

Interaction between heterocyclic aromatic amines and antioxidants: a food safety challenge (RIC IPG 156/07)

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Through diet, humans are exposed to complex mixtures of substances that may lead to pathological states. Some dietary harmful compounds are naturally formed during cooking. Heterocyclic aromatic amines (HAAs) are a group of carcinogenic compounds that may occur in meat and fish, cooked at high temperatures. These compounds are in general divided in two groups according to the precursors and temperature: thermic amines are formed at moderate temperatures (over 190°C) through complex reactions between creatin(in)e, amino acids and sugars. Some examples, include IQ, MeIQ, MeIQx, 4,8-DiMeIQx, 7,8-DiMeIQx and PhIP. Pyrolytic amines are formed at high temperatures (usually above 300°C) from pyrolysates of proteins and include compounds such as Trp-P-1, Trp-P-2, Glu-P-1, Glu-P-2, AαC and MeAαC.

The evaluation of exogenous dietary factors that can influence human exposure to HAAs and interaction between these compounds and antioxidants is an important issue. Epidemiological evidence has showed that phenolic compounds can contribute to the prevention of degenerative processes caused by oxidative stress. Moreover, these compounds present free-radical scavenging capability inhibiting HAAs formation. Thus, the antioxidants from diet can be a useful mitigation strategy for carcinogenic effects.

The main goal of this Project was to answer the following questions: Meat/fish: how to cook?! Is interaction with antioxidants helpful? For that purpose, different goals were established, namely, (i) to correlate HAAs in Portuguese meat and fish dishes with known determinants (cooking duration, maximum surface temperature, weight loss due to cooking and way of cooking), (ii) to compare the levels of HAAs in meat cooked with and without usual ingredients from Portuguese diet, that are antioxidant rich, (iii) to compare the effect of beer marinades, red wine marinades or green tea marinades in the reduction of HAAs formation in pan fried beef and on sensory characteristics.

Rare samples of sardines, salmon and bovine meat, produced not detected amounts of HAAs, medium done samples and well done samples presented different qualitative and quantitative profiles of HAAs when cooked under similar conditions of temperature and doneness.

Inhibition of HAAs formation was observed depending on concentration of antioxidants, namely, it was possible to reduce the formation of HAAs in meat, using red wine, beer or green tea marinades. The possibility of beer marinade be used to reduce the formation of mutagenic HAAs in beef was evaluated for the first time in this work and good results were obtained. For shorter periods of marinade, beer proved to be more efficient in reducing HAAs. Additionally, the descriptive sensory analysis showed that sensory characteristics of beef marinated samples were more similar to those of usual beef.