

Original Article

Hill Lemon-Based Phytotherapy as a Promising Intervention for Teat Fibrosis in Cattle

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Abstract - Teat fibrosis, a significant health issue in cattle, compromises productive lifespan and milk quality, necessitating effective therapeutic interventions. This study investigates the therapeutic efficacy of Hill Lemon (*Citrus pseudo lemon* Tanaka) essential oil, both independently and in combination with other drugs like a traditional local recipe (Hill lemon extract), in treating teat fibrosis (teat hardness, stiffness, nodularity, and atrophy) among cattle in the Swat district, Khyber Pakhtunkhwa, Pakistan. The therapeutic trial was conducted on 32 cattle diagnosed with teat fibrosis, divided into four treatment groups designated as A, B, C and D. Group A received 1% hill lemon essential oil 10ml per affected teat IMM, Sid, for 14 days; Group B, a local recipe (Hill lemon extract) containing Hill Lemon pulp, sugar, Himalayan pink salt and ammonium chloride 500g on alternative days for 14 days (PO); Group C, a combination of Hill Lemon essential oil 10ml per affected teat IMM, Sid, for 14 days and the local recipe (Hill lemon extract) 500g on alternative days for 14 days (PO); and Group D, Hill Lemon essential oil 10ml per affected teat IMM, Sid, for 14 days scombined with the commercial preparation Mastifit (10ml IMM,60ml Bid PO). Each treatment protocol was administered over 14 days with assessments on days 0, 5, 10, 15, and 20. Recovery metrics for teat hardness, stiffness, nodularity, and atrophy indicated that Group C achieved the highest efficacy, showing nearly complete recovery across the first three parameters (100%) and partial recovery of the fourth parameter (90%) by day 20. The combination of Hill Lemon essential oil and the local recipe (Group C) emerges as a potent intervention for teat fibrosis in cattle, demonstrating superior recovery outcomes. These findings position Hill Lemon essential oil as a promising natural therapeutic agent for fibrotic mastitis management in cattle.

Keywords - Cattle, Mastitis, Teat Fibrosis, Hill Lemon, Essential Oils, Intra Mammary (IMM), Orally (PO), Sid (once in a day), Bid (twice a day).

1. Introduction

Teat fibrosis develops as a result of chronic mastitis when inflammation in the cattle udder persists for an extended period of time (Zhang et al., 2025). Teat fibrosis has the principal consequence of reducing the animal's productive lifespan by either blocking or destroying the udder's secretory tissue(Kan et al., 2022).

Myofibroblasts typically go through apoptosis after repairing damaged tissue(Micallef et al., 2012), however in fibrosed mastitic cows, they continue to secrete extracellular matrix instead of going through apoptosis(Redente et al., 2020). Excess extracellular matrix causes tissue to become hard, nodular, stiff, and prone to atrophy(Ishihara and Haga 2022). Fibrosis may be localised, ranging from pea-sized lesions to bigger masses near the base or tip of the teat, or widespread, affecting a quarter Blood et al., (2006). Teat fibrosis is characterized by a change in the morphology of the epithelial cells, including a transition from a cobblestone to a spindle-like appearance (Cheng and Han, 2020). Fibrosis may occur as a result of infectious pathogens, autoimmune, and genetic vulnerability (Thannickal et al., 2014).

Streptococcus agalactiae travels from an infected to a healthy udder during milking, reaching at the milk follicle and sinus, where the duct that transports milk to the milk sinus is blocked by chronic inflammation because of inadequate antibiotic penetration (Mohsin et al., 2022). Fibrotic mastitis in dairy cattle is diagnosed using diagnostic methods such as ultrasound, telescopy (teat endoscopy), physical examination (by touching the teat and mammary tissue), and recognizing symptoms (Mohsin et al., 2022a).

Conventionally, antimicrobial therapy and homoeopathic treatments like Masta_forte (2ml) and Actino cure (2ml), taken orally twice daily for 20 days, are used to treat teat fibrosis (Parsani et al., 2023). Homoeopathic treatments for fibrosis, such as Phellandrium (30c) for 21 days and Carbo animalis (30c) for 42 days, have a 62.48% success rate (Makkar, 2017). Additionally, 500g of lemon fruit, 250g of sugar, and 120g of mitha soda are used to cure fibrosis over a three-day period, while 250g of red chilli powder in 1L of water is used to treat mastitis. For the treatment of teat obstruction, 250g of lemon and 250g of mustard oil are taken orally. The combination of these traditional therapies shows possibilities in promoting the



repair of fibrosis Siyal et al., (2017). But even with these conventional treatments, the overall rate of recovery from teat fibrosis is still minimal.

