



Treating anoestrous and delayed pubertal Achai dairy cattle with *Ferula jaeschkeana*

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Abstract

Ferula Jaeschkeana is renowned for its application in human reproductive disorders and its estrogenic effects observed in laboratory animals. This study aimed to investigate the reproductive implications of *Ferula Jaeschkeana* (FJ) on animals exhibiting anestrus and delayed pubertal reproductive disorders. The experiment involved 24 Achai dairy cows divided into four groups based on different doses of *Ferula Jaeschkeana* i) FJ-0, serving as the control group; ii) FJ-30 receiving 30 g; iii) FJ-50 receiving 50 g; and iv) FJ-70 receiving 70 g of the product. The herb, prepared as a shade-dried powder, was administered orally to the animals as a bolus along with their regular feed. Consequently, 33.34% animals from the delayed pubertal heifer group and 75% from the anestrus multiparous animal group (54.16% of entire treated animals) displayed behavioral estrus manifestations such as restlessness, bellowing, and mounting. Physical changes, including vulvar swelling and mucus discharge, were observed in these animals. Additionally, a small percentage 8.33% of animals in the delayed pubertal heifer group and 58.33% of animals from the anestrus multiparous animal group attained pregnancy, as confirmed on day 90 post-breeding. Furthermore, a significant elevation in serum estradiol levels and a reduction in serum progesterone concentrations were noted in FJ-50 and FJ-70 groups compared to the control (FJ-0) and the FJ-30 group. Thus, it can be concluded from this study that administering 50 grams of *Ferula Jaeschkeana* herb roots or extract to anoestrous and delayed pubertal Achai cows may induce hormonal alterations, promote behavioral estrus, and facilitate conception in this breed of cattle.

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1. Introduction

Reproductive disorders and anomalies are significant concerns for animal producers, as they directly affect reproductive efficiency in domestic animals. These disorders include anestrus, silent estrus, delayed puberty, and post-parturient complications such as mastitis and retained placental membranes. Anestrus, in particular, is prevalent and detrimental to the productivity of a dairy animal (Kumar et al. 2013). Delayed puberty, another common reproductive anomaly, poses economic challenges, especially in breeds like Achai cattle known for their resilience to local conditions. Various factors contribute to delayed puberty, including nutrition, seasonal births, and environmental extremes (Opsomer et al. 2000). Livestock farming is integral to the economy and social fabric of communities in the northern highlands of Pakistan, where traditional remedies are relied upon for treating livestock ailments. However, the use of commercial medical products has somewhat diminished the

use of herbal medicines, posing a risk to the preservation of indigenous knowledge and medicinal plant species. Noteworthy traditional remedies include *Artemisia absinthium*, *Zizyphus jujuba*, and *Daphne oleoides* for internal parasites, *Nicotiana tabacum* leaves for external parasites, and *Eucalyptus canaldulensis* and *Salvia moorcroftiana* for digestive disorders.

Research by Kumawat et al. (2016) explored the effects of *Aegle marmelos* and *Murayya koenigii* on estrus induction, conception, and calving rates in delayed pubertal heifers, demonstrating a significant induction of fertile estrus with 61.5% conception rate. Anestrus, a common reproductive disorder, negatively impacts dairy cow productivity and reproductive performance, resulting in economic losses. Studies estimate substantial economic losses associated with anestrus, underscoring the importance of effective treatments. Herbal remedies have long been utilized to enhance fertility and manage reproductive disorders in livestock due to factors such as accessibility, cost-effectiveness, and safety. Ethno-veterinary medicines, widely used, are driven by economic constraints

and shortage of qualified personnel (Kumawat et al. 2016). Documenting and validating these traditional practices are crucial for advancing therapeutic approaches.

One such herbal plant, *Ferula Jaeschkeana*, found abundantly in the northwest Himalayan region of Pakistan, has shown promise for its reproductive biological properties. Previous studies have explored its anti-reproductive effects in human females, isolating active compounds with estrogenic properties (Singh and Booth 1979). However, research on its potential for treating reproductive disorders in animals, including Achai cows, remains limited (Ayoka et al. 2008). Therefore, this study aimed to investigate the efficacy of *Ferula Jaeschkeana* in inducing estrus and treating anestrus and delayed puberty in Achai cows. The findings are expected to contribute to novel therapeutic approaches in animal reproduction.

