ANIMAL AND VEGETAL COMPONENTS IN RELATION WITH THE CONTAMINATION BY NITRITES AND NITRATES IN COMPLEX FOOD

Chiş Adriana*, Purcărea Cornelia

* University of Oradea, Faculty of Environment Protection
Oradea, 26 Gen. Magheru Bd., zip code 410048, andichis@yahoo.com

Abstract
This paper presents the results of the contamination tests of certain complex food products, made with raw materials of vegetal and animal origin that are likely to contain nitrates and nitrites accumulations. The spectrofotometric method was used and the calculation was direct for nitrites and indirect by reducing the nitrates to nitrites with metallic cadmium, for nitrates. The obtained results were under the MRL values for all tested food. The main contributor to nitrates and nitrites contamination was carrot and celery for vegetal origin components and feta cheese or ham for animal origin component.

Keywords: nitrite/nitrate contamination, complex food

INTRODUCTION

As we all know, "fast-food" is one of the favourites foods for infants and teen-agers. This kind of food has a various composition, generally bread, with different stuffing, having vegetal and animal origin. Mainly because of the pollution the food is in danger to be contaminated by different chemical substances. For complex food it is important to appreciate the possible sources of contamination in relation with the specific composition of the investigated product.

The concentration of nitrates in vegetables depends on factors relating to agricultural procedures such are: type of soil, light intensity (AFFSA, 2007, Weightman et al, 2006, Premuzic et al., 2002), correct use of GAP techniques. In the same time, technological procedure has influence on nitrates concentration such are storage (Wallace, 1986, Chung, 2004), refrigeration Chung, 2004, processing (Czarnieka-Skubina et al., 2003, Golaszewska and Zalewski, 2001, Dejonckheere et al, 1994).

For vegetal origin food, the nitrates are among the contaminant under surveillance through GEMS - type indicators starting from the drinking water and finishing with total diets (Savu and Georgescu, 2004). Human exposure to nitrate is mainly exogenous through the consumption of vegetables, and to a lesser extent water and other foods (EFSA, 2008). Nitrates has endogenous sources too, but in limitated quantity (Lundberg et al., 2004 and 2008). In contrast exposure to nitrite is mainly from endogenous nitrate conversion.

Nitrate *per se i*s relatively non-toxic, but its metabolites and reaction products e.g., nitrite, nitric oxide and N-nitroso compounds, have raised concern because of implications for adverse health effects. such as methaemoglobinaemia and carcinogenesis .

The toxicological risk of nitrites is due to the specific methaemoglobinaemia effect (Avery, 1999, Sánchez-Echaniz.and Benito-Fernández, 2001) but also as a nitrosamines precursor (Tofana, 2006, FAO, 2003) which are involved in carcinogenesis.

In vegetal products, the maximum admitted valued are different according to the cultivation place (greenhouse or field) and the harvesting period (spring – autumn) but there are no such differences in baby foods. Moreover, in these foods, the CMA value is 10 – 22,5 times lower than in vegetables, that is maximum of 200/kg (Order 97, 2005).The food in discussion in this study are certainly not baby food but in the same time we believe that being consumed by young people, a great attention to any kind of contaminant is of interest. It is well known that young people are more sensitive on contamination with those inorganic compounds so the investigation of them has a great importance in food preferred by this group of consumers

MATERIALS AND METHODS

Materials

The study focused on some foods components susceptible to nitrites/nitrates accumulation (Marin et al., 1998) that are known to be part of complex menus. The samples studied are fast-food menus, among those preferred by children and adolescents. There were six types of foods containing vegetal and animal origin component. The components was separated and the determination was performed on each component susceptible to nitrite/nitrate contamination The codes for the tested products are in brackets:

1. Salad A
   - iceberg salad (IS), tomatoes (TM), cucumbers (CB), olives(OV), feta cheese (FC), sweet corn (SC), bread, dressing, tuna fingers(FF)
2. Salad B
   - iceberg salad (IS), tomatoes (TM), cucumbers (CB), cabbage (CG), carrots (CT), olives(OV feta cheese (FC), sweet corn (SC), egg, bread, mild pepper(PP), dressing, ham(HM)
3. Salad C
   - pasta, ham(HM), cucumber pickles (CCP), sweet corn (SC), mozzarella (MZ)
4. Salad D

- Celery(CL), carrots (CT), apple(AP), dressing

Methods

The calculation of nitrites was performed using a spectrofotometric by method (Griess) (Dumitrescu et al, 1997, Mănescu et al.1982, Popescu et al, 1986). The nitrites concentration was performed indirectly and it presents several phases as it follows:

1. Deproteinization of tests
2. The separation of a clear extract
3. The calculation of the nitrites content
4. The reduction of the nitrates to nitrites.
5. The calculations of nitrates

RESULTS AND DISCUSSIONS

The results are written in table 1 and 2, separately for vegetables and animal origin products. We performed series of three calculations for each product.

