

## HUMAN NUTRITION

**Title:** A National Survey of the Nitrite/Nitrate Concentrations in Cured Meat Products and Non-meat Foods Available at Retail - NPB #08-124

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### SCIENTIFIC ABSTRACT

A random survey of 467 cured meat products representing 6 major categories and 197 fresh, raw broccoli, cabbage, celery, lettuce and spinach samples were taken from retail outlets in 5 U.S. cities (Chicago, Dallas, Los Angeles, New York, Raleigh). Samples were analyzed for nitrite/ nitrate (NO<sub>2</sub>/NO<sub>3</sub>) content (mg/kg or ppm) using an ENO-20 HPLC System equipped with a reverse phase column as described by Bryan and Grisham (2007). The values obtained provided a benchmark for comparison to historic databases and enabled a more accurate evaluation each food's contributions to NO<sub>2</sub>/NO<sub>3</sub> load in the American diet. This survey is the first to our knowledge to evaluate the NO<sub>2</sub>/NO<sub>3</sub> content of organic meat product categories. NO<sub>2</sub>/NO<sub>3</sub> concentrations in drinking water of 25 major U.S. cities were also compiled to provide an additional database for evaluating water's contribution to NO<sub>2</sub>/NO<sub>3</sub> load. The study was analyzed as a completely randomized design with main effects of metropolitan area (MA), vegetables (V), cured meat products (MP) and product type (PT) [conventional, organic]. A log transformation of the data was performed to satisfy the conditions of homogenous variances and a normal-like distribution. Because of significant interactions displayed in the ANOVA, a more detailed examination of the mean NO<sub>2</sub>/NO<sub>3</sub> concentrations was conducted using a Bonferroni multiple comparison of the least squares means. Also, a Bonferroni pair-wise comparison of the mean NO<sub>2</sub>/NO<sub>3</sub> concentrations across MPs was conducted separately for each combination of V and PT and for each combination of MP and PT. Generally, there were no differences in nitrite levels between conventional and organic cured meat categories, but a few organic products surveyed in certain cities were lower in nitrate content. When evaluated across five cities, nitrite contents of all conventional cured meat categories were not different and the same was true for most organic products. NO<sub>2</sub>/NO<sub>3</sub> levels in cured meat products evaluated across MPs were not appreciably different. NO<sub>2</sub>/NO<sub>3</sub> levels of fermented cooked sausage, cured dried uncooked sausage, whole-muscle dry-cured cooked, cured cooked sausage, whole-muscle brine cured cooked and whole-muscle brine cured uncooked categories averaged 0.64/ 35.66, 0.74/ 78.81, 1.95/ 67.43, 6.86/ 27.68, 7.16/ 14.81 and 7.31/ 25.57 ppm, respectively. Weighted means for NO<sub>2</sub>/NO<sub>3</sub> across all cured meat categories were 4.54 and 37.07 ppm. Nitrite values observed were consistent within each MP category and not appreciably different from those previously reported by Cassens (1997a). This study's NO<sub>2</sub>/NO<sub>3</sub> values were substantially lower than those reported by NAS (1981) as well as those from other countries. Very few

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differences were noted in mean nitrite levels of conventional and organic vegetables taken from 5 MPs. Differences in nitrate content between conventional and organic vegetables were observed with organic vegetables being lower. Nitrate levels of conventional broccoli, cabbage, celery, lettuce and spinach were 394.38, 417.56, 1,495.48, 850.46 and 2,797.18 ppm, respectively, while their organic counterparts averaged 204.29, 551.97, 911.94, 844.06 and 1,317.73 ppm. With one exception, organic vegetables had numerically lower nitrate concentrations than conventional vegetables. The fact that the  $\text{NO}_2/\text{NO}_3$  contents of vegetables are variable poses a potential dilemma for determining actual vegetable consumption (an in turn  $\text{NO}_2/\text{NO}_3$  dietary load) of a population. Based on this survey, regional variation may need to be taken into consideration when developing predictions based on consumption of specific vegetables. This variation might be of sufficient magnitude to alter epidemiological predictions if not considered appropriately. All drinking water sources were within the allowable limits for nitrate (and nitrite if reported) established by the EPA.