2. Materials and methods

2.1 Selection of animals

The study was conducted at the Achai Cattle Conservation Center and Development Farm in District Lower Dir Timergara. Twenty-four dairy Achai cattle, comprising 12 delayed pubertal heifers and 12 anestrus multiparous cows, were selected. A detailed gynecological examination was conducted to determine any structural abnormality and in the same manner the multiparous animals were examined at least 3-5 months after parturition. All delayed pubertal animals in this study were above 25 months of age, with body weights ranging from 200 to 300 kg and a body condition score of 3. The animals in the anestrus group were multiparous and exhibited similar average body weights ranging from 250 to 350 kg, with body condition scores between 3 and 4. Both groups were subsequently subdivided into three additional groups (FJ-30, FJ-50 and FJ-70) along with the control groups based on treatment levels, with the aim of determining the optimal dosage of FJ for inducing estrus.

2.2 Collection and feeding of plants

The roots of the *Ferula Jaeschkeana* plant were collected and shade-dried. After drying, the roots were cut into small pieces with a knife and ground into a powder to facilitate easy mixing with animal feed or other food boluses. This powder was then stored for later use. Over a period of two days, cows were fed varying doses of the powdered Ferula as part of their regular feeding routine. Specifically, the FJ-30 group received 30 grams, the FJ-50 group received 50 grams, and the FJ-70 group received 70 grams in the feeding trail of two days .

2.3 Blood collection

Blood samples were collected from each animal prior and 24 hours following treatment (feeding of ferula) to assess changes in hormone profiles during the experimental trial. Serum was separated and stored at -20°C until analysis.

2.4 Insemination and pregnancy diagnosis

Animals showing signs of estrus were inseminated with quality semen. Pregnancy diagnosis was conducted manually 45 days post-insemination, followed by confirmation after 90 days.

2.5 Determination of hormone concentrations

Serum progesterone and estradiol levels were measured using commercially available ELISA kits and readers. Hormone levels from all samples (before and after feeding Ferula) were analyzed collectively to assess any differences.

2.6 Statistical analysis

Data were expressed as percentage \pm standard deviation. Significance levels were set at 0.05 for both anestrus and delayed puberty groups. Statistical analysis of hormone concentrations among treated groups was performed using factorial design with a significance level of 0.05.

3. Results

Following the experimental trial, behavioral and physical signs of estrus were observed in 54.16% of animals in the experimental groups (specifically subgroups FJ-50 and FJ-70), characterized by restlessness, tail raising, bellowing, vulva swelling, and mucus discharge. Estrus detection in 33.33% of delayed pubertal heifers and 75% of anestrus multiparous cows was confirmed via rectal palpation and mucus discharge, followed by the insemination with quality semen. Subsequently, 8.33% of delayed pubertal heifers and 58.3% of anestrus multiparous cows became pregnant, with confirmation three months post-breeding. Notably, the majority (7 out of 8) of pregnancies occurred in the anestrus group, with only one pregnancy in the delayed pubertal heifers group.

Analysis of blood collected from both experimental groups revealed significant differences in estrogen and progesterone levels before and three days after feeding the plant product compared to control. Specifically, subgroups FJ-50 and FJ-70 exhibited a significant decrease in progesterone concentration and a marked increase in estradiol levels three days post-feeding. Conversely, no significant differences in serum hormone levels were observed between subgroup FJ-30 and the control groups of both experimental sets.

3.1 Serum progesterone

The mean serum progesterone concentrations across all the treated and control groups are presented in Table 1. In subgroups FJ-50 and FJ-70 of the anestrus multiparous group, progesterone levels were initially high before feeding, followed by a significant decrease post-feeding, resembling the estrus phase. Conversely, no significant difference was noted between the control and FJ-30 treated groups. In the delayed pubertal group, there were no significant differences in serum progesterone concentrations between FJ-30 and FJ-50 subgroups, while a significant difference was observed between subgroup FJ-70 and control group FJ-0.

3.2 Serum estradiol

The mean serum estradiol concentrations for all treated and control groups are presented in Table 2. Prior to *Ferula Jaeschkeana* feeding, estradiol concentrations were low. However, a significant increase in serum estradiol levels was observed after feeding in subgroups FJ-50 and FJ-70 of both experimental groups (anestrus multiparous and delayed

Table 1 Mean serum progesterone concentration (ng/dl) in animals fed different levels of *Ferula Jaeschkeana* (FJ) powder

Progesterone	Treatment	Mean ± S.D	Difference with control ± S.D	P value
Progesterone (AMC)	Control	0.453 ± 0.36		
	FJ-30	0.404 ± 0.062	0.495 ± 0.714	0.496
	FJ-50	0.127 ± 0.062	0.3258 ± 0.714	0.00*
	FJ-70	0.125 ± 0.062	0.328 ± 0.714	0.00*
Progesterone (DPC)	Control	0.518 ± 0.62		
	FJ-30	0.68 ± 0.107	0.158 ± 12354	0.216
	FJ-50	0.35 ± 0.107	0.166 ± 12354	0.193
	FJ-70	0.191 ± 0.107	0.3278 ± 12354	0.015*

* Significance levels (P<0.05); AMC: Anestrus multiparous cows, DPC: Delayed pubertal cows; SD: Standard deviation

pubertal group), indicating the onset of estrus. Conversely, subgroup FJ-30 in both groups did not exhibit significant differences in serum estradiol concentrations compared to the control group FJ-0.

