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Short Communication

The Effects of Oral Methyl Tert-Butyl Ether (MTBE) on Mouse Sperms

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Abstract

Methyl Tert_Butyl Ether (MTBE) is an organic oxygenated compound for decreasing Carbon Monoxide emissions during combustion. In this research, the effect of MTBE on the NMRI mice sperm was studied, MTBE was administered to mice at dose levels of 1600 mg/kg/day. After two weeks of treatment, the mice were anesthetize, and their testes and epididymis were removed. Their epididymal ducts were dissected, then the sperms were studied. No Significant changes were observed in the number of sperms, but sperms` viability had been decreased significantly .This experiment indicates that, relatively high dose of MTBE can exert toxicity on cells in the mouse sperms.

Keywords: Oral MTBE, mouse, sperm.

Introduction

Methyl Tertiary – Butyl Ether (MTBE) is a volatile organic compound with $C_5H_{12}O$ chemical formula[1]. MTBE is a petroleum refinery product[2]. It is used in gasoline composition, instead of Lead Tetra Ethyl to increase the Octane number of gasoline, complete combustion, decrease the amount of Carbon Monoxide, Ozone, volatile organic compounds and unburned Hydrocarbons in the air[3]. This substance can be dispersed from different sources in the environment such as: air, soil, underground water and produces contamination and poisonousness. For this reason, protection of underground water is very important and complex. Because of the high solubility of this substance and resistance against biodegradation, it is almost impossible to clean up the ground water[4,5,6]. MTBE is known as an animal carcinogenic substance that probably can be carcinogenic for human being[7]. MTBE can enter the human body in three ways: oral, skin contact and respiration. Regarding the time of exposure the effects of this substance has been demonstrated in 3 forms of: acute (14 days or less), intermediate (15-364 days), chronic (365 days or more)[8]. Oral MTBE can cause acute or chronic indisposition. In the present study, contamination of drinking water has been known as the most common risk factor for almost every body[9]. Some effects of MTBE consist of : headache, nausea, ataxia, respiratory disorders, eye irritation and probably blood cancer (Leukemia)[10]. This substance absorbed into the blood and goes to all tissues. Because of its lipophilic transfer to the cell membrane easily. Because of its toxic effects on human and lack of resources in relation to the impact on living organism, this study investigated the effects on mouse sperm cells.

Material and Methods

In this research the effects of MTBE was studied on the male mouse sperm. In this research, MTBE effects were studied on Albino NMRI male mice with (8 to 10 weeks ages). Male mice with an average weight of (29/5 g) were classified into three groups: Control, Solvent, Gavage (treatment). In Gavage method, (0/1 ml) of Solvent and MTBE solution (0/06 ml MTBE + 0/04 ml olive oil) were administrated orally by Insulin syringe and Gavage needle to Solvent and Gavage groups for 14 days, every day at a dose of (1600 mg/kg of body weight).At the end of each period, all the mice were euthanized, dissected in abdomen and testis and epididymis were removed. Then epididymis ducts were put in PBS medium (1ml). They were cut and the sperms were released. They were put in the incubator with (37ºC, %5 CO2) for 30 minutes[11]. Then the number of sperms and viability were studied. To distinguish the motility live sperms and motionless live sperms of the dead sperms , the supra vital staining was used. A drop of the sperm sample was poured on the slide ,and a drop of Eosin (%5 in saline) was added to it[11] . Slides were examined with magnification of 400. The dead sperms` head absorb the Eosin and become red, because of membrane disorders. The number of the live and dead sperms were counted in five areas. For counting the number of sperms a drop of sample was poured on the Neubar Hemocytometer slide and studied with microscope (magnification of 400). The number of sperms multiplied by 10^4, that it shows the number of sperm in (1ml) approximately. In this research for analyzing the data SPSS soft ware and analytic method one-way ANOVA, Tukey test were used.

Results and Discussion

No significant change was observed in the number of sperms between control, Solvent and Gavage groups (table 1). But percentage of the sperm viability was decreased in the Gavage group (table 2). Results showed that MTBE at a dose of 1600 mg /kg of body weight for 14 days had no effect in the number of the sperms but the percentage of the dead sperms

was increased. Also our previous studies had been shown that MTBE (1600 mg/kg / body weight for 14 days) decreased the testis weight to the body weight, Spermatogony cells and primary Spermatocyte cells areas, degeneration of the epithelium layer in percentage of the Seminiferous tubules[12]. Therefore when MTBE enters the body, it solves in the blood and diffuses to all the tissues and organs, and it affects the connective tissue, nourishment of the cells and finally decreases the cell storage and decreases the organs and body weights, MTBE is lipophilic and transfers the cell membrane easily and can exert poisonous effects.

Table-1
Compare the number of sperms (Mean ± Standard deviation) in Control, Solvent and Gavage group

Group	(Sperm count in 0/0001 ml) $\times 10^4$
Control	330 ± 40
Solvent	320 ± 34
Gavage	295 ± 40

Table -2
Compare the percentage of sperm viability (Mean ± Standard deviation) in the Control, Solvent and Gavage group

Group	Percentage of the sperm viability
Control	58 ± 2
Solvent	55± 3
Gavage	42 ± 3

Conclusion

This research shows that relatively high dose of MTBE have toxicity effects on the mouse sperms and increase dead cells. Decrease of sperms can lead to abortive. MTBE maybe have effects on the germ cell gene and causes disorders in embryo and next offspring that suggest this subject be studied in other researches. In result MTBE that use in gasoline and diffuse to the air, environment, water and enter the body, maybe have this effects on human germ cells and the risk of it should be consider.

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