



ISSN (E): 2277- 7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.23  
TPI 2022; SP-11(3): 1384-1386  
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Received: 09-12-2021

Accepted: 20-01-2022

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## Fertility status in relation to the physical characteristics of Cervico-vaginal mucus in Lakhimi cattle

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### Abstract

Fertility of cow is the main concern of profitable dairy farming. Cervico-vaginal mucus has a direct relationship with the fertility of cow. As Lakhimi is a newly registered breed from Assam, no information could be traced delineating the association of rheological properties of the estrual discharge with fertility in the Lakhimi breed of cows. Hence, the present study was undertaken to find out the fertility status in relation to the physical properties of cervico-vaginal mucus such as pH, colour, consistency, spinnbarkeit value and fern pattern. The cervico-vaginal mucus was collected at mid-estrus and pH was estimated immediately. The colour was observed at the time of collection and consistency, spinnbarkeit value and fern pattern were observed at laboratory condition.

In cows having clear, thin, alkaline ( $\text{pH}=7.36\pm 0.08$ ) cervico-vaginal mucus with higher spinnbarkeit value ( $11.41\pm 0.49$  cm), and typical fern pattern were observed to be more fertile. In heifers, the cervico-vaginal mucus with clear, thin, alkaline ( $\text{pH}=7.27\pm 0.07$ ), higher spinnbarkeit value ( $12.10\pm 0.33$  cm) and showing typical fern pattern appeared to favour conception.

**Keywords:** Cervico-vaginal mucus, colour, consistency, Estrus, fertility, fern pattern, pH, spinnbarkeit value

### Introduction

At the follicular phase of the estrus cycle in cow the cervical luminal lining tall, columnar epithelial cells get ruptured and pour cytoplasm to the cervical lumen as mucus (Parks, 1956) [9]. Physically it is a hydrogel with 92%-95% water (Tsiligianni *et al.*, 2001) [17]. The non-soluble portion of cervical mucus is mainly glycoproteins named as Mucin and it is a major component of cervical mucus (Rutllant *et al.*, 2005). The cervical mucus forms a three dimensional network which consists of water and a solid component having two or more units. Under certain physical conditions cervical mucus tend to pose some rheological properties. Based on the rheological properties the appropriate time for insemination can be predicted (Srivastava *et al.*, 2000) [16]. The physico-chemical properties of cervico-vaginal mucus have profound effect on the fertilizing capacity of spermatozoa and hence the characteristics like colour, consistency, pH, spinnbarkeit value and fern pattern are considered as effective laboratory tools for prediction of fertility in cattle (Rangnekar *et al.*, 2002) [11]. Repeat breeding cows are reported to have abnormal colour, consistency and elasticity values of cervicovaginal mucus as compared to the normal cyclic cows (Pandey *et al.*, 1983) [8]. Similarly, the maximum spinnbarkeit value is observed before or during ovulation (Hamana *et al.*, 1971) [6]. However, no information could be traced delineating the association of rheological properties of the estrual discharge with fertility in the Lakhimi breed of cows. Hence the present study was undertaken.

### Materials and Methods

The present study was conducted under the formal approval of institutional ethics committee from August, 2020 to July, 2021 in College of Veterinary Science, Assam Agricultural University following covid-19 protocols. In the present study, total 36 numbers of apparently healthy Lakhimi cattle were selected on the basis of history and findings of clinic gynaecological examination. The animals were divided into two groups, namely, G1 (normal cyclic cows, n=18) and G2 (pubertal heifers without breeding history, n=18). Cervico-vaginal discharge samples were collected aseptically from each of the animals at mid heat and evaluated for various rheological properties.

### Colour

The colour of the cervical mucus was examined visually immediately after collection. Based on the colour, the samples were classified into a) clear (raw egg white appearance), b) turbid (cloudy in appearance) and c) dirty colour (yellowish, greyish etc.) (Gohel, 2012)<sup>[5]</sup>.

### Consistency

Consistency of the cervico-vaginal mucus was examined to find out the thickness. The mucus samples were classified into a) thick and b) thin (Gohel, 2012)<sup>[5]</sup> as per following criteria.

