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Therapeutic efficacy of Ovsynch and progesterone based protocol in goats with ovarian follicular cyst

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Abstract

Ovarian follicular cysts are an important cause of infertility in goats, yet limited information is available regarding their clinico-endocrine characteristics and therapeutic management. Fourteen goats with follicular cysts were evaluated using ultrasound and were treated with two protocols: Ovsynch (Group I, n=6) and intravaginal progesterone sponge (Group II, n=8). Affected goats had a mean age of 2.4 ± 0.27 years and body condition score of 2.5–3.5. Follicular cysts were either solitary with mean size of 11.0 ± 0.9 mm or multiple having a mean size of 9.50 ± 0.27 mm. The mean wall thickness of cyst was 1.10 ± 0.023 mm and the uterus was uniformly hypoechoic with occasional luminal contents. Serum oestradiol concentration was 41.78 ± 4.26 pg/dL and 36.74 ± 3.11 pg/dL in group I and group II, respectively, in affected goats and following treatment the mean values were 42.38 ± 6.67 pg/dL in Group I and 40.51 ± 3.64 pg/dL in Group II at induced oestrus. Mean progesterone level was 0.62 ± 0.28 ng/mL on the day of presentation and remained <1 ng/mL at induced oestrus in both the groups. Post-treatment fate of cyst revealed regression (16.7% Group I; 12.5% Group II), luteinisation (50% both groups) and persistence (33.3–37.5%). Dominant follicles were detected in 50 percent of goats in both the groups following therapy with non-significant difference in the mean size (7.35 ± 0.51 mm in Group I; 6.90 ± 0.54 mm in Group II). Conception rates at induced oestrus were 16.67 and 50 per cent, respectively, indicating better outcomes with the intravaginal progesterone sponge protocol.

Keywords: *Goat, Ovarian follicular cyst, Ultrasonography, Ovsynch, Intravaginal Progesterone sponge*

Ovarian follicular cysts represent an important cause of infertility and subfertility in domestic ruminants and are increasingly recognised as a significant reproductive disorder in goats. Although extensively studied in cattle, information on the occurrence, diagnosis, pathophysiology, and therapeutic management of follicular cysts in goats remains comparatively limited. Ovarian cysts have been observed as one of the most common causes of infertility in goats with an incidence of 2.59 per cent in abattoir studies (Beena et al., 2015). In small ruminant production systems, reproductive inefficiency has major economic implications through prolonged kidding intervals, reduced lifetime productivity and increased culling rates. Consequently, early diagnosis and effective treatment of ovarian cystic conditions are essential

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for improving reproductive performance and overall herd profitability.

Follicular cysts in goats are classically defined as thin walled, fluid filled ovarian structures >10 mm persisting for more than 10 days in the absence of functional luteal tissue (Medan et al., 2004). These cysts cause hormonal imbalance, anoestrus, irregular oestrous cycles and reduced conception. Their development is attributed to disruption of the hypothalamic pituitary gonadal axis, in which altered oestrogen feedback results in abnormal luteinising hormone release, failure of ovulation and persistence of dominant follicles that secrete inhibin and oestradiol (Vanholder et al., 2006), thereby delaying follicular turnover (Todoroki et al., 2004). Diagnosis is based on clinical signs such as nymphomania and prolonged anoestrus, with ultrasonography regarded as the gold standard in goats. Therefore, ultrasonography has become an indispensable tool for accurate diagnosis, allowing real time visualisation of ovarian structures, assessment of cyst number, size, wall thickness, and evaluation of luteal tissue. In addition, hormonal profiling, particularly serum progesterone and oestradiol concentrations, provides valuable information regarding ovarian functional status and aids in differentiating follicular cysts from luteal cysts and other ovarian pathologies.

