



INTISARI

Latar belakang: Pencemaran logam berat di ekosistem sungai perkotaan merupakan ancaman serius bagi kesehatan masyarakat karena sifatnya yang toksik, persisten, dan mampu terakumulasi dalam rantai makanan. Sungai Code di Yogyakarta, yang melintasi wilayah dengan kepadatan permukiman dan aktivitas industri, berpotensi menjadi lokasi yang berisiko terhadap akumulasi logam berat.

Tujuan: Menilai konsentrasi logam berat (Pb, Cd, Cr) di media lingkungan dan biota, serta mengevaluasi risiko kesehatan dan persepsi masyarakat akibat konsumsi ikan lele (*Clarias spp.*) yang terpapar logam berat dari ekosistem sungai perkotaan.

Metode: Penelitian observasional analitik dengan desain *cross sectional*. Sampel air, sedimen, dan ikan dianalisis menggunakan *ICP-OES* untuk mengukur konsentrasi Pb, Cd, dan Cr. Penilaian risiko kesehatan dengan pendekatan ARKL secara deterministik dan dilengkapi simulasi *Monte Carlo* untuk menangkap variabilitas eksposur. Persepsi risiko diukur dari 385 responden melalui survei pengetahuan, sikap, dan kesediaan bertindak.

Hasil: Pb tidak terdeteksi di air dan ikan, namun ditemukan dalam sedimen. Cd terdeteksi dalam kadar rendah di air dan sedimen, sementara Cr terdeteksi di seluruh media, dengan konsentrasi di air melebihi baku mutu (rata-rata 0,10 mg/l). Penilaian risiko menunjukkan $RQ < 1$ dan ECR rata-rata dalam kategori dapat diterima, namun nilai maksimum ECR ($1,5 \times 10^{-4}$) mengindikasikan potensi risiko karsinogenik pada individu dengan paparan tinggi. Simulasi *Monte Carlo* mengungkap risiko lebih tinggi pada laki-laki, kelompok dewasa, dan konsumen ikan ukuran besar. Survei persepsi risiko menunjukkan 75,8% responden berpengetahuan tinggi, namun hanya 52,2% bersikap positif dan 54,5% bersedia bertindak. **Kesimpulan:** Risiko kesehatan umumnya dapat diterima, namun simulasi *Monte Carlo* mengidentifikasi subkelompok berisiko tinggi. Kesenjangan antara pengetahuan dan tindakan masyarakat menegaskan perlunya integrasi pendekatan toksikologis dan sosial dalam strategi mitigasi berbasis komunitas.

Kata kunci: ikan lele; logam berat; risiko kesehatan; sungai perkotaan; *Monte Carlo*



ABSTRACT

Background: Heavy metal contamination in urban river ecosystems poses a serious threat to public health due to its toxic, persistent nature and ability to accumulate in the food chain. The Code River in Yogyakarta, which flows through densely populated and industrial areas, is potentially at risk for heavy metal accumulation.

Objective: To assess the concentrations of heavy metals (Pb, Cd, Cr) in environmental media and biota, and to evaluate the health risks and public perception due to consumption of catfish (*Clarias* spp.) exposed to heavy metals from an urban river ecosystem.

Methods: Analytical observational study with cross sectional design. Water, sediment, and fish samples were analyzed using ICP-OES to measure Pb, Cd, and Cr concentrations. Health risk assessment was conducted using the deterministic Environmental Health Risk Assessment (EHRA) approach, supplemented by Monte Carlo simulation to capture variability of exposure. Risk perception was measured in 385 purposively selected respondents through a structured survey covering knowledge, attitude, and willingness to act.

Results: Pb was not detected in water and fish, but was present in sediment. Cd was found at low levels in both water and sediment, while Cr was detected in all media, with concentrations in water exceeding quality standards (mean: 0.10 mg/l). Risk assessment indicated $RQ < 1$ and average ECR within acceptable limits; however, the maximum ECR (1.5×10^{-4}) suggested potential carcinogenic risk in highly exposed individuals. Monte carlo simulation revealed higher risk in males, adults, and consumers of larger fish. The perception survey showed that while 75.8% of respondents had high knowledge, only 52.2% exhibited a positive attitude and 54.5% were willing to take action.

Conclusion: Overall, health risks were generally acceptable, but Monte Carlo simulation identified high-risk subgroups. The gap between public knowledge and behavioral response underscores the need to integrate toxicological and social approaches into community-based mitigation strategies.

Keywords: catfish; heavy metals; health risk; urban river; monte carlo