ORIGINAL ARTICLE

Effects of Genetically Modified Cotton Seed Oil on Fertility among Female Albino Rats

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ABSTRACT

Background: Increasing infertility rate among humans is now becoming a global health issue not only in Western countries but also in developing countries.
Aim: To compare the toxic effects of different cottonseed oil on fertility of female rats.
Study design: Randomized controlled trial.
Methodology: Twenty four adult female albino rats (12 weeks of age) were divided into 04 groups. Group-1 (Control) rats were given orally distilled water @ 400mg (equivalent to 400µl)/kg body weight per day. Group-2, Group-3 & Group-4 rats were given cottonseed oil obtained from insecticide free non-GM crop, cottonseed oil obtained from insecticide sprayed non-GM crop, cottonseed oil obtained from insecticide free GM (Bt) crop @ 400mg (equivalent to 432µl)/kg body weight per day, respectively, for a period of 30 days. Data analyzed by SPSS 24.0v.
Results: LH levels (mlU/ml) found in Group-1, Group-2, Group-3 and Group-4 were 7.480±0.389, 7.350±1.049, 7.462±0.513 and 7.753±0.876, respectively. Similarly, FSH levels (mlU/ml) among all groups were 0.891±0.123, 1.231±1.038, 0.847±0.567 and 0.870±0.745, respectively. However, number of follicles and ova were reduced in all other Groups except control.
Conclusion: This study concluded that the crude cottonseed oil significantly affected female rat fertility in terms of reduced number of follicles and ova**.** However, it did not affect fertility parameters like LH levels and FSH levels. Hence, its use in edible products might adversely affect women fertility.
Keywords: Cottonseed Oil, Hormone levels and Number of Follicles.

INTRODUCTION

Increasing infertility rate among humans is now becoming a global health issue not only in Western countries but also in developing countries[1,2]. It has been estimated that almost one third of female infertility was due to ovulation problems. Number of reasons like imbalance of Luteinizing Hormone (LH) and Follicle-Stimulating Hormone (FSH), an injury to the hypothalamus or pituitary gland and pituitary tumors may be the contributing factors[3]. Apart from pathological reasons, woman's ability to get pregnant is also affected by her lifestyle (such as cigarette smoking, obesity and advanced maternal age), occupational risk factors and exposure to chemicals present in environment and diet[4]. However, the concern regarding fertility from exposure to environmental contaminants is increasing.

Fertility problems affect one in seven couples in the UK (National Institute for Clinical Excellence, 2004). The factors that contribute to this trend have not been completely defined. No doubt social / economic factors i.e. better contraception awareness and the increased focus on working due to changed role of women play a role besides others[5]. Up to 26% of infertile couples have unexplained infertility. Genetic transfer of traits in transgenic plants by using recombinant DNA technology is another area related to environmental concerns. Although, biotechnology has developed insect resistant crop varieties, including cotton, but at a cost of human health[6].

The only genetically modified crop approved for commercialization and grown in Pakistan is BT cotton. Since edible cotton seed oil is being obtained from both conventional and biotech cottonseeds therefore present study was carried out to compare the toxic effects of different cottonseed oil on fertility of female rats.

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METHODOLOGY

Twenty four adult female albino rats (12 weeks of age) were divided into 04 groups. The animals were kept at 22±2°C at a humidity level of 55±10% with a 12:12 h light–dark cycle and allowed free access to food and water inside standard metallic cages following the guidelines established by the Ethical and Practical Principles of the Use of Laboratory Animals and University of Health Sciences, Lahore[7].

Group-1 (Control) rats were given orally distilled water @ 400mg (equivalent to 400µl)/kg body weight per day. Group-2, Group-3 & Group-4 rats were given cottonseed oil obtained from insecticide free non-GM crop, cottonseed oil obtained from insecticide sprayed non-GM crop, cottonseed oil obtained from insecticide free GM (Bt) crop @ 400mg (equivalent to 432µl)/kg body weight per day, respectively, for a period of 30 days[8].