Citrus is the most important crop in the world in terms of production (Alabed et al., 2024), according to the Food and Agricultural Organisation (FAO), with 240,780 million metric tons produced in 2013 (Ben Hsouna et al., 2017). The Citrus genus, which comprises around 140 genera and approximately 1,300 species, is part of the Rutaceae family (Kamal et al., 2011). One of the lesser-known species within this genus is *Citrus pseudolimon Tanaka*, commonly referred to as Galgal or Hill lemon, contains higher levels of carbohydrates, proteins, phenolics, flavonoids, vitamin C and tannins, indicating its potential for medicinal use. (Thakur and Kumari 2022). The quantitative phytochemical screening demonstrates that flavonoid content in peel is 5.47 mg/100 mg, phenolic content is 5.58 mg/100 mg, tannin content is 35.70 mg/100 mg (Thakur et al., 2025). In antimicrobial analysis, juice of Hill lemon showed stronger activity against gram-negative bacteria *Escherichia coli* zone (24 mm) than gram-positive bacteria *Staphylococcus aureus* (18 mm) (Kaur et al., 2025). It can be concluded that the peels revealed high phytochemical content with strong antioxidant activity, while the juice fraction was recorded with strong antibacterial activity. (Thakur and Kumari 2022). Galgal or Hill lemon exhibits anti-inflammatory, antimicrobial, antioxidant, anticancer, anti-diabetic, antiviral, and antifungal effects (Grover et al., 2023).

Despite the availability of various conventional and supportive therapies for teat fibrosis in cattle, treatment outcomes remain suboptimal due to slow healing, incomplete recovery, and recurrence in many cases. Furthermore, there is little data on the therapeutic potential of herbal phytomedicines (Hill lemon) for the treatment of teat fibrosis. In veterinary medicine, this marks a substantial research gap. Therefore, the goal of the present research was to develop and verify a novel phytotherapeutic protocol that included oral Hill lemon extract and essential oil of Hill lemons (*CITRUS PSEUDO LIMON TANAKA*), IMM. It was believed that the suggested combination would accelerate tissue regeneration, minimize fibrotic alterations, and enhance clinical recovery, offering a more practical and successful solution for teat fibrosis.

2. Materials and Methods

2.1. Area of Study

The study was carried out at four tehsils (Tehsil Matta, Charbagh, Kabal and Barikot) in the district Swat, Khyber Pakhtunkhwa, Pakistan, as shown in Figure 1.

2.2. Collection of Hill lemon

The fruit of the hill lemon was collected from the Bahawalnagar district of Punjab on November 30, 2023.

2.3. Essential Oil Extraction

The essential oil was extracted from the peel of Hill lemon/ Galgal (*Citrus pseudo Limon Tanaka*) using hydrodistillation via a Clevenger apparatus through the process mentioned by (Handa and plants 2008).

2.4. Sample Size

The study was conducted on a total of 1200 cattle in the district of Swat (Ausvet Epitools cite). Cattle showing teat fibrosis in early stages was selected irrespective of age and stage of lactation. Before the study began, ethical approval was given by the Institutional Animal Ethics Committee of the University of Veterinary and Animal Sciences (UVAS), Lahore. A non-invasive method was practiced for the evaluation of fibrotic teats, consisting of visual inspection and palpation. Teats were palpated by hand to assess hardness, stiffness, nodularity and atrophy. The prevalence of teat fibrosis manifestations like Hardness, Stiffness, Nodularity, and Atrophy were evaluated from fibrosed mastitis cases.

2.5. Study Design

Among the fibrosed mastitis cases, 32 cattle's were randomly selected for treatment protocol and are divided into 4 Groups (A, B, C, D). Each group having 8 cattle, including 3 cattle with teat hardness, 2 with teat stiffness, 2 with teat nodularity, and 1 with teat atrophy. Group A were treated with 1% Essential oil of hill lemon peel along with coconut oil used as a vehicle, IMM, Sid, for 14 days. Coconut oil ensures safe IMM delivery of the active compound, enhances the absorption and penetration of essential oil and are non-toxic to mammary tissue. Group B were treated with local recipe of Hill lemon extract consisting of (pulp of Hill lemon provide citric acid, flavinoids and antioxidants (2kg), sugar as preservative and energy source (1kg), nosadar (Ammonium chloride) act as systemic acidifier and break down abnormal tissue deposit (230g), shisha namak (Himalayan pink salt) rich in trace minerals (230g)), 500g/animal, PO, on alternative day for 14 days. Group C were treated with 1% Essential oil of hill lemon peel IMM, Sid, for 14 days and the local recipe of Hill lemon 500g/animal, PO, on alternative day for 14 days. Group D were treated with 1% Essential oil of hill lemon IMM, Sid, for 14 days and Market available drug Mastifit containing of (Apis Mellifica (20000mg), Turmeric Extract (15000mg), Rice Husk (20000mg), and Poke Root Extract (12000mg)), 60ml/animal, PO, bid, daily for 14 days as shown in table 1.

To evaluate the treatment, four key parameters were used: hardness, stiffness, nodularity, and atrophy of the affected teat. Each parameter was quantified on a recovery scale ranging from 0 to 6, where 0 denoted no recovery (0%), 1 indicated minimal recovery (30%), 3 reflected partial recovery (60%), 5 signified recoveries up to (90%), and 6 shows complete recovery (100%). Assessments were systematically conducted at predetermined intervals (Day 5, 10, 15, and 20) to track the progression of recovery over the course of the treatment.