Therapeutic strategies for follicular cysts aim to restore normal ovarian cyclicity by inducing luteinisation or regression of cystic follicles and synchronising emergence of a new follicular wave. Protocols based on gonadotrophin releasing hormone (GnRH), prostaglandin $F_2\alpha$ ($PGF_2\alpha$), and exogenous progesterone have been used successfully in goats (Medan et al., 2004). However, comparative evaluations of these treatments in goats, incorporating clinical, ultrasonographic and endocrine parameters, remain limited in follicular cyst conditions. Therefore, the present study aimed to evaluate serum hormonal profiles in goats with follicular cysts and to compare the therapeutic efficacy of Ovsynch and progesterone-based vaginal sponge protocols.

Materials and methods

Goats presented to TVCC Mannuthy, UVH Kokkalai, and University Goat and Sheep Farm, Mannuthy with a history of reproductive failure were screened for ovarian follicular cysts. Animals were selected based on clinical signs suggestive of ovarian dysfunction, including prolonged anoestrus, repeat breeding, or irregular oestrous behaviour. After detailed anamnesis and body condition scoring, transrectal ultrasonography was carried out to assess the ovarian function. Both ovaries were examined to identify the presence, size, number and perifollicular blood flow of cystic structures. Follicular cysts were diagnosed based on the presence of thin walled, anechoic fluid filled structures exceeding 10 mm size and persisting in the absence of a corpus luteum (Khan et al., 2016). Uterine echotexture and presence or absence of luminal contents was also evaluated. Since the animals were presented as clinical infertility cases, diagnosis was based on a single ultrasonographic examination supported by clinical findings and hormonal profiling. In particular, low serum progesterone concentrations (<1 ng/mL) were used to help rule out luteal cysts. Goats with follicles ≥10 mm were allocated randomly to Group I (Ovsynch, n=6) and Group II (intravaginal progesterone sponge, n=8). Group I received double injections of Buserelin acetate 10 µg intramuscular (IM) on days 0 and 9 and Cloprostenol 125 µg IM on day 7, followed by natural service (NS) 12–24 h later. Group II received intravaginal progesterone sponge 350 mg for 5 days from day 0, Cloprostenol 125 µg IM on day 5 and Buserelin 10 µg IM, followed by NS on day 7.

Ultrasonographic examinations were repeated to monitor ovarian response to treatment, characteristics of dominant follicles and resolution of cystic structures on the day of induced oestrus. Blood samples were collected for the estimation of oestradiol on day 0 and on the day of induced oestrus. Progesterone was estimated on days 0, 7, 10 (Group I) and 0, 5, 7 (Group II). Following treatment, animals were closely observed for the behavioural and physiological signs of oestrus. The oestrus response rate and duration of oestrus were also recorded and compared. Pregnancy diagnosis was performed using transabdominal ultrasonography on day 45 post-mating. Presence of embryonic vesicles and/or foetal structures was used to confirm pregnancy. Conception rate was calculated as the percentage of treated animals that were confirmed pregnant out of the total number of animals mated. Data were analysed using SPSS version 24. The Mann–Whitney U test was used for dominant follicle number and size, Fisher's exact test for oestrus response rate and conception rate, independent and paired t-tests for serum E_2, and repeated measures analysis of variance (ANOVA) for serum P_4.

Result and discussion

Out of 288 goats presented with a history of infertility, 14 animals were diagnosed with ovarian follicular cysts, resulting in an overall occurrence of 4.86 per cent. It represents a clinically relevant cause of infertility in small ruminants and observed occurrence is lesser than cattle which suggest that follicular cysts in goats may be underdiagnosed due to subtle clinical presentation and lack of routine ultrasonographic screening. Among the affected goats, 64.3 per cent (9/14) exhibited nymphomania or frequent oestrus, whereas 35.7 per cent (5/14) showed anoestrus of approximately three to four month's duration. The predominance of nymphomania and prolonged anoestrus among affected animals reflected the variable endocrine manifestations of follicular cysts. Persistent oestrogen secretion from cystic follicles may account for behavioural signs of nymphomania, whereas disruption of follicular wave dynamics and failure of ovulation may result

in anoestrus in other animals (Medan et al., 2004).

