

# 2016 SCIENTIFIC REPORT



MINISTRY OF FOOD AND DRUG SAFETY

National Institute  
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## Risk Assessment of Furan

Furan is a colorless, highly volatile substance with a boiling point of 31 °C. It is formed from denatured carbohydrates, amino acids, or heated lipids in foods during canning, heat treatments, and cooking. The IARC classified furan as “possibly carcinogenic” to humans (Group 2B).

Residual hazardous substances in food that are formed during food manufacturing, processing, or cooking, and remain in the foods afterward, may pose a threat to food safety, even in small amounts, as they tend to be ingested for a lifetime. This has heightened anxiety over food safety among the Korean people. Under the existing monitoring system for hazardous substances, the content of a hazardous substance in uncooked food is measured to estimate its exposure dose based on the monitoring results. This approach fails to capture the true content of a harmful substance accurately because of changes that occur during the cooking process, where concentrations can be increased or decreased due to both physical and chemical interactions. For this reason, this risk assessment determined daily exposure doses more accurately based on a TDS, which estimates daily intakes through an analysis of table-ready foods, or an analysis of the content of hazardous substances. A quantitative assessment of potential health risks was also performed.

This risk assessment was carried out in accordance with the Regulations on Risk Assessment Methods and Procedures, as well as the Risk Assessment Guidelines, in the following four stages: hazard identification, hazard characterization, exposure assessment, and risk characterization. Target foods were selected from the 2008–2013 (six years) Integrated Database, and the study covered 97.4% of the total food intake of Koreans and 98% or more of their energy, protein, fat, and carbohydrate intakes. A final set of 1,227 sample pairs was

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selected (291 pairs from agricultural products, 96 from livestock products, 233 from fishery products, and 607 from processed foods) after adding food commodities intended to be eaten uncooked (raw) with the “food and cooking method pairs.” The analysis of furans present in food was performed using automated headspace solid-phase microextraction-gas chromatography-mass spectrometry, and samples of the food commodities, purchased across the country, were combined to create composite samples. One sample was analyzed for each cooking method per food, and the pairs from which furan was not detected were considered to have a zero content.

Results of our TDS-based risk assessment indicate that risk from dietary exposure to furan is within the margin of safety. The exposure dose of furan was 0.210  $\mu\text{g}/\text{kg}$  bw/day, and the largest contributors to this exposure are listed in the following order: wet noodles (7.7%), beer (5.9%), instant jajangmyeon or noodles with black soybean sauce (5.1%), soy beans (4.8%), imported beef (4.5%), makgeolli or rice wine (3.6%), bread (3.4%), ramyeon (instant noodles) in a styrofoam container (3.1%), and tofu (3.1%). For the hazardous substances assessed, their top 10 contributing foods generally account for 70% or more of the overall exposure in the population; however, in the case of furan, they are detected in a wide variety of foods. Consequently, the top 10 contributors account for less than half of total furan exposure. According to the 2011 risk reassessment report by the EFSA, dietary exposure to furan is 0.25  $\mu\text{g}/\text{kg}$  bw/day, which is at a similar level to that in this study. However, as eating habits change, or as the environment changes, exposure levels may exceed the margins of safety. Therefore, it is necessary to continue monitoring exposure trends and reducing exposure levels by finding new methods to reduce the formation of furan during cooking or manufacturing, and by focusing on foods where exposure levels show an upward trend.

Furan is highly volatile; therefore, after opening a processed food that has been hermetically sealed, it is recommended that it remain open for some time before it is consumed to allow the furan to evaporate. In the case of processed baby food, the recommended “breathing”

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time is five to ten minutes before feeding it to a baby. Retorts, toppings, and soybean milk products should be heated before eating. A baby drink also should not be ingested immediately after purchase. Instead, it should be kept in the refrigerator, with the lid open, for at least one day before drinking. Meat products should be heated at 50 °C–70 °C in the microwave, or using other methods, before eating. In the case of instant coffee or brewed coffee, it is advisable to let it “breathe” with the lid open for one to five minutes to allow furans to evaporate before drinking, rather than drinking it immediately after adding hot water.

**Key words:** Furan, Foods, Risk Assessment, Total Diet Study, ALARA, Reduction