Table 1

The nitrites and nitrates content in vegetables

	NaNO2	**NO_2^-**	**KNO_3**	**NO_3^-**
UM	mg/kg	mg/kg	mg/kg	mg/kg
Mean □SD				
Fresh vegetables				
IS	8.80	5.87	50.49	30.95
CG	9.15	6.10	55.65	34.11
CT	17.58	11.73	89.66	54.96
CL	9.64	6.43	48.12	29.50
TM	1.12	0.75	6.24	3.82
PP	2.40	1.60	10.55	6.47
AP	0.89	0.59	4.37	2.68
CB	12.65	8.44	61.36	37.61
Preserved vegetables				
CCP	16.98	11.33	83.06	50.91
SC	2.15	1.43	11.26	6.90
OV	2.33	1.55	19.57	11.99

Table 2

The nitrites and nitrates content in animal origin samples

	NaNO2	NO_2^{-}	NO_2^{-}
	mg/100	mg/100	mg/kg
Mean □SD			
MZ	0.23	0.15	1.5
FE	2.77	1.84	18.4
HM	1.91	1.27	12.7
FF	0.52	0.35	3.5

Looking to the results obtained for vegetal origin food, we can see the fact that in all cases, the calculated values for nitrates concentration was under the maximum admitted even for children food. The nitrates content for the tested meals is revealed in figure 1, separately for the components in each case.

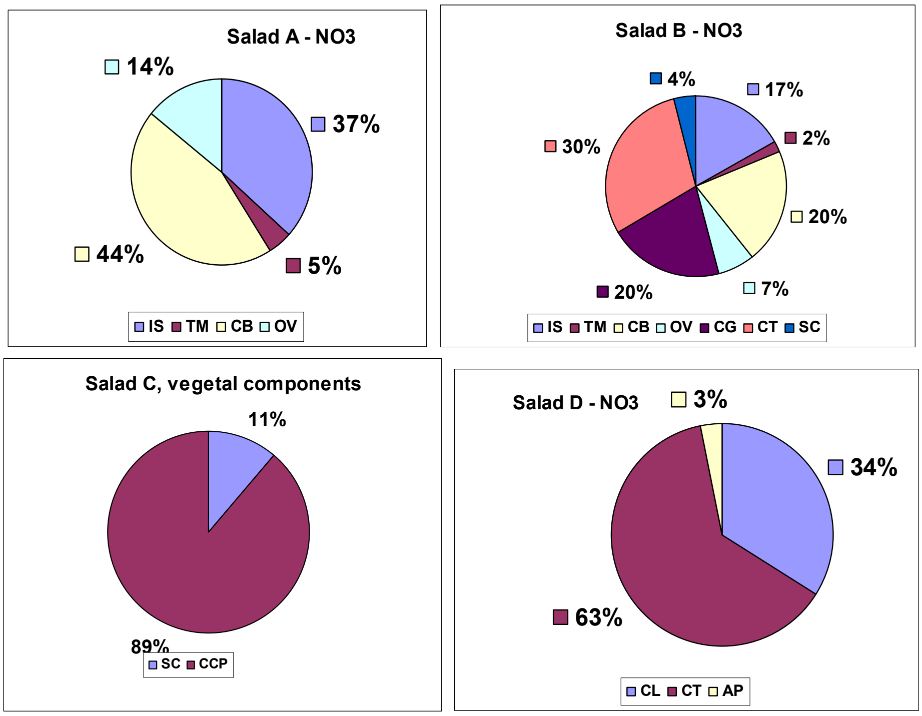


Fig. 1 - Salad A, B, C and D, nitrates content

For the first tested meal, salad A, cucumber with 44% was the main contributor to nitrates content, followed by iceberg salad with 37%. In salad B the main contributor was carrots (30%), followed by cabbage and cucumber with 20% each. Salad C has 88% for cucumbers pickles, salad D 63% for carrots and 34% for celery.