3. Results

3.1. Prevalence of Teat Fibrosis and its Manifestation: Hardness, Stiffness, Nodularity, and Atrophy

The results indicate that, out of a total sample size of 1200 cattle, 75 were found to be fibrosis-positive. This indicates that, as illustrated in figure 2, the overall

prevalence of teat fibrosis across the four Tehsils in district Swat is 6.25%, whereas 93.75% of animals do not exhibit any signs of the disease. Table 3 and Figure 3 demonstrate that when these positive cattle were screened, 88% of the cattle had teat hardness, 66.6% had teat stiffness, 57.3% had teat nodularity, and 28% had teat atrophy, the least prevalent finding. According to table 4, the area has a significant impact on the occurrence of teat fibrosis, as indicated by the P-value of 0.047, which is less than the level of significance (0.05) by using R software. The prevalence percentage in the tehsil Matta was 7.3%, with 22 out of 300 cattle having a diagnosis of teat fibrosis. In this tehsil, 90% of the cattle were found to have teat hardness, 70% to have teat stiffness, 50% to have teat nodularity, and 30% to have teat atrophy, according to the results of the screening of fibrosed animals (figure 4). Twenty of the three hundred cattle in Tehsil Charbagh were affected, resulting in a 6.7% prevalence rate. According to figure 3, when fibrosed animals in this tehsil were screened, 80% atrophy. The prevalence percentage in the tehsil Kabal was 6%, with 18 out of 300 cattle testing positive. As illustrated in figure 6, when fibrosed animals in this tehsil were screened, 94% of the cattle had teat hardness, 56% had teat stiffness, 61% had teat nodularity, and 28% had teat atrophy. In the tehsil Barikot, the prevalence rate was 5.0%, with 15 out of 300 cattle having fibrosis. According to table 3 and figure 7, when fibrosed animals in this tehsil were screened, 87% of the cattle had teat hardness, 67% had teat stiffness, 60% had teat nodularity, and 26% had teat atrophy.

3.2. Efficacy of Treatment Groups on Teat Hardness, Stiffness, Nodularity, and Atrophy in Cattle with Teat Fibrosis

3.2.1. Efficacy of Treatment Groups on Teat Hardness Recovery in Cattle with Teat Fibrosis

The outcomes showed that the various medication groups had a distinct recovery trajectory in teat hardness. The biggest improvement was seen in Medicine Group C, where the average percentage recovery of the fibrosed teats (animals CO17, CO18, and CO19) increased from 40% on Day 5 to 100% on Day 20. Medicine Group A had recovery rates of 20% at Day 5 (average percentage recovery of animals CO1, CO2, and CO3), 40% at Day 10, 70% at Day 15, and 93.3% at Day 20. Significant recovery was also shown by Medicine Group D, which began at 30% on Day 5 (average percentage recovery of animals CO25, CO26, and CO27), increased to 40% on Day 10, 70% on Day 15, and reached 93.3% on Day 20. The recovery rates for Medicine Group B were the lowest, starting at 0% on Day 5 (average percentage recovery of animals CO9, CO10, and CO11), and reaching 50% by Day 20, as shown in table 4.

3.2.2. Efficacy of Treatment Groups on Teat Stiffness Recovery in Cattle with Teat Fibrosis

Results showed that, in terms of teat stiffness, Medicine Group C produced the best healing results. The average percentage recovery of animals' CO20 and CO21 from fibrosed teats increased from 45% on Day 5 to 100% on Day 20. At Day 5, Medicine Group A's recovery rate (average percentage recovery of animals' CO4 and CO5) was 30%.

By Day 10, recovery had increased to 60%, and by Day 15, it had reached 90%. The recovery rates for Medicine Group D also showed improvement, beginning at 30% on Day 5 (average percentage recovery of animals CO28 and CO29), rising to 60% on Day 10, 90% on Day 15, and 100% on Day 20. The least improvement was seen by Medicine Group B, which started with a recovery score of 0% at Day 5 (average percentage recovery of animals CO12 and CO13) and only reached 75% by Day 20. Table 5 shows that intermediate values were 30% at Day 10 and 45% at Day 15.

3.2.3. Effectiveness of Treatment Groups on Teat Nodularity Recovery in Cattle with Teat Fibrosis

According to the findings, the best treatment for lowering teat nodularity was Medicine Group C. The average percentage recovery of animals' CO22 and CO23 nodularity had reached to 30% on Day 5 to 100% by day 20. Medicine Group D also showed significant improvement, with recovery rates reaching 30% on Day 5 (average percentage recovery of animals CO30 and CO31), rising to 45% at Day 10, 75% at Day 15, and finally reaching 95% by Day 20. Medicine Group A showed a gradual improvement, reaching a recovery rate of 15% on Day 5 (average percentage recovery of animals CO6 and CO7) and 95% by Day 20. With an average percentage recovery of animals CO14 and CO15 of 0% on Day 5 and only 60% by Day 20, Medicine Group B showed the least efficacy. Table 6 shows intermediate values of 15% at Day 10 and 30% at Day 15.

3.2.4. Efficacy of Treatment Groups on Teat Atrophy Recovery in Cattle with Teat Fibrosis

Results showed that the best treatment for teat atrophy was Medicine Group C. By Day 20, the recovery of teat atrophy had advanced from 0% on Day 5 to 90%. Additionally, Medicine Group D had encouraging outcomes, with recovery rates reaching 0% on Day 5 and 60% by Day 20, as well as a 30% recovery at Day 10 and a continued level by Day 15. Medicine Group A, on the other hand, showed little progress, recovering 0% on Days 5 and 10 before increasing to 30% on Days 15 and 20. As indicated in table 7, medicine group B followed this pattern, exhibiting no improvement on days five to fifteen and recovering 30% by day twenty.

