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AMELIORATING POTENTIAL OF GINGER AGAINST ARSENIC TOXICITY IN KIDNEY OF SWISS ALBINO MICE

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ABSTRACT

Arsenic is a known industrial pollutant which accumulates in the kidney and its exposure leads to the production of reactive oxygen species (ROS). The present study was carried out to evaluate the ameliorating effects of ginger against arsenic trioxide induced toxicity in kidney of albino mice. The biochemical alternations in kidney tissue were observed. The results showed that arsenic administration reduction in the content of glycogen, cholesterol and total proteins in kidney. Ginger treatment prevented degentrative changes induced by arsenic trioxide and also aided in reduction of oxidative stress and restored the biochemical changes occurring in kidney tissue.

Key words:

Arsenic (As), Ginger and Antioxidant

INTRODUCTION

Heavy metals has become a common problem throughout the world due to contaminated drinking water, food and air. Arsenic is one of the most important metalloids and persists in organic, inorganic and elemental form in nature. Trivalent arsenic species are most toxic than pentavalent arsenic compounds (Chowdary et al., 2008). A chronic exposure through contaminated drinking water has become an increasing global problem of public health concern. Epidemiological studies have shown that inorganic arsenic exposure may lead to cancer of the liver, kidney, bladder, prostate, skin, lung, colon and nasal cavity (Jin et al., 2004). The kidney is a second major target organ for both arsenic metabolism and toxicity. Arsenic induced renal injury is known to be exerted through excess production of reactive oxygen species**.** The harmful expressions of arsenic are primarily due to an imbalance between pro-oxidant and antioxidant homeostasis in physiological system and also due to its fascination to bind sulfhydryl groups of proteins and thiols of glutathione (GSH) (Mathews et al., 2012). Several classes of antioxidant dietary compounds have been suggested to present health benefits, and there is evidence that consumption of these products leads to reduction in the expression of various oxidative stress biomarkers (Peng et al., 2000; Halliwell et al., 2002; Jacob et al., 2003). A positive correlation has also been established between dietary supplementation with certain vegetables and plants and the reduction of toxic effects of various toxicants, environmental agents including heavy metals (Nandi et al., 1997).

Ginger rhizome, having a pleasant aroma and pungency, has been used as a spice and medicine for thousands of years. It contains the pungent principles, gingerols and shogoals. which are phenolic in nature and pharmacologically are the most active components of ginger (Afzal et al., 2001). Ginger extract possesses

antioxidative characteristics, since it can scavenge superoxide anion and hydroxyl radicals. It contains a host of compounds which includes acid resins, vitamin C compounds [folic acid, inositol, choline and panthotenic acid] (Arfeen, 2000), gingerol, sesquiterpene, vitamin B3 and B6, volatile oils and bio-trace elements [Ca, Mg, P and K] (Ernst and Pittler, 2000). The medicinal values of ginger have been intensively reported.

Therefore in the present investigation, protective effects of ginger against arsenic induced biochemical changes in the kidney of Swiss albino mice have been studied.

MATERIALS AND METHODS

ANIMALS: Albino mice weighing 27±2 gm were procured from GADVASU,Ludhiana. They were kept and accalimatized to the laboratory conditions for 15 days, The animals were given standered mice feed and water ad libitum. The animals were handled in accordance with guidelines of the committee for purpose of Control and Supervision of Experiments on animals (107/GO/Rebi/S/99/CPCSEA/2017-21).), India. Institutional animal ethical committee has approved the present study.

CHEMICALS: Arsenic trioxide was dissolved in double distilled water and administrated orally to mice. Ginger was dissolved in distilled water and administered to mice.

EXPERIMENTAL DESIGN: Animals were randomly divided into group as follows: Group 1 – Animals were given distilled water kept as control. Group 2 – Albino mice were treated with a single dose of (5mg/kg b.w) arsenic trioxide. Group 3 Mice were given an acute dose of 5mg/kg bw of arsenic trioxide orally followed by a daily dose of 20 mg/kg bw of ginger for 15 days.

TISSUE ANALYSIS : Kidney homogenates were prepared with the help of tissue homogenizer in 3ml of phosphate buffer and used for estimation of glycogen,cholesterol and total protein content by the methods of Montogmery et al.(1957), Zlatkis et al. (1953) and Lowery et al. (1951).

STATISTICAL ANALYSIS: The biochemical data was analyzed statistically by using Student's t-test.

