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Concentrations of the Sunscreen Agent, Benzophenone-3, in Residents of the United States: National Health and Nutrition Examination Survey 2003–2004

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## **Running title**

Exposure Assessment of the US Population to Benzophenone-3

## **Keywords**

Benzophenone-3, biomonitoring, exposure, human, NHANES 2003–2004, sunscreen, urine

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## **List of Abbreviations**

Benzophenone-3	BP-3
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
LOD	Limit of detection
LSGM	Least squares geometric mean
NHANES	National Health and Nutrition Examination Survey
OR	Odds ratio

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## **Abstract**

**Background:** The capability of benzophenone-3 (BP-3) to absorb and dissipate ultraviolet (UV) radiation facilitates its use as a sunscreen agent. BP-3 has other uses in many consumer products (e.g., as fragrance and flavor enhancer, photoinitiator, UV curing agent, polymerization inhibitor).

**Objectives:** To assess exposure to BP-3 in a representative sample of the U.S. general population aged 6 years and older.

**Methods:** We analyzed 2,517 urine samples collected as part of the 2003–2004 National Health and Nutrition Examination Survey using automated solid-phase extraction coupled to high-performance liquid chromatography–tandem mass spectrometry.

**Results:** We detected BP-3 in 96.8% of the samples. The geometric mean and 95<sup>th</sup> percentile concentrations were 22.9 µg/L (22.2 µg/g creatinine) and 1,040 µg/L (1,070 µg/g creatinine), respectively. Least square geometric mean (LSGM) concentrations were significantly higher ( $P \leq 0.04$ ) for females than for males, regardless of age. LSGM concentrations were significantly higher for non-Hispanic whites than for non-Hispanic blacks ( $P \leq 0.01$ ), regardless of age. Females were more likely than males (adjusted odds ratio [OR], 3.5; 95% confidence interval [CI], 1.9–6.5), and non-Hispanic whites were more likely than non-Hispanic blacks (adjusted OR, 6.8; 95% CI, 2.9–16.2) to have concentrations above the 95<sup>th</sup> percentile.

**Conclusions:** Exposure to BP-3 was prevalent in the general U.S. population during 2003–2004. Differences by sex and race/ethnicity probably reflect differences in use of personal care products containing BP-3.