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## ***VI. SUMMARY***

### **Biochemical, Histopathological, Molecular and Electron microscopical studies on different tissues of male rats treated with monosodium glutamate with special reference to the possible protective effects of taurine as an Antioxidant**

#### **Background and aims of the work:**

Monosodium glutamate (food additive) has a reactive role in the biological setting. It's function is a substrate for protein synthesis, precursor of glutamine, N-transport, neurotransmitter, cell signaling, delta carboxylation of glutamate, substrate for glutathione production, precursor of N-acetylglutamate, active sites of enzymes, inhibitor of glutaminase reaction, citric acid cycle intermediate and energy source for some tissues. So, glutamate plays essential roles that when it was provided in high doses for a long period, it can cause a toxic effect (**Olney 1994**).

Taurine (2-amino ethansulfonic acid) is the major free intracellular amino acid derivative that produces antioxidants in many tissues, including the liver, kidney and pancreas (**Chesney, 1985** and **Wright et al., 1986**).

Taurine's role was in bile acid metabolism, acts as scavenger for toxic metabolites, regulates intracellular calcium, enhances bile flow and increases cholesterol clearance by the liver (**Huxtable, 1992**). Also taurine has a critical role in osmoregulation (**Wright, 1986**), insulin-like activity (**Maturo & Kulakowski, 1987**).

So, this study was achieved to improve the toxic effect of monosodium glutamate (MSG) on liver, kidney and pancreatic tissues, to investigate the possible protective role of taurine against the toxic effect of MSG and finally to compare the biochemical results obtained through this work with those of histopathological and ultrastructural observations in some organs of rat mainly liver, kidney and pancreas.

**Materials and methods:**

Chemicals used are MSG with purity 98% and antioxidant taurine with purity 99%, both chemicals were administered orally.

**Experimental animal grouping:**

The animals (male rats) were divided into five groups (control, taurine (1000mg/kg/d), MSG (400mg/kg/d), therapeutic (MSG+ taurine) and protective (taurine + MSG); each group contains 30 male rats.

**Blood samples:**

The blood samples were taken from the eye each two weeks all over (until) eight weeks. The parameters analysed are ALT, AST, and ALP, bilirubin (direct & total), urea, creatinine, triglyceride, cholesterol, HDL, LDL, glucose and calcium levels.

**Tissue samples:**

Pathological and electron microscopic examinations were undertaken on liver, kidney and pancreas for one and two months.

**Results:**

The results showed that serum levels of ALT, AST, ALP, total and direct bilirubin, urea and creatinine are all significantly ( $p < 0.01$ ) increased as regarded to control. Similarly, a marked elevation ( $p < 0.01$ ) in serum levels of total cholesterol, triglyceride, HDL, LDL, and glucose were observed. A nonsignificant increase in the serum level of calcium was

observed. All these changes were period-dependent of administrated dose and also depend on chronicity of administration. Parallel to the latter, a second experiment was done in a group of rats treated orally with taurine daily in a dose of 1000mg/kg body weight/d for 8 weeks. A third experiment was done to visualize the possible protective effects of taurine against MSG. The results suggested that the MSG-treated animals induced impairment in the liver, kidney and pancreatic functions, hyperlipidemia, hyperglycemia beside a marked inhibitory effect on enzymes in a period-dependent manner. Treatment of rats with taurine for 8 weeks induced hypolipidemia and hypoglycemia and a significant decrease ( $p < 0.01$ ) in the liver enzymes. In addition, it was noticed that oral taking of taurine before (protective) and not after (therapeutic) MSG ameliorate all the adverse effects of MSG specially when given in a dose (1000mg/kg/d) nearly double to that of MSG (400mg/kg/d).

### **Conclusion:**

In conclusion, our study clearly revealed that:-

1. MSG is highly hepatotoxic.
2. MSG is highly nephrotoxic.
3. MSG is highly hyperlipidemic.
4. MSG is highly hyperglycemic.

Our results indicated that ultrastructural investigation of some organs as liver, kidney and pancreas strongly confirm the previous observations that taurine has hepatoprotective, nephroprotective, hypolipidemic and hypoglycemic effects. There is no significant changes in the calcium level whatever under the effect of MSG or therapeutic or protective effect of taurine.

### **Recommendation:**

We advice to add a special dose of taurine to any type of food

contain MSG as a food additive to minimize its side effects.