The age of goats affected with ovarian follicular cysts ranged from one to four years, with an overall mean age of 2.4 ± 0.27 years indicating predominance of the condition in young, reproductively active does and consistent with the reports of Medan et al. (2004; 3–6 years), Gupta et al. (2024; 2–5 years) and Al-Wan and Amine (2010; 2–5 years). Cysts were most frequent in first parity goats (50%), followed by third parity (28.6%), second parity (14.3%) and >4 (7.1%), indicating greater susceptibility in low parity animals, and could be correlated to the transitional endocrine states or metabolic stress associated with early reproductive life. Margatho et al. (2019) reported similar higher prevalence in primiparous goats, whereas Gupta et al. (2024) observed that 80.48 per cent of goats affected with hydrometra and concurrent ovarian cysts were multiparous.

Most goats maintained moderate body condition scores (2.5–3.5; 92.86 %), which was consistent with the findings of Medan et al. (2004) and Khan et al. (2016), suggesting that overt under nutrition or over conditioning was not a major contributing factor in the present population. This finding indicated that follicular cyst development in these goats was more likely related to endocrine dysregulation rather than gross nutritional imbalance (Wiltbank et al., 2006). The absence of postpartum complications further suggested that uterine pathology and puerperal disease were not primary predisposing factors in this group, which is contradictory to the report of Shringi et al. (2016), who associated cysts with postpartum uterine infections. However, Laporte et al. (1994) suggested that cyst formation in dairy cattle was primarily linked to ovarian dysfunction rather than uterine pathology.

Ultrasonographic findings demonstrated that multiple follicular cysts (Fig 2) were predominant (2 – 9 numbers; 85.7%) and solitary cysts (Fig 1) were observed only in 14.20 per cent goats. While Al-Wan and Amine (2010) reported exclusively single cysts, the presence of multiple cysts had been documented by Kouamo et al. (2020) in goats. The discrepancy might be related to differences in the chronicity of the cystic condition, as prolonged endocrine dysfunction may favour repeated follicular persistence and multiple cyst formation. In the present study, cysts were mainly unilateral (71.4%), with left ovarian predominance (42.85%) than the right (28.57 %), consistent with reports of Al-Wan and Amine (2010). While bilateral involvement was observed in 28.57 per cent of affected goats which was also observed by Kouamo et al. (2020). Laterality patterns varied among studies and might be influenced by breed, management, and diagnostic methodology.

Mean diameter of single cysts was 11.0 ± 0.9 mm, whereas multiple cysts were smaller (9.50 ± 0.27 mm), and wall thickness averaged 1.10 ± 0.023 mm, comparable to the descriptions by Al-Wan and Amine (2010). Mild to moderate perifollicular blood flow suggested partial luteinisation (Fig 2) and was detected in 50 per cent of cases, resembling findings of Balaro et al. (2022). Such findings emphasised the value of Doppler ultrasonography in refining diagnosis and understanding cyst physiology. Uterine echotexture was heterogeneously hypoechoic before the treatment, consistent with Simoes et al. (2009), and coincided with elevated oestradiol concentrations (38.90 ± 2.53 pg/dL), indicative of oestrogen-induced endometrial oedema. Luminal fluid was detected in 28.5 per cent of goats prior to the treatment with lumen diameter of 1.2–5.8 mm.

