Co-exposure to aluminium and cadmium mediates postpartum maternal variation in brain architecture and behaviour

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Background

- Impaired neurodevelopment in children has become a growing public health concern.
- However, the association between cross-metal exposures of pregnant mothers and postpartum neuroendocrine functions have remained largely unexplored.
- Aluminium and cadmium are two metals that are most ubiquitous in the environment with a high potency of their co-exposure.
- Both metals are known to jointly exist in most exposure endpoints and are also involved in several neurodevelopmental and neurodegenerative pathologies.
- While scant studies have investigated the effects of their co-exposure on the liver, their effects on postpartum maternal adjustments remains unexplored.
- This study was carried out to investigate the effect of Aluminium ($AlCl_3$) and Cadmium ($CdCl_2$) co-exposure on postpartum maternal behaviour, oxidative stress, endocrine indices and brain architecture.

Methods

MODEL ANIMAL; Pregnant Mice

Treatment: Control (CTR): Saline (10 ml/kg), $AlCl_3$ (10mg/kg), $CdCl_2$ (1.5 mg/kg), $AlCl_3$ (10mg/kg)+ $CdCl_2$ (1.5mg/kg).

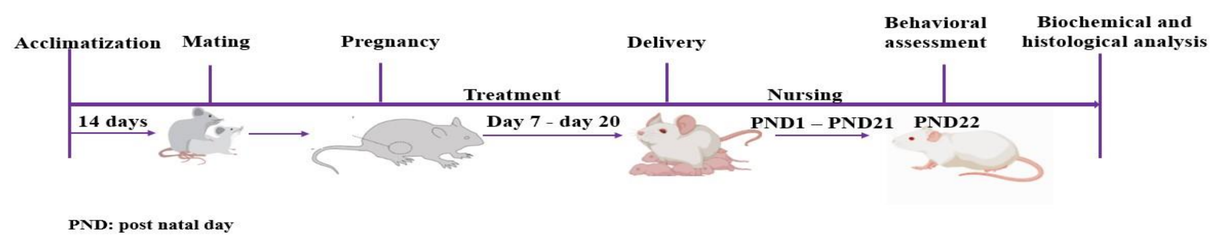
BEHAVIORAL ANALYSIS, OFT, Y-MAZE, SIT N= 5

ENDOCRINE INDICES (Elisa): Estrogen, Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH) Target; Serum: N= 5

ANTIOXIDANTS AND STRESS MARKERS (Spectroscopy) (GSH, CAT, SOD, NO, MDA, Ach) Target Area: Whole Brain; Group: N= 5

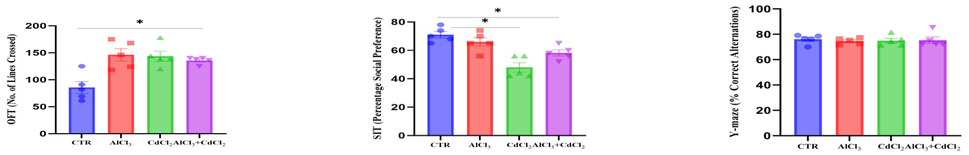
HISTOPATHOLOGY (NISSL)
Target Areas: Prefrontal Cortex. Striatum, Hippocampus, Hypothalmus) N= 3

