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RESEARCH ARTICLE

RHEOLOGICAL PROPERTIES OF CERVICO-VAGINAL MUCUS IN RELATION TO FERTILITY IN CROSSBRED COWS AND HEIFERS.

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Abstract

This study was carried out on cows (n=20) and heifers (n=20) belonging to the Dairy farm of College of Veterinary Science and Animal Husbandry, Mhow and clinical cases of progressive farmers brought for artificial insemination to the Teaching Veterinary Clinical Complex and at the doorstep of farmers in nearby villages. The cervico-vaginal mucus samples were collected from the animals at oestrus and were immediately used for physical parameter analysis. Physical profile revealed that the mean pH value of cervico-vaginal mucus was observed in conceived and non-conceived crossbred cows and heifers, with the difference being non-significant in all the groups, but in pooled heifers, the respective values for pH were highly significant ($P<0.01$). The mean spinnbarkeit value of cervico-vaginal mucus was observed in conceived and non-conceived crossbred cows and heifers, with the difference being highly significant ($P<0.01$) in all the groups. The per cent incidence of typical, atypical and nil fern patterns of cervico-vaginal mucus samples were highly significant ($P<0.01$) in all the groups of conceived and non-conceived crossbred cows and heifers. Pregnancy was confirmed by rectal palpation after 2 months of insemination.

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Introduction:-

The nature of cervical mucus has pronounced influence on the fertilizing capacity of the spermatozoa in female reproductive tract and its physical properties have direct relationship with the fertility status of the animals (Rangnekar *et al.*, 2002).

Oestrus, the most visible phase of the oestrous cycle is characterized by nervousness, bellowing and mounting, stands to be mounted by another cow, reduced feed intake and milk production. Fertility of a dairy cow is the ability of the animal to conceive and maintain pregnancy if served at the appropriate time in relation to ovulation. Lack of determination of oestrus sign causes lowers bovine productivity and fertility resulting in significance economic loss to the dairy industry. This study was planned to determine the fertility with physical properties in crossbred cows and heifers.

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Materials and Methods:-

The study was carried out on cows and heifers belonging to the Dairy farm of College of Veterinary Science and Animal Husbandry, Mhow and clinical cases of progressive farmers brought for AI to the Teaching Veterinary Clinical Complex and at the doorstep of farmers in nearby villages. All the crossbred cows (n=20) and heifers (n=20) included in this study were apparently healthy, cyclical having no palpable reproductive clinical abnormality on two consecutive rectal palpations, 10 days apart and were negative to white side test to rule out subclinical endometritis and were divided into groups as 1A, 1B, 2A and 2B which consists of 10 animals in each group. Pregnancy was confirmed by rectal palpation after 2 months of insemination. The cervico-vaginal mucus samples were collected from the animals at oestrus and were immediately used for physical parameter analysis. The pH of cervical mucus was measured with the help of pH paper (2.0 to 10.5). Spinnbarkeit and fern pattern was classified as described by Verma *et al.* (2014). The data was analyzed as per the standard statistical method by employing student's 't' test for pH and spinnbarkeit values and X^2 -tests for fern pattern (Snedecor and Cochran, 1994).

Results and Discussion:-

The physical properties viz., pH, spinnbarkeit value and fern pattern of cervico-vaginal mucus (CVM) in conceived and non-conceived crossbred cows and heifers at oestrus are presented in Table 1.

pH:-

The mean pH values of cervico-vaginal mucus in conceived crossbred cows and heifers were observed in different groups (1A, 1B, 2A and 2B) at oestrus as 8.28 ± 0.28 , 8.16 ± 0.30 , 8.12 ± 0.29 and 8.00 ± 0.36 , whereas, in non-conceived crossbred cows and heifers these values were found to be 7.66 ± 0.33 , 7.50 ± 0.28 , 7.50 ± 0.50 and 7.25 ± 0.25 , respectively, with the difference being non-significant in all the groups, but in pooled heifers, the respective values for pH were highly significant ($P < 0.01$) (Table 1).