### pH

The pH of the Cervico-vaginal mucus samples were measured using digital pH-meter.

### Spinnbarkeit value

It was measured by following the methods of Verma *et al.*, 2014<sup>[18]</sup>. Three consecutive reading was taken and calculated mean value was considered as the spinnbarkeit value the samples.

**Fern pattern (Arborization or crystallization):** The fern patterns were categorized following the methods described by Gohel, 2012<sup>[5]</sup> as follows

- a. **Typical:** Fern pattern showing primary, secondary and tertiary branching.
- b. **Atypical:** Fern pattern showing only primary and secondary branching.
- c. **Nil:** Fern pattern without primary, secondary or tertiary branching.

### Statistical Analysis

Data were analysed by chi square test and one way ANOVA using statistical software package SAS Enterprise Guide-4.3 software.

### Results and Discussion

**Colour:** Out of 18 samples observed in group G1 cows, 11 (61.11%), 5 (27.78%) and 2 (11.11%) had clear, turbid and dirty mucus, respectively. In case of G2 heifers, clear and turbid mucus could be seen in 14 (77.78%) and 4 (22.22%) out of 18 animals, respectively. The conception rates observed in cows were 72.72, 60.00 and 0.00 per cent with clear, turbid and dirty cervico-vaginal mucus, respectively. However, Probability test revealed no significant difference between the conception rate of clear and turbid coloured mucus in cows. In case of heifers, the conception rates differed significantly ( $P < 0.05$ ) with clear (71.42%) and turbid (50.00%) cervico-vaginal mucus.

The present result is in agreement with the findings of Sharma *et al.* (1987)<sup>[15]</sup>. Similarly, Salphale *et al.* (1993)<sup>[13]</sup> and Gohel *et al.* (2012)<sup>[5]</sup> reported 66.67 and 100 per cent conception rate, respectively with clear mucus. The lower levels of conception rate in cows with turbid mucus in the present study may either be due to reduced or arrested sperm motility (Dev *et al.* 1997)<sup>[3]</sup>. Further, the cellular debris content in dirty mucus in cows might increase the pH of mucus leading to conception failure in the animals (Salphale *et al.*, 1993)<sup>[13]</sup>.

### Consistency

Out of all animals in both G1 and G2 group, 11 (61.11%) and 7(38.88%), and 13 (72.22%) and 5(27.78%) were found to

have thin and thick mucus, and the conception rate in both the groups with thin and thick mucus was 90.90 and 14.28 per cent, and 76.92 and 40.00 per cent, respectively. Probability test revealed highly significant difference ( $P < 0.01$ ) in conception rate between the thin and thick mucus in both G1 and G2 ( $P < 0.05$ ) group.

The present study was in agreement with the findings of Rangnekar *et al.* (2002)<sup>[11]</sup> who reported higher conception rate with thin than that of thick cervico-vaginal mucus. The lower conception rate with thick cervico-vaginal mucus may be due to the intertwined muco-proteins, which may impair the penetration and progressive movement of spermatozoa as reported by Verma *et al.* (2014)<sup>[18]</sup>.

### pH

The overall mean pH value of the cervico-vaginal mucus in Lakhimi cows and heifers were  $7.55 \pm 0.10$  and  $7.46 \pm 0.90$ , respectively without any statistical difference. The pH of mucus was  $7.36 \pm 0.08$  in conceived cows of G<sub>1</sub> group, whereas,  $7.85 \pm 0.18$  was reported in non-conceived cows. In G<sub>2</sub>, the values in conceived and non conceived heifers recorded were as  $7.27 \pm 0.07$  and  $7.84 \pm 0.13$ , respectively. Analysis of variance showed highly significant ( $P < 0.01$ ) difference between the pH values of conceived and non-conceived animals in both G1 and G2 group.

