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Antifertility Effects of Aqueous Seed Extract of *Foeniculum vulgare* (Mill.) on Seminal Parameters of Male Albino Mice

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Abstract: ***This study examines the impact of aqueous seed extract of Foeniculum vulgare on several semen parameters in male albino mice, such as epididymal sperm count, seminal pH, sperm motility sperm mortality, and sperm abnormalities.24 male albino mice were included for this research. All mice were divided into two groups as control and treated group. The mice of treated group were administered daily with 0.1 ml (70 mg/kg bd. Wt.) of the aqueous seed extract of F. vulgare for a period of 45 days. They were sacrificed at intervals of 15, 30, and 45 days for analysis. Results on the test sample showed that the highly significant (p<0.001) decrease in sperm count, motility and seminal p after 45 days of exposure as compared to control group of mice. While highly significant increase in mortality and abnormality of spermatozoa were also observed after 45 days of exposure as compared to control group of mice. These findings indicate that the aqueous seed extract of Foeniculum vulgare has anti - fertility effects in male albino mice, as it adversely affects sperm count, motility, and viability, and increases sperm abnormalities.***

Keywords: Anti - fertility, sperm count, sperm motility, sperm mortality, seminal pH, *Foeniculum vulgare*

1. Introduction

Rapid population growth is one of the main causes of poverty and pollution in developing countries like India (Kooti et. al., 2014). The increase in population brings an additional load on the ecosystem. This population explosion can be addressed with only through proper family planning measures. Most contraceptive methods are designed primarily for females, such as tubectomy, IUDs, birth control pills, and condoms. Whereas fewer contraceptive options are available for males, such as condoms, vasectomy, and withdrawal methods, none of which are completely free from unwanted side effects (Ringheim, 1993). Therefore, there is a need to find an effective, safe, eco - friendly, reversible, acceptable, and indigenous contraceptive agent of plant origin. One such herbal contraceptive is *Foeniculum vulgare*. Various studies have reported that the aqueous seed extract of *F. vulgare* showed an anti - spermatogenic effect in mice (Mohamed et. al., 2014). *Foeniculum vulgare* that belongs to Family – Apiaceae, is commonly known as fennel is one of the oldest plants, extensively grown in arid and semi - arid regions and is considered as one of the most important medicinal herbs worldwide. Its economic importance pharmaceutical applications are significant (Rather et. al., 2012). One of the primary reasons why medicinal herbs are considered excellent alternative to chemical medications is their lower incidence of adverse effects. Medicinal herbs reduce the toxicity of synthetic drugs due to their anti - oxidants property and have fewer side effects. These natural substances facilitate the biological balance and prevent the accumulation of drugs in the body. Consequently, various diseases can be managed using medicinal plants *F. vulgare* has been reported to exhibit anti - inflammatory activity (Setyawati et. al., 2020), osteogenic activity (Orhan et. al., 2012), antipyretic activity (Tanira et. al., 1996), anti - oxidant property (Madhavi et. al., 2017), anti - cancer activity (Zaahhouk et. al., 2015), anti - diabetic activity (Soud et. al., 2015), anti - bacterial activity (Shahat et. al., 2011), reduce obesity (Ahmed et. al., 2022), anti - nephrotoxicity (Alsalame et. al., 2018), anti - stress activity (Sadeghpour et. al., 2015), anti - fertility activity (Mansouri et. al., 2016) etc.

Other plants like *Carica papaya* (Kumari et. al., 2017) and *Aegle marmelos* (Kumar et. al., 2017) have also been reported anti - fertility property on the seminal quality of mice.

2. Material and Methods

Plant Material

Fennel seeds were purchased from a local market in Bhagalpur district. To remove unwanted dust, the dried fennel seeds were cleaned with tap water. Remaining excess moisture was wiped off using a cotton cloth. The seeds were then dried at room temperature for 48 hours. Finally, the dried seeds were crushed using a grinder mill and sieved to achieve a powder particle size of less than 0.2 mm.

Plant Extract Preparation

The aqueous extract was prepared by dissolving 35 gm of the milled powder of *F. vulgare* seeds in 1000 ml of distilled water. The mixture was refluxed overnight. After reflux, the mixture was filtered with a large filter paper and then filtered through a Buchner funnel. The filtered solution was stored in a glass jar for the treatment of the mice. The filtrate was kept at 4°C in the refrigerator until use (Shayan et. al., 2019).