RESULTS AND DISCUSSION:

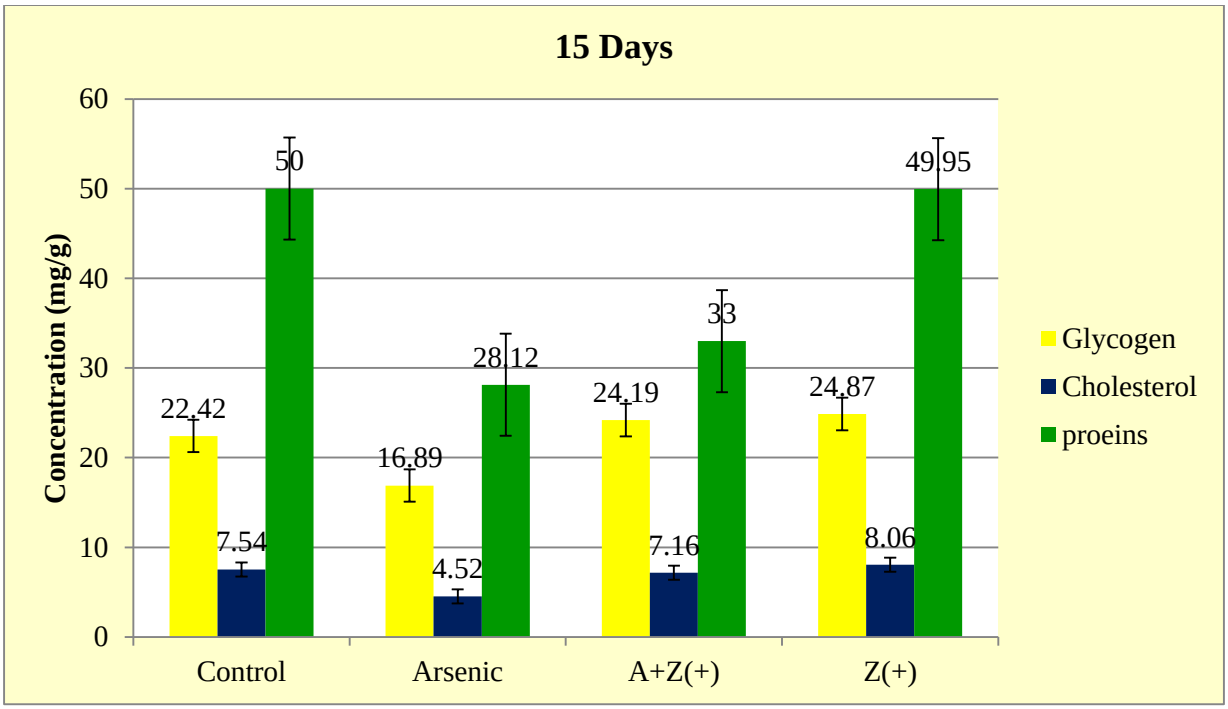
Glycogen content in arsenic treated kidneys was found to be reduced significantly ($p<0.0001$) in the present study (Fig.1). Ivanova-Chemishanska (1982) suggested the changes in the levels of glycogen to be either due to increased catabolism of the biomolecules to meet the enhanced energy demand of animals under stress or their reduced synthesis due to impaired tissue function.

Arsenic exposure in the present study caused significant decrease ($p<0.05$) in kidney cholesterol (Fig.1). These observations are in accordance with the findings of Khan (1980); Purohit et al. (1993).

A significant decrease ($p<0.0001$) in protein content of kidneys was observed (Fig.1) which indicated that the amount of total proteins is adversely affected by arsenic. Omata et al. (1978) suggested that the decrease in protein synthesis can be correlated to direct toxic effects of heavy metals. They also believed that ribosomes can be intoxicated by heavy metals which led to their deterioration and reduction in protein synthesis. Swamy et al. (1992) suggested that decrease in total proteins and soluble proteins indicate their metabolic utilization. They also correlated the increase in proteases with decrease of soluble and total proteins.

In ginger treated mice, total glycogen, total cholesterol and total proteins were found to attain almost normal values and showed marked make over in the presence of the protective agents as shown in Fig.1

Treatment with ginger brought back the enzymes level to near normal indicating clearly the therapeutic value of ginger.



CONCLUSION:

It could be concluded that ginger acts as a potential antioxidant that prevents renal toxicity induced by arsenic in albino mice. Though supplementation with ginger resulted in beneficial effects against renal toxicity, but it was dose dependent.

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