Influence of green tea marinades on the formation of heterocyclic aromatic amines and flavour of pan-fried beef

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Heterocyclic Aromatic Amines (HAAs) are described as genotoxic carcinogens associated with important types of human cancer in meat-eating populations, such as cancer of breast, colon or pancreas. These compounds are formed in cooked meats through pyrolysis reactions of different amino acids in the presence or absence of creatin(in)e and sugars. They can be divided in two classes, aminoimidazole-azaarenes (AIAs) and amino-carbolines (ACs). AIAs formation is the result of complex reactions that involve creatine, free amino acids and carbohydrates through the Maillard Reaction. ACs are produced from pyrolysis of proteins or amino acids heated at high temperature (>250ºC). Several studies indicate that AIAs formation can be reduced by addition of compounds with an antioxidant potential. Thus, the addition of natural products containing antioxidants that may act as free radical scavengers reduces the amount of AIAs in the heat-processed meat. Studies of the effect on ACs formation are scarce, but meat marinating with alcoholic drinks, such as, beer and red wine can reduce significantly the formation of ACs and AIAs [1]. Marinating implies preincubation with a fluid of some sort to impart flavor prior to cooking.

Tea, the extract of *Camellia sinensis*, is consumed usually as water extract; it is rich in polyphenols and can be an alternative marinate for alcoholic beverages, although the use of tea to marinated meat is not usual in Western countries.

The objective of this study was to evaluate the effect of tea marinades in the reduction of AIAs and ACs formation in pan fried beef. In addition, the influence of green tea marinade in meat organoleptic characteristics was evaluated. Thus, the beef samples were tested for descriptive sensory analysis by two trained sensory panels.

Green tea marinade reduced significantly the amount of PhIP ($p < 0.05$), 74% after 6 hours. Concerning 4,8-DiMeIQx and MeIQx levels, two AIAs, no significant differences were observed between levels obtained for meat marinated with green tea and control samples ($p > 0.05$). AαC is present in higher levels in red meat then in other types of meat. The green tea marinade reduced significantly the amount of AαC ($p<0.05$), this reduction ranged between 27 and 73%, significant differences were observed on AαC reduction at different marinating time ($p < 0.05$). Other ACs compounds such as Trp-P-1, Trp-P-2 and MeAαC were identified only in concentrations near the detection limit of the analytical method.The descriptive sensory analysis showed that slightly lower scores of odor intensity, meat odor, red / brown color, juiciness, overall quality and residual taste were observed in tea marinated meat when compared with control meat samples. However, differences were not significant, thus the marinade of green tea has little impact on the sensory characteristics of grilled meat and therefore, should be readily accepted by the public.

1. Melo, A; Viegas, O; Petisca, C; Pinho, O; Ferreira, IMPLVO. *Effect of Beer / Red Wine Marinades on the Formation of Heterocyclic Aromatic Amines in Pan Fried Beef.* 2008, Journal of Agricultural and Food Chemistry, 56 (22), 10625-10632.