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Toxic effects of glucose on Caenorhabditis elegans; the protective role of glyoxalase-1

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Although chronic hyperglycemia is an important etiologic factor leading to complications of diabetes mellitus the mechanisms by which it leads to such diverse cellular and organ dysfunction are unknown. Several biochemical changes induced by hyperglycemia have been described as being responsible for its damaging effects. Intracellular ROS generation, subsequent methylglyoxal (MG) formation and MG derived modification of proteins seem to be some of the essential steps in mediating the deleterious effects of hyperglycemia. The glyoxalase-I-system, consisting of the enzymes glyoxalase-I and glyoxalase-II, is an integral component of the cellular metabolism in mammalian systems protecting from the hyperglycemia/ROS induced cascade.

C. elegans due to the simplicity of its nervous system and the biochemical similarities to humans has been used in this study to observe the toxic effects of glucose on several parameters. We have been able to demonstrate that hyperglycaemic conditions significantly reduce life-span, motility and increase neuronal degeneration on wild type C. elegans. Cloned animals with neuronal-specific glyoxalase-1 overexpression have been able to show improving results in comparison with wild type C. elegans on those parameters mentioned above. Furthermore overexpression of the methylglyoxal-detoxifying enzyme glyoxalase-1 attenuated reduction on motility, increase of neural degeneration and subsequently life shortening effect of glucose.