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Peer Review

Review of: "Human Exposure to Arsenic and Toxic Metals Through Meat Consumption in Africa: A Review of Scientific Literature"

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Review of the Scientific Paper

Strengths:

1. **Comprehensive Scope**:
   - The review covers a wide range of toxic metals/metalloids (As, Cd, Hg, Pb, Cr, Ni) in meat across multiple African countries, providing a broad perspective on contamination risks.
   - The inclusion of studies from 2000–2024 ensures relevance to current trends in meat consumption and pollution.
2. **Well-Structured Methodology**:
   - The search strategy (PubMed and Scopus) is clearly defined, with explicit inclusion/exclusion criteria, enhancing reproducibility.
   - The focus on peer-reviewed English-language studies ensures data reliability, though it may introduce language bias.
3. **Regional Focus with Global Context**:
   - The paper acknowledges Africa's lower per capita meat consumption compared to Western nations but highlights growing risks due to pollution.
   - Comparisons with global data (e.g., Asia, Europe) help contextualize Africa's situation.
4. **Risk Assessment Integration**:
   - The review evaluates health risks using metrics like Estimated Daily Intake (EDI), Target Hazard Quotient (THQ), and Hazard Index (HI), providing a quantitative risk perspective.

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- It differentiates between muscle and organ meats, recognizing higher contamination in offal.

5. **Policy and Public Health Implications**:
   - The discussion suggests practical interventions (e.g., pollution control, dietary diversification) and calls for stricter monitoring, which is valuable for policymakers.

Weaknesses and Limitations:

1. **Geographical Bias**:
   - The review notes a heavy reliance on Nigerian studies, with limited data from other African regions. This skews conclusions and may not represent continent-wide trends.
   - Countries with high meat consumption (e.g., South Africa, Kenya) are underrepresented.
2. **Inconsistent Data Quality and Reporting**:
   - Variations in analytical methods (wet weight vs. dry weight, detection limits) complicate cross-study comparisons.
   - Some studies lack details on sample sizes, sampling protocols, or contamination sources, weakening reliability.
3. **Overgeneralization of Conclusions**:
   - The claim that "meat is not the primary dietary source of toxic metals" may not hold in high-exposure regions (e.g., near mines or waste sites).
   - The review does not sufficiently address vulnerable populations (e.g., children, subsistence farmers) who may rely heavily on locally sourced meat.
4. **Lack of Longitudinal or Intervention Data**:
   - Most studies are cross-sectional; temporal trends in contamination (e.g., changes due to anti-lead policies) are inferred rather than empirically demonstrated.
   - No discussion of mitigation success stories (e.g., reduced Pb levels post-leaded gasoline phase-out in some regions).
5. **Minimal Discussion on Meat Processing**:
   - Processed meats (e.g., cured, smoked) may have higher contaminant levels due to additives or cooking methods, but this is only briefly mentioned.
6. **Confounding Factors Ignored**:
   - The review does not explore how livestock husbandry (free-range vs. industrial) affects metal accumulation.

- Synergistic effects of multiple contaminants (e.g., Pb + Cd) are not addressed.

Suggestions for Improvement:

1. **Expand Geographic Coverage**:
   - Collaborate with researchers in underrepresented African nations to fill data gaps.
   - Include grey literature or local-language studies where peer-reviewed data is scarce.
2. **Standardize Risk Assessment Metrics**:
   - Encourage future studies to report data uniformly (e.g., µg/g wet weight) and provide detection limits.
   - Incorporate probabilistic risk models to account for variability in exposure scenarios.
3. **Address Vulnerable Groups**:
   - Explicitly evaluate risks for high-consumption subgroups (e.g., urban poor, children) and occupational exposures (e.g., butchers).
4. **Discuss Mitigation Strategies**:
   - Highlight case studies where regulatory or community-led efforts reduced contamination (e.g., soil remediation, feed controls).
5. **Clarify Limitations**:
   - Acknowledge that the absence of data from certain regions does not equate to safety.
   - Discuss potential underreporting due to limited food safety infrastructure in some African countries.

Final Assessment:

This review provides a valuable synthesis of toxic metal contamination in African meats, particularly for Cd and Pb, but its conclusions are constrained by uneven data distribution and methodological inconsistencies. While it successfully identifies key risks (e.g., organ meats, pollution hotspots), broader generalizations should be tempered until more representative studies are available. The paper's recommendations for enhanced monitoring and pollution control are well-founded and should be prioritized in future research.

Rating: **3.5/5** (Informative but limited by regional biases and data heterogeneity).

Recommendation: Essential reading for African food safety researchers, but policymakers should supplement it with localized risk assessments.

Which lines here showed that the variations in analytical methods (wet weight vs. dry weight, detection limits) complicate cross-study comparisons in this review paper?

The variations in analytical methods (wet weight vs. dry weight, detection limits) that complicate cross-study comparisons are highlighted in the following parts of the review paper:

Explicit Mentions:

1. **Discussion Section**:
   - *"Furthermore, variations in sampling strategies, analytical methods (though not reviewed in detail here), and reporting units (e.g., ww vs dw) across studies can complicate direct comparisons and synthesis."*
     - This directly acknowledges that differences in wet weight (ww) and dry weight (dw) reporting affect data comparability.
2. **Nigeria Case Studies**:
   - **Ihedioha & Okoye (2012, 2013)**: Reported Cd and Pb in **dry weight (dw)**.
   - **Ogbomida et al. (2018)**: Reported As, Cd, Pb, and Hg in **wet weight (ww)**.
   - **Adetunji et al. (2014)**: Did not specify weight basis, making it unclear if concentrations are ww or dw.
   - This inconsistency makes it difficult to assess whether high Cd/Pb levels in one study are truly higher than in another.
3. **Ghana & Uganda Studies**:
   - **Bortey-Sam et al. (2015)**: Used **ww** for metals in free-range animals.
   - **Kasozi et al. (2018, 2021, 2023)**: Did not always specify weight basis, but later studies used **ww**.
   - Without conversion factors (e.g., typical 70-75% moisture content in meat), direct comparisons are unreliable.
4. **Egypt & South Africa**:
   - **Kamaly & Sharkawy (2023)**: Reported in **ww**.
   - **Ambushe et al. (2012)**: Did not specify, but likely **ww** since bone and tissue moisture was considered.

Implicit Issues (Detection Limits & Methods):

- **Olusola et al. (2012)**: Measured Cd/Pb in **µg/dL** (uncommon unit for meat, usually µg/g), raising questions about method sensitivity.
- **Adejumo et al. (2016)**: Detected Cd but not Pb/Cr/Ni—were detection limits too high?
- **Mohamed et al. (2023)**: Reported As in **µg/g** (high for meat), but no method details (e.g., ICP-MS vs. AAS).

Critical Implications:

- **Dry weight values appear higher** (since water is removed), potentially exaggerating risks if compared to ww studies.
- **Detection limits vary**: Some studies may underreport contaminants if their methods were less sensitive.
- **Lack of standardization** weakens meta-analysis attempts (e.g., calculating average African meat contamination).

Suggested Fixes for Future Work:

1. **Require all studies to report ww/dw and detection limits.**
2. **Include a conversion table** (e.g., dw = ww × 3–4 for muscle tissue).
3. **Highlight methodological differences in tables** (e.g., "†dw" or "‡LOD: 0.01 µg/g").

This inconsistency is a major limitation in drawing unified conclusions about contamination levels across Africa.

Declarations

Potential competing interests: No potential competing interests to declare.