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Development of a food frequency questionnaire for the assessment of dietary heterocyclic amine intakes

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High intake of red meat has been associated with an increased risk of human cancer⁽¹⁾ and amongst the possible causative agents are carcinogenic heterocyclic amines (HCAs)⁽²⁾. Food diaries (FD) have generally been considered a robust method to assess dietary intake and have thus been used to measure the dietary intake of HCAs⁽³⁾. However, FD may be prone to inaccuracy due to the relatively short recording period. Therefore, this study describes the development and validation of a food frequency questionnaire (FFQ) for estimating habitual HCA intakes.

An FFQ was developed using a systematic analysis of the UK National Diet & Nutrition Survey to rank the meat and meat dishes most commonly consumed by UK consumers. In addition, the FFQ included questions on meat cooking methods and doneness preferences. HCA values were applied to each food in the FFQ using published databases^(4,5). To validate the FFQ, 60 healthy and non-smoking volunteers completed a 7-day food diary (FD) before completing the FFQ. The intake of three HCAs were evaluated: 2-amino-3,8-dimethylimidazo [4,5-f] quinoxaline (MeIQx), 2-amino-3,4,8-trimethylimidazo[4,5-f]-quinoxaline (DiMeIQx), and 2-amino-1-methyl-6-phenylimidazo [4,5-b] pyridine (PhIP). The validity of the FFQ was assessed by comparing total and individual HCAs between FD and FFQ using (i) correlation coefficients, (ii) calculation of % of volunteers in the same quintile when ranked in each method (iii) calculation of % of volunteers in the same or adjacent quintile, using the method described by Cantwell *et al*⁽³⁾.

HCAs (ng/day)	FFQ		FD		Same quintile (%)	Same or adjacent quintile (%)
	Mean	SD	Mean	SD		
MeIQx	207	178	78.1	103	33	71
DiMeIQx	68.5	87.3	29.4	38.1	20	55
PhIP	650	486	355	464	23	62
Total	925	669	463	574	25	62

HCA intakes assessed by both methods are shown in the table. There were significant positive correlations between the two methods for MeIQx ($r^2 = 0.372$; $p < 0.05$), PhIP ($r^2 = 0.438$; $p < 0.01$) and total HCAs ($r^2 = 0.411$; $p < 0.01$). Classification of individuals by the FFQ into the same or adjacent quintiles as the FD for HCA intake (shown in the table) were similar to previous findings⁽³⁾. In conclusion, although the FFQ overestimated HCA intakes, its ability to rank individuals according to MeIQx and PhIP intake was acceptable. This study suggests that FFQs may be an effective tool for ranking individuals' HCA intakes in nutritional epidemiological research.

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