

HYGIENIC ASSESSMENT OF N-NITROSAMINE CONTENT IN FOOD PRODUCTS FOR YOUNG CHILDREN (USING CANNED MEAT AS AN EXAMPLE)

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Abstract

As part of the hygienic assessment of unintentionally present compounds in canned meat for infant food, nitrosamines were identified as priority potentially hazardous contaminants in the studied food products.

Current hygienic standards in most countries regulate the content of only two compounds in this group (NDMA and NDEA); however, modern analytical methods allow for the detection of a significantly broader spectrum of compounds (including NMEA, NDBA, DPNA, and others) in food products. The cumulative dietary intake of these compounds is currently not accounted for. At the same time, non-carcinogenic effects-primarily hepatotoxicity-can manifest even at low exposure levels, creating additional health risks for infants and young children as the most vulnerable population group.

In an experimental study on Wistar rats (n=90), the combined exposure to four N-nitrosamines administered via feed over 28 days was evaluated. A statistically significant increase in the activity of liver enzymes (AST, ALT, GGT, alkaline phosphatase) and bilirubin levels was established in the experimental groups ($p < 0.05$ for each indicator), along with a significant increase in the number of Kupffer cells ($p = 0.002$ and $p = 0.01$ for the first and second experimental groups, respectively) and inflammatory infiltration of the portal tracts, as revealed by histological analysis.

Based on the dose-response model, the Benchmark Dose Lower Confidence Limit (BMDL) for the sum of the four studied nitrosamines was determined ($0.63 \mu\text{g/kg}$ body weight). Using a total modifying factor of 360, the Acceptable Daily Intake (ADI) was calculated at $0.00175 \mu\text{g/kg}$ body weight/day. Verification against the carcinogenic risk criterion confirmed that this standard ensures an acceptable level of oncological safety ($\text{CR} = 2.14 \times 10^{-6}$ at an acceptable level of 1×10^{-4}).

A comparative assessment of non-carcinogenic risk, applying the justified ADI for infants and young children regarding N-nitrosamine intake from canned meat, revealed substantial differences in health risk levels for the target population between the Russian Federation and the Socialist Republic of Vietnam. The Russian Federation exhibits a concerning level of risk: according to the semi-quantitative assessment, the Hazard Quotient (HQ) was 1.67. Conversely, the Socialist Republic of Vietnam recorded a minimal risk level with an HQ of 0.38. For the pediatric populations of both countries, the carcinogenic risk (CR) falls within the 10^{-6} – 10^{-5} range (Russia: 2.49×10^{-5} ; Vietnam: 6.45×10^{-6}), which is below the established hygienic criterion of 1×10^{-4} and corresponds to an acceptable level. It was established that the primary reason for the identified differences is the significant disparity in canned meat consumption levels between the two countries.