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Xenobiotic emissions from solid waste landfill induced neurotoxicity: meta-analysis of assessed biomarkers

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INTRODUCTION & AIM

Solid wastes (SW) generation, a growing global menace, emits mixture of xenobiotics capable of crossing blood-brain membrane to induce neurological disorders (NDs).

Alterations in biomarkers of brain toxicity induced by xenobiotics from SW is a poorly assessed etiology of NDs.

NDs is fast growing as emerging global health burden with 3.4 billion persons suffering at least an ND (GBD, 2024)

The aim is to assess adverse effects of SW on biomarkers of NDs in exposed experimental models using systematic review and meta-analysis.

METHOD

Figure 1. PRISMA showing inclusion and exclusion criteria for article selection.
Meta-analysis of selected articles utilized standardized mean difference (SMD) as the outcome measure with a random-effects model. Heterogeneity (i.e., Tau²) was estimated using restricted maximum-likelihood estimator. The Q-test for heterogeneity and the I² statistics were reported. When Tau² > 0, a prediction interval for the true outcomes was examined.

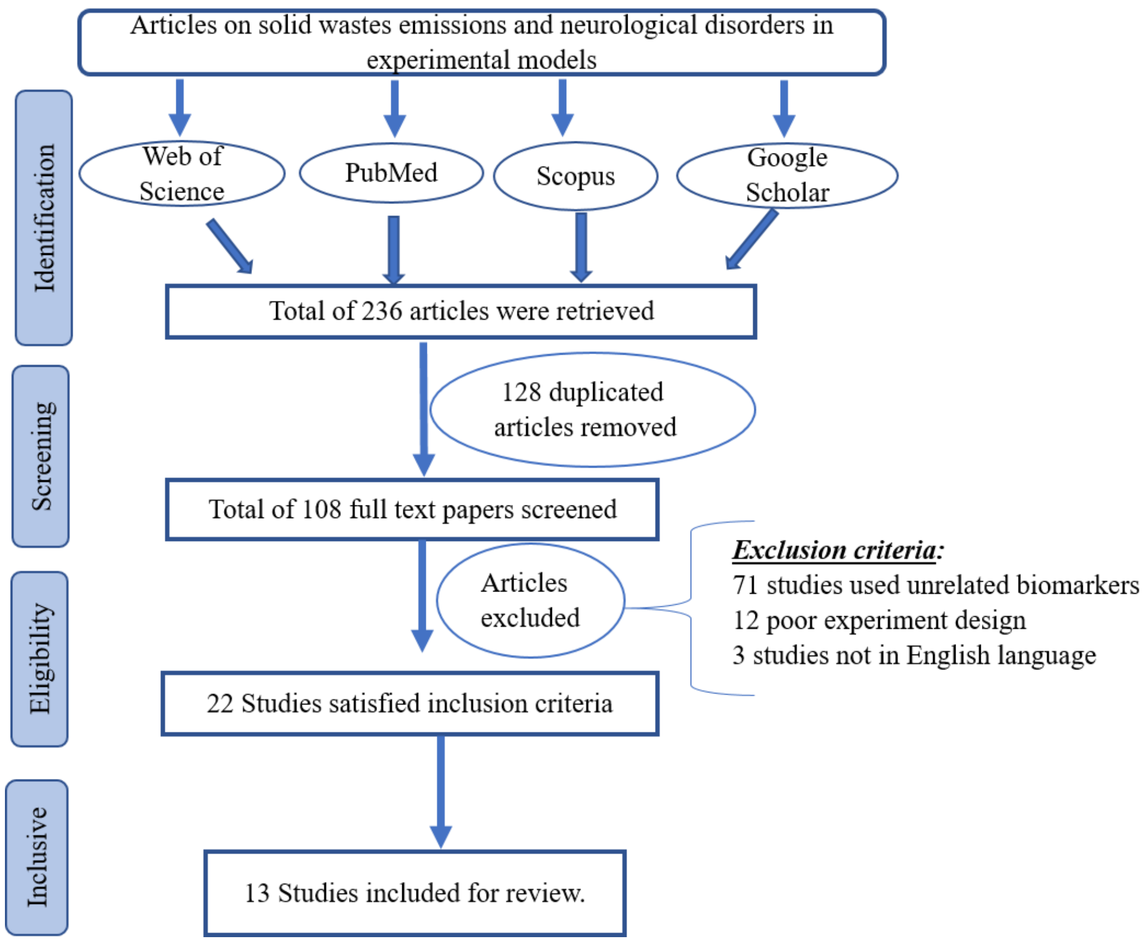


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta- Analysis (PRISMA)

FUTURE WORK / REFERENCES

1. Effective policy for solid waste management should be instituted.
2. Regular human exposure assessment for NDs via monitoring biomarkers of neurotoxicity.

Global Burden of Diseases 2021 and Nervous System Disorders Collaborators (2024). Global, regional, and national burden of disorders affecting the nervous system, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet Neurolo*, 23: 344–381. https://doi.org/10.1016/S1474-4422(24)00038-3