Looking at the content of each tested dish, the graphs in figures 2, 3, 4 and 5 shows the contribution of the components to the contamination by nitrites. In one hand, were it is the case, it is shown the contribution of vegetal and animal component and, at the other hand, in the interior of each category the contribution of each component is revelled.

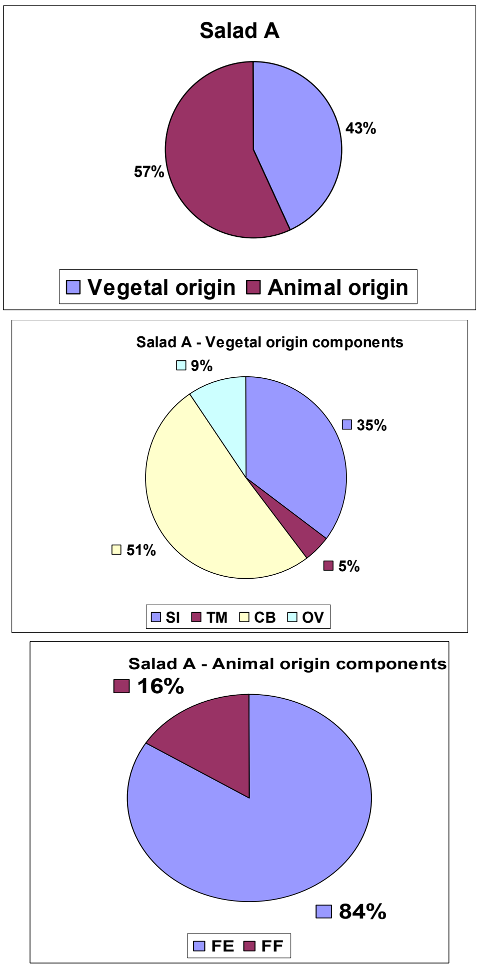
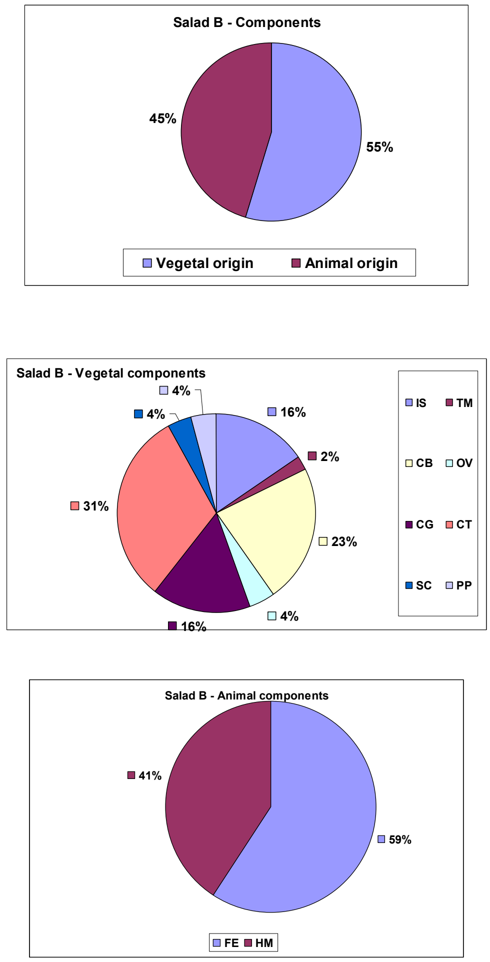


