CHRD 2022: Abstract & Poster Submission Form

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Presenter Status
- ○ Undergraduate Students
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Research Category
- ◉ Basic Science
- ○ Clinical
- ○ Community Health / Policy

Role in the project
- ☑ Design
- ☑ Perform Experiments
- ☑ Analyze Data
- ☑ Write Abstract
- ☐

Title
Identification of the functional mechanism of alcohol-Wnt signaling pathway interactions in tooth development

Background

Each year in Canada, it is estimated that nine babies in every 1000 live births are born with Fetal Alcohol Spectrum Disorder (FASD) which is described as birth defects associated with prenatal alcohol exposure. Animal studies have shown that embryonic alcohol exposure can affect early Tooth Development (TD). The cell signaling pathway molecules such as Wnt are important for proper TD. Specifically, studies on zebrafish (Danio rerio) (ZF) can provide a broader understanding of the morphogenetic mechanisms of TD.

Objective

We hypothesized that interaction of alcohol-Wnt pathway during embryonic development can cause defects in TD.

Methods

A total of 350 ZF embryos were treated with 1% alcohol, Wnt pathway activator (2mM LiCl) and inhibitor (10nM WC59) at 10 hours post fertilization (hpf). Samples were fixed at 15, 20, 25 and 30 days post fertilization (dpf) to analyze the dental phenotypes. Whole mount cartilage and bone staining and ultrastructural microscopic analysis were carried out for examination of tooth number, length and width measurements, mineralization, and cusp shape. The independent T-test analysis were performed, and statistically significant outcomes reported as $P < 0.05$ in all analyses.

Results

The teeth of all treated samples were deformed evident from straight cusp morphology compared to hook-like cusp in control samples. No significant change was seen in the number of teeth in treated samples compared with controls ($P > 0.05$). Further, the length and width of teeth in the alcohol, alcohol combined with LiCl, WC59, and alcohol combined with WC59 treated samples were significantly less than the control ($P < 0.001$). However, the length and width of LiCl-treated samples were significantly higher than the control ($P < 0.001$).

Conclusion

The results support our hypothesis, and it is concluded that alcohol exposure and Wnt–alcohol interactions affect the development and patterning of the dentition in ZF.

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Authors

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Identification of the functional mechanism of alcohol-Wnt signaling pathway interaction in tooth development

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	Mean of Tooth Number				Mean of Tooth Length (µm)				Mean of Tooth Width (µm)			
	15dpf	20dpf	25dpf	30dpf	15dpf	20dpf	25dpf	30dpf	15dpf	20dpf	25dpf	30dpf
Control	11.75	12.33	11.75	12.45	69.81	72.40	90.85	98.76	22.73	24.65	29.18	48.74
1%alcohol	10.8	12.31	11.41	12.38	58.29	63.96	91.43	98.05	14.29	22.35	30.17	48.19
2mMLiCl	10.06	10.47	12.82	11.65	71.89	78.50	100.5	122.6	25.49	28.17	39.86	48.22
1%alcohol +2mMLiCl	11.93	11.88	11.35	11.68	54.35	61.42	67.57	77.94	17.48	19.12	23.87	32.69
10nMWC59	11.33	11.53	10.6	10.6	52.65	59.90	65.02	71.88	14.32	18.13	24.43	28.06
1%alcohol +10nMWC59	10.25	10.2	10.4	10.8	40.09	55.25	63.02	69.90	13.54	19.27	22.86	27.17