

Effects of Honey-Spices Marination on Polycyclic Aromatic Hydrocarbons and Heterocyclic Amines Formation in Gas-Grilled Beef Satay

ABSTRACT

The effects of honey-spices marination on simultaneous formation of polycyclic aromatic hydrocarbons (PAHs) and heterocyclic amines (HCAs) in gas-grilled beef satay were investigated at different grilling temperatures (150 °C, 250 °C, and 350 °C). Beef satay samples used in this study were prepared using two types of honey-spices marination (*Apis mellifera*-spices and *Trigona sp.*-spices). Quantifications of fifteen PAHs using high performance liquid chromatography with fluorescence detection (HPLC-FLD) and nine HCAs using liquid chromatography tandem-mass spectrometry (LC-MS/MS) were performed with gradient programme. Results on PAHs and HCAs in marinated samples were compared with control. Highest concentrations ($p < 0.05$) of PAHs (marinated beef satay) and HCAs (control) were detected at 350 °C. The most prominent PAH and HCA were phenanthrene (24.61–84.36 ng/g) and 9H-pyrido-[4,3-b]indole (Norharman) (2.67–393.89 ng/g). Marination significantly ($p < 0.05$) reduced naphthalene, fluorene, pyrene, 2-amino-9H-pyrido[2,3-b]indole (AαC), 1-methyl-9H-pyrido-[4,3-b]indole (Harman), and Norharman in gas-grilled beef satay across all temperatures. Overall, inverse quantitative profiles of PAHs and HCAs formation were observed in marinated gas-grilled beef satay.