

## **Inhibitory effect of mixture herbs/ spices on formation of heterocyclic amines and mutagenic activity of grilled beef**

### **ABSTRACT**

Natural antioxidants in spices and herbs have attracted considerable attention as potential inhibitors against the formation of mutagenic heterocyclic amines (HCAs) in heat-processed meat. In this study, the inhibitory activity of four spices/herbs and their mixtures on HCAs formation in grilled beef were examined. A simplex centroid mixture design with four components comprising turmeric, curry leaf, torch ginger and lemon grass in 19 different proportions were applied on beef samples before grilling at 240 °C for 10 min. The HCAs were extracted from the samples using solid phase extraction (SPE) method and analysed using Liquid chromatography mass spectrometry LC-MS/MS. All spices/herbs in single or mixture forms were found to reduce total HCA concentrations in marinated grilled beef ranging from 21.2% for beef marinated with curry leaf to 94.7% for the combination of turmeric and lemon grass (50:50 w/w). At the optimum marinade formula (turmeric: lemon grass 52.4%: 47.6%), concentration of 2-amino-3-methylimidazo[4,5-f]quinolone (IQ), 2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (PhIP), Harman, Norharman and AαC were 2.2, 1.4, 0.5, 2.8 and 1.2 ng/g, respectively. The results of the mutagenic activity demonstrated that this optimised marinade formula significantly ( $p < 0.05$ ) diminished mutagenicity of marinated grilled beef in bacterial Ames test.

**Keyword:** Heterocyclic amines; Marinated grilled beef; Herbs/spices; Antioxidant activity; Mutagenicity