ABSTRACT

Sweeteners are considered to be potential high-consumption food additives because of their use in a wide range of products. Aspartame is one of the most widely used artificial sweeteners worldwide. Since its introduction into the market, aspartame is heavily subjected to criticism because of its possible adverse effects. The consumption of aspartame has increased significantly and it is important to explore the effect of long term consumption of aspartame. The study focuses on the effects of aspartame on biochemical profile, antioxidant status, neurochemistry, food intake, body weight and glucose homeostasis at different doses; in which the ADI dose (50mg/kg b.wt) was selected as the low dose.

The results demonstrated that long term intake of aspartame could produce alterations in biochemical variables and in the antioxidant defence system. This study found a significant increase in serum bilirubin concentration when administered with the high dose (1000mg/kg b.wt) of aspartame. Liver marker enzymes AST, ALT, ALP and GGT showed a marked increase in the high dose group whereas, 500mg/kg b.wt produces an increase in AST and GGT levels. This study observed a significant decrease in glutathione peroxidase, glutathione reductase and reduced glutathione concentrations in blood and liver at the highest experimental dose. The 500mg/kg b.wt aspartame group showed a marked variation in glutathione reductase and reduced glutathione concentrations. Brain exhibited a significant decrease in glutathione reductase and
glutathione in the 1000mg/kg b.wt aspartame group while, 500mg/kg b.wt group showed a variation in glutathione only.

Histopathological studies showed leukocyte infiltration in the liver and congestion in brain at high dose of aspartame. Results indicate that chronic intake of aspartame at high dose decreases the activity of acetylcholine esterase and Na$^+$ K$^+$-ATPase, that play a crucial role in the regulation of acetylcholine metabolism and ionic homeostasis respectively. The study also observed significant changes in sodium and potassium concentrations and induction of apoptosis at high dose of aspartame. Tyrosine hydroxylase, the rate limiting enzyme in dopamine synthesis showed a significant decrease in activity. A marked increase in phenylalanine and tyrosine and decrease in tryptophan was observed at high dose of aspartame. The changes in concentrations of amino acids are followed by a significant decrease in dopamine in the cerebral cortex and corpus striatum and a decrease in serotonin in striatum at high dose of aspartame. Although changes were prominent at high dose of aspartame, a significant change in acetylcholine esterase activity and phenylalanine and dopamine concentrations were observed at low dose also.

Studies were done to investigate the effect of aspartame on food intake, body weight, glucose homeostasis and hepatic glucose metabolism in diabetic and non diabetic rats. The results showed no significant effects of aspartame on food intake, body weight and glucose homeostasis in diabetic groups. But aspartame at high dose produce a significant increase in insulin level in diabetic rats compared to diabetic control, but failed to augment to the normal level of insulin. Interestingly the non diabetic rats fed with high dose of
aspartame showed a significant increase in insulin level than that of the normal control group. In addition, we also observed a significant decrease in food intake and body weight in the non-diabetic group fed with high dose of aspartame.

In conclusion findings of this study suggested that chronic over consumption of aspartame may impair the normal functions of the liver and brain. The diverse effects of aspartame observed in this study may possibly result from the antioxidant imbalance induced by the metabolites of aspartame, the generation of ROS, and the impairment in amino acid transport produced by phenylalanine resulting alterations in neurotransmitter synthesis. Moreover, the results of the study suggest a possible role of aspartame in insulin secretion by some mechanism associated with the taste receptors in the gastrointestinal tract. At the very outset this study provides an improved understanding of the qualitative and quantitative effects of long term consumption of aspartame in liver and brain.