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

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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 spectrophotometric 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 as: 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 as storage (Wallace, 1986, Chung, 2004), refrigeration Chung, 2004, processing (Czarniecka-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 limitted quantity (Lundberg et al., 2004 and 2008). In contrast exposure to nitrite is mainly from endogenous nitrate conversion.
Nitrate per se is 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 methaemoglobinemia and carcinogenesis.

The toxicological risk of nitrites is due to the specific methaemoglobinemia 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 values 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 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](image)

<table>
<thead>
<tr>
<th></th>
<th>NaNO2</th>
<th>NO$_2^-$</th>
<th>KNO$_3$</th>
<th>NO$_3^-$</th>
</tr>
</thead>
<tbody>
<tr>
<td>UM</td>
<td>mg/kg</td>
<td>mg/kg</td>
<td>mg/kg</td>
<td>mg/kg</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh vegetables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS</td>
<td>8.80</td>
<td>5.87</td>
<td>50.49</td>
<td>30.95</td>
</tr>
<tr>
<td>CG</td>
<td>9.15</td>
<td>6.10</td>
<td>55.65</td>
<td>34.11</td>
</tr>
<tr>
<td>CT</td>
<td>17.58</td>
<td>11.73</td>
<td>89.66</td>
<td>54.96</td>
</tr>
<tr>
<td>CL</td>
<td>9.64</td>
<td>6.43</td>
<td>48.12</td>
<td>29.50</td>
</tr>
<tr>
<td>TM</td>
<td>1.12</td>
<td>0.75</td>
<td>6.24</td>
<td>3.82</td>
</tr>
<tr>
<td>PP</td>
<td>2.40</td>
<td>1.60</td>
<td>10.55</td>
<td>6.47</td>
</tr>
<tr>
<td>AP</td>
<td>0.89</td>
<td>0.59</td>
<td>4.37</td>
<td>2.68</td>
</tr>
<tr>
<td>CB</td>
<td>12.65</td>
<td>8.44</td>
<td>61.36</td>
<td>37.61</td>
</tr>
<tr>
<td>Preserved vegetables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCP</td>
<td>16.98</td>
<td>11.33</td>
<td>83.06</td>
<td>50.91</td>
</tr>
<tr>
<td>SC</td>
<td>2.15</td>
<td>1.43</td>
<td>11.26</td>
<td>6.90</td>
</tr>
<tr>
<td>OV</td>
<td>2.33</td>
<td>1.55</td>
<td>19.57</td>
<td>11.99</td>
</tr>
</tbody>
</table>

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**Table 2**

- Deproteinization of tests
- The separation of a clear extract
- The calculation of the nitrites content
- The reduction of the nitrates to nitrites.
- The calculations of nitrates

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The nitrites and nitrates content in animal origin samples

<table>
<thead>
<tr>
<th></th>
<th>NaNO2</th>
<th>NO₂⁻</th>
<th>NO₃⁻</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mg/100</td>
<td>mg/100</td>
<td>mg/kg</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MZ</td>
<td>0.23</td>
<td>0.15</td>
<td>1.5</td>
</tr>
<tr>
<td>FE</td>
<td>2.77</td>
<td>1.84</td>
<td>18.4</td>
</tr>
<tr>
<td>HM</td>
<td>1.91</td>
<td>1.27</td>
<td>12.7</td>
</tr>
<tr>
<td>FF</td>
<td>0.52</td>
<td>0.35</td>
<td>3.5</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

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.

![Salad A, B, C and D, nitrates content](image)

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.

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.

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 which 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 as carrot and celery or cucumbers have 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 have 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 (Chiş, 2008a, Chiş 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


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