4. Discussion

According to this study, the overall prevalence of teat fibrosis in the four tehsils of district Swat was 6.25 percent; Tehsil Matta had the highest frequency at 7.3%, followed by Charbagh (6.67%), Kabal (6%), and Barikot (5%). However, 10% of cases had teat fibrosis, according to research conducted at the Ontario Veterinary College by (Ducharme et al., 1987). This difference in prevalence is because the current study used non-invasive diagnostic techniques, while the study by (Ducharme et al., 1987) used histopathological investigation.

In compared to other Medicine groups (A, B, and D), the results indicate that Medicine Group C's treatment protocol, which included administering 1% Hill Lemon

Essential Oil (10 mL per affected teat, intramammary, daily) in addition to a locally developed recipe that included Hill Lemon pulp, sugar, nosadar (ammonium chloride), and shisha namak (Himalayan pink salt) orally at a dose of 500 g per animal on alternate days over 14 days (total of 7 doses), showed the highest and fastest therapeutic efficacy in cases of teat fibrosis. Upon hardness in the teat, Medicine C showing a progressive recovery 40% on Day 5 to 100% by Day 20; A 20% to 93.3%; B 0% to 50%; and D 30% to 93.3%, respectively. Using medication against teat stiffness. Medicine group C showing recovery of 45% on Day 5 to full recovery (100%) by Day 20; A 30% to 100%; B 0% to 75%; D 30% to 100%, respectively. Teat nodularity with Medicine group C recovered 30% on day 5 to 100% by day 20, A 15% to 95%, B 0% to 60%, D 30% to 95%, respectively. Teat atrophy with Medicine group C recovered from 0% on day 5 to 90% by Day 20, A 0% to 30%, B 0% to 30%, D 0% to 60% respectively. These findings represent the first documented therapeutic approach to treat teat fibrosis using Medicine Group C, A, B, and D.

According to (Kumar 2020), 89% of cows with teat fibrosis healed after using homoeopathic medications Carboanimalis 200c, Silicea 200c, and Conium maculatum 200c orally for 20 days. The majority of the cows recovered in 27 days. The current study's rapid recovery is attributed to the concurrent usage of oral and intramammary drug administration and different chemical compositions.

(Shah et al., 2010) grouped 81 cows with fibrotic mastitis into two groups at random for their study. Calcaria Flour 200 C and Silicea 200 C, two homoeopathic medications, were administered orally to the groups. Groups A and B experienced recovery rates of 46.45% and 75.0%, respectively, during the 20- and 40-day observation periods. The reason for the discrepancy in the results is that (Shah et al., 2010) used oral medication, whereas the current study used both oral and intramural medications with different chemical compositions.

A study by (Makkar 2017) found that when homoeopathic remedies Phellandrium 30c and Carboanimalis 30c were taken orally for 21 days, the

recovery rate was 64% during the observation period. In a research by (Kumar 2020), 18 cows with udder and teat fibrosis were split into two groups at random. During a 20-day observation period, group 1 had a 67% recovery rate after receiving oral administration of homoeopathic remedies such as Conium maculatum 200c, Carboanimalis 200c, and Silicea 200c. Group 2, which was monitored for a longer duration, had an 89% recovery rate, demonstrated the efficacy of homoeopathic treatments for cows with chronic mastitis and teat fibrosis. Because the medication is only administered orally, the recovery rate is slow.

According to (ChunYan et al., 2010), a number of human cervical adenocarcinoma cell lines (HeLA) were used to test the antiproliferative properties of lemon essential oil. The results showed that lemon essential oil has strong antiproliferative effects on the HeLA cell line in addition to notable antioxidant qualities. These findings support the use of lemon essential oil as a natural anticancer agent in medical applications by demonstrating its therapeutic potential in preventing the growth of cancer cells.

4.1. Limitation and Future Research

Investigate molecular pathways through which Hill lemon essential oil acts on teat tissues to understand its precise mechanism of action.

5. Conclusion

According to the study, 6.25% of cattle in four tehsils in the Swat area had teat fibrosis. The most effective treatment was (Medicine Group C) Hill Lemon Essential Oil, IMM, Sid, 14 days and traditional local recipes (Hill lemon extract 500g/animal), PO, on alternative day for 14 days. By day 20, the recovery of 90% in teat atrophy and 100% in teat hardness, stiffness, and nodularity had been achieved.

These findings demonstrated the efficacy of the Hill Lemon Essential Oil, IMM, and traditional local recipes, PO, as a viable natural solution for the management of cow teat fibrosis.