The mean pH values (8.20 ± 0.20) of cervico-vaginal mucus in conceived crossbred cows were lower as compared to those reported in buffaloes by Vadodaria (1987), 8.36 ± 0.00 ; in Kankrej cows by Modi *et al.* (2011), 8.39 ± 0.17 and in crossbred cows by Rathod (2016), 8.45 ± 0.11 , but it was comparatively higher than those values reported in crossbred cows by Rangnekar *et al.* (2002), 7.71 ± 0.17 ; Siddiquee (2006), 7.48 ± 0.09 and Zaman *et al.* (2013), 7.35 ± 0.16 ; in cows by Bennur *et al.* (2004), 8.13 ± 0.07 ; in Rural crossbred cows by Gavit (2010), 7.57 ± 0.05 ; in Rural buffaloes by Jethva (2010), 7.21 ± 0.02 ; Sharma *et al.* (2013), 8.10 ± 0.05 and in Murrah buffaloes by Verma *et al.* (2014), 7.83 ± 0.02 .

The mean pH values (7.60 ± 0.24) of cervico-vaginal mucus in non-conceived crossbred cows were lower as compared to those reported in buffaloes by Vadodaria (1987), 8.39 ± 0.04 ; Sharma *et al.* (2013), 7.88 ± 0.14 ; in cows by Bennur *et al.* (2004), 8.15 ± 0.06 and in crossbred cows by Rathod (2016), 8.62 ± 0.12 , but it was comparatively higher than those reported in crossbred cows by Siddiquee (2006), 7.40 ± 0.09 and Zaman *et al.* (2013), 7.95 ± 0.09 ; in Rural crossbred cows by Gavit (2010), 7.31 ± 0.05 ; in Rural buffaloes by Jethva (2010), 7.08 ± 0.06 and in Kankrej cows by Modi *et al.* (2011), 6.19 ± 0.18 .

The mean pH values (8.08 ± 0.22) of cervico-vaginal mucus in conceived crossbred heifers were lower as compared to those reported in buffaloes by Vadodaria (1987), 8.36 ± 0.00 ; Sharma *et al.* (2013), 8.10 ± 0.05 ; in cows by Bennur *et al.* (2004), 8.13 ± 0.07 ; Modi *et al.* (2011), 8.39 ± 0.17 in Kankrej cows and in crossbred cows by Rathod (2016), 8.45 ± 0.11 , but it was comparatively higher than those reported in crossbred cows by Rangnekar *et al.* (2002), 7.71 ± 0.17 ; Siddiquee (2006), 7.48 ± 0.09 and Zaman *et al.* (2013), 7.35 ± 0.16 ; in Rural crossbred cows by Gavit (2010), 7.57 ± 0.05 ; in Rural buffalo heifers by Jethva (2010), 7.20 ± 0.03 and in Murrah buffaloes by Verma *et al.* (2014), 7.83 ± 0.02 .

The mean pH values (7.37 ± 0.18) of cervico-vaginal mucus in non-conceived crossbred heifers were lower as compared to those reported in buffaloes by Vadodaria (1987), 8.39 ± 0.04 and Sharma *et al.* (2013), 7.88 ± 0.14 ; in cows by Bennur *et al.* (2004), 8.15 ± 0.06 ; in crossbred cows by Siddiquee (2006), 7.40 ± 0.09 and Rathod (2016), 8.62 ± 0.12 , but it was comparatively higher than those reported in Rural crossbred cows by Gavit (2010), 7.31 ± 0.05 ; in Rural buffalo heifers by Jethva (2010), 6.95 ± 0.09 ; in Kankrej cows by Modi *et al.* (2011), 6.19 ± 0.18 and in crossbred cows by Zaman *et al.* (2013), 7.95 ± 0.09 .

Spinnbarkeit value:-

The mean spinnbarkeit values of cervico-vaginal mucus in conceived crossbred cows and heifers were found in different groups (1A, 1B, 2A and 2B) at oestrus as 14.42 ± 0.48 , 12.00 ± 0.44 , 14.75 ± 0.59 and 12.16 ± 0.30 cm, whereas, in non-conceived crossbred cows and heifers, these values were observed as 10.66 ± 0.33 , 7.75 ± 0.25 , 10.50 ± 0.50 and 8.75 ± 0.25 cm, respectively, with the difference being highly significant ($P < 0.01$) in all the conceived and non-conceived groups (Table 1).

