Introduction

- Preeclampsia is medically defined as a maternal body’s vascular reaction to placental implantation.
- The maternal body can develop hypertension or other symptoms in response to the fetus as a foreign body.
- There is substantial evidence uncovered that long-term exposure to toxic metals may lead to preeclamptic symptoms.
- Populational exposure can occur through consuming tainted foods or water and can build up in a maternal body.
- This potentially exposes the fetus to the toxic bodily build up.
- So, to test for toxic metal concentrations, samples of urine, blood, plasma, and placental tissue can be analyzed in a laboratory.
- The objective of the overall review was to analyze previously gathered raw biosample data detailing links between toxic metal exposure and preeclamptic symptoms.
- Additionally, the review investigates types of metals found with the strongest connection to preeclampsia.

Methods

- Google Scholar, PubMed and PlosOne were searched for raw data studies published from 1995 to September 31st, 2022.
- Key search terms and text words included: “metals linked to preeclampsia”, “preeclampsia worldwide”, “preeclampsia”, “toxins”, as well as additional key words detailed in Table 1.
- The criterion for selection was settled before the actual search was conducted and is outlined in Table 2.
- After compiling a list of articles from the database search, articles were then measured against the criterion in Table 2. A study must meet all Acceptable Criteria to be accepted into this review. Additionally, if an article was unclear in any manner, it was measured under Unacceptable Criterion and not included in any further study.

Discussion and Conclusion

- Of the 33 different toxic metals mentioned in the 17 criterion-studies exhibited noticeable concentrations within preeclamptic patients. Lead and cadmium (Table 3) are the most tested for metals across the studies and are also the two most strongly linked to preeclampsia (Figure 2).
- Of the studies focused solely on maternal blood lead levels, showing already a significant interest into that correlation.
- The ATSDR denotes that there is no safe blood level of lead, 5.0 µg/dL and above is an unsafe level.
- In Table 3, you can see 6.66 µg/dL, 4.388 µg/dL, 3.36 µg/dL. Only one of those numbers is above 5.0 µg/dL.
- Cadmium blood levels of 0.2 µg/dL or less, are safe numbers, but levels above that are toxic and should be treated.
- The calculated average blood cadmium level from North America specifically, cadmium is the leading linking metal, is 1.525 µg/L or 0.1525 µg/dL (Table 3).
- Analyses of the seventeen criterion-studies shows that the association between preeclampsia and toxic metals lead and cadmium, are the dominant links (Figure 2).
- This conclusion prompts further investigation and research into the specific threshold of bodily concentration of lead and cadmium that correlate with preeclampsia.

Main Findings

- The locations of the final seventeen criterion-met studies are shown in Figure 1.
- The final list of metals specifically tested for in all 17 studies, in alphabetical order, are: aluminum (Al), antimony (Sb), arsenic, (As), bARIum (Ba), beryllium (Be), bismuth (Bi), cadmium (Cd), calcium (Ca), cesium (Cs), chromium (Cr), cobalt (Co), copper (Cu), indium (In), iron (Fe), lead (Pb), lithium (Li), magnesium (Mg), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), phosphorus (P), platinum (Pt), potassium (K), selenium (Se), sodium (Na), strontium (Sr), tellurium (Te), thallium (Tl), tin (Sn), tungsten (W), uranium (U), vanadium (V), and zinc (Zn).

- Figure 2 is a breakdown of the number of times each metal is tested for in the seventeen criterion-met papers.
- Table 3 contains all other relevant information pulled from the criterion-met articles.