

Histopathological Changes in the Uterus of Rats After an Administration of Sodium Fluoride



Science

KEYWORDS : Sodium fluoride, uterine toxicity, albino rat

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ABSTRACT

After administration of sodium fluoride (5mg/kgbw/day, 10mg/kgbw/day, 15mg/kgbw/day, 20mg/kgbw/day) on albino rats, body weight and histopathology of uterus were observed at a 15 days of duration. At all the doses, body and uteri weight decreased while highly destructed uterine cells were observed as increasing the level of sodium fluoride.

Introduction

Water is overall reflector of animals health provides important profiles for toxicological impacts on animal tissues. The underground water polluted by many hazardous pollutant and fluoride is one of them. It is one of the most important health related geo- environmental issue in India (Sharma *et al.*, 2004). Fluoride has major impact on various human and animal tissues and organ (Whitford, 2000). A number of animal studies have indicated an adverse reproductive and developmental outcome occurs in individual exposed to relatively high concentration of fluoride (Dhar and Bhatnagar, 2009). A study in different animal species like rats, mice and rabbits found alterations in the level of reproductive hormone, fertility and histological structures and developmental outcome (Colline *et al.*, 2001, Elbetieha *et al.*, 2000, Kumar and susheela, 1994). The sodium fluoride exposed animal showed the disturbed uterine cells and its musculature in which they found squeezed endometrial cells, altered blood vessels and accumulation of cells (Kamble and Velhal, 2010).

The aim of the study was to investigate the effect of sodium fluoride on female albino rat and to examine the body weight and organ (uterus) weight and histopathology of uteri in rats that had been exposed to sodium fluoride.

Materials and Methods

Sexually matured female rat *Rattus norvegicus* weighing of about 150-200gm were used for investigation. They were raised in departmental animal house unit at RTM Nagpur university, Nagpur, under the controlled temperature 26 ± 1.0 OC on a 12 hrs light /dark cycle. They were housed in plastic cages with one animal in each and supplied with a standard diet. In experimental study, the rats were divided into five groups in which one as control and other four as experimental groups of animal. The doses of sodium fluoride (NaF SRL (India) limited) at 5mg, 10mg, 15mg and 20mg /kg body weight /day /rat were given orally as a solution in distilled water for 15 days of duration. After completion of exposure period on 16th day, all the groups of animal were sacrificed and immediately desired organs as uterus were continued for histological study by following microtechnique procedure. The microscopic slides were observed for histological alteration in uterus in control as well as sodium fluoride induced experimental rats.

Results

In the present investigation the alterations in the body weight and reproductive organs weight showed inverse proportion to the concentration of toxicant and exposure period (Figs. 1, 2)

In the light micrograph of normal uterine histology was composed of three layers. The outer layer perimetrium was formed by epithelial cells with single nuclei. The thick middle layer myometrium contained smooth muscles. The inner layer endometrium showed well organized uterine lumen lined by columnar epithelial cells, presence of large number of uterine glands around the lumen which were seen to be filled with secretions and large number evenly distributed stromal cells (Fig-3). After exposed to increasing concentration of sodium fluoride changes

in uterine histology were observed in this three layers. In the treated rats the concentration of 5, 10,15 mg/kgbw/day irregularities were seen in the structure.

The myometrium layer was seen to be merger with the endometrial layer also the shape of uterine lumen was changed with no clear lining of luminal epithelial cells, the number of uterine glands were much more reduced with no secretions in the glandular lumen and there was also a reduction in the stromal cells as the concentration of sodium fluoride increased changes were observed (Figs.4, 5, 6). Again in the case of 20mg/kg body weight treated rats this irregularity of three layers were further intense with totally destroyed section of uterus showed complete destruction of uterine lumen, stromal cells along with uterine glands (Fig. 7).

Discussion

In the present investigation the experimental groups of animals showed reduced body weight. The uterine morphology as the dose intoxication period was increased weight of uterus in experimental animals was reduced as compared to the weight of the uterus in control group of animals. The results are in agreement with those reported by (Al-Hiyasat *et al.*, 2000, Darmani *et al.*, 2000, Kamble and Velhal, 2010).