The mean spinnbarkeit values (14.60 ± 0.37 cm) of cervico-vaginal mucus in conceived crossbred cows were very close to that reported in crossbred cows by Rangnekar *et al.* (2002), 14.59 ± 0.57 cm and Gavit (2010), 14.61 ± 0.33 cm in Rural crossbred cows, whereas, it was comparatively lower than those reported by Modi *et al.* (2011), 15.30 ± 0.51 cm in Kankrej cows, but it was comparatively higher than those values reported by Bennur *et al.* (2004), 7.38 ± 0.56 cm in cows; Jethva (2010), 10.80 ± 0.34 cm in Rural buffaloes; Sharma *et al.* (2013), 11.10 ± 0.33 cm in buffaloes; Verma *et al.* (2014), 14.16 ± 0.60 cm in Murrah buffaloes and Rathod (2016), 14.24 ± 0.78 cm in crossbred cows.

The mean spinnbarkeit values (10.60 ± 0.24 cm) of cervico-vaginal mucus in non-conceived crossbred cows were lower as compared to those reported by Gavit (2010), 12.16 ± 0.48 cm in Rural crossbred cows; Sharma *et al.* (2013), 11.00 ± 0.12 cm in buffaloes and Rathod (2016), 11.71 ± 0.73 cm in crossbred cows, but it was comparatively higher than those reported by Rangnekar *et al.* (2002), 9.83 ± 0.30 cm in crossbred cows; Bennur *et al.* (2004), 8.05 ± 1.33 cm in cows; Jethva (2010), 7.40 ± 0.75 cm in Rural buffaloes and in Kankrej cows by Modi *et al.* (2011), 8.0 ± 0.32 cm.

The mean spinnbarkeit values (12.08 ± 0.25 cm) of cervico-vaginal mucus in conceived crossbred heifers were lower as compared to that reported in crossbred cows by Rangnekar *et al.* (2002), 14.59 ± 0.57 cm and Rathod (2016), 14.24 ± 0.78 cm; Gavit (2010), 14.61 ± 0.33 cm in Rural crossbred cows; Modi *et al.* (2011), 15.30 ± 0.51 cm in Kankrej cows; Verma *et al.* (2014), 14.16 ± 0.60 cm in Murrah buffaloes. However, comparatively lower values were reported by Bennur *et al.* (2004), 7.38 ± 0.56 cm in cows; in Rural buffalo heifers by Jethva (2010), 10.77 ± 0.43 cm and in buffaloes by Sharma *et al.* (2013), 11.10 ± 0.33 cm.

The mean spinnbarkeit values (8.25 ± 0.25 cm) of cervico-vaginal mucus in non-conceived crossbred heifers were lower as compared to those reported in crossbred cows by Rangnekar *et al.* (2002), 9.83 ± 0.30 cm and Rathod (2016), 11.71 ± 0.73 cm; Gavit (2010), 12.16 ± 0.48 cm in Rural crossbred cows; Sharma *et al.* (2013), 11.00 ± 0.12 cm in buffaloes. However, comparatively lower values were reported by Bennur *et al.* (2004), 8.05 ± 1.33 cm in cows; Jethva (2010), 6.92 ± 0.70 cm in Rural buffalo heifers and in Kankrej cows by Modi *et al.* (2011), 8.0 ± 0.32 cm.

Fern pattern:-

The per cent incidence of typical fern pattern of cervico-vaginal mucus was observed in different groups (1A, 1B, 2A and 2B) at oestrus as 85.71, 83.33, 87.50 and 83.33, respectively, whereas, atypical fern pattern was found as 14.29, 16.67, 12.50 and 16.67 per cent in conceived crossbred cows and heifers, whilst in non-conceived crossbred cows and heifers typical fern pattern was observed in 66.67, 50.00, 50.00 and 75.00 per cent, respectively, whereas, atypical fern pattern was found in 33.33, 50.00, 50.00 and 25.00 per cent, respectively. Nil type of fern pattern was not observed in animals of all the groups, with the difference being highly significant ($P < 0.01$) in all the groups (Table 1).

The per cent incidence of typical fern patterns (86.67 per cent) of cervico-vaginal mucus in conceived crossbred cows were very close to those per cent indices reported in cows by Bennur *et al.* (2004) 87.50 and in buffaloes by Sharma *et al.* (2008), 87.50, whereas, comparatively lower per cent values were reported in crossbred cows by Mehta (1986), 75.00; Sharma *et al.* (1987), 60.46; Srivastava *et al.* (2000), 63.33; Rangnekar *et al.* (2002), 81.82; Selvaraj *et al.* (2002), 50.00 and Rathod (2016), 83.33; Modi *et al.* (2011), 65.00 in Kankrej cows and in Murrah buffaloes by Verma *et al.* (2014), 54.25. However, comparatively higher per cent values was reported by Bishnoi *et al.* (1982), 96.00 in cows; Gavit (2010), 91.23 in Rural crossbred cows and in Rural buffaloes by Jethva (2010), 95.83.

