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Study to Investigate the Hormone Analysis in Male Albino Rats under the Pharmacological Kinetics of Thimerosal

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Abstract

Thimerosal is a compound centered on ethyl mercury which has been remained a component of vaccines. Vaccines and other medicinal product that hold thimerosal are the potential basis of relevance of havoc mercury. In the current study, the effects of thimerosal were checked on the sex hormones in adult albino rats at low 15mg/kg and high 40 mg/kg dose per day by the use of gavage for a month. Testosterone was noticeably reduced ($p < 0.05$) in both low and high dose treated rats. Concentration of LH and FSH also decreased ($p < 0.05$) tremendously in both treated groups. However, a minor decrease was observed in the level of prolactin in low dose group while prolactin was found to be reduced significantly ($p < 0.05$) in high dose exposure. Daily sperm production and efficiency of sperm production was also checked in this study and both are lowered sharply ($p < 0.05$) in rats treated with thimerosal. These results demonstrated that thimerosal has strong effects on male sex hormones and their DSP and efficiency of DSP in adult albino rats.

Key words: Thimerosal, Ethyl mercury Albino rat, Sex hormones.

INTRODUCTION

Mercury is a noxious waste product present in water, soil and air and is very lethal mutagen. When its concentration is high it causes a risk to human health and ecology. Anthropogenic exploits, such as mercury use in fungicides, cosmetics, electronic devices production companies and automobile industry are main source of release of mercury in environment at present time [1-3].

A little information is known for potential influences of mercury on human reproductive system but some studies explained abnormalities in female menstrual cycle and also reduced reproductive functions in male when treated with methyl mercury. Reproductive system of humans and animals is potentially affected by mercury as even at minute concentrations mercury damage the endocrine system by effecting pancreas, pituitary, thyroid and adrenal glands. Therefore, concentration of sex hormones is most important for measuring the reprotoxic effects of mercury [4-8].

Thimerosal contains 49.6 % Hg by mass and splits into ethyl mercury and thiosalicylate in the body. Studies show that thimerosal metabolized and released inside the cells in the form of ethyl mercury by the activities of enzymes. Moreover, positive results of patient's patch-test by reactions with ethyl mercuric chloride, suggested that allergic reactions by the use of thimerosal is due to ethyl mercury component. It has been observed that babyish vaccines composed of thimerosal is the contributing agent of autism in children treated with thimerosal vaccines conversely, this indication is a topic of argument yet. Currently, studies on T- lymphocytes, neural cells have been explained the mechanism of thimerosal side effects. Apoptosis in fibroblasts and neural cells in humans has been observed recently in a study by the activation of caspase-3 under the influence of thimerosal. In humans, medicinal products, mercury polluted fish, thimerosal vaccines and cinnabar are main contacts of mercury [9, 10].

People of developing countries are exposed to various thimerosal containing medicines, which may possibly lead to irreversible damage to their health. Effects of methyl mercury are well known but There is a little information about the influences of thimerosal on living organisms, therefore the maximum record about thimerosal in collected works is based on information of methylmercury as the effects of methyl mercury are well known [11].

Humans are treated with vaccines composed of thimerosal, consequently they have been encountered to mercury present in thimerosal. Moreover, behavioral abnormalities and sever neurological damages have been reported in studies on rodents. The present study meant for understanding how thimerosal effects the reproductive sex hormones on male albino rat[12].

MATERIAL AND METHODS

Experimental Design

In this study male Albino rats were used. For thirty days' rats were placed in Animal house with control conditions at about 25^0C temperature and lighting 12 hrs. light and dark cycle. Proper tap water and dry food pellets were feed to rats. Rats were placed in 3 groups; each group has 6 rats. Group 1: Control rats, given tap water and normal food. Group 2: Experimental rats, given low dose 15 mg/kg of thimerosal. Group 3: These rats were treated with High dose 40 mg/kg of thimerosal via feeding tubes.

After the end of experiment of 30 days that were required for the accomplishment of spermatogenic cycle in rats, rats were dissected, and testicular tissues were removed and blood was transferred into heparinized tubes. The plasma took by centrifugation of blood at 3000 rpm and put in storage at -20 ºC for hormonal analysis.

Hormonal Analysis

Concentration of Plasma testosterone in testicular homogenates was evaluated by using (enzyme-linked immunosorbent assay) ELISA kits. Immuno-Assay Test Kits were used to measure the concentrations of PRL, LH and FSH [13].

Estimation of daily sperm production by homogenization method

The calculation of DSP is done by dividing number of spermatozoa and spermatids in the homogenate by 6.3 which is the time divisor for rats i.e. cycle of the complete days the seminiferous tubules occupied by the spermatids and spermatozoa [14].

