

**Effect of Acrylamide on the Tongue Musculature of
Adult Male Albino Rat and the Possible Protective
Role of Vitamin E: Light and Electron Microscopic
Study**

Thesis

**Submitted in partial fulfillment of M.Sc. degree in Anatomy and
Embryology**

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2018

Summary

Acrylamide is an environmental public health problem, it is present in plant material like potatoes, carrots, onions, spinach, rice, sugar and olives. Direct exposure to acrylamide results from ingestion of high carbohydrate foods prepared at high temperatures such as fried potatoes and crackers, which are widely consumed and results in a significant human exposure to acrylamide.

This study aimed to demonstrate the light and electron microscopic effects of acrylamide on the musculature of adult male albino rat tongue for two different durations, short duration (twenty days) and long duration (forty days) and to investigate the possible protective effect of vitamin E co-administration.

Sixty adult male albino rats were divided into six groups, each group included ten rats. **Group I (control)** received no medication. **Group II (Sham control)** received normal saline solution and vitamin E. Vitamin E is present in the form of capsules, each capsule contains 400 mg. Each vitamin E capsule was dissolved in 20 ml of corn oil in a daily dose of 100 mg/kg, with 30 minutes interval between the two doses, for 40 days. **Group III** received acrylamide in a daily dose of 20 mg/kg for 20 days. **Group VI** received acrylamide in a daily dose of 20 mg/kg for 40 days. **Group V** received acrylamide in a daily dose of 20 mg/kg and vitamin E in a daily dose of 100 mg/kg, with 30 minutes interval between the two doses, for 20 days. **Group VI** received acrylamide in a daily dose of 20 mg/kg and vitamin E in a daily dose of 100 mg/kg, with 30 minutes interval between the two doses, for 40 days.

All medications were given orally by gastric gavage.

Rats from groups **(I and II)** were divided into two subgroups (5 rats in each subgroup), 5 rats were sacrificed after 20 days and 5 rats were sacrificed after 40 days, rats from groups **(III and V)** were sacrificed after 20 days, rats from groups **(IV and VI)** were sacrificed after 40 days.

At the end of the experiment the tongue was dissected out for light and electron microscopic studies. For histological examination, coronal sections of the tongue will be stained with hematoxylin and eosin (H&E), Masson's trichrome and P.A.S. stains. The ultrastructural study of tongue samples will be carried out with transmission electron microscope.

Histomorphometric study and statistical analysis was done for percentage of collagen fibers in all groups and mean PAS optical density in all groups.

The skeletal muscle fibers of tongue of group I (control) and group II (Sham control) showed normal histological architecture in both light and electron microscopic studies.

Under the light microscope, the skeletal muscle fibers appeared running in different directions, the muscle fibers appeared parallel, long, with crossly striated sarcoplasm. The nuclei were multiple, elongated and peripheral in position under the sarcolemma. Sections stained with Masson's trichrome visualized a normal pattern of collagen deposition around skeletal muscle fibers. Sections stained with PAS, the skeletal muscle fibers were shown to have a strong positive PAS reaction in the form of small red granules filling their sarcoplasm denoting considerable amounts of glycogen.

Under the electron microscope, myofibrils arranged parallel, the myofibrils showed regular arrangement of alternating light (I) and dark (A) bands. Z line was seen bisecting the light band. Sarcomeres were seen between two successive Z lines. Mitochondria were seen separating the myofibrils and few mitochondria were also observed at the subsarcolemmal area.

Light microscopic study of tongue skeletal muscles in group III revealed abnormal wavy course and splitting of the muscle fibers with inflammatory cellular infiltration and fatty infiltration in between.

Moreover, pyknosis and remnants of nuclei were detected.

Sections stained with Masson's trichrome showed increased amount of collagen fibers deposition among skeletal muscle fibers and around blood vessels.

Sections stained with PAS showed faint PAS reaction indicating reduced glycogen content.

Electron microscopic study of group III revealed marked aggregation of mitochondria, formation of giant and vacuolated mitochondria and partial loss of myofilaments.

These changes were exaggerated by prolonged duration of acrylamide exposure in group IV.

Co-administration of vitamin E with acrylamide ameliorated most of the above mentioned histological changes in both groups (V and VI) with mild focal histological changes in both light and electron microscopic studies.

The histomorphometric study of the mean percentage of the collagen fibers, the mean area of the optical density of glycogen content and their subsequent statistical analysis data supported the above mentioned findings.

It could be concluded that, exposure to acrylamide leads to skeletal muscle damage in rat tongue which becomes worse with prolonged duration of exposure. This toxic effect of acrylamide could be minimized when vitamin E is given concomitantly with it.