Before treatment, serum oestradiol concentration in cyst-affected goats was 41.78 ± 4.26 pg/dL and 36.74 ± 3.11 pg/dL in group I and group II respectively, markedly higher than values reported by Medan et al. (2004; 12.7 ± 0.9 pg/mL) and Khan et al. (2016; 5.8 pg/mL), reflecting substantial steroidogenic activity of cystic follicles. These findings aligned with observations in cattle, where follicular cysts secrete high oestradiol with minimal progesterone, resembling dominant follicles (Vanholder et al., 2006). On

Fig 1. Solitary follicular cyst

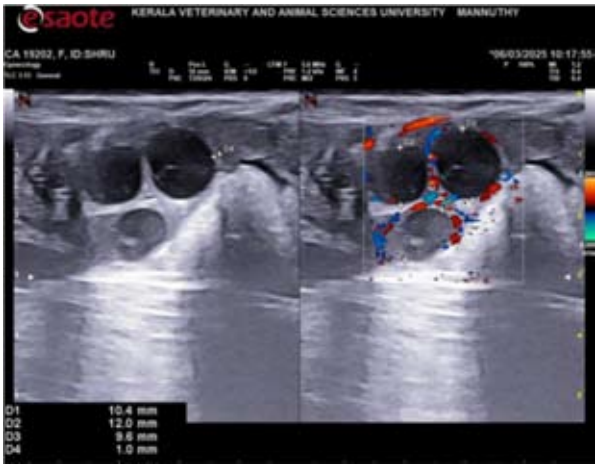

Fig 2. Multiple follicular cyst with luteinisation around the cyst wall

the day of induced oestrus, oestradiol concentrations were 42.38 ± 6.67 pg/dL in Group I and 40.51 ± 3.64 pg/dL in Group II, with no significant difference, contrasting with lower values reported in goats by Medan et al. (2004; 3.5 ± 0.4 pg/mL) and Khan et al. (2016; 0.42 pg/mL). These concentrations approximated the pre-ovulatory range in normal cyclic Beetal goats (Murtaza et al., 2019; 11.1 ± 2.9 pg/mL) but were higher, likely due to breed differences or enhanced follicular recruitment following oestrus induction. Comparable peaks were reported by Chemineau et al. (1982; 13.8–44.3 pg/mL at 18 h post-PMSG), though values exceeded those reported by Bareera (2022) and Aiswariya (2024) under various progesterone- and GnRH-based protocols, reflecting differences in ovarian status and protocol design.

Mean serum progesterone prior to treatment was 0.62 ± 0.28 ng/mL, indicating low luteal activity typical of follicular cysts and comparable to the observations of Medan et al. (2004; 0.7 ± 0.2 ng/mL) and Khan et al. (2016; ~1.0 ng/mL). A significant rise ($p<0.05$) in progesterone on day 7 in Group I and day 5 in Group II indicated luteinisation or formation of functional luteal tissue, reaching 13.5 ± 1.69 ng/mL in the Ovsynch group and 6.87 ± 1.09 ng/mL in the sponge group. These values aligned with Medan et al. (2004; 4.0 ± 0.5 ng/mL by Day 10) and Khan et al. (2016; 11 ng/mL by Day 7). Higher progesterone concentrations in Ovsynch reflected effective luteinisation or ovulation, whereas lower levels in the intravaginal progesterone sponge group were attributed to exogenous progesterone supplementation without dynamic luteal function (Fonseca and Torres, 2005; Bareera, 2022). Progesterone concentrations declined sharply at induced oestrus to 0.41 ± 0.17 ng/mL (Group I) and 0.44 ± 0.08 ng/mL (Group II) with no significant difference between protocols. This was consistent with $PGF_2\alpha$ induced luteolysis or progesterone withdrawal and in agreement with Khan et al. (2016), Bareera (2022) and Aiswariya (2024), confirming restoration of a low progesterone, oestradiol dominant environment during oestrus.

After treatment protocols, on the day of induced oestrus, dominant follicles were present in 50 per cent of goats in both the groups, indicating partial restoration of follicular dynamics and compromised ovarian responsiveness in cyst affected goats, even after therapeutic intervention. Although direct literature in cyst affected goats was limited, Khan et al. (2016) reported emergence of 8 mm dominant follicles following $PGF_2\alpha$ induced regression. Dominant follicle numbers were lower than those reported in normal cyclic goats by Aiswariya (2024; median 2), likely due to compromised follicular dynamics in cystic conditions. Mean dominant follicle diameter did not differ between groups (7.35 ± 0.51 mm vs 6.90 ± 0.54 mm), aligning with Khan et al. (2016), Bareera (2022) and Aiswariya (2024).

