RESEARCH ARTICLE

Ultrasonography Vs. Per Rectal Examination for Uterine Involution in Methyl Ergometrine and Other Supplements Treated Crossbred Cows

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Abstract

Normally calved 36 post-partum HF crossbred cows from first to seventh parity were selected from University Farm and divided randomly into 6 equal groups. In all treatment groups (T1 to T5), injections of methyl ergometrine maleate (Ergovet, 2 mg, i/m, OD) at 1/2 hr, 2nd and 3rd day post-partum were given. Additionally, in T2, calcium (Mifex, 50 mg/ml, @ 300 ml, i/v) and phosphorus (Tonophosphan, 0.2 gm/ml, @ 10 ml, i/m, OD) were injected on second day of calving; in T3, Vit. ADE (Intavita, @ 10 ml, i/m, OD) on the second day of calving; in T4, Ceftiofur sodium (Xyrofur, 1 gm, i/m, OD) for three days from the second day of calving, and in T5, Calcium, phosphorus, Vit. A D E and Ceftiofur sodium were given with same dosage. The sixth group (T6, control) was left untreated. Cervical and uterine (previously gravid; PG and non-gravid; NG horns) diameters and uterine involution were examined by USG and per rectal palpation, at 5 days interval from day 12 to day 40 post-partum, to observe the effect of methyl ergometrine with and without above combinations on uterine involution. The reduction was observed earlier in T1, T2, and T5, by per rectal palpation compared to USG examination, while in T3, T4 and C, both methods were at the same time. PG and NG horn diameters were reduced significantly ($p < 0.05$) earlier in all treatment groups (T1 to T5) as compared to control. Uterine involution was found to be completed by per rectal palpation on day 32 post-partum in all treatment groups and on day 37 in control, whereas by USG examination, it was on day 32 in T1 and T5 and on day 37 in all other groups. Methyl ergometrine along with Ca, P, Vit. ADE and ceftiofur, enhanced uterine involution in CB cows. Further, the uterine and cervical assessment by per-rectal palpation revealed fast involution as compared to USG.

Keywords: Methyl ergometrine, Uterine involution, Nutrient supplements, USG, Fertility, Lochial discharge, Pelvic brim.

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Introduction

Involution of the genital tract is a normal phenomenon in mammals. Complete uterine involution is a major determinant of post-partum fertility (Scully *et al*., 2013). The post-partum involution period involves myometrial smooth muscle contractions and necrosis of the caruncular stalk, breakdown of the superficial layer of the caruncle, expulsion of secundus (lochia), regeneration of the endometrium (LeBlanc *et al.,* 2011), elimination of bacterial contamination from the reproductive tract with resumption of ovarian function (Senger, 2012). Delayed uterine involution significantly prolongs the inter-calving period and results in progressive economic loss to the dairy farmers (Patel *et al*., 2006). Ecbolics or Uterotonic drugs evacuate the uterine contents by increasing its contractility and thus accelerate the process of involution. Methyl ergometrine, an ecbolic, acts directly on the uterine musculature and leads to contraction mediated by voltage-gated calcium channels, which are open directly and indirectly by agonist receptors (Ruttner *et al*., 2002). Along with ecbolics various minerals and vitamins also help in uterine involution (Hess, 2000).

Uterine involution can be monitored by USG and per rectal palpation. Ultrasonographic examination of the bovine genitalia post-partum revealed that the cervical and endometrial diameters and endometrial thickness decreased to reach static size till complete uterine involution. The dimensions evaluated by per rectal palpation are often about 1 to 2 cm greater than ultrasound measurements; presumably, because operators include the rectal wall thickness when using per rectal palpation (Hartmann *et al.,* 2016). In view of above, the present study was conducted to observe the effect of methylergometrine maleate alone or

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in combination with Ca, P, Vit. ADE and ceftiofur on uterine involution assessed by USG and per rectal palpation in HF crossbred cows.

Materials and Methods

The study was conducted at Instructional Dairy Farm, Nagla, Pantnagar, Uttarakhand from November 2019 to May 2020. Total 36 normally calved HF crossbred cows were randomly divided into six equal groups (n = 6 each). T1 - was treated with only methyl ergometrine maleate (Ergovet, Carus Laboratories Pvt. Ltd. 2 mg, i/m, OD) at 1/2 hr, second and third day post-partum; T2- along with methyl ergometrine as in T1, calcium (Mifex, Prima Vet Care Pvt. Ltd. 300 mL, i/v) and phosphorus (Tonophosphan, MSD animal health, 10 mL, i/m) were injected once on 2nd day of calving. T3 - Methyl ergometrine was injected as in T1 with Vit. ADE (Intavita, Intas Pvt. Ltd. 10 mL, i/m) once on the second day of calving. T4 - Methyl ergometrine as in T1 and Ceftiofur sodium (Xyrofur, Intas Pharma Pvt. Ltd. 1 gm, i/m, OD) injected for three days. T5 - Methyl ergometrine as in T1 with all supplements injected in same dosage, and C (Control) - cows were left untreated.