Model Animal Selection

In this investigation 24 Swiss albino mice of aged 12 - 14 weeks were included, weighing on average 25 grams to 30 grams, obtained from the authentic source of P. G. Department of Zoology, Bhagalpur. All male mice were caged in propylene cage and maintained under hygienic

conditions in a well - ventilated room. They were fed bread, green vegetables, nuts, milk, and germinated seeds along with water ad libitum.

Dose and Duration: -
A systematic study was performed on albino mice that were divided into 2 groups containing 6 mice in each. The animals were treated as per the following protocol.

Group1: This group of animal was considered as control group.

Group2: Animals of this group were considered as the treated group and fed 0.1ml of aqueous seed extract of *F. vulgare* (70mg/Kg bd. Wt.) was given orally for 15, 30, and 45 days of exposure.

Statistical Analysis:
Student t - test was applied for the analysis of data.

3. Result

Result presented in table - 1 shows that the highly significant ($p<0.001$) decline in sperm count, sperm motility and seminal pH as compared to control group of mice from 15 to 45 days of exposure. The result also shows that the highly significance ($p<0.001$) increase in mortality and abnormality of spermatozoa as compare to control group of mice from 15 to 45 days of exposure *F. vulgare* at the dose of (70 mg/kg bd. wt.) 0.1 ml per mice/day.

Table 1: Showing the effects of aqueous seed extract of *Foeniculum vulgare (*Mill.) on Sperm Counts, Motility, Mortality, Seminal pH, Abnormality of Spermatozoa of male albino mice

Group	Sperm Counts (x10^4 Sperms/ml)	Motility (In %)	Mortality (In %)	Seminal pH	Abnormality of Spermatozoa (In %)
Control	230.16±7.21	83.33±4.46	16.66±2.16	7.20±0.17	17.50±1.45
15 days	184.5±4.68*	69.66±1.47*	30.34±1.77*	6.45±0.12*	28.00±0.98*
30 days	148.00±5.30**	56.83±2.08***	43.17±1.42***	5.90±0.15**	38.00±1.44***
45 days	108.83±4.40***	41.00±1.39***	59.00±1.74***	5.10±0.21***	52.00±1.16***

Data presented as Mean SEM; *, **, *** shows significant at 0.05, 0.01 and 0.001 level with the value in control.

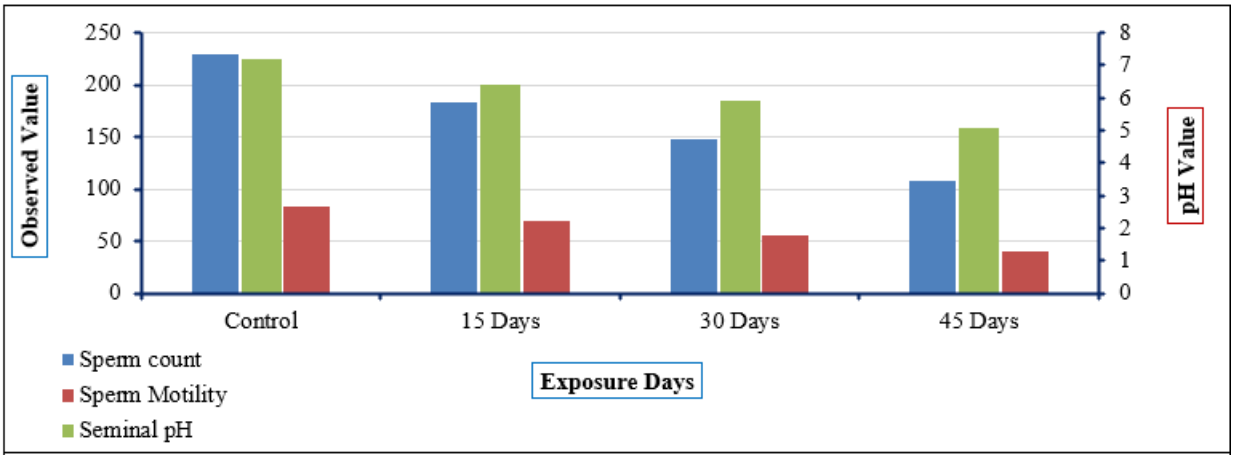

Figure 1: Histogram showing the changes in Sperm Counts (x104 Sperms/ml), Motility, Seminal pH during treatment of aqueous seed extract of Foeniculum vulgare in Swiss albino mice