Histological and structural alterations in rat uterus were seen after fluoride treatment as reported earlier (Kamble and Velhal, 2010, Kumari *et al.*, 2011, Zhou *et al.*, 2013) the similar result was observed in present study. The main function of uterus is to harbour the developing fetus during pregnancy and then to expel the product of conception. In the present investigation the adversity of NaF upon uterus was moan and the myometrium layer of uterus was also seen to be drastically damaged with the increasing concentration from 5 to 20 mg/kgbw/day. Myometrium layer merger into the endometrium and these myometrium is composed of numerous fusiform shaped cells that possess gap junctions in between which play an essential role during parturition and in the control and co-ordination of uterine contractility (Tabb *et al.*, 1991).

The toxic effect of fluoride observed in the present study the destruction and reduction in the number of uterine gland, similar result was observed by (Mamta *et al.*, 2011), the destruction and reduction in the uterine gland may lead to suppressed immunity at the time if implantation of blastocyst. Uterine receptivity has been correlated with the proliferation of stromal cells (Tachi *et al.*, 1972). Stromal cell responsible for the progesterone receptor which is not found in luminal epithelial cells (John and Rogers, 1972). The destruction of stromal cell due to toxic effect of fluoride may result in non-proliferation of stromal cell as well as luminal epithelial cells because there exist a paracrine relationship between endometrial stromal cells and epithelial cells (Mamata Kumari *et al.*, 2011). Arnold *et al.*, 2001 demonstrated the normal paracrine relationship between human endometrial stromal cell and epithelial cells which was reconstituted in vitro and it was found that stromal cells regulate both growth and differentiation of human endometrial epithelial cells. The similar results were observed in the present study.

Histological investigation results that increased concentration and exposure period of sodium fluoride in the reproductive organs of female rats, has hazardous and lethal effect indicating its toxicity in more concentration and exposed duration.

Conclusion

Sodium fluoride may have toxic effect on uterine structure. The findings in our present investigation may help to find out the reason behind the cases of still births in women living in endemic areas for fluorosis.

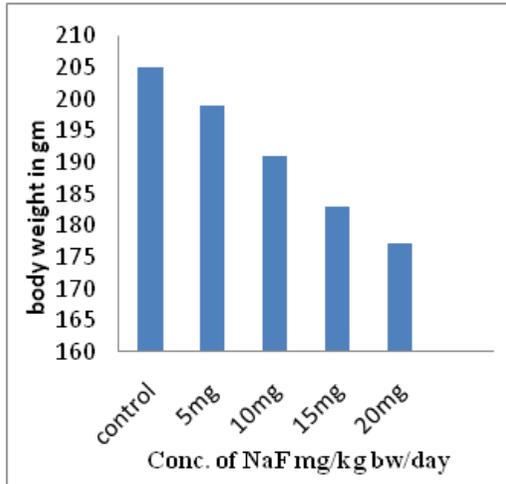


Fig.1. Body weight of control and NaF-treated groups. The values are mean ± SE of p<0.001.

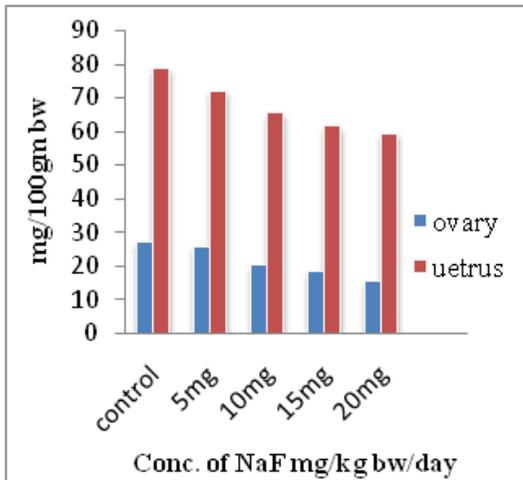


Fig. 2. Organ weight of control and NaF-treated groups. The values are mean ± SE p<0.001