Daily sperm production (DSP) = Y/6.3 Where, Y = Number of spermatozoa and spermatids found in homogenate

Efficiency of daily sperm production

Efficiency of DSP is calculated by following formula:
Efficiency of sperm production = DS /weight of decapsulated testis

STATISTICAL ANALYSIS

Data was presented as means (±SEM). Statistical analysis was concluded by using One-way ANOVA followed by Dunnett's test for comparison of treated groups with control group. At $p < 0.05$ differences were measured significant [15].

RESULTS & DISCUSSIONS

Hormonal results shown in Table 1 after the administration of Thimerosal. Results shows that, exposure of thimerosal cause significant decrease ($p < 0.05$) in level of LH, FSH and Testosterone as compared to control groups and this decrease was dose dependent. The level of prolactin was remarkably decreased in rats treated with high dose of thimerosal ($p < 0.05$), and prolactin level was not significantly affected in low dose treated rats.

There is a notable ($p < 0.05$) reduction daily DSP and efficiency of DSP in the treated rats than in control group when given High and low doses of thimerosal as results predicted in the table 2.

Table-1: Effects of Thimerosal on reproductive hormones in male albino rat

Hormone's mg/kg	Control		Low dose mg/kg		High dose mg/kg
Testosterone	7.15 ± 0.06a		6.22 ± 0.06b		5.11 ± 0.08c
LHconc	2.68 ± 0.05a		2.40 ± 0.03b		2.25 ± 0.04c
FSHconc	3.43 ± 0.06a		3.02 ± 0.04b		2.93 ± 0.04c
Prolactin	15.91 ± 1.98a		13.78 ± 1.95b		10.51 ± 1.91c

Results are mean as (±SEM). Means are significantly different that do not show same letters.

Table-2: Effects of thimerosal on DSP and efficiency of DSP

Groups	Daily sperm production × 10^6/ testis	Daily sperm production × 10^6/ testis
Control	21.26 ± 0.5a	13.27 ± 0.35a
High dose	16.87 ± 0.26b	11.85 ± 0.21b
High dose	15.54 ± 0.20c	10.66 ± 0.20c

Results are mean as (±SEM). Means are significantly different that do not show same letters. Thimerosal a constitute of vaccine, broken-down into two compounds ethyl mercury and thiosalycilic acid and sharply deposited into the tissues of body and this ethyl mercury is very lethal than that of the thimerosal [16]. Moreover, ethylmercury released from thimerosal immediately absorbed via skin and inhalation.

In our finding's thimerosal caused decreased concentration of FSH and LH. Two hormones, Follicle stimulating hormone and Luteinizing hormones released by adenohypophysis regulate the fertility of male mammals through the testosterone production by Leydig cells in their interstitial cells [17-20].

Small dosage of mercury treatment caused negative effects on male reproductive system. Albino rats treated by mercury resulted in decreased concentration of FSH and LH. Thimerosal caused a reduction in concentration of testosterone, as in previous studies, there is an intense drop in testosterone in the animals infected with mercury exposure. Thimerosal resulted in decreased accessibility of gonadotropin hormones to the Leydig cells of testis due to minimized level of testosterone [21-24].

Present study shows that high dose of thimerosal exposure to treated rats' results in decrease level of prolactin. In spite of the fact that functional role of prolactin in male reproductive system have not been clearly studied, but the prolactin is concerned with the infertility of male. Hyperprolactinemia suppresses the synthesis of testosterone and fertility of male as prolactin inhibited the release of gonadotropin releasing hormone or by inducing the excitable release of adrenal corticoids [25].

Though, by upregulation of luteinizing hormone receptors located on Leydig cells, prolactin also found to play important role in production of testosterone. Role of prolactin is not clear but the study is under investigation. When level of prolactin is high in men result in infertility of men, erectile dysfunction, sexual desire and level of testosterone is decreased. But current research have also associated that low concentration of prolactin caused psychological variations and sexual problems in men. In this study effect of thimerosal was also observed on the daily sperm production and efficiency of DSP, in our findings thimerosal drastically reduced the DSP and efficiency of DSP in the treated rats. As the decreased levels of testosterone, LH, FSH and PRL due to thimerosal, resulted in decrease in sperm production and their efficiency. Thus, our investigation shows that exposure of thimerosal changes the sex hormonal concentration in rats, which ultimately have adverse effects on the reproductive system of male rats [26-29].

CONCLUSION

Present study concluded that thimerosal has strong effects on male sex hormones and their DSP and efficiency of DSP in adult albino rats.

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Conflict of Interest

Authors declare no conflict of interest.

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