USG (Digi 600M Pro Vet, India) and per rectal palpation were done on day 12, 17, 22, 27, 32, 37 and 40 post-partum for evaluation of cervical and uterine (previously gravid; PG and non-gravid; NG) horn diameters. Uterine involution is considered completed when both the gravid, non-gravid horns are almost of the same diameter or almost symmetrical to each other, no further changes in cervical and uterine diameter occur and on per rectal examination whole genitalia is palpated within the pelvic brim (Noakes *et al*., 2009). Data was analyzed statistically for analysis of variance (ANOVA), and correlation was estimated between observations of USG and per rectal palpation by using Statistical Package for the Social Sciences (SPSS 16.0 Version).

Results and Discussion

Cervical Diameter

The cervical diameter measured by USG was found to be gradually and significantly ($p < 0.05$) reduced from day 12 to day 32, in T1, T2, T3, and T5 with non-significant differences thereafter till day 37/40 post-partum, while in T4 and control, it was reduced significantly ($p < 0.05$) till day 37. On per rectal palpation, the cervical diameter was reduced significantly ($p < 0.05$) earlier by one week in different groups as compared to USG findings (Table 1, Fig. 1). Results revealed that the reduction was observed earlier in T1, T2, and T5 by per rectal palpation as compared to USG examination, while in T3, T4, and C, it was on the same time by both methods. Further, in the group treated with methyl ergometrine along with

Fig. 1: Cervical diameter on day 12 Post-partum

Table 1: Cervical diameter (mm) of CB cows during post-partum by ultrasonographic examination and per rectal palpation (Mean ± SE)

	Days post-partum						
GP	*D12*	*D17*	*D22*	*D27*	*D32*	*D37*	*D40*
Cervical diameter (mm) by ultrasonographic examination							
T1	67.28 ± .1.92^{bcA}	53.28 ± 0.78^{bcB}	45.58 ± 1.72^{abC}	36.44 ± 0.33^{abD}	29.42 ± 0.27^{abE}	26.20 ± 0.15^{aE}	25.42 ± 0.13^{abE}
T2	66.31 ± 0.41^{bcA}	54.05 ± 0.33^{bcB}	43.08 ± 1.48^{bcC}	36.41 ± 0.35^{abD}	29.75 ± 0.22^{abE}	26.42 ± 0.16^{aE}	25.95 ± 0.19^{abE}
T3	68.51 ± 0.94^{bcA}	55.61 ± 2.63^{bB}	44.14 ± 3.01^{bcC}	38.19 ± 1.8^{abD}	29.47 ± .18^{abE}	26.43 ± 0.18^{aE}	25.62 ± 0.16^{abE}
T4	70.81 ± 2.44^{bA}	56.76 ± 1.15 ^{abB}	43.13 ± 1.54^{bcC}	37.29 ± 0.45^{abD}	30.15 ± 0.21^{abD} .	26.74 ± 0.13^{aE}	25.91 ± 0.11^{abE}
T5	63.65 ± 1.57^{cA}	50.40 ± 0.80^{cB}	38.89 ± 0.64^{cC}	33.73 ± 0.84^{bD}	26.54 ± .0.69^{bE}	26.44 ± 0.66^{aE}	25.10 ± 0.73^{bE}
C	75.93 ± 1.85^{aA}	60.45 ± 1.78^{aB}	49.64 ± 2.26^{aC}	40.15 ± 2.09^{aD}	36.76 ± 0.88^{aD}	27.24 ± 0.74^{aE}	26.26 ± 0.58^{aE}
Cervical diameter (mm) by per rectal examination							
T1	87.5 ± 0.54^{abA}	60.0 ± 0.36^{bcB}	48.3 ± 0.21^{bcC}	35.0 ± 0.12^{bcD}	33.3 ± 0.10^{aD}	30.0 ± 0.00^{bD}	30.0 ± .00^{bD}
T2	86.6 ± 0.66^{abA}	60.8 ± 0.49^{bcB}	47.5 ± 0.40^{bcC}	32.5 ± 0.11^{bcD}	31.6 ± 0.10^{bD}	30.0 ± 0.00 ^{bD}	30.0 ± .00^{bD}
T3	90.8 ± 0.37^{bA}	66.6 ± 0.24^{bB}	50.8 ± 0.23^{bC}	37.5 ± 0.25^{bcD}	34.1 ± 0.23^{aDE}	30.0 ± 0.00 ^{bE}	30.0 ± .00^{bE}
T4	87.5 ± 0.46^{abA}	67.5 ± 0.28^{bB}	51.6 ± 0.30^{bC}	39.1 ± 0.20^{bD}	32.5 ± 0.11^{bDE}	30.0 ± 0.00 ^{bE}	30.0 ± .00^{bE}
T5	74.1 ± 0.15^{bA}	52.5 ± 0.35^{cB}	39.1 ± 0.23^{cC}	30.8 ± 0.08^{cD}	30.0 ± 0.00^{bD}	30.0 ± 0.00^{bD}	30.0 ± .00^{bD}
C	97.5 ± 0.17^{aA}	87.5 ± 0.52^{aB}	66.6 ± 0.40^{aC}	48. ± 0.40^{aD}	36.6 ± 0.10^{aE}	31.6 ± 0.10^{aF}	31.6 ± 0.10^{aF}

Means with different superscripts within group (A,B,C,D,E) and between groups (a,b,c) differ significantly ($p < 0.05$).