Fig. 2 - Salad A, nitrites content

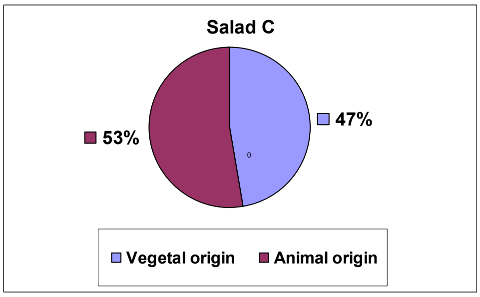


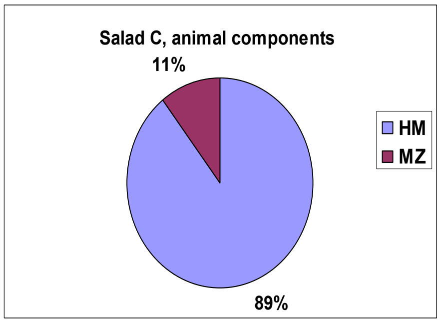
Fi. 3 - Salad B, nitrites content

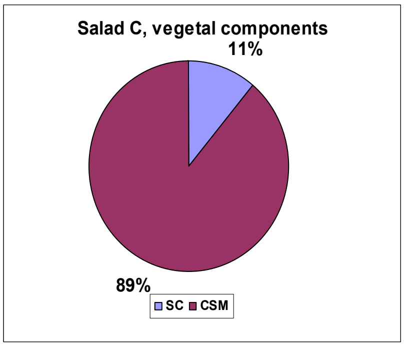
For the first three studied meals, where they are vegetal and animal components, the balance between them is closed and without significant variations: 43 – 55 – 45 for vegetal and 57 – 45 – 53 for animal components respectively, indifferently of the number or type of the components

Looking to the vegetal components, for the first tested meal, salad A, cucumber with 51% was the main contributor to nitrites content, followed by iceberg salad with 35%. In salad B the main contributor was carrots

(31%), followed by cucumber with 23%. Salad C has 89% for cucumbers pickles, salad D 63% for carrots and 34% for celery. The situation is very closed to this for nitrates in what concern the main contributors. The differences are in salad B where there is the largest number of vegetal components, respectively eight.







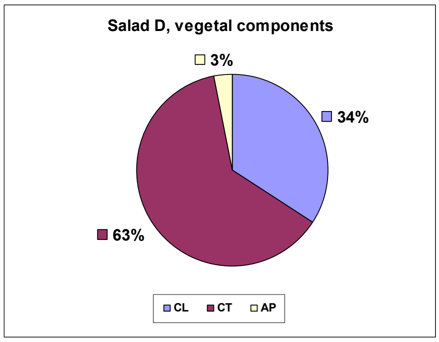


Fig. 4 - Salad C, nitrites content

Fig. 5 - Salad D, nitrites content

Looking to the animal components, the dairy present product is the major contributor with 84% and 59% in salad A and B but the situation changes in salad C where it is ham with 89%. But in this last product the dairy is mozzarella witch is not salty, in respect to feta cheese present in A and B salad.

CONCLUSIONS

Nitrates contamination

- Despite the fact that only green salad and spinach have MRL values in the legislation, we can see that vegetables such carrot and celery or cucumbers has major contribution to contamination by nitrates.
- Thinking at the fact that e.g. carrot has major role in children diet, in could be useful to establish MRL values for this type of vegetables too.

Nitrites contamination

- The results shown that vegetal and animal components has almost equal contribution to the contamination of the tested mixed food.
- The vegetables who has the major contribution to contamination by nitrates are the main contributors for nitrites too.
- As for the animal origin components, the major contribution from cheese can proceed from the massive content of salt in feta cheese even that ham is usually conserved with nitrites.

The continuous study of this type of foods (Chi□, 2008a, Chi□ et al 2008 b and c) both from the point of view of the compositions and the methods applied is justified by the scientific preoccupation connected to the toxicological potential of the nitrates and nitrites studied by the qualified bodies of the European Commission. (EFSA, 2008).

REFERENCES

1. AFFSA (Agence Francaise de Securite Sanitaire des Alimentes). 2007.Estimation du niveau d'exposition aux nitrates et aux nitrites de la population francaise. Reponse a la demande d'appui scientifique et technique de la DGCCRF ref. 2007-SA-0070 du 8/01/07
2. Avery, A, A. 1999. Infantile methemoglobinemia: re-examining the role of drinking water. Environmental Health Perspectives, 107, 583 – 586.
3. Chiş, A., 2008, The incidence of nitrates contamination in vegetables during 2002-2008 in the Bihor county , International Symposium "Priorities and perspectives in agriculture, food-security and environment protection" 5-6 June 2008 Oradea
4. Chis, A., Purcarea C., Fodor A., b 2008, Non-organic nitrogen compounds in vegetal foods under sanitary-veterinary surveillance, International Symposium "Priorities and perspectives in agriculture, food-security and environment protection" 5-6 June 2008 Oradea
5. Chiş, A., Purcarea C., Fodor A., c 2008. Vegetal food for Children Likely to be Contaminated with Inorganic Compounds whit Nitrogen, Journal of Agricultural Sciences, Debrecen, 2008, HU ISSN :1588-8363, pag 206- 211:

