

Reduction of Heterocyclic Aromatic Amines formation in pan-fried meat by red wine and pilson beer

C. Petisca¹, A. Melo², O. Viegas^{1,2}, I.M.P.L.V.O. Ferreira², O. Pinho^{1,2}

¹ Faculdade de Ciências da Nutrição e Alimentação da Universidade do Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal

² REQUIMTE- Serviço de Bromatologia, Faculdade de Farmácia da Universidade do Porto, Rua Aníbal Cunha 164, 4099-030 Porto; Portugal

Meat products are the major source of Heterocyclic Aromatic Amines (HAAs). Several strategies for the prevention or reduction of their formation in broiled and grilled meats, and consequently exposure to these mutagenic and carcinogenic compounds, can be used. Lowering the cooking temperature, turning the meat frequently and cooking meat together with foodstuffs containing phenolic antioxidants may be useful to lessen the levels of HAAs produced. Thus, the addition of natural products containing antioxidants that may act as free radical scavengers, such as polyphenols, reduces the mutagenic activity of the cooked products and the amount of HAAs in the heat-processed meat.

The use of antioxidant rich beverages such as wine and beer, in marinades are practical common in Portugal and Spain. This practice gives better flavor and texture and can influence the levels of HAAs in cooked meat. [1]

The effect of beer and red wine marinades in the reduction of HAAs formation in pan fried beef (*Longissimus dorsi* muscle of middle-aged bovine carcasses) was studied. The red wine was from Douro valley region, 13% alcohol, produced with *Tinta Roriz*, *Touriga Nacional* and *Touriga Franca* grape varieties. Beer was pilson with 5.4% alcohol, made from water, malt, unmalted cereals and hop. The grilling experiments were performed under well controlled temperature and time conditions. The samples were analyzed for HAA contents using solid-phase extraction and HPLC-DAD/FLD. Unmarinated samples cooked in similar conditions provided reference HAAs levels. Marinating with red wine or with beer during 1h, 2h, 4h and 6h, resulted in decreased levels of HAAs. The amount of PhIP and MeIQx reduced significantly, respectively, around 88% and 40% after 6 hours of marinating with beer or with wine. High oscillations were observed for reductions of AαC, ranging between 7 and 77%. Only beer marinade reduced significantly the levels of 4,8-DiMeIQx at 1, 2 and 4 hours of marinating. Multivariate statistical treatment of results was applied to the contents of HAs in unmarinated meat and meat marinated with Pilsen beer and red wine. For 1 and 2 hours of marinating time beer can be more efficient on the reduction of HAAs formation than wine. In addition, results from descriptive sensory analysis of unmarinated and 2-hours marinated beef samples, were tested for by two trained sensory panels. Control samples presented high levels of PhIP, 4,8-DiMeIQx, MeIQx and AαC. Beer marinated samples during 1 and 2 hours differed from wine marinated samples, with similar marinating time. For longer marinating times differences between wine and beer marinated samples were lower.

In conclusion, HAAs formation in cooked meat is affected by red wine and beer marinades. However, beer marinades can be more efficient on the reduction of some HAAs, such as 4,8-DiMeIQx and MeIQx. Additionally, beer marinade has not influenced the usual overall appearance and quality of the pan fried steaks.

[1] Smith, J.S., Ameri, F., Gadgil, P. *Effect of marinades on the formation of heterocyclic amines in grilled beef steaks*, 2008, Journal of Food Science, 73 (6), T100-T105.