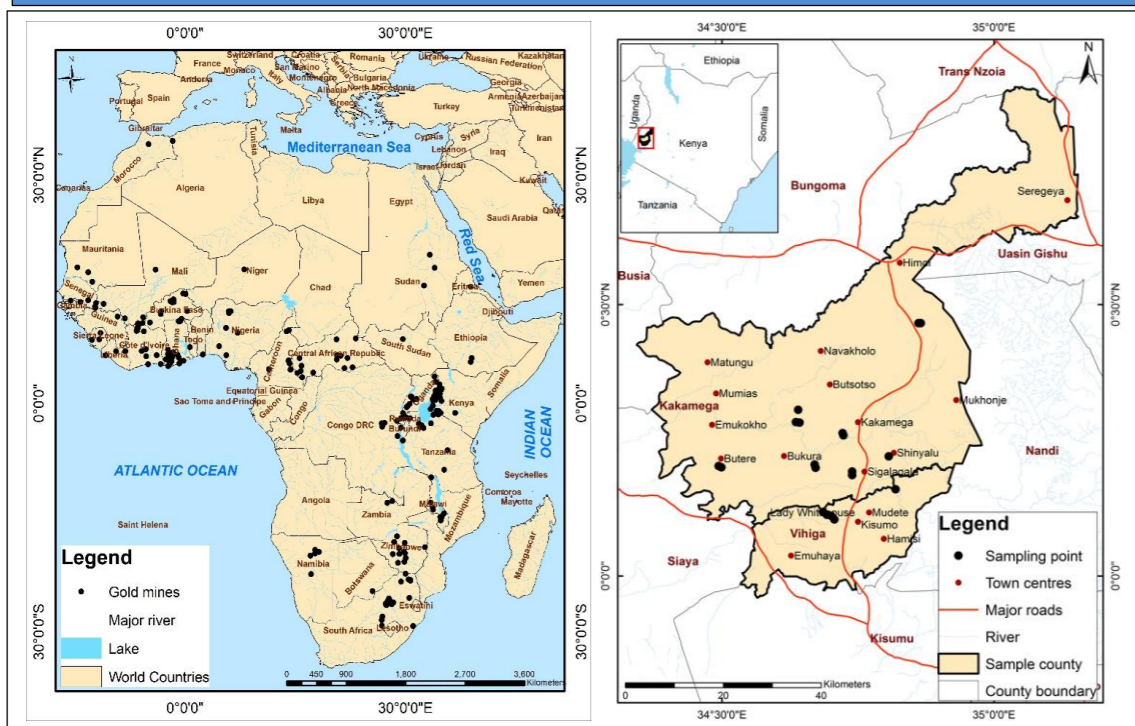


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1. Background

- Over nine million Artisanal and Small-scale Gold Mining (ASGM) workers in Africa and populations living near ASGM activities are heavily exposed to geogenic and anthropogenic potentially harmful elements (PHEs).
- The hazards and risks posed by ASGM are well categorized.
- However, coordinated multidisciplinary environmental characterization with combined public health studies is limited. Often, piecemeal and snapshot studies are reported continent-wide.
- Besides, studies are often not connected with efforts to holistically minimize hazards and associated risks.
- Thus, more innovative, adaptive and multidisciplinary measures are needed in these contexts. This study reviewed published literature on environmental pollution, human exposure and health effects of ASGM activities across Africa besides conducting environmental and dietary evaluation coupled with public health assessment of ASGM workers and residents in Western Kenya.

4. Geographic Location



7. References

- Ondayo, M.A., Watts, M.J., Hamilton, E.M. et al. Artisanal gold mining in Kakamega and Vihiga counties, Kenya: potential human exposure and health risk. *Environmental Geochemistry and Health* 45, 6543–6565 (2023). <https://doi.org/10.1007/s10653-023-01647-z>
- Ondayo, M. A., Watts, M. J., Mitchell, C. J., King, D. C., & Osano, O. (2023). Artisanal Gold Mining in Africa—Environmental Pollution and Human Health Implications. *Exposure and Health*, 1-29. <https://doi.org/10.1007/s12403-023-00611-7>
- Ondayo, M. A., Watts, M. J., Humphrey, O. S., & Osano, O. (2024). Public health assessment of Kenyan ASGM communities using multi-element biomonitoring, dietary and environmental evaluation. *Ecotoxicology and environmental safety*, 277, 116323. <https://doi.org/https://doi.org/10.1016/j.ecoenv.2024.116323>

2. Research Aims

- In addition to the review, this research comprehensively investigated exposure to potentially harmful elements (PHEs) from ASGM activities, risk factors, and subsequent effects on human health in Kakamega and Vihiga counties, Kenya by;
 - Environmental characterisation by determining PHE concentrations in soils, ores, mine wastes, sediments and waters within ASGM villages.
 - Dietary characterisation by determining the concentrations of PHEs in locally grown staple food crops and drinking water in ASGM villages.
 - Biomonitoring of ASGM communities using nail, hair, and urine matrices.
 - Assessing practices and risk factors of the ASGM communities to potential PHE exposure and toxicity associated with ASGM activities.
- Study findings provide scientific evidence to inform intervention actions to safeguard the environment and ASGM communities' health.

3. Methods

- Systematic review:** Involved review of 173 articles on environmental and human health hazards in ASGM in Africa and Identified gaps in research robustness, technology, regulation and policy framework, risk detection, surveillance and management.
- Interviews,** to collect data on risk factors to PHE exposure, general health and nutrition status of ASGM communities.
- Environmental and dietary characterization;** Involving collection and analysis of soils, sediment, water, ores, mine tailings and staple food crops from 19 ASGM villages to determine exposure extent.
- Human biomonitoring:** Involving collection human hair, nails and urine samples in the studied villages and analysis for up to 58 major and trace elements using ICP-MS.

5. Key findings

- Ore milling and other ASGM activities primarily disperse the geogenic PHEs across the wider environment, food sources and communities with severe health implications for both ASGM workers and residents.
- Hg is introduced in large amounts during ore processing and gold recovery.
- Heavily contaminated (solid and liquid) mine wastes are often disposed of untreated in nearby soils and waterways and are secondary sources of elevated PHEs.
- Despite international and in-country mitigation efforts, ASGM-related hazards and risks in Africa are getting worse.
- Regional and in-country coordinated action and multidisciplinary collaborative approaches that connect environmental, dietary, and public health research to effectively characterize disease burden in ASGM in Africa and sustainably maximize the benefits of ASGM while protecting public health and the environment are critical.

- The study recommends exposure prevention in ASGM, policy formulation to protect ASGM workers' and residents' health, and further research.
- The findings have been shared with respective counties' Medical Services, Public Health, Agriculture, and Environment Management departments to inform intervention actions to safeguard the environment and, residents' and ASGM workers' health.