Similar results were also reported by Pandey *et al.* (1983)<sup>[8]</sup> and Mehta (1986)<sup>[7]</sup>. In contrast, Wani *et al.* (1982) reported lower pH ( $6.80 \pm 0.41$ ) in normal cyclic Sahiwal cows. Contrary to the statement of Rangnekar *et al.* (2002)<sup>[11]</sup> mentioning alkaline pH of mucus as more favourable for progressive motility of spermatozoa and suitable uterine environment, the present study recorded significantly ( $P < 0.01$ ) higher conception rate in both the groups with lower pH values of cervico-vaginal mucus. The lower conception with higher pH values in mucus of present study may be due to the mild uterine infection causing conception failure (Salphale *et al.*, 1993)<sup>[13]</sup> in animals.

### Spinnbarkeit value

In the present investigation average spinnbarkeit value of cervico-vaginal mucus recorded in Lakhimi cows and heifers was  $10.20 \pm 0.53$  and  $11.09 \pm 0.42$  cm, respectively without any statistical difference between the two. The values recorded in conceived and non-conceived cattle were  $11.41 \pm 0.49$  and  $8.30 \pm 0.64$  cm, and  $12.10 \pm 0.33$  and  $9.07 \pm 0.25$  cm for G1 and G2 groups, respectively. Analysis of variance revealed highly significant difference ( $P < 0.01$ ) between the values of conceived and non-conceived cattle in both the G1 and G2 groups.

The present result was corroborated with the findings of Enkhia and Kohli (1982)<sup>[4]</sup>, and Rangnekar *et al.* (2002)<sup>[11]</sup>. However, Reddy (1973)<sup>[12]</sup> failed to get any association between fertility and elasticity of cervical mucus. Higher levels of estrogens cause the cervical mucus to be abundant, clear and stretchable and the spermatozoa might be able to easily swim through these types of mucus (Sharma *et al.* 2013)<sup>[14]</sup>. This might be the reason of higher conception rate in the animals under the present investigation with higher spinnbarkeit value of cervico-vaginal mucus.

### Fern Pattern

Among the animals in G1 and G2 groups, 10 (55.56%), 6 (33.33%) and 2 (11.11%), and 13 (77.22%), 4 (22.22%) and 1 (5.56%) exhibited typical, atypical and nil type of fern

patterns, respectively. The conception rate with typical, atypical and nil type fern patterns were 100.00, 16.67 and 0.00, and 84.61, 25.00 and 0.00 per cent in G1 and G2 animals, respectively. Probability test revealed highly significant difference ( $P < 0.01$ ) between the conception rates with typical and atypical fern pattern in both the G1 and G2 groups.

The present findings are in agreement with the reports of Enkhia and Kohli (1982)<sup>[4]</sup>. However, a much lower values of conception rate were reported with typical (51.61%), atypical (10.00%) and nil (0.00%) fern pattern, respectively by Choudhary and Purbey (1983)<sup>[2]</sup>. In contrary to present findings, Reddy (1973)<sup>[12]</sup> and Bennur (1998)<sup>[1]</sup> could not find any significant association between fern pattern and conception rate. Perkins (1974)<sup>[10]</sup> observed that estrogen increases the fern pattern and progesterone decreases. Sharma *et al.* (2008) stated that cervico-vaginal mucus with classical arborisation pattern due to increased salt and organic constituents favoured sperm survival and transportation. Verma *et al.* (2014)<sup>[18]</sup> opined that higher incidence of typical fern pattern may be due to the increase peripheral concentration of estrogen at the time of estrus leading to effective LH surge, ovulation and better conception rate.

### Conclusion

In the light of foregoing results it can be concluded that the Lakhimi cows and heifers with clear, thin, slightly alkaline pH, higher spinnbarkeit value and typical fern-pattern in cervico-vaginal mucus exhibited significantly higher conception rate and hence, these physical properties of cervico-vaginal mucus can be considered as indicators of fertility in Lakhimi cows and heifers.

### Acknowledgement

I acknowledge Dean, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati-781022 for providing me necessary facilities to perform the research work. Financial assistance from the project ICAR-AICRP on Nutritional and Physiological Interventions for enhancing Reproductive performance in animals is also acknowledged.

