

Accepted Manuscript

The effect of common spices and meat type on the formation of heterocyclic amines and polycyclic aromatic hydrocarbons in deep-fried meatballs

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PII: S0956-7135(18)30249-4
DOI: 10.1016/j.foodcont.2018.05.018
Reference: JFCO 6142
To appear in: *Food Control*
Received Date: 15 March 2018
Revised Date: 09 May 2018
Accepted Date: 10 May 2018

Please cite this article as: Fei Lu, Gunter K. Kuhnle, Qiaofen Cheng, The effect of common spices and meat type on the formation of heterocyclic amines and polycyclic aromatic hydrocarbons in deep-fried meatballs, *Food Control* (2018), doi: 10.1016/j.foodcont.2018.05.018

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1 **The effect of common spices and meat type on the formation of heterocyclic**
2 **amines and polycyclic aromatic hydrocarbons in deep-fried meatballs**

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6 **Abstract**

7 Spices are commonly used as flavour enhancer and natural antioxidants in
8 processed meat products. However, effect of spices on the formation of carcinogens
9 especially heterocyclic amines (HCAs) and polycyclic aromatic hydrocarbons (PAHs)
10 in different meat system has yet been investigated. In this study, 0.5% garlic, onion,
11 red chilli, paprika, ginger and black pepper powder was added into beef and chicken
12 meatballs fried at 180°C. Formation of HCAs and PAHs was examined to evaluate
13 the inhibitory efficiency of spices in beef and chicken meatballs. Control meatballs
14 (without adding spice) contained the highest amount of HCAs compared with all
15 spice added meatballs of both beef and chicken. All the spices powder reduced the
16 formation of total HCAs, while ginger powder achieved the highest inhibition
17 efficiency compared with all other spices. The correlation coefficient (r) between
18 antioxidant capacity of spices and total HCAs was - 0.853 ($p < 0.01$) for TEAC and -
19 0.712 ($p < 0.05$) for ORAC. Chicken meatballs contained less HCAs than beef, but no
20 difference was observed in total PAHs between beef and chicken meatballs
21 ($p > 0.05$). Both electron transfer and hydrogen donation were involved with the
22 inhibitory effect of spices for developing HCAs, but only electron transfer mainly in
23 the formation of PAHs. In conclusion, antioxidant capacity of spices determined their
24 efficiency in prohibiting formation of HCAs and PAHs, and meat type affected the
25 formation of HCAs, but not PAHs.

26 **Key words: Antioxidant capacity; Free radicals; Phenolic; Thermal stability.**

27 **Chemical compounds studied in this article**

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