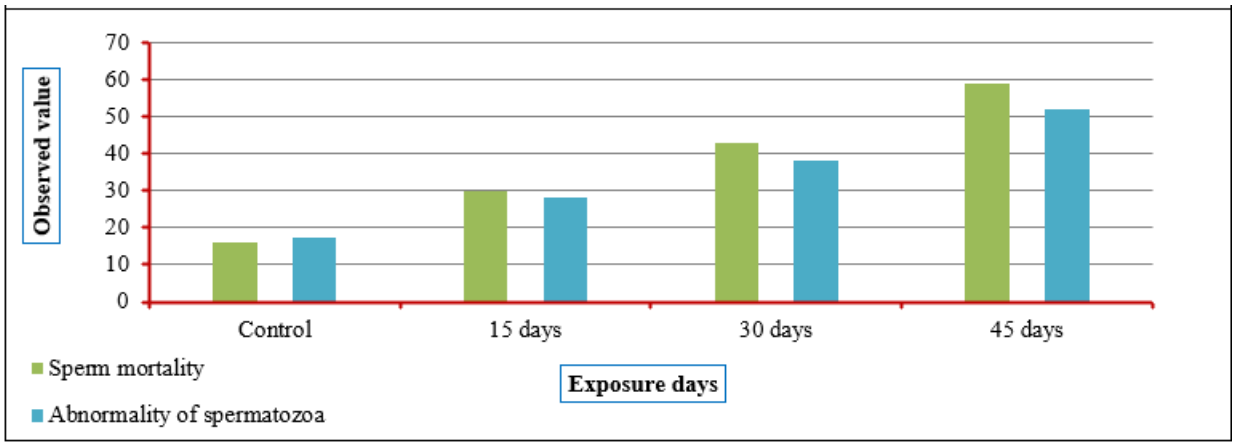

Figure 2: Histogram showing the changes in Mortality Abnormality of Spermatozoa during treatment of aqueous seed extract of *Foeniculum vulgare* in Swiss albino mice.

4. Discussion

In the current study it was found that the sperm count, sperm motility and seminal pH of *Foeniculum vulgare* treated mice declined significantly ($p<0.001$) from 15 to 45 days of exposure. In a similar study Kumar et. al. found that the aqueous extract of *Aegle marmelos* decreases sperm count, sperm motility, seminal pH significantly ($p<0.001$) as compare to control group of mice. This may be due to anti - spermatogenic and anti - androgenic activity of *Aegle marmelos (*Kumar et. al., 2017). In another study it was also observed that, the aqueous extract of *Carica papaya* decrease the sperm count, motility of spermatozoa and seminal pH significantly ($p<0.001$) as compare to control group. This reduction in the parameters may be due to anti - testicular activity of *Carica papaya* (Kumari et. al., 2017). Sperm maturation in the epididymis is indicated by a decrease in sperm motility, which also lowers the rate of female gamete fusion (Lohiya & Goyal, 1992). These processes are dependent on the quantity of androgen (Satyaraj et. al., 2010). In the present study it might be possible that due to the same reason *F. vulgare* decreased the sperm count, motility and seminal pH in the treated group of mice.

The study also found that, the mortality of spermatozoa and abnormality of spermatozoa increased highly significantly ($p<0.001$) from 15 to 45 days of exposure of aqueous seed extract of *F. vulgare* at the dose of 0.1ml/mice/day (70mg/kg bd. wt.) as compare to control group of mice. Androgen deprivation may be the cause of the higher proportion of spermatozoa mortality in the treated group of mice (Ahmad et. al., 2002). Seminal plasma becomes acidic if its pH drops, and sperm become extremely delicate in an acidic environment, leading to a high spermatozoa death rate. This contributes to the rise in sperm abnormalities and mortality (Turner and Reich, 1985). In another study some researchers also reported that, due to the low pH level in seminal plasma sperms become more fragile which causes high mortality and abnormality of spermatozoa (Pragya et. al., 2012).

5. Concluson

From this study it can be concluded that *F. vulgare* has antifertility property which leads to great reduction in sperm count, motility of spermatozoa and seminal pH. It significantly increases the mortality and abnormalities of spermatozoa. Hence, it may be a good male contraceptive agent to control the population which is locally available, cost effective, cheaper, indigenous and have without any side effects.

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Conflict of Interest:
Author has no conflict of interest.

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