

## Nutrition Congress 2015: Concentrations of polycyclic aromatic hydrocarbons in some popular smoked fish consumed in Nigeria- F I Bassey- University of Calabar

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### Abstract

Polycyclic Aromatic Hydrocarbons or Poly-nuclear Aromatic Hydrocarbons (PAHs) are ubiquitous environmental contaminants of both marine and terrestrial environments formed during the incomplete combustion of carbonaceous materials. Lipophilicity, semi-volatility as well as persistency are the characteristic properties of these contaminants. PAHs are known to accumulate in fatty tissues of fish as a result of their uptake. They are also known to possess chemical stability as part of their affinity to lipids in living tissues. Fishes are therefore good indicators of pollution in coastal waters, hence their extensive use for environmental monitoring. The applications of polycyclic aromatic hydrocarbons definite in 9 popular smoked fish species *Clariasgari epinus*, *Paranchana obscura*, *Heterotis niloticus*, *Sardinella sp.* *Scrombus*, *Pseudotholitus niloticus*, *Ethmolosa fimbriata* in the Nigerian marketplace with a sight to provide info on the health risk associated with consumption of these products. The meditations of PAHs were dignified by gas chromatography prepared with flame ionization revealing (GC-FID) after dichloromethane/hexane abstraction and clean-up. The  $\Sigma 16$  PAHs concentration of these species were in the range of 52.4  $\mu\text{g kg}^{-1}$  to 1225.9  $\mu\text{g kg}^{-1}$  while the concentration of the eight carcinogenic PAHs (PAH8) were in the range of not detected to 530.8  $\mu\text{g kg}^{-1}$ . The estimated daily intake based on any of the indicators for occurrence of PAHs in food (BaP, PAH2, PAH4, PAH8) ranged from nd-184 mg  $\text{kg}^{-1}$  bw day<sup>-1</sup>. The figured margin of disclosure (MOE) values were 10,000 for *Clariasgari epinus*, *Gymnarchus niloticus* and *Ethmolosa fimbriata* signifying serious concern for the consumers' health.

In this study, the spike retrievals of the PAH compounds ranged from 78.6 to 104.2%. The relative standard deviations for replicate analyses ( $n \sim 3$ ) were less than 9%. The detection and quantification limits were evaluated on the basis of noise obtained with the analysis of a blank sample ( $n \sim 4$ ). The detection and quantification limits were defined as the concentration of the analyte that produced a signal-to-noise ratio of 3 and 10, respectively. The  $r^2$  values for the calibration lines for the PAH compounds ranged between 0.9992 and 0.9999, while the limits of detection and

quantification for the PAH compounds ranged from 0.03 to 0.06 and 0.1 to 0.2 mg  $\text{kg}^{-1}$ , respectively. The performance characteristics of the present method meet the criteria specified in the European Commission Regulation 836/2011 (recovery between 50 and 120%). The mean concentrations of the  $\Sigma 16$  PAHs measured within the selected popular fish species within the Nigerian market. The concentrations and profiles of PAHs in these fish species varied significantly ( $P, 0.05$ ) within a given fish species and among the various species studied. The concentrations of  $\Sigma 16$  PAHs in these fish species varied between 6.8 and 532.3 mg  $\text{kg}^{-1}$ . In this study, one specimen of tilapia had an exceptionally higher concentration of  $\Sigma 16$  PAHs than either other tilapia specimens or fish species investigated. The lowest and highest concentrations of  $\Sigma 16$  PAHs were found in the tilapia samples. In this study, tilapia and sardine samples have higher mean concentrations of  $\Sigma 16$  PAHs than other fish species examined. This could be associated partly with the fat content and feeding habits. The tilapia is benthopelagic, while *S. aurita* prefers rocky bottom and omnivore feeding habits. The accumulation and depuration of PAHs in fish tissues is a function of the fat content, route and duration of exposure, environmental factors, and difference in species, age, sex, and exposure to other xenobiotics. In this study, the freshwater fish species had higher average concentrations of PAHs than those sourced from the marine environment.

Estimation of dietary intake and risk assessment: The estimated daily intakes of PAHs based on the suggested indicators of PAHs are displayed in Table 2. The daily intake of the suggested indicators of PAHs through fish consumption ranged from not detected to 4.9, 0.7 to 11.3, 1.9 to 15.3, and 3.7 to 23.2 ng  $\text{kg}^{-1}$  bw day<sup>-1</sup> for BaP, PAH2, PAH4, and PAH8, respectively. The highest intakes of BaP and PAH8 were obtained from the consumption of sardine, while the highest intakes of PAH2 and PAH4 were obtained from consumption of tilapia. In this study, higher PAH intake is obtained from the consumption of sardine and tilapia in comparison with those of the other fish species investigated. The estimated daily intakes of BaP in this study were lower than the average intakes of PAHs (1.77 to 10.7 ng  $\text{kg}^{-1}$  bw day<sup>-1</sup>) through fish consumption in India. Llobet et al.

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reported a PAH daily intake of 3.3 to 5.3 ng kg<sup>-1</sup> bw day<sup>-1</sup> through fish and sea food consumption by different age and sex groups in Catalonia, Spain. Akpambang et al. reported human daily exposure of 1.2 to 52.0 ng BaP kg<sup>-1</sup> bw day<sup>-1</sup> and 21 to 269.8 ng PAH8 kg<sup>-1</sup> bw day<sup>-1</sup> from consumption of 100 g of smoked or grilled fish per day in Nigeria, which is somewhat higher than the estimated daily exposure in this study. However, it must be borne in mind that once the fish is cooked the levels of PAHs could be higher. Saeed et al. Reported an average daily intake of PAHs through consumption of fish in Kuwait as 231 ng day<sup>-1</sup>. Moon et al. reported PAH daily intakes of 13.8 to 16.7 ng kg<sup>-1</sup> bw day<sup>-1</sup> from consumption of fish in Korea. The estimated MOEs based on BaP, PAH2, PAH4, and PAH8 are listed in Table 2. As displayed in Table 2, fish had BaP, PAH2, PAH4, and PAH8 MOE values greater than 10,000, which indicates no potential risk for consumers of these species of fish. The results of the present study indicate that the majority of the popular fish species consumed in Nigeria are not heavily contaminated with PAHs. BaP occurred in 23% of these fish species at concentrations above the European Commission permissible limit of 2.0 mg kg<sup>-1</sup>. In general, the concentrations of the suggested indicators of occurrence and effects of PAHs were low in most species. The estimated MOE values in significant proportions of these fish species, obtained by using the different indicators for occurrence and effects, are greater than 10,000, which indicate that no health hazards are related with the intake of these fish species.

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