Post treatment fate of cyst revealed low percentage of cyst regression (16.7% Group I; 12.5% Group II) (Fig 3), predominant luteinisation (50% in both groups) and persistence of cyst (Fig 4) in 33.3 and 37.5 per cent of goats, respectively. These findings differed from observations of Gupta et al. (2024), who reported 100 per cent luteinisation with GnRH and 57.14 per cent regression with hCG, and Medan et al. (2004), who reported an 80 per cent response to GnRH, highlighting variability related to protocol, cyst chronicity and endocrine status. Post-treatment, no apparent variation was observed in the uterine echotexture which remained heterogeneously hypoechoic, however reduced intra luminal fluid (0.98–1.5 mm) was observed in 42.80 per cent of goats. This finding suggested delayed uterine structural normalisation despite endocrine recovery, however effective evacuation of luminal contents had occurred.

Oestrus response was 66.67 per cent in the Ovsynch group and 62.50 per cent in the intravaginal progesterone sponge group, lower than values reported by Medan et al. (2004) and Allam et al. (2019) but comparable to Gupta et al. (2024). Mean oestrus duration was 45.33 ± 7.74 h in the Ovsynch group and 32.00 ±

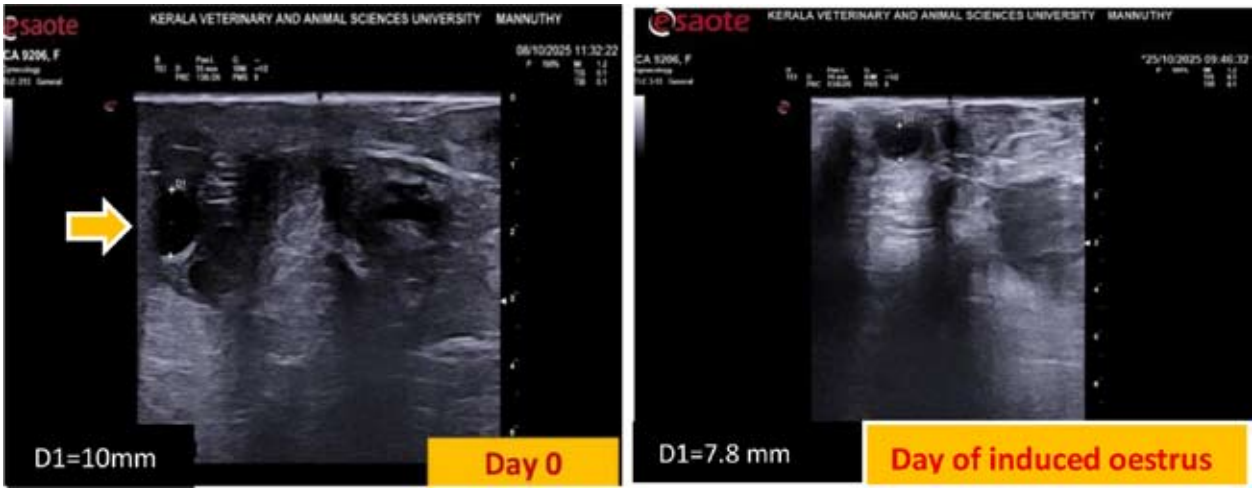

Fig 3. Regression of the follicular cyst

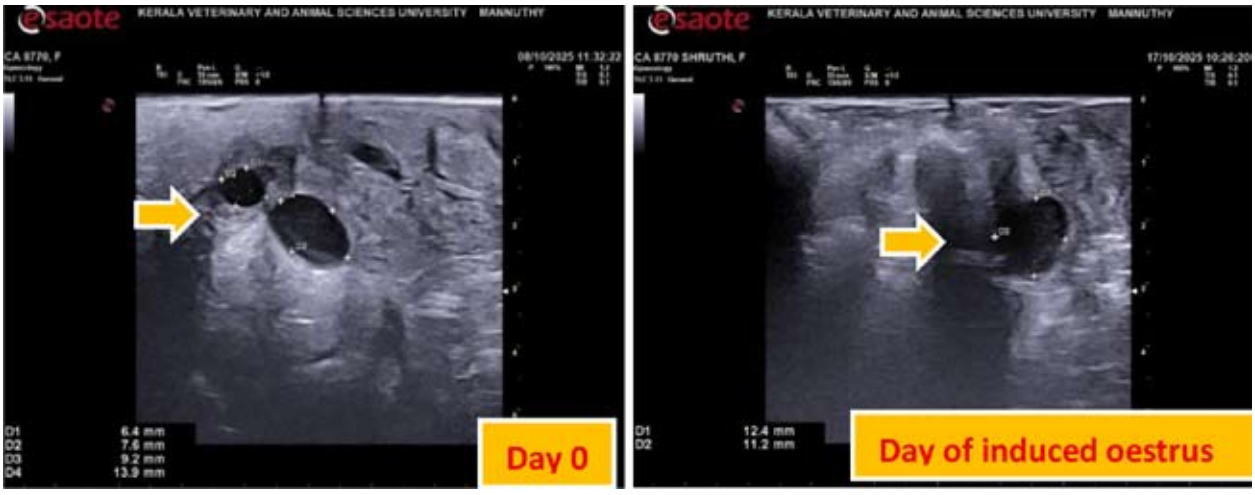

Fig 4. Persistence of follicular cyst

3.12 h in the sponge group, with no significant difference. These durations aligned with previous reports in cyst affected and postpartum anoestrous goats (Medan et al., 2004; Khan et al., 2016; Bareera, 2022; Aiswariya, 2024). The longer duration observed with Ovsynch may reflect prolonged endocrine effects or residual cystic pathology influencing follicular dynamics. In contrast, the intravaginal progesterone sponge protocol produced oestrus durations comparable to physiological ranges reported in normal cycling goats, suggesting more controlled synchronisation of follicular emergence.

