Mercury and Nicotine-induced Oxidative Stress Changes in Bull Spermatozoa: Modulation by Manganese and Albumin

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Abstract

Introduction: Oxidative stress (OS) is an important factor in the etiology of male infertility which presents abnormal increase in the production of free radicals with negative influences on reproduction. The aim of present study is evaluation effect of mercury (Hg) (600& 1200 micro molar) and nicotine (0.75 mM), in vitro, on membrane integrity (LPO), GSH content, motility, and acrosome reaction of bull spermatozoa with/ without manganese (Mn) and albumin (BSA).
Materials and Methods: Lipid peroxidation (LPO) was assessed by measurement of MDA levels. Reduced glutathione (GSH) content evaluated by levels of reduced DTNB and acrosome reaction evaluated by gelatin digestion test. Sperm motility was assessed by under phase contrast microscopy at room temperature until 120 min. Statistical analysis performed using SPSS software by t- test, at $p<0.05$ significance level.
Results: Our results showed that addition of Hg and nicotine to the sperm samples resulted in elevation of LPO rate ($p<0.001$). Meanwhile, Hg and nicotine treatments caused a significant reduction in the GSH content, motility, and acrosome reaction of bull sperm cells. Concomitantly, there was also an improvement in the mentioned altered processes following albumin and manganese addition. Here, Mn had better results than BSA. We found that BSA act as a pro-oxidant when added to medium containing high concentrations of metal ions, imposing more deleterious effects on bull spermatozoa [more increase in the LPO and decrease in GSH level ($p<0.01$), decreased acrosome reaction ($p<0.001$) and dropped motility].
Conclusion: According to our results, Hg and nicotine may impose sperm dysfunction in bull spermatozoa via altering some biochemical and physiological aspects of sperm like membrane integrity and cell movement. Our data suggest BSA and Mn that involved in antioxidant capacity are as double-edged swords (particularly BSA), which may show unwanted and negative effects.

Key Words: Spermatozoa, Mercury, Nicotine, Manganese, Albumin, Oxidative stress, Motility, Acrosome reaction, GSH, Antioxidant.

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