Implications for Diabetes-Related Developmental and Phenotypic Variation via Sugar Modulation on Zebrafish Embryogenesis

Ramineni, Sanjana (School: Texas Academy of Mathematics and Science)

The first hours post-fertilization represent critical time points in teleost development and may be an overlooked source of adult phenotypic variation. There are underlying mechanisms involved in their development and regulation that are still unclear. Because of this, the purpose of this experiment was to investigate sugar concentration exposure in Danio rerio during their first hours post-fertilization, compare this change between three groups that develop at different rates, and identify related pathology. The hypothesis was that the rate of early development in Danio rerio has an impact on lipid accumulation, weight, length, and survival when exposed to various levels of glucose, sucrose, or fructose. To test this, zebrafish embryos, divided into groups of slow, medium, and fast developmental rates, were exposed to varying levels of glucose, sucrose, or fructose concentrations from fertilization to 48 hours post-fertilization by tracking cell division. The Oil Red-O staining protocol was initiated at the end of day two post-fertilization of zebrafish larvae and data analysis was completed. ImageJ was used to measure the amount of the Oil Red-O staining on zebrafish and its lengths. The mean stain sizes significantly increased across glucose concentrations when higher glucose dosages were used. Additionally, similar bell-curve trends were noticed in glucose, sucrose, and fructose groups when Fulton's condition factor was compared, but the minimum and maximum values of Fulton's condition factor differed between sugar types. Both the rate of early development and sugar concentration had a significant effect on morphology, developmental rate, and survival rate as well.

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