

COMPLETION REPORT

Comparison study of food safety associated with heavy metals contamination between Japan and Southeast Asia

Dr. Suthipong Sthiannopkao (+3)
Assistant Professor
Faculty of Environmental Engineering
Dong-A University, Korea

Rice, fish, and other seafood are daily staples for Asian populations. Health impacts from metals in these foods are thus a serious concern. This study was conducted to i) monitor and compare rice, freshwater fish, and seafood in Thailand, Vietnam, and Japan for concentration and speciation of metals contained, and to ii) assess human health risk from consumption of rice, fish, and seafood in Japan, Thailand, and Vietnam.

The fish investigated were mackerel, trevally, catfish, snakehead, silver barb, climbing perch, common carp, tilapia, and snapper. Not all varieties of fish were sampled in each country, due to local availability and tastes. The seafood types were cuttlefish, squid, octopus, prawn, and shrimp. In Thailand and Vietnam, samples of varieties of polished and of brown rice were collected. A large body of data on heavy metals in rice in Japan is already available, so it was not necessary to perform another analysis. Samples were collected in such marketplaces in each country where end-users of food products typically make purchases.

Heavy metal concentrations were determined by inductively coupled plasma mass spectroscopy. The metals of interest were As, Cd, Co, Cr, Cu, Fe, Mn, Ni, and Zn. Rice samples were stored under controlled conditions then ground to flour and prepared for spectroscopy by acid digestion and milli-Q water dilution. Fish and seafood preparation involved converting fillets to freeze-dried powder, centrifuging, and filtering.

The ranking of heavy metals by amounts found in samples was almost the same across all varieties of rice: Zn > Mn > Fe > Cu > Ni > Cr > As > Co > Cd. The order by amounts in fish was similar: Zn > Fe > Cu > Mn > Ni > Cr > As > Co > Cd.

There were non-significant differences in heavy metal concentrations in different varieties of rice, fish, and seafood. Most samples of rice from Thailand and Vietnam had metal concentrations within the CODEX standards, indicating safe consumption on a daily basis. Additional risk assessment tools, using ratios of ingestion amount per kg body weight to daily reference doses, however, found daily consumption of this rice could cause toxic health impacts from levels of Zn in all rice grain types. For fish, safety from negative impacts of consumption was found in all study areas. For seafood consumption, the risk was only in Japan, for noncarcinogenic toxic effects of As. However, the actual As toxicity from seafood consumption may be lower than the risk based on the hazard quotient, because the less toxic organic As species were found to predominate (>99%) in the seafood. Inorganic As was found in less than 1% in all seafood samples analyzed for As species. As(III), the most toxic As species, could not be determined in any samples.

Publication of the Results of Research Project:

<p>Verbal Presentation (Date, Venue, Name of Conference, Title of Presentation, Presenter, etc.) Date: October 27-29, 2014, Venue: Danang, Vietnam Name of conference: Issues on Environmental Multi-Pollutants Title of Presentation: Monitoring concentrations of heavy metal contained in rice cultivated in the Lower Mekong River Basin Presenter: Suthipong STHIANNOPKAO</p>
<p>Thesis (Name of Journal and its Date, Title and Author of Thesis, etc.) Will be submitted to the journal Agriculture, Ecosystems & Environment, on June 30, 2015. We will submit it under the following title, which is more interesting and informative. Health risks of heavy metals in rice, fish, and seafood in Japan, Vietnam, and Thailand Penradee Chanpiwat, Seiichiro Himeno, Suthipong Sthiannopkao</p>
<p>Book (Publisher and Date of the Book, Title and Author of the Book, etc.) N/A</p>