Metals levels and human health risk assessment in eight commercial fish species collected from a market, Wuhan, China

Jiaojiao Yin1,2,†,\*, Liangyu Cheng1,†, Xiaoming Jiang2, Li Wang3, Pan Gao1,2, Wu Zhong1,2, and Xuezhen Zhang 4,\*

1Hubei Key Laboratory for Processing and Transformation of Agricultural Products, School of Food Science and Engineering, Wuhan Polytechnic University, Wuhan, 430023, People’s Republic of China

2Key Laboratory of Edible Oil Quality and Safety for State Market Regulation, Wuhan Institute for Food and Cosmetic Control, Wuhan, 430012, People’s Republic of China,

3School of Modern Industry for Selenium Science and Engineering, Wuhan Polytechnic University, Wuhan 430048, People's Republic of China

4College of Fisheries, Huazhong Agricultural University, Wuhan, 430070, People’s Republic of China

†These authors contributed equally to this work and share first authorship

**\* Correspondence:**Corresponding Author  
yinjiaojiao@whpu.edu.cn (Jiaojiao Yin), xuezhen@mail.hzau.edu.cn (Xuezhen Zhang)

**Table S1** Optimized instrumental parameters of inductively coupled plasma mass spectrometry (ICP-MS).

|  |  |
| --- | --- |
| Parameters | Values |
| RF forward power | 1500 W |
| Cooling gas flow rate | 14 L/min |
| Auxiliary gas flow rate | 0.8 L/min |
| Helium gas flow rate | 5.0 L/min |
| Atomizer velocity | 1.0 L/min |
| Atomizing chamber temperature | 4 ℃ |
| Detector voltage | 1200 V |
| Focus voltage | 21 V |
| Sample depth | 5.0 mm |
| Sampling cone | Ni |
| Sampling cone | 4 |

**Table S2** Heavy metal concentrations (mg/kg) and recoveries in spike muscle samples.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Metal | Certified value | Measured value | Recovery (%) | RSD (%) |
| Ni | 8.333 | 6.703 ± 0.215 | 80.5 | 3.2 |
| Cu | 8.333 | 8.297 ± 0.106 | 99.6 | 1.3 |
| Zn | 8.333 | 8.487 ± 0.074 | 101.9 | 0.9 |
| Cd | 8.333 | 7.430 ± 0.110 | 89.2 | 1.5 |
| Pb | 8.333 | 8.770 ± 0.056 | 105.3 | 0.6 |

**Table S3** Correlation analysis among metals in fish samples.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Ni | Cu | Zn | Pb |
| Ni | 1 |  |  |  |
| Cu | -0.227 | 1 |  |  |
| Zn | 0.399 | 0.178 | 1 |  |
| Pb | -0.280 | 0.400 | -0.218 | 1 |

**Table S4** The average metal content in different fish feeds (mg/kg).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Feed of different fish | Ni | Cu | Zn | Cd | Pb |
| *C. idellus* | 0.553 | 14.454 | 86.959 | 0.095 | 0.083 |
| *M. amblycephala* | 0.587 | 16.139 | 96.406 | 0.098 | 0.260 |
| *H. molitrix* | 1.088 | 15.378 | 110.921 | 0.116 | 0.680 |
| *H. nobilis* | 1.038 | 16.049 | 113.279 | 0.124 | 1.020 |
| *C. auratus* | 0.546 | 15.258 | 94.694 | 0.101 | 0.196 |
| *C. carpio* | 0.580 | 16.724 | 116.571 | 0.082 | 0.335 |
| *C. alburnus* | 1.007 | 15.765 | 144.028 | 0.111 | 0.393 |
| *L. japonicus* | 0.194 | 12.694 | 136.894 | 0.460 | 0.524 |

**Table S5** Correlation analysis between metal content in feed and metal content in fish tissues.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Ni | D | V | H |  |  | Cu | D | V | H |
| Ni | 1 |  |  |  |  | Cu | 1 |  |  |  |
| D | 0.396 | 1 |  |  |  | D | 0.508 | 1 |  |  |
| V | 0.515 | 0.778\*\* | 1 |  |  | V | 0.191 | 0.708\* | 1 |  |
| H | 0.282 | 0.465 | 0.805\* | 1 |  | H | 0.214 | 0.358 | 0.742\* | 1 |
|  |  |  |  |  |  |  |  |  |  |  |
|  | Zn | D | V | H |  |  | Pb | D | V | H |
| Zn | 1 |  |  |  |  | Pb | 1 |  |  |  |
| D | -0.137 | 1 |  |  |  | D | -0.651 | 1 |  |  |
| V | -0.215 | 0.904\*\* | 1 |  |  | V | -0.527 | 0.956\*\* | 1 |  |
| H | -0.045 | 0.978\*\* | 0.922\*\* | 1 |  | H | -0.430 | 0.578 | 0.603 | 1 |