3.3 Comparison between delayed pubertal and anestrus animal groups

The comparative effect of feeding *Ferula Jaeschkeana* on the

differences were observed in behavioral and reproductive outcomes. Specifically, only 33.34% of animals in the delayed pubertal group exhibited estrous behavior, whereas 75% of cows in the anestrus group displayed such behavior. Similarly, conception rates differed, with only 8.33% of delayed pubertal animals and 58.33% of anestrus animals becoming pregnant, as confirmed 90 days post-breeding. Though there is a complete paucity of literature pertaining to the role of *Ferula Jaeschkeana* in dairy animals, the effects of *Aegle marmelos* and *Murayya*

Table 2 Mean serum estradiol concentration (pg/ml) in animals fed different levels of *Ferula Jaeschkeana* (FJ) powder

Progesterone	Treatment	Mean ± S.D	Difference with control ± S.D	P value
Progesterone (AMC)	Control	9.492 ± 3.43		
	FJ-30	18.220 ± 5.938	8.728 ± 6.856	0.218
	FJ-50	45.875 ± 5.938	36.383 ± 6.856	0.000*
	FJ-70	47.9525 ± 5.938	38.46 ± 6.856	0.000*
Progesterone (DPC)	Control	13.182 ± 4.129		
	FJ-30	16.412 ± 7.151	-3.23 ± 8.25	0.700
	FJ-50	30.098 ± 7.151	-16.91 ± 8.26	0.054*
	FJ-70	36.145 ± 7.151	-22.96 ± 8.26	0.012*

* Significance levels (P<0.05); AMC: Anestrus multiparous cows, DPC: Delayed pubertal cows; SD: Standard deviation

anestrus multiparous cows and delayed pubertal cows is depicted in Table 3.

4. Discussion

The current study investigated the efficacy of *Ferula Jaeschkeana* in inducing estrus and improving reproductive outcomes in Achai dairy cattle. Results showed promising outcomes, with significant improvements in estrus behavior, conception rates, and hormonal profiles in treated groups, particularly in those receiving 50 g of *Ferula Jaeschkeana*. Although there were significant differences in the hormonal profiles of delayed pubertal and anestrus cow groups, much pronounced

koenigii on estrus induction, conception, and calving rates in delayed pubertal heifers have been reported, demonstrating a significant induction of fertile estrus with 61.5% conception rate (Kumawat et al. 2016).

Furthermore, physical signs of heat, such as mucous discharge, bellowing, and mounting were more pronounced in the anestrus group compared to the delayed pubertal group. These findings suggest that treatment with *Ferula Jaeschkeana* is more effective in anestrus animals compared to delayed pubertal animals in inducing estrus and improving reproductive outcomes. These findings suggest that the plant's estrogenic compounds may contribute to hormonal changes

Table 3 Mean serum progesterone (ng/dl) and estradiol (pg/ml) concentration in animals fed different levels of *Ferula Jaeschkeana* (FJ) powder

Parameters	Before feeding (control) Mean \pm S.D	After feeding Mean \pm S.D	Mean difference \pm S.D	P value
Progesterone (ng/dl) (AMC)	0.519 \pm 0.062	0.464 \pm 0.107	0.055 \pm 0.045	0.00*
Progesterone (ng/dl) (DPC)	0.453 \pm 0.36	0.219 \pm 0.36	0.324 \pm 0.5	0.00*
Estrogen (pg/ml) (AMC)	9.492 \pm 3.428	37.35 \pm 5.938	27.858 \pm 2.51	0.00*
Estrogen (pg/ml) (DPC)	13.182 \pm 3.77	27.55 \pm 3.778	24.167 \pm 5.33	0.00*

* Significance levels (P<0.05); AMC: Anestrus multiparous cows, DPC: Delayed pubertal cows; SD: Standard deviation

and fertility enhancement, making it a potential treatment for delayed puberty, silent estrus, and anestrus in Achai cattle. While the study provides valuable insights into the reproductive benefits of *Ferula Jaeschkeana*, further research is warranted to elucidate its functional and molecular mechanisms in reproductive biology. Given the limited existing literature on the topic, additional studies are needed to strengthen understanding and validate the findings.

5. Conclusion

In conclusion, feeding 50 g of *Ferula Jaeschkeana* root powder enhances fertility and promotes estrus signs in Achai dairy cattle. However, further research is recommended to explore the functional and molecular mechanisms underlying the plant's reproductive benefits.

Declarations

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