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Appendix

Figures

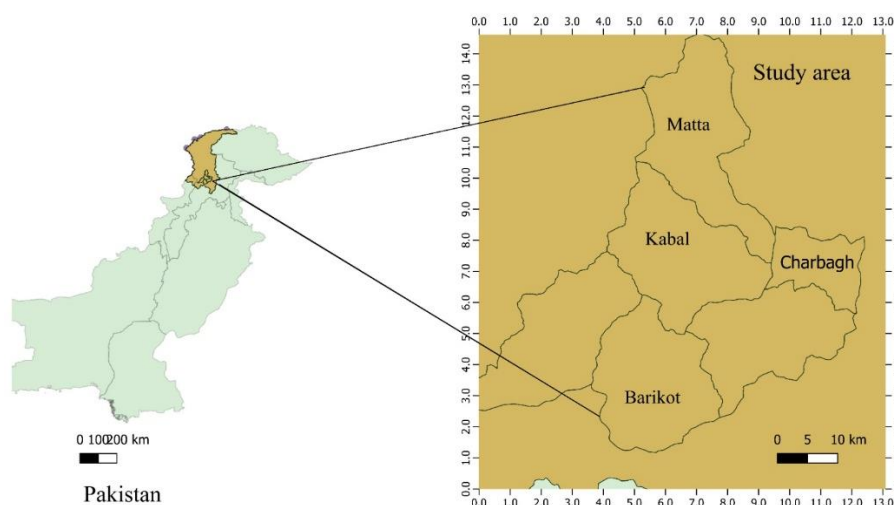


Fig. 1 Tehsil Matta, Charbagh, Kabal, and Barikot in district Swat, kpk, Pakistan

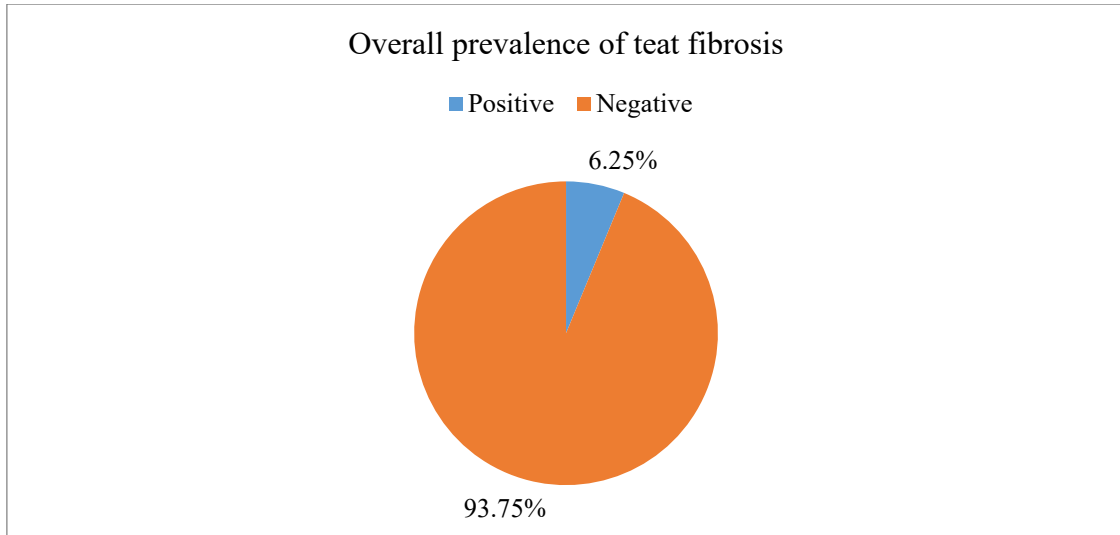


Fig. 2 Overall prevalence of Teat Fibrosis in Cattle across the Tehsil of Swat

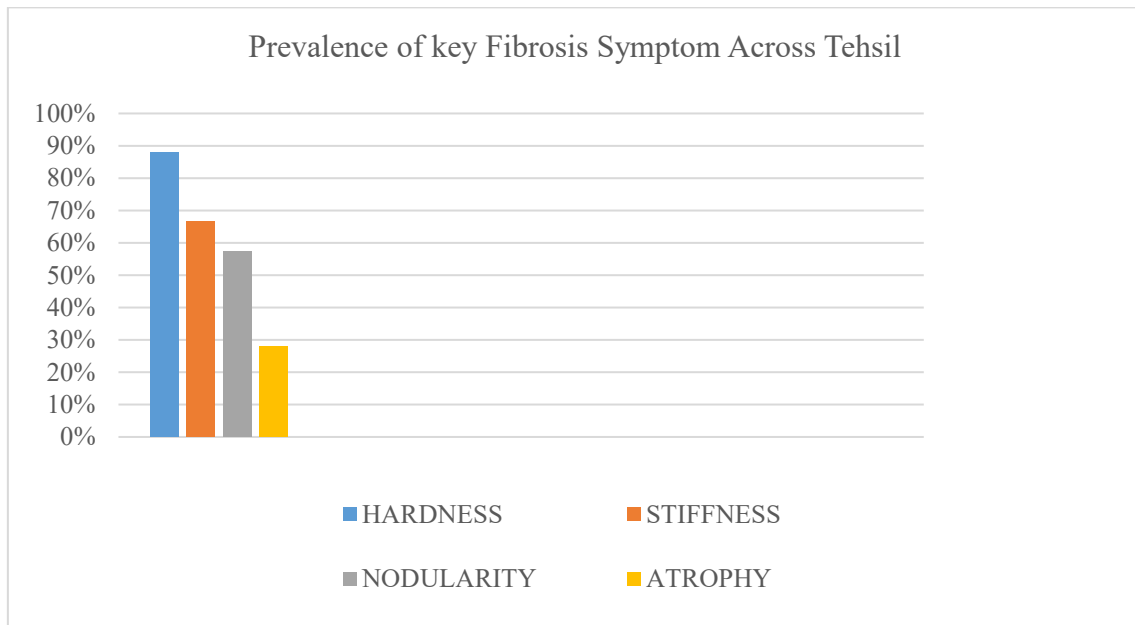


Fig. 3 Prevalence of Teat Fibrosis Manifestations (Hardness, Stiffness, Nodularity, Atrophy) in Cattle across Tehsil

