

Estimation of metal and organochlorine pesticide exposures and potential health threat by consumption of oyster in Taiwan.

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Abstract

Pollutant concentrations detected in oysters from 12 different culture areas of Taiwan (especially for the Hsiangshan area and the Machu Islands) from 1991-98 were evaluated to investigate potential carcinogenic (inorganic As and organochlorine pesticides) and non-carcinogenic (Cu, Zn, Cd and inorganic As) risk to the public from ingestion of the oysters. The highest geometric mean (GM) Cu and Zn concentrations of 1108 (range 113-2806) and 1567 (range 303-3593) $\mu\text{g/g}$ dry weight were obtained in oysters from the Hsiangshan coastal area. The maximum GM Cd and As concentrations of 6.82 and 19.3 $\mu\text{g/g}$ dry weight were found in oysters from the Machu Islands area. The p,p'-DDE values range from not detectable in Penghu Islands' oysters to 164 ng/g dry weight in Machu Islands' oysters. The highest tDDT (sum of p,p'-DDE, p,p'-DDD and p,p'-DDT) concentrations of 337 and 340 ng/g dry weight were found in oysters from Kimmen and Machu Islands, respectively. A calculated target hazard quotient (THQ; daily intake/reference dose) of 11.4 (based on 139 g oysters/day) for Cu caused by consuming oysters from the Hsiangshan area is higher than that from other areas (range 0.124-5.95). The highest average Cu intake from Hsiangshan's oysters for individuals is 11.4 times (i.e. $\text{THQ} = 11.4$) more than that of reference dose (40 $\mu\text{g/kg/day}$). However, the maximum THQ values for Cd and As caused by consuming oysters collected from the Machu Islands were 5.57 and 2.63 for Cd and As, respectively. Generally, the results of THQ showed that if only the maximally exposed individuals were considered, the value of 65.4% for oyster was higher than 1.0 in comparison with reference dose. All cancer risk estimates for inorganic As from consuming oysters were higher than 10^{-6} (range from 128×10^{-6} to 509×10^{-6} for maximally exposed individuals and range from 17.1×10^{-6} to 68.0×10^{-6} for typically exposed individuals, respectively); that is the risk of the lower end of the range of acceptable risk. The highest risk estimate for inorganic As was 509×10^{-6} for consumption of oysters by Machu Islands' residents. The lifetime cancer risks of 19.0×10^{-6} for tDDT by consuming oysters from the Machu Islands was higher than

those from the Penghu Islands (0.37×10^{-6}). Therefore, the sum of lifetime cancer risks for tDDT and inorganic As had the highest risks (total risk = 528×10^{-6}) of consuming oysters from the Machu Islands. Furthermore, a 10^{-6} upper limit on lifetime risk as the health protection standard would require maximum oyster consumption rates of approximately 0.26 g/day.