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# NITRATES AND NITRITES CONTENT IN DAILY FOOD RATIONS FOR SELECTED GROUPS OF CHILDREN

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Nitrates and nitrites content in daily food rations for children aged 4–12 years was estimated. Food rations taken in autumn, winter and spring were evaluated. Excessive amounts of nitrates in daily food rations were found with exception of 10–12 years old children in spring. Nitrites content exceeded acceptable daily intake (ADI) for children aged 4–6 in all examined seasons and in winter and spring also for other groups.

## INTRODUCTION

FAO/WHO Committee Experts of Food Additives determined acceptable daily intake (ADI) for nitrates and nitrites in consumed food. Generally, considerable amounts of these compounds present in food as a consequence of immoderate fertilization in agricultural production or penetration to soil from industrial drains and communal wastes cause excess of acceptable daily intake.

These compounds are harmful for the health of children and elderly people especially those suffering from intestinal tract deseases [Majchrzak, 1985; Szponar et al, 1984; Świątkowska, 1987]. Excessive intake of nitrates and nitrites can cause methemoglobinemia, anemia, growth retardation, brain and thyroid gland damage [Kafel, 1984; Majchrzak, 1985, Świątkowska, 1987]. They also show cancerogenic effect as nitrosoamine precursors [Jendryczko, Dróżdż, 1991; Kafel, 1987], being dangerous for health. This gave a reason to undertake the studies on nitrate content in food rations for children from orphanage.

## MATERIALS AND METHODS

Daily food rations were taken from canteen at one of selected orphanages in Warsaw. They included breakfast, dinner and supper meals, collected during autumn and winter 1992 and spring 1993. Combined daily meals were weighed,

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mixed and 100 g samples were put into twist off jars and frozen. Samples were collected during ten consecutive days. Before laboratory analyses samples were defrozen, then homogenized and 10 g transferred to 200 $cm^3$ volumetric flask, with addition of 50 $cm^3$ of distilled water (temperature 70–80°C) and 5 $cm^3$ of saturated water solution of borax. The whole was kept for 15 minutes in boiling water bath, cooled to room temperature and then 10 $cm^3$ of deproteinized solution I and II [Bilczuk, 1991] was added and left for 30 minutes. After that, samples were completed with redistilled water, shaken and filtered. Nitrates and nitrites level in filtrate was estimated by colorimetric method [PN-74/4-82114]. All analyses were made in triplicate for each sample.

Acceptable daily intake (ADI) of nitrates and nitrites for children aged 4–12 years was determined according to Wolański [1979]: 4–6 years – 20 kg body weight, 7–9 years – 28 kg body weight and 10–12 years – 32 kg body weight. Having these and FAO/WHO data for adults, i.e. 5 mg of $KNO_3$ and 0.2 mg of $NaNO_2$ per kg of body weight, the acceptable daily intake was calculated for all age groups of children. The concentration in food rations was compared with calculated ADI. The percentage share of food products groups in nitrates and nitrites supply was calculated from the menu, nitrates content in food products (from literature) and total nitrates content in daily food ration expressed as 100%. The results were evaluated statistically employing standard deviation and variability coefficients [Wójcik, 1987].

## RESULTS AND DISCUSSION

The mean nitrates content (Table 1) in daily food rations during examined period show the highest differentiation in autumn and the lowest in spring, with considerable fluctuation throughout the days of season. During autumn, the significant per cent of food rations showed nitrates content exceeding acceptable daily intake for all age groups (Table 3). This improved slightly in winter, and much more in spring.

Table 1. Mean nitrates ($KNO_3$, mg) contents in daily food rations

| Marker | Autumn | Winter | Spring |
|---|---|---|---|
| x | 166.0 | 125.0 | 97.2 |
| $\delta$ | 106.0 | 55.0 | 24.7 |
| V, % | 64.1 | 44.1 | 25.4 |

x – mean value of decade; $\delta$ – standard deviation; V – variability coefficient

According to nitrates ADI for each children group, there were days in autumn with 3.5 times excess for 4–6 years old children, 2.5 times excess for 7–9 years ones and 2 times for the group aged 10–12. During winter there

occurred the days with 25% excess of ADI for 4–6 years old children, 50% for 7–9 years old and 8% for 10–12 ones. In spring there were some days with 50% excess of ADI for the group aged 4–6 and 9% for 7–9 years old ones. No excess of ADI was observed in the group of 10–12 years. Considering the mean value, overconsumption of nitrates was not observed for any group of children during spring, but for 7–9 years and 10–12 years old in winter, and in autumn only for 10–12 years old one.

The nitrite content (Table 2) in daily food ration was the highest in winter – 5.9 mg, and the lowest in autumn – 3.6 mg.

Table 2. Mean nitrite ($NaNO_3$, mg) contents in daily food rations

| Marker | Autumn | Winter | Spring |
|---|---|---|---|
| x | 3.6 | 5.9 | 5.7 |
| $\delta$ | 1.1 | 2.3 | 2.0 |
| V, % | 30.7 | 38.7 | 34.5 |

x – mean value of decade; $\delta$ – standard deviation; V – variability coefficient

However, 20–90% of examined food rations (Table 3), depending on children age, contained nitrites in amounts exceeding ADI during winter and spring time. The mean value of excess for 4–6 years old children ranged from 47.5% in winter to 43% in spring. These data have approximate character as they concern gross intake, not the actual. In view of this, children could consume less of those compounds. Nevertheless, the risk of their harmful effect remains a fact.

Table 3. Percentage of food rations exceeding acceptable daily intake of nitrates and nitrites

| Season | $KNO_3$ | | | $NaNO_2$ | | |
|---|---|---|---|---|---|---|
| | Age | | | | | |
| | 4–6 | 7–9 | 10–12 | 4–6 | 7–9 | 10–12 |
| Autumn | 70 | 50 | 30 | 40 | 0 | 0 |
| Winter | 70 | 30 | 20 | 80 | 50 | 30 |
| Spring | 30 | 10 | 0 | 90 | 40 | 20 |

Analyzing the sources of nitrates in food rations (Table 4) the 54% share of potatoes and 39% of vegetables was found. Together, those two groups supplied 93% of nitrites. The share of other groups was not remarkable, about few percent. Our results are in agreement with other authors [Bilczuk, 1991; Szponar et al, 1984]. Amarowicz et al. [1986] obtained higher figures which can be due to agrotechnical operations as well as environmental pollution.

Table 4. Percentage of selected products in nitrates supply with daily food rations.

| Product group | Autumn | Winter | Spring | Average |
|---|---|---|---|---|
| Potatoes | 54.9 | 54.7 | 52.1 | 53.9 |
| Vegetables | 37.7 | 38.2 | 40.3 | 38.7 |
| Total | 92.6 | 92.9 | 92.4 | 92.6 |
| Meat and offals | 3.9 | 4.1 | 2.9 | 3.6 |
| Cereal products | 2.1 | 2.2 | 3.7 | 2.7 |
| Milk and dairy products | 1.4 | 0.8 | 1.0 | 1.1 |

As regards nitrities, the mean values obtained in our study are not high when compared to previous data. Although the quoted data were obtained almost ten years ago they confirmed the necessity of search for lowering the nitrates and nitrites content in children food rations, by reasonable fertilization, proper storage of raw material and products and also control of nitrites content in food products.

## CONCLUSIONS

1. The daily food rations contained excessive amounts of nitrates for each age group with exception of spring when there was no one ration exceeding acceptable daily intake for 10–12 years old children.
2. Acceptable daily nitrites intake was exceeded for 4–6 years old children in all investigated seasons but in winter and spring also for the other age groups.

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