

THE INCIDENCE OF NITRATES CONTAMINATION IN VEGETABLES DURING 2002-2008 IN THE BIHOR COUNTY

Adriana Monica Chiș*

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea,
Romania, e-mail: andichis@yahoo.com

Abstract

The paper presents a synthesis regarding the Bihor county about the contamination with nitrites and nitrates of some vegetal products under sanitary veterinary surveillance in the last six years. It refers to the comparative situation of the Bihor county in respect of the Ardeal geographic area both from the point of view of the number of samples submitted to verification and of view of the values obtained. There were no exceeding of the maximum admitted values, but this aspect needs to be related with the reduced number of samples, in parallel with the necessity of extending this activity, especially on the baby-food, that it not the object of a continuous verification.

Keywords : nitrates, nitrites, lettuce, spinach

INTRODUCTION

The monitoring of the food contamination is an essential component of food safety [7] and, according to Codex Alimentarius, it supplies basic information on the identity of the chemical contaminants for selecting the priorities in what regards their follow-up and the admitted limits. The special nutritive characteristics of this group of foods impose their presence in the balanced daily diet, during the year [6] but their obtaining makes them susceptible to nitrate contamination [1].

The GEMS/Food Program (Global Environment Monitoring System/Food Contamination Monitoring and Assessment Program) has as a purpose the evaluation of the chemical contaminants level and their influence on public health and, in our country, its objectives fall under the National Program 1, sub-programme 1.4. “The evaluation of the health state and risk factors: objective 1 – „Health protection and prevention of illnesses associated with the environment risk factor” through the activity „Monitoring the chemical contamination of the foods, with the GEMS/Food”.

The only ionic-type non-organic contaminants followed through this program are the nitrite and nitrate ion, as seen in table 1. According to this program, we can observe that the determinations do not refer only to basic foods but also for the ones that along the food chains can be responsible for contamination, in this case – water.

Table 1

Chemical contaminants under sanitary-veterinary surveillance – extract,
from Hura Carmen, 2005

Contaminant	Food
Nitrites/nitrates	Vegetables, other products, total diets, drinking water

MATERIALS AND METHODS

The study shown refers to the systematization and interpretation of data from periodical reports of the Public Health Authority Bihor, regarding the nitrites and nitrates contamination of vegetal foods from samples gathered in the period 2002-2008 in the Bihor County. Where possible, we linked these data with the ones corresponding to the Ardeal geographical area, according to the way of realizing the national synthesis [2], [3], [4]

Due to legislative modification both in what regards the type of vegetables submitted to verification and the maximum admitted limits for nitrites and nitrates respectively, the report and comparison methods of the results is not unequivocal for the entire period of study.

The average content of nitrites and nitrates in vegetal products analyzed in Ardeal in the period 2002-2004, is shown in tables 2,3 and 4. The tables have different forms, according to the monitoring requests of the Health Ministry corresponding to that year. In each table we showed the situation of the monitoring in the Bihor county in comparison with the Ardeal area.

In the year 2002 was analysed 380 samples of different vegetal products (carrot, lettuce, potatoes, cabbage). Most of the vegetal samples have been analysed in the Mureş county (121 samples) and a few of them have been analysed in the Bistriţa county (14 samples). The average nitrites content was 5.8 mg/kg and varied between 1.11 mg/kg (Bihor county) and 18.1 mg/kg (Mureş county).

In Ardeal, in the year 2003, was analyzed 542 samples of very different vegetal products, varying from one county to another, that is: spinach, lettuce, carrot, radishes, potatoes, apples, beetroot. The average content of nitrates in vegetal products from the Ardeal area has been 1284,6 mg/kg while the number of non-corresponding samples has been at 13.4% from the total analysed samples, as shown in table2 .

Table 2

Average nitrites/nitrates content in vegetal products from Bihor / Ardeal, 2002, mg/kg

County	Nr Samples	Nitrites				Nitrates			
		Average	Min	Max	A	Media	Min	Max	A
Bihor	47	1,11	0,11	3,76	3,65	34,60	1,35	366,1	364,75
Total Ardeal	380	5,8	nd	82,5	82,5	377,0	nd	12543,9	12543,9

Table 3

Average nitrites/nitrates content in vegetal products from Bihor / Ardeal, 2003, mg/kg

County	Nr samples	Nitrites			Nitrates			Average	Min	Max
		Average	Min	Max	Nr	Non corresp Samples				
						Nr.	%			
Bihor	55	1,7	Nd	6,9	55	-	-	2,5	nd	11,02
Total Ardeal	542	4,2	Nd	413,5	542	73	13,4	1284,6	nd	41161

Table 4

Average nitrites/nitrates content in vegetal products from Bihor / Ardeal, 2004, mg/kg

Product	Harvest period	County	Nr. Analyzed samples	Nr of non-corresp. Samples		Nitrates		
				Nr.	%	Average	Min	Max
Lettuce	Nov 1st – mar 31st	Bihor	9	-	-	1,9	0,67	4,45
		Total Ardeal	63	2	3,2	785,0	0,67	102,37
Spinach		Bihor	13	-	-	3,1	0,81	6,85
		Total Ardeal	60	5	8,3	520,7	0,81	4849,4
Lettuce	Apr. 1st – Oct 31st	Bihor	41	-	-	2,1	0,48	5,18
		Total Ardeal	140	10	7,1	973,2	0,48	11178,9
Spinach		Bihor	39	-	.	2,2	0,38	5,85
		Total Ardeal	134	10	7,5	792,6	SLD	5838,8

For the last three years and the first semester of the current year we only had at our disposal the data corresponding to the Bihor samples, therefore we cannot show a comparison with the Ardeal area.