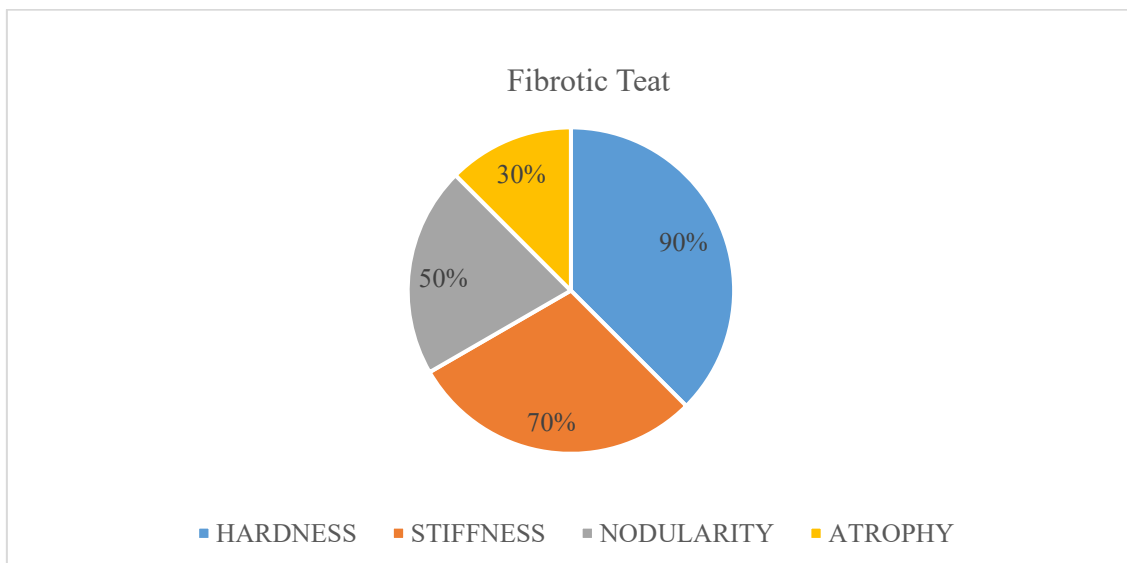


Fig. 4 Distribution of Fibrotic Changes in Cattle Diagnosed with Teat Fibrosis in Tehsil Matta

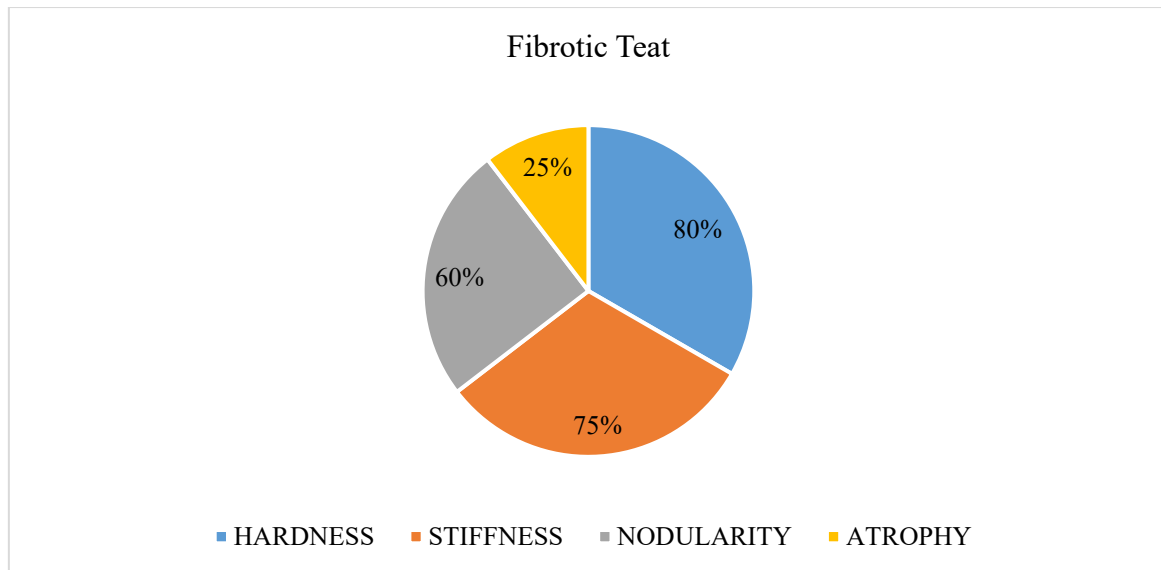


Fig. 5 Distribution of Fibrotic Changes in Cattle Diagnosed with Teat Fibrosis in Tehsil Charbagh