Conception at induced oestrus was 16.67 per cent in Group I and 50 per cent in Group II, with cumulative conception rates over breedings at three successive oestrus of 33.30 per cent and 62.50 per cent, respectively, though differences were not significant. These values were lower than those reported by Medan et al. (2004) and Gupta et al. (2024), likely due to chronic cystic pathology and endocrine disruption. Overall, both protocols effectively induced oestrus and restored ovarian cyclicity, with higher fertility in the progesterone sponge group, suggesting improved follicular synchrony and uterine responsiveness compared with Ovsynch in goats affected with follicular cysts.

Conclusion

The present study highlights that ovarian follicular cysts, though relatively underreported as a cause of infertility in goats, largely due to diagnostic challenges, constitute a clinically important reproductive disorder. The integration of detailed anamnesis with ultrasonographic evaluation and hormonal profiling proved effective in accurately identifying and classifying cystic ovarian conditions, with sonography emerging as a particularly reliable diagnostic tool. Therapeutic interventions using hormone-based protocols, including Ovsynch and intravaginal progesterone sponge regimens, yielded promising results in inducing oestrus and promoting follicular development. Both approaches were effective in managing the condition, with the progesterone-based protocol showing a tendency toward improved conception rates and more physiologically consistent oestrus expression.

Overall, the study underscores that timely diagnosis aided by ultrasonography, coupled with appropriate hormonal treatment protocols, can successfully address follicular cyst associated infertility in goats.

Conflicts of interest

The authors declare that they have no conflict of interest.

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