RESULTS

In what regards the Bihor county, the harvesting of the samples and the monitoring of nitrates contamination respected the requests of the program and the data are enclosed in the tables bellow,. In these samples there were not exceeding of the maximum admitted values.

The situation of the monitoring of the vegetal products contamination in the Bihor county in the year 2003 is shown in table 5. One

can observe that fact that samples of various vegetables have been tested (spinach, lettuce, carrot, cabbage, radishes, beetroot).

Table 5

Average nitrites/nitrates content in vegetal products from Bihor / Ardeal, 2003, mg/kg

County	Nr sm	Nitrites			Nitrates			Average	Min	Max
		Average	Min	Max	Nr	Non-corresp. Samples				
						Nr	%			
Lettuce	2	0,8	0,2	1,4	2	-	-	4,8	0,35	9,3
Field lettuce	8	0,6	0,3	1	8	-	-	2,2	0,3	10,9
Greenhouse spinach	4	4,7	2,7	6,9	4	-	-	0,48	0,3	0,6
Field spinach	3	4,6	4,6	4,6	3	-	-	3,75	3,75	3,75
Carrot	10	0,7	Nd	1,5	10	-	-	1,9	nd	11,02
Cabbage	10	0,6	Nd	2,5	10	-	-	1,9	0,01	9,1
Radishes	8	0,5	Nd	1,5	8	-	-	0,4	nd	1,5
Beetroot	10	1,4	0,05	3,3	10	-	-	4,3	0,02	10,4
Total Bihor	55	1,73	Nd	6,9	55	-	-	2,46	nd	11,02

In the year 2004 we submitted to nitrites content monitoring only samples of lettuce and spinach, in two periods, according to the data from table 6. These periods refer to the cultivation method – that is, respectively greenhouse, solarium or field. In total, in Ardeal we analysed 203 samples of lettuce of which 5.9% have been uncorresponding and 194 spinach samples of which 7.7% have been uncorresponding. .

Table 6

Evaluation of the nitrates content in vegetal products in Bihor, in the year 2004

Product	Harvesting period	Nr. Of analysed samples	Noncoresp. Samples		Nitrates		
			Nr.	%	Average	Min	Max
Lettuce	Nov 1st – mar 31st	9	-	-	1,9	0,67	4,45
Spinach		13	-	-	3,1	0,81	6,85
Lettuce	Apr. 1st – Oct 31st	41	-	-	2,1	0,48	5,18
Spinach		39	-	-	2,2	0,38	5,85

In the years 2005 and 2006 there were determinations only for nitrates; the number of samples testes and the values (average, minimum and maximum) are written in table 7 and 8.

Table 7

Evaluation of the nitrates content in vegetal products in Bihor, in the year 2005

Product	Contaminant	Nr. Of analyzed samples	Nr. of noncorresp samples		Values, mg/Kg		
			Nr.	%	Average	Min	Max
Lettuce	Nitrates	15	-	-	3,1	0,55	7,63
Spinach		36	-	-	4,1	0,91	6,52

Table 8

Evaluation of the nitrates content in vegetal products in Bihor, in the year 2006

Product	Contaminant	Nr. Of analyzed samples	Nr. of noncorresp samples		Values, mg/Kg		
			Nr.	%	Average	Min	Max
Lettuce	Nitrates	3	-	-	2,5	0,91	7,2
Spinach		1	-	-	3,8	3,8	3,8

In the year 2007 there were calculations both for nitrates and for nitrites. The number of samples and the values (average, minimum and maximum) are written in table 9.

Table 9

The evaluation of the nitrates content in vegetal products in Bihor, in the year 2007

Product	Contaminant	Nr. Of analyzed samples	Nr. of noncorresp samples		Values, mg/Kg		
			Nr.	%	Average	Min	Max
Lettuce	Nitrates	20	-	-	6,16	0,94	19,1
Spinach		20	-	-	2,27	0,81	11,26
Lettuce	Nitrites	20	-	-	1,05	0,31	2,5
Spinach		20	-	-	0,65	0,11	2,63

The number of samples estimated to be analysed in the year 2008 is significantly higher than the last three years, which results from the data presented in table 10 that includes the results of the control activity from the first semester of the current year:

Table 10

The evaluation of the nitrates content in vegetal products in Bihor, in the 1st trimester – year 2008