The per cent incidence of atypical fern patterns (13.33 per cent) of cervico-vaginal mucus in conceived crossbred cows were very close to those per cent indices reported by Bennur *et al.* (2004), 12.50 in cows and Sharma *et al.* (2008), 12.50 in buffaloes, whereas, comparatively higher per cent values were reported in crossbred cows by Mehta (1986), 25.00; Sharma *et al.* (1987), 27.91; Srivastava *et al.* (2000), 26.67; Rangnekar *et al.* (2002), 18.18; Selvaraj

et al. (2002), 50.00 and Rathod (2016), 16.66; in Kankrej cows by Modi *et al.* (2011), 35.00 and in Murrah buffaloes by Verma *et al.* (2014), 37.24, whereas, comparatively lower per cent values were reported by Bishnoi *et al.* (1982), 4.00 in cows; Gavit (2010), 8.77 in Rural crossbred cows and in Rural buffaloes by Jethva (2010), 4.17.

The per cent incidence of typical fern patterns (60.00 per cent) of cervico-vaginal mucus in non-conceived crossbred cows were lower as compared to those per cent values reported in crossbred cows by Mehta (1986), 85.71; Panchal *et al.* (1994), 71.11 in buffaloes; Bennur *et al.* (2004), 80.00 in cows; Gavit (2010), 69.77 in Rural crossbred cows and in Rural buffaloes by Jethva (2010), 78.13, whereas, comparatively lower per cent indices were reported in crossbred cows by Rangnekar *et al.* (2002), 33.33 and Selvaraj *et al.* (2002), 57.80 and in Kankrej cows by Modi *et al.* (2011), 25.00.

The per cent incidence of atypical fern patterns (40.00 per cent) of cervico-vaginal mucus in non-conceived crossbred cows were lower as compared to those per cent indices reported in crossbred cows by Rangnekar *et al.* (2002), 55.56 and Selvaraj *et al.* (2002), 42.10 and in Kankrej cows by Modi *et al.* (2011), 55.00, but it was comparatively higher than those per cent values reported in crossbred cows by Mehta (1986), 9.53; Panchal *et al.* (1994), 22.96 in buffaloes; Bennur *et al.* (2004), 20.00 in cows; Gavit (2010), 30.23 in Rural crossbred cows and in Rural buffaloes by Jethva (2010), 15.63.

The per cent incidence of typical fern patterns (83.33 per cent) of cervico-vaginal mucus in conceived crossbred heifers were very close to those per cent indices reported by Rathod (2016), 83.33 in crossbred cows whereas, comparatively lower per cent values were reported in crossbred cows by Srivastava *et al.* (2000), 63.33 and Rangnekar *et al.* (2002), 81.82; Modi *et al.* (2011), 65.00 in Kankrej cows and in Murrah buffaloes by Verma *et al.* (2014), 54.25. However, comparatively higher per cent values were reported by Bennur *et al.* (2004) 87.50 in cows; Gavit (2010), 91.23 in Rural crossbred cows and in Rural buffalo heifers by Jethva (2010), 95.24.

The per cent incidence of atypical fern patterns (16.66 per cent) of cervico-vaginal mucus in conceived crossbred heifers were very close to those per cent values reported by Rathod (2016), 16.66 in crossbred cows whereas, comparatively higher per cent indices were reported in crossbred cows by Srivastava *et al.* (2000), 26.67 and Rangnekar *et al.* (2002), 18.18; Modi *et al.* (2011), 35.00 in Kankrej cows and in Murrah buffaloes by Verma *et al.* (2014), 37.24, whereas, comparatively lower per cent values were reported by Bennur *et al.* (2004), 12.50 in cows; Gavit (2010), 8.77 in Rural crossbred cows and in Rural buffalo heifers by Jethva (2010), 4.76.

The per cent incidence of typical fern patterns (62.50 per cent) of cervico-vaginal mucus in non-conceived crossbred heifers were lower as compared to those per cent indices reported by Bennur *et al.* (2004), 80.00 in cows; Gavit (2010), 69.77 in Rural crossbred cows and in Rural buffalo heifers by Jethva (2010), 75.00, whereas, comparatively lower per cent values were reported by Rangnekar *et al.* (2002), 33.33 in crossbred cows and Modi *et al.* (2011), 25.00 in Kankrej cows.