6. Chung, J.C., Chou, S.S., Hwang, D.F. 2004. Changes in nitrate and nitrite content of four vegetables during storage at refrigerated and ambient temperature, Food Addit. Contam.,21, 317-322
7. Czarnieka-Skubina, E., Golaszewska, B., Wachowicz, I. 2003. Effect of culinary process on beet root quality. Electronic Journal of Polish Agricultural Universities, Food Science and Technology, Volume 6, www.eipau.media.pl
8. Dejonckheere, W, steubbaut, W., Drieghe, S., Verstraen, R., Braeckman, H. 1994. Nitrate microbiologie-Aliments-Nutrition 12, p 359-370
9. Dumitrescu H, Milu C-tin, Dumitrecu, CR, Ciubotaru-Bordeianu A, Albulescu VL, 1997, Controlul fizico-chimic al alimentelor, Editura Medicală, Bucureşti
10. EFSA, Opinion of the Scientific Panel on Contaminants in the Food chain on a request from the European Commission to perform a scientific risk assessment on nitrate in vegetables, *The EFSA Journal* (2008) Journal number, 689, 1-79..
11. FAO/WHO (Food and Agriculture Organisation of the United Nations/World Health Organization). 2003. Nitrate (and potential endogenous formation of N-nitroso compounds). WHO Food Additive series 50, Geneva: World Health Organisation.
12. Golaszewska, B. and Zalewski, S. 2001.Optimisation of potato quality in culinary process. Polish Journal of Food and Nutrition Sciences. 10/51, p 59-64
13. Marin, J., Zee, J.A., Levallois, P., Desrosiers, T., Ayotte, P., Poirier, G. and Pratte, L. 1998. Consumption of potatoes and their contribution to dietary nitrate and nitrite intakes. Sci. des Aliments, 18, 163-173. 785-791
14. Mănescu S., Dumitrescu H., Bărduță Zenovia, Diaconescu Mona Ligia, 1982, Chimia sanitară a mediului, Vol II, Solul şi alimentele, Editura Medicală, Bucureşti
15. Order 97.from 10.7.2005 of the President of the Veterinary National Authority regarding the approval of the Sanitary-Veterinary and Food Safety Standard regarding certain contaminants from animal and non-animal foods published in the official journal of Romania, nr. 1056 bis from November 26th 2005
16. Popescu N, Popa G., Stănescu V., 1986, Determinări fizico-chimice de laborator pentru produsele alimentare de origine animală, Editura Ceres, Bucureşti
17. Premuzic, Z., Gárate, A. and Bomilla, I. 2002. Yield and quality of greenhouse lettuce as affected by form of N fertiliser and light. In: Development in plant and soil sciences, Vol 92. Ed: W. J. Horst, M. K. Schenk, A. Bürkert, N. Claassen, H. Flessa, W. B. Frommer, H. Goldbach, H. -W. Olfs, V. Römheld, B. Sattelmacher, U. Schmidhalter, S. Schubert, N. v. Wirén and L. Wittenmayer. Springer Netherlands.
18. Sánchez-Echaniz,J.and Benito-Fernández, J 2001, Methaemoglobinemia and consumption of vegetables in infants. Pediatrics, 107, 1024-1028.
19. Savu C-tin, Georgescu Narcisa, 2004, Food safety, Semne Publishing House, Bucharest
20. Tofană Maria, 2006, Food additives – Interraction ith the products, Academicpres Publishing House, Cluj-Napoca
21. Wallace, W. 1986. Distribution of nitrate assimilation between the root and shoot of legumes and a comparison with wheat. Physiol Plantarum. 66, p630-636
22. Weightman, R.M., Dyer, C., Buxton, J., Farrington, D.S., 2006, Effects of light level, time of harvestand position within field on the variability of tissue nitrate concentration in commercials crops of lettuce (Lactuca sativa) and endive (Cichorium endiva), Food Addit. Contam, 23, pag 462-469;