On day 31, each rat was anaesthetized by putting it in a plastic container with chloroform soaked cotton wool (Holmer and Tronier, 1975). Two ml blood was drawn in 5 ml disposable syringe by cardiac puncture (Hoff, 2000). Later, it was centrifuged. The clear serum was collected and at -80°C for future estimation of serum FSH and LH levels.

Statistical analysis: Data analyzed by SPSS 24.0v. One-way Analysis of Variance (ANOVA) and post hoc Tukey's Multiple Comparison Test were applied.

RESULTS

LH levels (mlU/ml) among female rats in all Groups were summarized in Table-1. One-way Analysis of Variance showed non-significant differences among means of different groups.

FSH levels (mlU/ml) among female rats in all Groups were summarized in Table-2. One-way Analysis of Variance showed non-significant differences among means of different groups.

The Number of Follicles in different rat groups were summarized in Table 3. One-way ANOVA which showed significant differences among different groups.

Table 4 showed that number of ova in different rat groups were 25.67±12.51, 8.25±4.48, 7.83±3.19 and 7.67±4.26, respectively.

Table 1: LH Levels of all Rat Groups (mlU/ml)

	Groups			
	G_1	G_2	G_3	G_4
Total	44.880	44.127	44.774	46.520
Means	7.480	7.354	7.462	7.753
SD	±0.389	±1.048	±0.513	±0.876
p-value	0.8228			

Table-2: FSH Levels of all Rat Groups (mlU/ml)

	Groups			
	G_1	G_2	G_3	G_4
Total	5.348	7.388	5.084	5.225
Means	0.891	1.231	0.847	0.870
SD	±0.123	±1.038	±0.567	±0. 745
p-value	0.7533			

Table 3: Number of Follicles in different Rat Groups

	Groups			
	G_1	G_2	G_3	G_4
Total	229	106.50	83.50	79.50
Means	38.17	17.75	13.92	13.25
SD	±15.43	±3.46	±4.35	±5.25
p-value	0.0002*			

*Statistically Significant

Table 4: Number of Ova in different Rat Groups

	Groups			
	G_1	G_2	G_3	G_4
Total	154.00	49.50	47.00	46.00
Means	25.67	8.25	7.83	7.67
SD	±12.51	±4.48	±3.19	±4.26
p-value	0.0005*			

*Statistically Significant

DISCUSSION

Present study was carried out to compare the toxic effects of different cottonseed oil on fertility of female rats. Female Albino rats were used as they have short length of the estrous cycle. It makes them ideal for investigation of changes occurring during the reproductive cycle. Literature review has revealed that Wistar Albino rats were used in many studies in order to evaluate the toxic effects of GM food on various organ system[9].

Our results showed that cottonseed oils had no effect on serum LH and FSH levels in rats fed with cottonseed oils compared with control group. Our results were in line with one previous study which suggested that certain factors occur among female animals that nullify its toxicity[2]. Paradoxically, one study showed decreased FSH and LH levels after administration of cottonseed extract to rats. This may be attributed to the fact in that study ethanolic extract of cottonseed was used[10].

Results in the present study regarding estimation for the number of follicles and ova showed that the cottonseed oil, irrespective of the source, had drastically reduced their numbers in the treated groups as compared with control. Our results were in line with one previous study which suggested that completely blocked ovulation in animals treated with locally extracted “crude” cottonseed oil[11]. Similarly, in another study conducted by Chyke et al., 2011 showed complete suppression of the release of ova and highly significant anti-implantation activity in rats[12].

Limitations: Present study had number of limitations like small sample size, financial constrains and limited resources. Only albino female rats were included.

CONCLUSION

This study concluded that the crude cottonseed oil significantly affected female rat fertility in terms of reduced number of follicles and ova**.** However, it did not affect fertility parameters like LH levels and FSH levels. Hence, its use in edible products might adversely affect women fertility.

Author’s contribution: MZ: Overall supervision, write up and literature review. MS & SA: Statistics application analysis literature review, help in write up. AS & TL: Literature review help in write-up.

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