The per cent incidence of atypical fern patterns (37.50 per cent) of cervico-vaginal mucus in non-conceived crossbred heifers were lower as compared to those per cent values reported by Rangnekar *et al.* (2002), 55.56 in crossbred cows and Modi *et al.* (2011), 55.00 in Kankrej cows, but it was comparatively higher than those per cent values reported by Bennur *et al.* (2004), 20.00 in cows; Gavit (2010), 30.23 in Rural crossbred cows and in Rural buffalo heifers by Jethva (2010), 25.00.

Among the conceived and non-conceived crossbred cows and heifers, none was found to have a nil fern pattern. Similar findings were also reported by Bennur *et al.* (2004) and Gavit (2010), who reported that among conceived and non-conceived animals, none was having nil fern pattern.

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Conflict of Interest:-

All authors declare no conflict of interest.

Table 1:-Group wise mean (\pm SE) distribution of physical properties of cervico-vaginal mucus in conceived and non-conceived crossbred cows and heifers

S. No.	Groups		Per cent (Animals)	Physical properties of CVM				
				pH	Spinnbarkeit value	Fern pattern		
				(Mean \pm SE)	(Mean \pm SE)	Typical	Atypical	Nil
1	1A (n=10)	Conceived	70.00 (7)	8.28 \pm 0.28	14.42 \pm 0.48**	85.71 ^a (6)	14.29 ^a (1)	0.00
		Non-conceived	30.00 (3)	7.66 \pm 0.33	10.66 \pm 0.33*	66.67 ^b (2)	33.33 ^b (1)	0.00
2	1B (n=10)	Conceived	60.00 (6)	8.16 \pm 0.30	12.00 \pm 0.44**	83.33 ^a (5)	16.67 ^a (1)	0.00
		Non-conceived	40.00 (4)	7.50 \pm 0.28	7.75 \pm 0.25*	50.00 ^b (2)	50.00 ^b (2)	0.00
3	2A (n=10)	Conceived	80.00 (8)	8.12 \pm 0.29	14.75 \pm 0.59**	87.50 ^a (7)	12.50 ^a (1)	0.00
		Non-conceived	20.00 (2)	7.50 \pm 0.50	10.50 \pm 0.50*	50.00 ^b (1)	50.00 ^b (1)	0.00
4	2B (n=10)	Conceived	60.00 (6)	8.00 \pm 0.36	12.16 \pm 0.30**	83.33 ^a (5)	16.67 ^a (1)	0.00
		Non-conceived	40.00 (4)	7.25 \pm 0.25	8.75 \pm 0.25*	75.00 ^b (3)	25.00 ^b (1)	0.00
5	CB cows (n=20)	Conceived	75.00 (15)	8.20 \pm 0.20	14.60 \pm 0.37**	86.67 ^a (13)	13.33 ^a (2)	0.00
		Non-conceived	25.00 (5)	7.60 \pm 0.24	10.60 \pm 0.24*	60.00 ^b (3)	40.00 ^b (2)	0.00
6	Heifers (n=20)	Conceived	60.00 (12)	8.08 \pm 0.22**	12.08 \pm 0.25**	83.33 ^a (10)	16.67 ^a (2)	0.00
		Non-conceived	40.00 (8)	7.37 \pm 0.18*	8.25 \pm 0.25*	62.50 ^b (6)	37.50 ^b (2)	0.00
7	Overall (n=40)	Conceived	67.50 (27)	8.14 \pm 0.14**	13.48 \pm 0.33**	85.19 ^a (23)	14.81 ^a (4)	0.00
		Non-conceived	32.50 (13)	7.46 \pm 0.14*	9.15 \pm 0.37*	61.54 ^b (8)	38.46 ^b (5)	0.00

Figures in parentheses indicate number of animals.

*The means bearing superscripts in column differ significantly ($P < 0.05$) and ** ($P < 0.01$).

Conceived Vs Non-conceived (Typical Vs Atypical)

Means bearing uncommon superscription in column differ significantly ($P < 0.01$)

Calculated x_2 : 7.65 (significant); Table x_2 = 6.63 at 1 d. f., $P < 0.01$.

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