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**Acute Toxic Effects of Commercial Glyphosate on Embryonic Development of Zebrafish
(*Danio rerio*)**

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Abstract

Glyphosate is a widely used herbicide and its potential effects on human health and aquatic biodiversity have been a subject of concern and scientific investigation. Glyphosate has been shown to have the ability to cause abnormalities or malformations in developing fish embryos upon ingestion through water and food. This study was focused on evaluating the early embryonic effect of glyphosate on fish embryos using zebrafish (*Danio rerio*). Zebrafish have external fertilization, transparent embryos, and shorter embryonic development time as a model organism. Commonly used commercial glyphosate product Anu 71 (Ammonium salt of glyphosate 71% SG) was selected and zebrafish embryos were exposed to a concentration series of 1.0 µgL⁻¹, 1.5 µgL⁻¹, 2.0 µgL⁻¹, 2.5 µgL⁻¹, 3.0 µgL⁻¹, 3.5 µgL⁻¹, 4.0 µgL⁻¹ after 1 hour of post-fertilization(hpf). Distilled water was used as the control. Fertilized eggs were carefully chosen under light microscope (10×4) observation and 30 eggs were added into each concentration. Hatching rate, hatching time, heart rate, mortality rate and morphological abnormalities were observed up to 96 hpf. After 1 hour of exposure, mortality of embryos in 3.0 µgL⁻¹ and 3.5 µgL⁻¹ solutions was 3.33%, and in 4.0 µgL⁻¹ solution it was 6.66%, while in control it was 0%. After 72 hpf the highest hatching rate of 26.6% was recorded in 1.0 µgL⁻¹ and the lowest of 10% was in 4.0 µgL⁻¹. In contrast, the control showed 46% hatching at the same time. All embryos were hatched after 96 hpf without any morphological abnormalities. Heart rate decreased from 132.6±1.34 bpm to 113.3±1.06 bpm with increasing concentrations and in control it was 155.9±2.02 bpm. As higher glyphosate concentrations alter the hatching rate, hatching time and heart rate of fish embryos, it can ultimately cause loss of survival in natural environments and lead to a diversity loss.

Keywords: Embryonic development, Glyphosate, Hatching rate, Mortality rate, Zebrafish