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Living beings encounter a wide range of xenobiotics, most of which pose threat to the system. The level of genetic integrity of human populations is increasingly under threat due to industrial activities that result in exposure to chemical and physical genotoxins. Other factors that can influence genetic damage include lifestyle factors (e.g., diet), various medical therapies and climatic changes (e.g., increased exposure to ultraviolet radiation due to depletion of atmospheric ozone).

Testing chemicals for their ability to induce genetic damage is necessary because it has been shown that most, if not all, cancers are characterized by chromosomal changes. Genetic apparatus of cells is a major target for carcinogenic action of diverse classes of chemicals.

Avian embryos have been proposed as an experimental model for genotoxicity (Tempel et al., 1992) and carcinogenicity (Enzmann and Brunemann, 1997) testing of chemical substances. Experiments using avian embryo as a model system can provide valuable information on the carcinogenic potential of chemical in study and may fill the gap between experiments employing whole organisms and the in vitro experiments, combining some advantages of both approaches (Enzmann and Brunemann, 1997). Chick embryo model has also been used to investigate the genotoxic effect of various physical and chemical agents using metaphase analysis, chromosome banding, sister chromatid exchange analysis etc., (Smith et al., 1978; Bloom, 1982; Lahijani and Ghafoori, 2000; Wilmer and Bloom, 1991; Moore and Owen, 1967).

The formation of micronuclei is a widely used and accepted endpoint of genotoxicity testing. The micronucleus assay provides a simple and rapid indirect measure of the induction of structural or numerical chromosome aberrations. Micronuclei analysis in chick embryo implicates the formation of micronuclei in erythrocytes of the peripheral blood as an end point of genotoxicity testing.

The chemical carcinogen used in the present study is acrylamide. The acrylamide is chemical toxicant (Dixit et al., 1981; Peters et al., 1995; Waisberg et al., 2003). The genotoxic effects of acrylamide using mammalian systems as well as
in vitro have been well documented (Adler et al., 1993; Abramson-Zetterberg, 2003; Jagetia and Adiga, 1994). However acrylamide studies on micronuclei induction in chick embryo were not conducted.

The purpose of the present study was to investigate whether the micronucleus test (MNT) in chick embryo is able to identify the genotoxicity of acrylamide and the possibility of using chick embryo as an alternative model for genotoxicity study using micronuclei analysis. Further evaluations involving well characterized mutagens and non-mutagens is necessary to expand the knowledge on sensitivity and specificity of this model.

The excess concentration of chemicals can cause damage to defense system and modifies tissue and it leads to cancer. To encounter the above damage, the organisms are well equipped with defense enzymes like superoxide dismutase, catalase, peroxidases, glutathione S- transferases, mixed function oxygenase etc. These enzymes can participate either to catabolise the molecules or excrete them from the body. Some of these enzymes are induced for secondary defense by using glutathione as primary substrate and the other chemical as secondary substrate.

The present study will focus on the effect of acrylamide exposure on lipid peroxidation and enzymatic and non enzymatic antioxidant defense system in brain of chick embryo; and also on the effect of acrylamide on the induction of glutathione S-transferases. The induction of glutathione S- transferases in the presence of these chemicals varies and are used as marker proteins to detect the chemical toxicity and carcinogenicity.

The aims of the present investigation are:

1. To evaluate the effect of acrylamide on lipid peroxidation, enzyme and non-enzymatic antioxidant activities in developing chick embryo brain.

2. To study, the purification and characterization of GSTs, total specific activity using substrates from 11th day old chick embryonic brain neurons and to docking studies using auto dock vina in PyRx,
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visualization of protein (GST) and ligand (acrylamide) interactions in PyMOL.

3. To investigate the genotoxicity of acrylamide in chick embryo using micronucleus test.

4. To isolate and fractionate the developing chick embryonic brain neuron DNA and to determine the DNA damage by restriction digestion analysis using Hind III and Bam HI.

5. To conduct histopathological studies and analyze the brain tissues using light microscope.

To study the above aims, experiments were conducted on chick embryos and the results obtained in this study were documented in five chapters.