RESULTS & DISCUSSION

1. The reviewed articles reported neurotoxicants in the analysed SW samples (Data not shown).

2. Figure 2a presents the assessed biomarkers of NDs in the various exposed experimental models (Figure 2b)

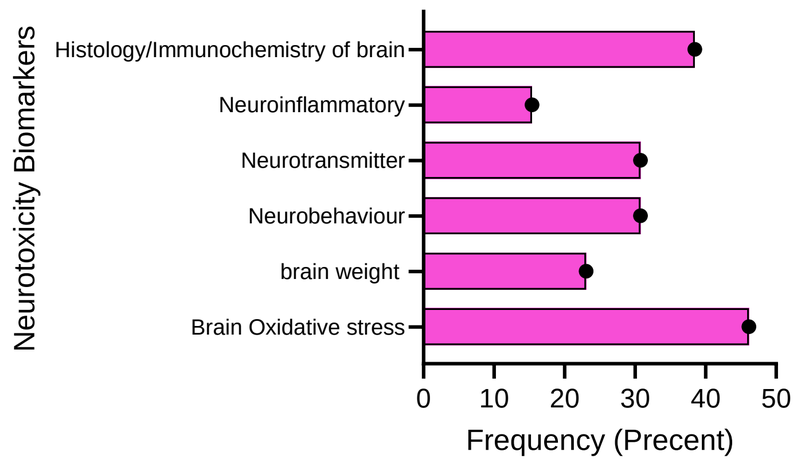


Figure 2a. Biomarkers assessed in exposed models

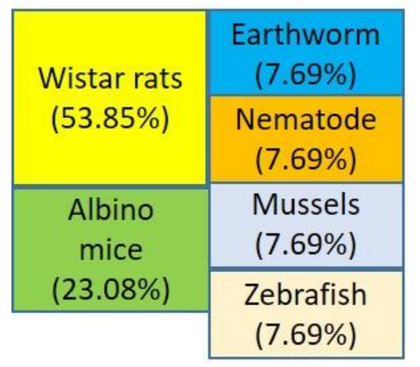
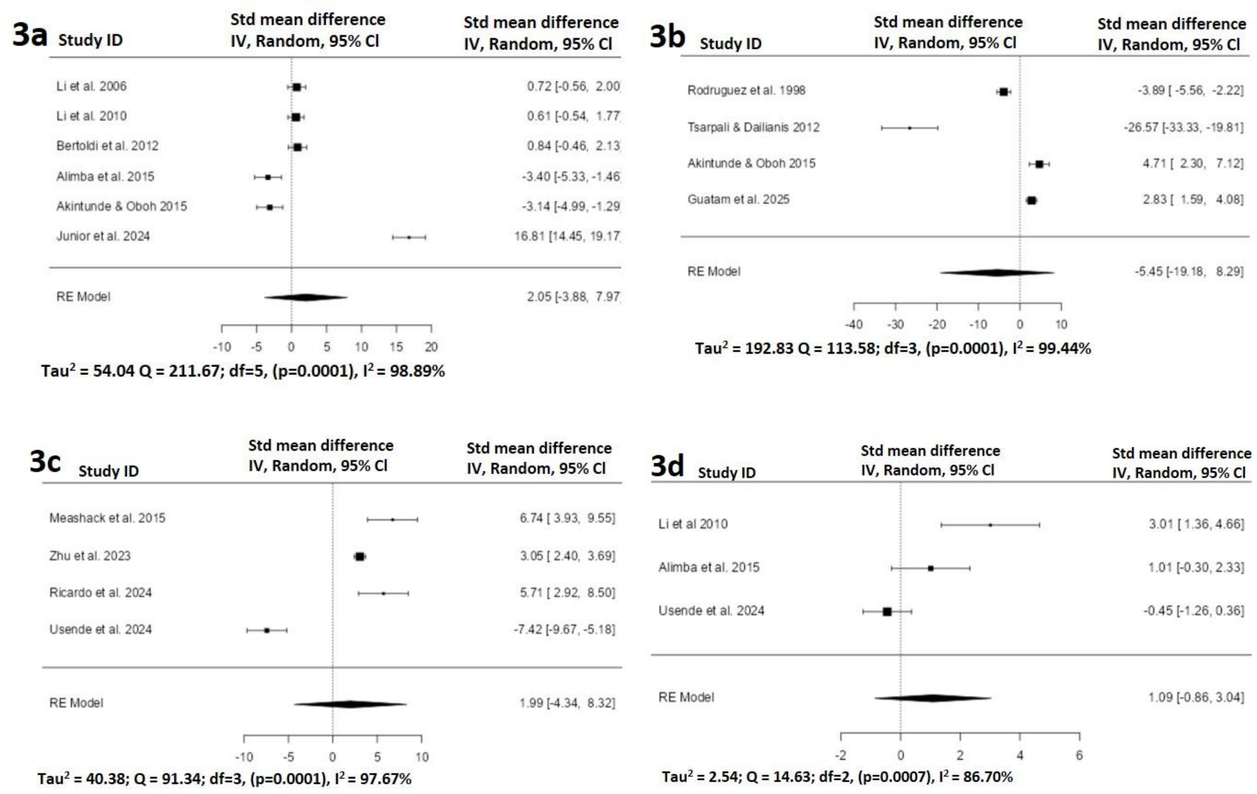


Figure 2b. Experimental models



3. Figure 3a –d presents the meta analysis

Meta analysis comparing SW exposed model and control groups showed that SMD data for brain oxidative stress biomarker (Fig. 3a), neurotransmitter biomarker (Fig. 3b), neurobehavioural biomarker (Figure 3c) and change in brain weight (Fig. 3d), confirmed positive effects, reflecting increase neurotoxicity induced by SW emissions in the exposed animals.

Alterations in brain histology and immunohistochemistry suggest xenobiotics in SW are able to cross blood brain barrier to cause physical damage to the brain tissues.

SW xenobiotics are able to induce oxidative stress and inflammation, which can cause abnormal behaviours linked to neurological disorders.

CONCLUSION

Meta analysis revealed that xenobiotics emitted from SW are able to induce neurological disorders in animal models by altering biomarkers of neurotoxicity.

The mechanisms of neurotoxicity may include oxidative stress and neuro-inflammatory induction.