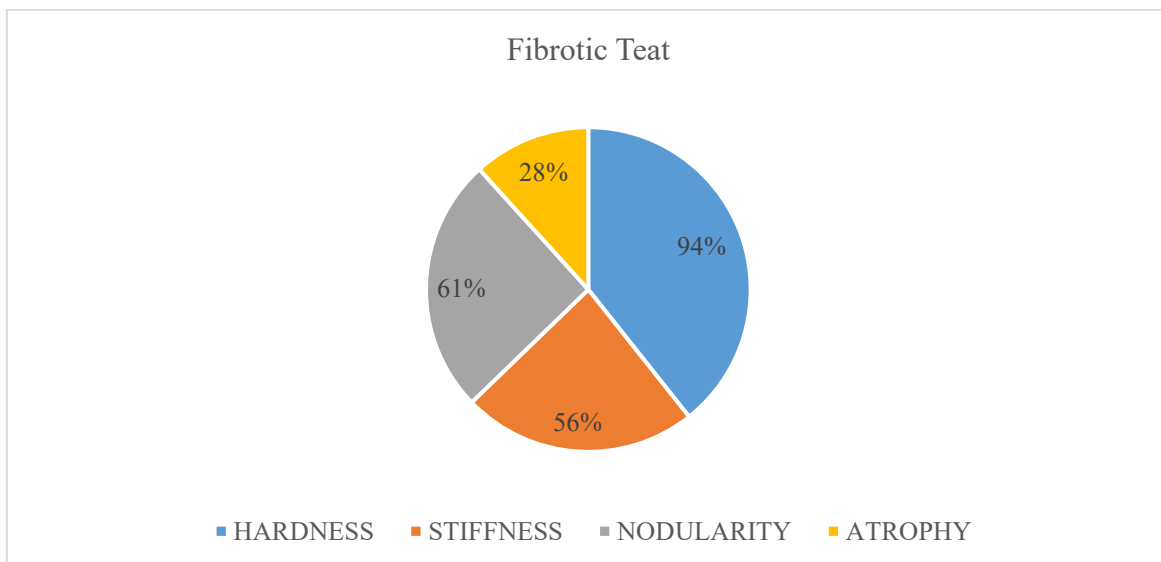


Fig. 6 Distribution of Fibrotic Changes in Cattle Diagnosed with Teat Fibrosis in Tehsil Kabal

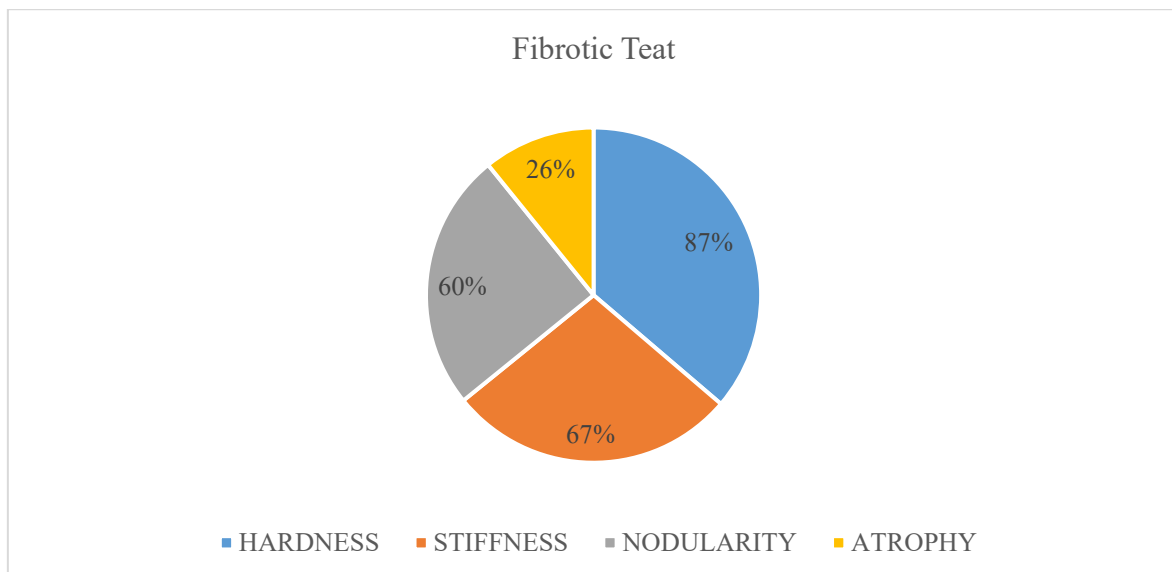


Fig. 7 Distribution of Fibrotic Changes in Cattle Diagnosed with Teat Fibrosis in Tehsil Barikot

Tables

Table 1. Treatment Protocol, Dosage, Frequency, and Evaluation for Hill Lemon Essential Oil and Combination Therapies

Group name	Treatment applied	Number of animals	Dose	Frequency of treatment	Evaluation
A	1%Essential oil of Hill lemon (1ml essential oil+99 ml coconut oil)	8	10ml/affected teat, IMM, daily	14 days	Day 0, 5, 10, 15, 20 Criteria: Hardness, Stiffness, Nodularity, Atrophy.
B	local recipe of Hill lemon	8	500g/animal, PO, alternative days	14 days 7 doses	Day 0, 5, 10, 15, 20 Criteria: Hardness, Stiffness, Nodularity, Atrophy.
C	1%Essential oil + local recipe of Hill lemon	8	10ml/affected teat, IMM, daily + 500g/animal, PO, alternative days	14 days	Day 0, 5, 10, 15, 20 Criteria: Hardness, Stiffness, Nodularity, Atrophy.
D	1%Essential oil + Mastifit	8	10ml/affected teat, IMM, daily + 60ml/animal PO, bid, daily	14 days	Day 0, 5, 10, 15, 20 Criteria: Hardness, Stiffness, Nodularity, Atrophy.

