MORTALIN AS A BIOMARKER FOR EARLY DETECTION OF CARCINOGENS IN WATER

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Cancer incidence has been increased in last few decades and is related to the increased global industrialization. Accidental leakage and disposal of chemical byproducts and industrial wastes that are toxic and potentially carcinogenic pose a risk of environmental disaster and health issues. These not only affect direct consumers but also the water flora and fauna, and thus the entire food chain in the ecological unit. Water pollution has been on alert in many parts of the world especially the developing countries where water is contaminated with heavy metals. Development of technologies to monitor water quality is one of the top priorities in environmental management. Living organisms respond to stress by induction of a specific set of proteins called stress proteins and offer a most sensitive system to detect changes in their immediate environment. We hypothesized that medaka fish (Oryzias latipes) could be used as a animal model to detect water pollution and chose to investigate the level of expression of mortalin, a HSP70 family protein. Mortalin has been found to be upregulated in a variety of cancers and has been studied extensively in our laboratory.

In our study, medaka fish were exposed to water containing carcinogens such as arsenic trioxide, nickel chloride, cadmium sulphate and hydrogen peroxide at different concentrations. Thereafter, the fish were sacrificed and the lysates were prepared using NP40 lysis buffer. The upregulation of mortalin was detected by immunoblotting using anti-mortalin monoclonal antibodies that specifically reacted to mortalin homologue in Medaka. We have established a sensitive ELISA method for the detection of mortalin.

We first tested a variety of antibodies raised against human mortalin protein and identified one with a specific epitope that reacted to mortalin homologue in medaka. Using these unique antibodies we performed Western blotting and ELISA on control and stressed medaka fish. We found that the stressed fish that were reared in arsenic trioxide, nickel chloride, cadmium sulphate and hydrogen peroxide contaminated water had higher level of mortalin protein. Whereas dietary restriction did not show any difference in the level of mortalin protein, the increasing concentrations of the pollutants lead to increase in mortalin in a dose-dependent manner. The results suggested that the changes in mortalin protein reflect the stressed physiological state of medaka fish. We propose the use of mortalin as a biomarker for early detection of environmental pollutants and carcinogens. Such biomarker detection can monitor water pollution to the levels that are relevant to the physiological tolerance of living organisms and hence can substantially protect against its deleterious consequences including cancers in the ecosystem.