Product	Contaminant	Nr. Of analyzed samples	Nr. Of uncorresp samples		Values mg/Kg		
			Nr.	%	Average	Min	Max
Lettuce	Nitrates	20	-	-	0,98	0,37	1,83
Spinach		20	-	-	1,53	0,13	4,86
Lettuce	Nitrites	20	-	-	0,25	0,04	0,72
Spinach		20	-	-	0,20	0,05	0,81

CONCLUSIONS

In what regards the number of samples submitted to monitoring for the contamination with nitrites / nitrates of vegetal foods, we can make comparisons only for spinach and lettuce. The number of samples submitted to verification in the Bihor county has been reduced, except for the year 2004, which can be seen in figure 1. The number of spinach and lettuce samples fall under the same values for each monitored period.

The maximum allowed level of nitrogen-compounds in some of the vegetal products such as spinach and lettuce, according to the National Regulations [9] conform with the Regulation of the European Commission nr. 1881/2006) is between 2000 and 4500 mg of NO_3/kg according to the cultivation place and harvesting period.

The comparisons of the minimum, maximum and average values refer continuously to the nitrates quantity but noncontinuously to the nitrites contamination in products such as lettuce and spinach.

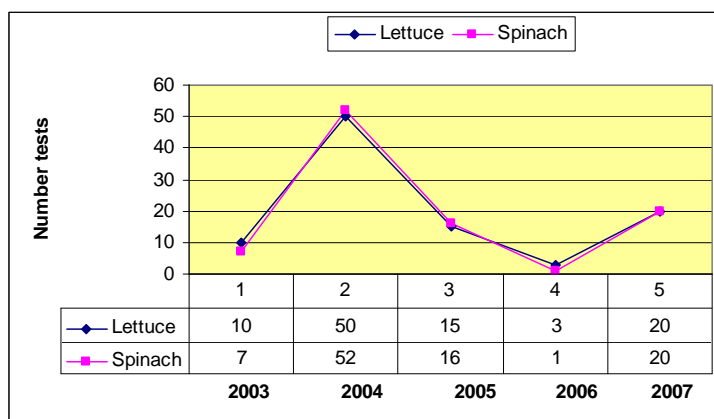


Figure 1- The variation of the number of samples in the Bihor county

In that regards the values registered in the nitrites/nitrates contamination in vegetal foods, we can make the following considerations :

The comparisons between the values registered in the Bihor county in relation with the ones registered in the geographic area it belongs to – that is Ardeal – refer to the period 2002-2004 for which we had access to national synthesis. In this period, the average values registered in the Bihor county are variable but fall under the average value registered in Ardeal. In the Bihor county there were no exceeding of the CMA values corresponding to that period but we have to mention the fact that the number of samples submitted to verification was very low, as explained before. The average

concentration values for nitrates, that is the contaminant followed through the sanitary veterinary norms is between 2 and 6.16 mg/kg, that is way under the CMA values the CMA values, as seen in the graphic in figure 2.



Figure 2 - The variation of the average content from the Bihor county

Even if in the Bihor county there were no exceedings of the CMA values in the discussed contaminants, the monitoring continues only on the chemical contamination and its effect on the health. Indeed, the number of samples submitted to control is increasing. Therefore, only in the first semester of the year 2008 we tested about 20 samples of lettuce and spinach, that equals the umber of samples tested during the entire previous year 2007. The calculations referred both to nitrites and nitrates. The registered values are under the CMA limit, but in spinach they are higher, which can be seen in figure 3.

In conclusion, the number of tests submitted to verification is far from satisfying a deep monitoring of this type of contaminant all the more that these products are used in foods for young children who are much more sensitive to the methemoglobinisant type toxic effect [8]. In the same time the preoccupation regarding the contamination of vegetal foods and nitrites and nitrates water are a current procedure in many areas from Europe, due to the toxicological potential of this type of contaminants [5].

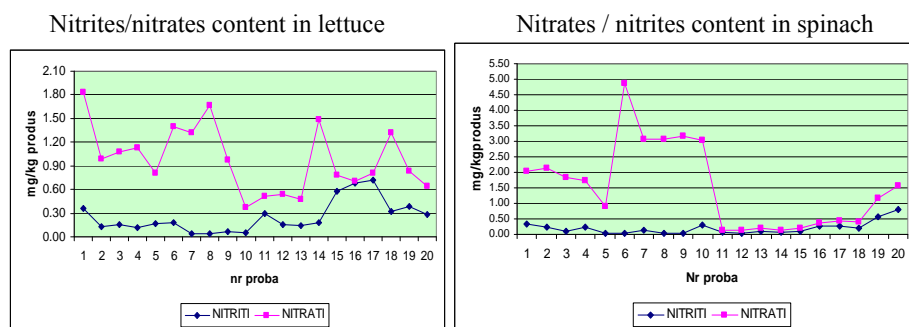


Figure 3 -The variation of the nitrites and nitrates and nitrites, 1 trimester – 2008, Bihor county

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