Table 2. Distribution and Prevalence of Teat Fibrosis and its Manifestations (Hardness, Stiffness, Nodularity, Atrophy) in Cattle across Tehsils of Matta, Charbagh, Kabal, and Barikot

Tehsil	Sample size	Fibrosed Positive	Prevalence %	Hardness	Stiffness	Nodularity	Atrophy
Matta	300	22	7.33	20 (90%)	15 (70%)	11 (50%)	07 (30%)
Charbagh	300	20	6.67	16 (80%)	15 (75%)	12 (60%)	05 (25%)
Kabal	300	18	6.00	17 (94%)	10 (56%)	11 (61%)	05 (28%)
Barikot	300	15	5.00	13 (87%)	10 (67%)	09 (60%)	04 (26%)
Total	1200	75	6.25%	88%	66.6%	57.3%	28%

Table 4.2: Statistical analysis of the overall prevalence of Teat Fibrosis in cattle

Specie	Sample Size	Positive	Negative	Prevalence (%)	Chi-square value	P-Value
Cattle	1200	75	1125	6.25	3.942	0.047

Table 4.3: Evaluation of Teat Hardness Recovery in Cattle with Teat Fibrosis by Treatment Groups A, B, C, and D, Over Time

Medicine Group	Animal treated	Tehsil	Tag number	Teat Fibrosis (Day 0)	Day 5	Day 10	Day 15	Day 20
A	3	Matta	C01	Hardness	0	1	3	5
			C02	Hardness	1	3	5	6
			C03	Hardness	1	1	3	5
			Recovery Rate		20%	40%	70%	93.3%
B	3	Charbagh	C09	Hardness	0	1	1	3
			C10	Hardness	0	0	1	1
			C11	Hardness	0	1	1	3
			Recovery Rate		0%	20%	30%	50%

C	3	Kabal	C17	Hardness	1	3	5	6
			C18	Hardness	3	5	6	6
			C19	Hardness	1	3	5	6
			Recovery Rate		40%	70%	93.3%	100%
D	3	Barikot	C25	Hardness	1	3	5	6
			C26	Hardness	1	1	3	5
			C27	Hardness	1	1	3	5
			Recovery Rate		30%	40%	70%	93.3%

Table 5. Evaluation of Teat Stiffness Recovery in Cattle with Teat Fibrosis by Treatment Groups A, B, C, and D, Over Time

Medicine Group	Animal treated	Tehsil	Tag number	Day 0	Day 5	Day 10	Day 15	Day 20
A	2	Matta	CO4	Stiffness	1	3	5	6
			C05	Stiffness	1	3	5	6
			Recovery Rate		30%	60%	90%	100%
B	2	Charbagh	C12	Stiffness	0	1	3	5
			C13	Stiffness	0	1	1	3
			Recovery Rate		0%	30%	45%	75%
C	2	Kabal	C20	Stiffness	3	5	6	6
			C21	Stiffness	1	3	5	6
			Recovery Rate		45%	75%	95%	100%
D	2	Barikot	C28	Stiffness	1	3	5	6
			C29	Stiffness	1	3	5	6
			Recovery Rate		30%	60%	90%	100%

Table 6. Evaluation of Teat Nodularity Recovery in Cattle with Teat Fibrosis by Treatment Groups A, B, C, and D, Over Time

Medicine Group	Animal treated	Tehsil	Tag number	Day 0	Day 5	Day 10	Day 15	Day 20
A	2	Matta	C06	Nodularity	1	3	5	6
			C07	Nodularity	0	1	3	5
			Recovery Rate		15%	45%	75%	95%
B	2	Charbagh	C14	Nodularity	0	0	1	3
			C15	Nodularity	0	1	1	3
			Recovery Rate		0%	15%	30%	60%
C	2	Kabal	C22	Nodularity	1	3	5	6
			C23	Nodularity	1	3	5	6
			Recovery Rate		30%	60%	90%	100%
D	2	Barikot	C30	Nodularity	1	3	5	6
			C31	Nodularity	1	1	3	5
			Recovery Rate		30%	45%	75%	95%

Table 7. Evaluation of Teat Atrophy Recovery in Cattle with Teat Fibrosis by Treatment Groups A, B, C, and D, Over Time

Medicine Group	Animal treated	Tehsil	Tag number	Day 0	Day 5	Day 10	Day 15	Day 20
A	1	Matta	C08	Atrophy	0	0	1	1
			Recovery Rate		0%	0%	30%	30%
B	1	Charbagh	C16	Atrophy	0	0	0	1
			Recovery Rate		0%	0%	0%	30%
C	1	Kabal	C24	Atrophy	0	1	3	5
			Recovery Rate		0%	30%	60%	90%
D	1	Barikot	C32	Atrophy	0	1	1	3
			Recovery Rate		0%	30%	30%	60%