### Conflict of interest

The authors state that they have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

### References

- Bennur PC. *In vitro* sperm mucus penetration tests and physical characters of cervico-vaginal mucus in relation to fertility of cows. Thesis, University of Agricultural Science, Dharwad, 1998.
- Choudhary SK, Purbey LN. Estrus and its relation to conception in rural cattle. *Indian J Anim. Reprod.* 1983;4:21-23.
- Dev S, Pangawkar GR, Sharma RK, Verma HK. Sperm penetration in relation to physical characteristics of buffalo estrual mucus. *Indian J Anim. Sci.* 1997;12:89-91.
- Enkhia KL, Kohli IS. Note on the physical properties of cervico-vaginal mucus during estrus in normal and repeat breeding Rathi cows. *Indian J Anim. Sci.* 1982;52(12):1239-1240.
- Gohel MM, Kavani FS, Hadiya KK. Physical properties of estrual mucus in Gir cows with reference to their body condition score and fertility. *Indian J Field Vet.* 2012;8(2):9-13.
- Hamana K, El-Banna AA, Hafez ESE. Sialic acid and some physicochemical characteristics of bovine cervical mucus. *Cornell Vet.* 1971;61:104-113.
- Mehta GB. Studies on repeat breeding condition in crossbred (K X J and K X HF) cattle with special reference to cervical mucus. M.V.Sc. Thesis, Gujarat Agricultural University, Anand, 1986.
- Pandey SK, Pandit RK, Chaudhary RA. Repeat breeding cows in relation to physical characteristics of cervical mucus, fertility and treatment. *Indian Vet, J.* 1983;60(11):946-947.
- Parks AS. *Marshal's Physiology of Reproduction.* Longmans, green and Co., N.Y. 1956;2:586-615.
- Perkins JL. Fluid flow of the oviduct. In: *The oviduct and its functions.* Johnson, A.D.; Foley, C.W. (Eds.), New York: Academic Press, 1974, pp. 119-132.
- Rangnekar MN, Dhoble RL, Gacche MG, Ingawale MV, Sawale AG, Jadhav JM. Physical properties of estrual cervical mucus in repeat breeding crossbred (HF) cows with reference to fertility. *Indian J Anim. Sci.* 2002;72(12):1122-1124.
- Reddy VN. Studies on certain physical and biochemical properties of cervical mucus of fertile and infertile dairy cows during oestrus. *Indian Vet. J.* 1973;60:731-734.
- Salphale GV, Kadu MM, Fasihuddin M, Kadu MS. Study of some physical properties of estrual cervical mucus in synchronized normal and repeat breeder crossbred cows with special reference to fertility. *Indian J Anim. Reprod.* 1993;14(2):77.
- Sharma V, Prasad S, Gupta HP. Studies on physical and rheological properties of Cervico-vaginal mucus during early pregnancy in buffaloes (*Bubalus bubalis*). *Vet. World.* 2013;6(8):508-511.
- Sharma VK, Tripathi SS. Physico-chemical properties of cervical mucus in relation to conception in normal and repeat breeding crossbred cows. *Indian J Anim. Reprod.* 1987;8:39-42.
- Srivastava SK, Umashankar, Agrawal SK, Sahni KL. Effect of estrual cervical mucus peroxidase and fern pattern on fertility in crossbred cows. *Indian J Anim. Sci.* 2000;70(8):807-809.
- Tsiligianni T, Karagiannidis A, Brikas P, Saratsis P. Physical properties of bovine cervical mucus during normal and induced (Progesterone and/or PGF<sub>2</sub>α) estrus. *Theriogenology.* 2001;55:629-640.
- Verma KK, Prasad S, Kumaresean A, Mohanty TK, Layek SS, Patbandha TK, *et al.* Characterization of physico-chemical properties of cervical mucus in relation to parity and conception rate in Murrah buffaloes. *Veterinary World.* 2014;7(7):467-471.
- Wani GM, Tripathi SS, Saxena VB. Studies on bio chemical properties of cervical mucus in normal and repeat breeding Sahiwal cows. *Indian J Anim. Health.* 1982;21(1):29-31.