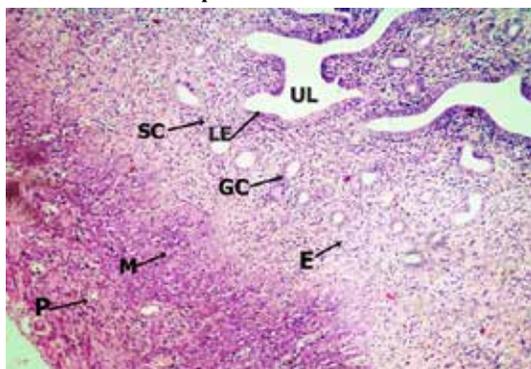


Fig.3. Showing all three layers of control rat uterus P=perimetrium , M=myometrium, E=endometrium, large

number of GC=glandular cell and SC=stromal cell with well organized UL=uterine lumen lined by LE=luminal epithelium. HEx400

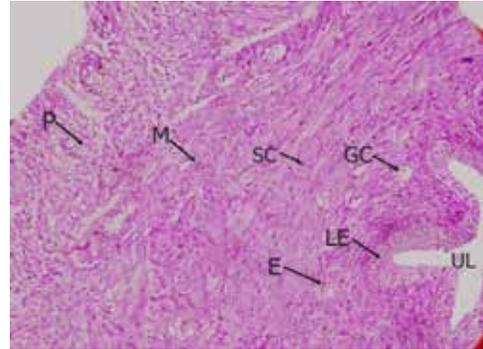


Fig.4. Intoxicated with 5mg/kgbw/day; showing all three layers P=perimetrium, M=myometrium, E=endometrium HEx400

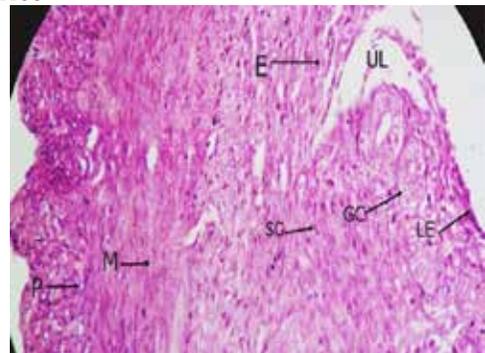


Fig.5. Intoxicated with 10mg/kgbw/day; showing irregularity in three layers P=perimetrium, M=myometrium, E=endometrium HEx400

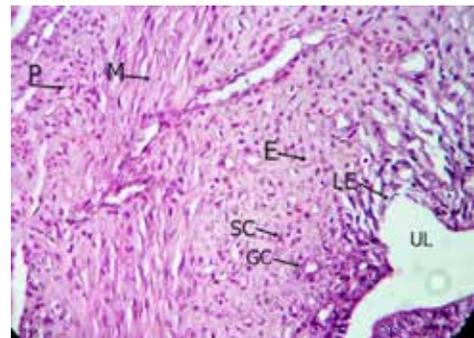


Fig.6. Intoxicated with 15mg/kgbw/day; showing irregularity in three layers P=perimetrium, M=myometrium, E=endometrium HEx400

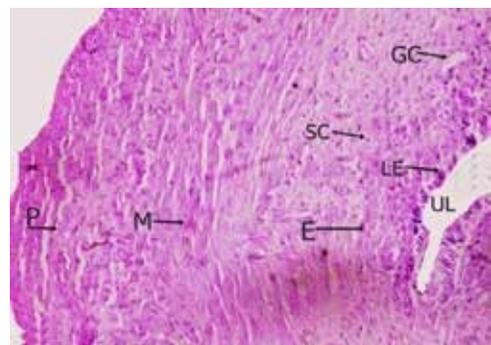


Fig.7. Intoxicated with 20mg/kgbw/day; showing irregularity in three layers P=perimetrium, M=myometrium, E=endometrium HEx400

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