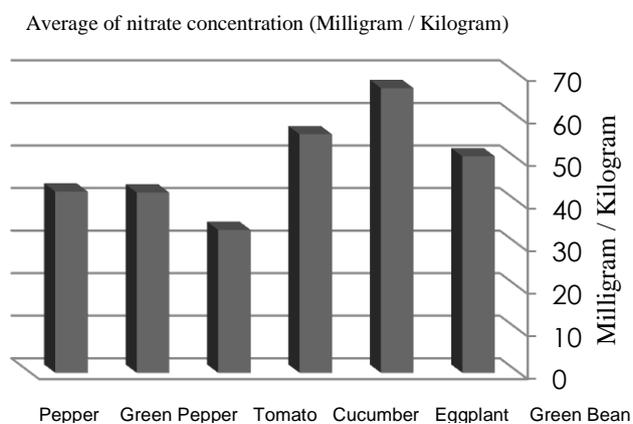


Fig 3: Comparison of Nitrate Concentration in Fruit Vegetables

Table 2: Standard limit which is healthy to use according to average of nitrate concentration

Kind of vegetable	Dairy consumption value (Gram / Kilogram)
Onion	12.2058
Potato	543.3802
Carrot	19.7415
Turnip	20.223
Green bean	37.6512
Eggplant	104.0144
Cucumber	162.0327
Tomato	356.496
Green pepper	27.136
Pepper	22.578
Cress	-
Savory	-
Celery	-
Mint	-
Parsley	-
Lettuce	38.5088
Spinach (Hashemimajd et al 2009)	103
Dill	-
Basil (Hashemimajd et al 2009)	463
Tarragon	-
Leek (Hashemimajd et al 2009)	718
White cabbage	36.66
Purple cabbage	31.33

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Table3: Average of Nitrate Concentration in all kinds Vegetables (Milligram / Kilogram)

Kind of vegetables	Dairy consumption value (Gram / Kilogram)
Leafy	53.81
Cucurbit bush	52.17
	48.74

In this study, nitrate concentration in all vegetables is determined lower than standard limit which is consistent to Hashemimajd et al study 2007 (Hashemimajd et al 2007)

Nitrate concentration in mint was higher than other (74.8 Milligram / Kilogram) and lower in tomato (33.6 Milligram / Kilogram) and is consistent to Ardekani, Shayeseh, Afyouni and Sofiani studies (Sobhan Ardekani et al 2005)

Nitrate concentration in potato was higher among cucurbit (7340 Milligram / Kilogram) and is consistent to Dish et al study (quoted by Dezfouli et al 2009) and Tabatabaei and Malakouti (1997)

(Tabatabaei et al 2005). Nitrate concentration was lower in onion and is consistent to Pasdar study in Kermanshah (Pasdar et al 2011). Generally, major nitrate enter to body through mint, potato and eggplant and lowest nitrate is allocated to savory, onion and tomato.

Average of nitrate concentration in leafy vegetable is more than cucurbit and is more in cucurbit compared to fruit vegetable (Table 4)

Highest and lowest nitrate concentration in cucurbit is for carrot and onion. Highest and lowest nitrate concentration in fruit vegetable is for eggplant and tomato. In leafy vegetable, highest nitrate is for cress and lowest is allocated to savory (Figure 4)

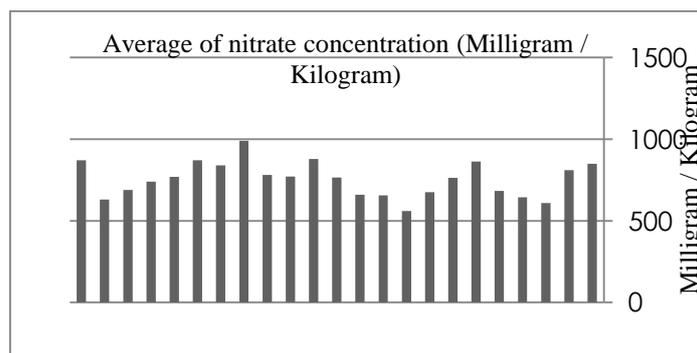


Fig 4: Average of nitrate concentration in vegetables

Table 4: Average of nitrite concentration in the samples

Kind of vegetable	Nitrite concentration (Milligram / Kilogram)
Onion	6.09
Potato	8.1
Carrot	8.50
Turnip	6.45
Green bean	7.64
Eggplant	8.63
Cucumber	6.84
Tomato	5.6
Green pepper	6.56
Pepper	6.75
Cress	9.9
Savory	6.3
Celery	8.7
Mint	8.78
Parsley	7.8
Lettuce	6.6
Spinach	7.4
Dill	8.7
Basil	8.4
Tarragon	7.7
Leek	6.9
White cabbage	7.65
Purple cabbage	7.7

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Conclusion: According to comparison, nitrate concentration in all samples was lower than standard limit of world health organization (table 1) and there is no hazard for Shiraz citizenship.

Average of nitrate concentration in leaf vegetable was more than fruit and cucurbit. Average of nitrate concentration for leaf vegetable, cucurbit and fruit was respectively 53.81 Milligram / kilogram, 52.17 Milligram / kilogram and 48.74 Milligram / kilogram (table 3). Nitrate concentration in mint was more (74.8 Milligram / kilogram) and was lower in tomato (33.6 Milligram / kilogram). Generally, major nitrate enter to body through mint, potato and eggplant and lowest nitrate is allocated to vegetables like savory, onion and tomato. Nitrate concentration in leaf vegetable in mint was more than other (74.8 Milligram / kilogram) and among cucurbit potato is more than other (73.4 Milligram / kilogram) (figure 2). Among fruit vegetables nitrate concentration of eggplants was more than other (66.93 Milligram / kilogram (Figure 3). Average of nitrite concentration in leaf vegetable was more than cucurbit and was more in cucurbit compared to fruit vegetable (Table 4)

Highest and lowest nitrate concentration in cucurbit is related to carrot and onion. Highest and lowest nitrite concentration in fruit vegetable is related to eggplant and tomato. In leaf vegetable highest nitrite concentration is related to cress and lowest is related to savory (Diagram 4)

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