Study Time-line

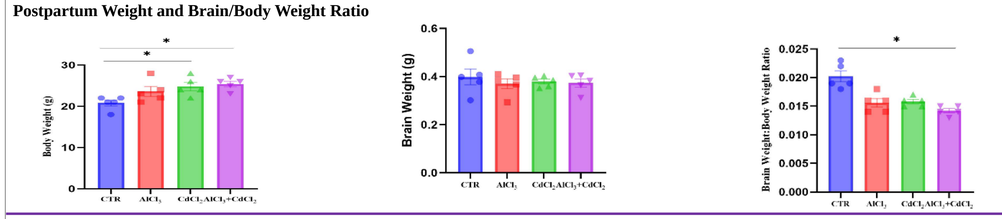


Results

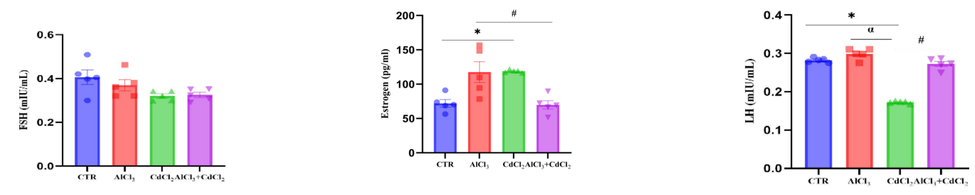
Postpartum Behavioral Changes



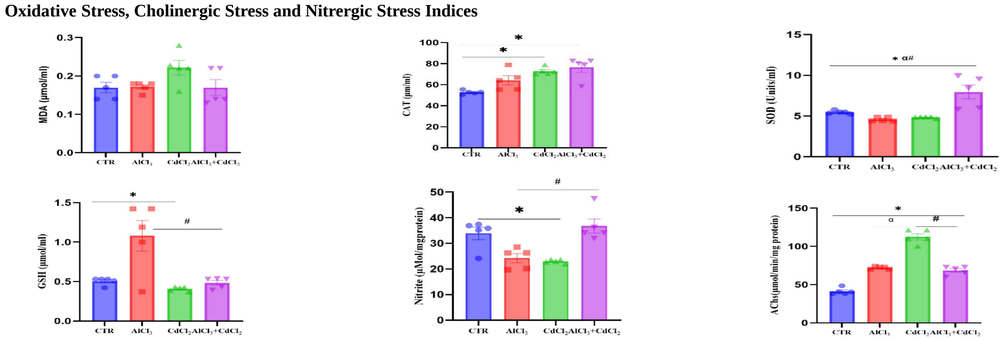
Postpartum Weight and Brain/Body Weight Ratio



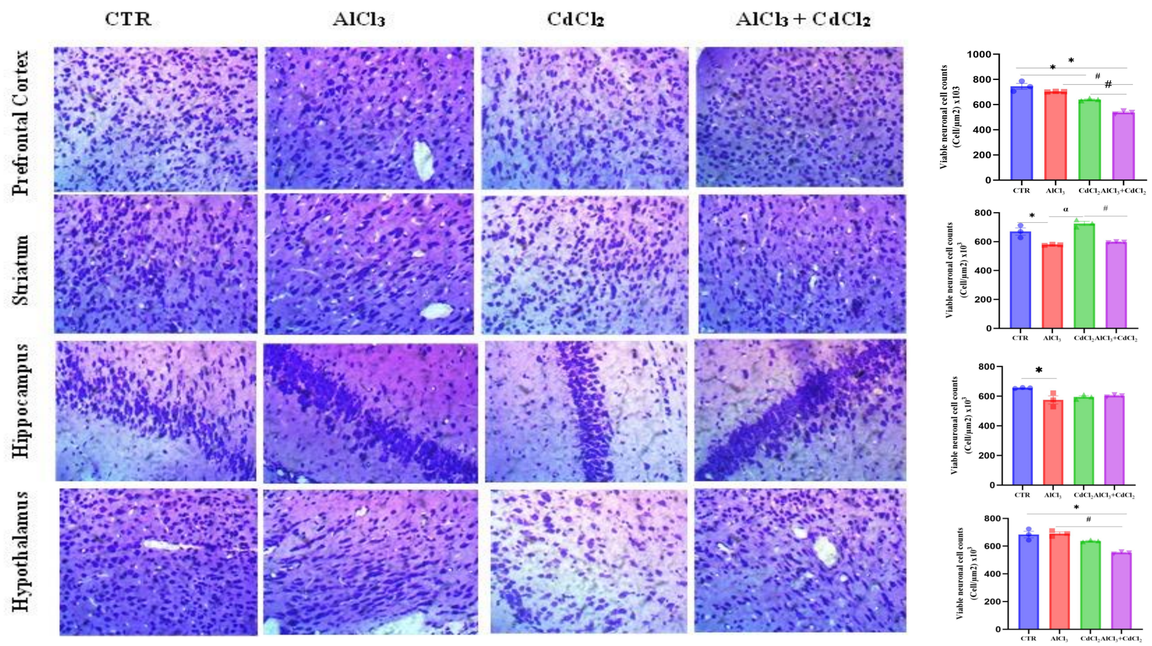
Postpartum Reproductive Hormonal Indices



Oxidative Stress, Cholinergic Stress and Nitrergic Stress Indices



Cresyl Violet Stain and Neuronal Cell Count



Effect of $AlCl_3$ and $CdCl_2$ co-exposures during pregnancy on postpartum maternal brain histo-architecture showing Nissl bodies and viable neuronal cell counts in the Prefrontal Cortex, Striatum, Hippocampus, and Hypothalamus) Magnification x100 * ($p<0.05$) compared to control, α ($p<0.05$) compared to $CdCl_2$, #<0.05) compared to Al+Cd

Conclusion

Major highlights of our findings are summarized as follows;

- Maternal co-exposures to $AlCl_3$ and $CdCl_2$ during pregnancy induced hyper locomotive activities.
- $AlCl_3$ and $CdCl_3$ co-exposure during pregnancy significantly influenced brain to body weight ration implying an increase in postpartum brain shrinkage.
- Maternal co-exposures to $AlCl_3$ and $CdCl_2$ increased activities of antioxidant enzymes catalase and SOD and cholinergic stress by increasing acetylcholinesterase activities.
- Maternal co-exposure to AlCl3 and CdCl2 co-exposures reduced Nissl bodies in the prefrontal cortex, striatum, hippocampus and hypothalamus evidenced by reduced viable neuronal cells.

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