Ca, P, ceftiofur and Vit. ADE, the cervical diameter reduced significantly earlier as compared to control and other groups and assessed by both USG and per-rectal methods (Table 1).

Similar significant reduction in cervical diameter by USG has also been reported between day 10 and 60 (73.20 ± 3.3 to 33.0 ± 2.26 mm) post-partum in cows (Shwetha, 2016). Atanasov *et al.* (2012), observed 45% decrease in diameter of cervix in normal cows from first to third week post-partum. Significant ($p < 0.05$) reduction in cervical diameter in methyl ergometrine-treated group was also recorded in earlier study from day 10 (38.88 ± 0.56 mm) to 30 (25.75 ± 0.18 mm) post-partum (Alagar *et al.*, 2016). Further, these results were also supported by Resum *et al.* (2018) and Bhoi *et al.* (2019).

Per rectal findings revealed that in treatment groups, the reduction in cervical diameter was slow after 27 days post-partum. Therefore, it can be concluded that the involution of cervix occurred from day 30 to 35 post-partum. These findings were also supported by earlier studies as cervical diameter reached to <5 cm by day 40 post-partum (Sheldon, 2004), 3.6 ± 0.6 and 2.9 ± 0.2 cm by 21 and 35 days post-partum, respectively (Lopez, 2012) and 15, 9-11, 7-8 cm by day 2nd, 10th and 30th post-partum, respectively (Elmetwally, 2018). Further, comparable to our study, cervical involution was completed by day 24-35 post-partum (Shah *et al.*, 2004). The reason behind the fast cervical involution in cows supplemented with methyl ergometrine as well as calcium, phosphorous, Vit. ADE and ceftiofur, might be the combined or synergistic effect of these chemicals as all of them directly or indirectly affect post-partum involution of genital organs.

Gravid and Non-gravid Horn Diameter

On USG examination, in all groups, the uterine diameters of previously gravid (PG) and non-gravid (NG) horns were observed to be reduced gradually and significantly ($p < 0.05$) from day 12 till day 32 post-partum by both USG and P/R palpation, except in T3 and control groups, wherein reduction continued till day 37 post-partum. Both PG and NG horns were of same size in T1, T2, T3, T4, T5 and control on 32, 32, 32, 32, 27, and 37 by USG, and 32, 32, 37, 37, 32, and 40 days post-partum by P/R palpation, respectively (Table 2, 3, Fig. 2). The reduction in T5 was non-significant after day 32 and around day 27; both the horns were the same size as other groups. Hence it might be concluded that T5 had a positive effect of methyl ergometrine in combinations with other drugs on enhanced uterine involution.

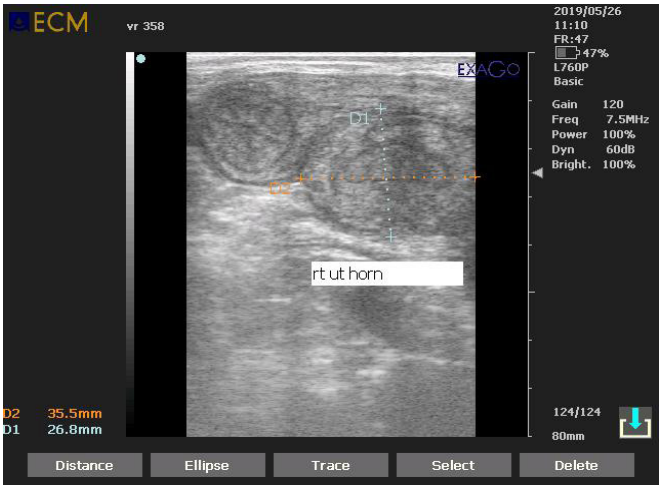

Fig. 2: Right uterine horn on day 27 post-partum

Table 2: Previously gravid (PG) and non-gravid (NG) uterine horn diameters (mm) in cows during post-partum period by ultrasonographic examination (Mean ± SE)

	Days post-partum						
GP	*D12*	*D17*	*D22*	*D27*	*D32*	*D37*	*D40*
Diameters of previously gravid (PG) uterine horn by USG (mm)							
T1	82.20 ± 1.72^{bA}	56.67 ± 2.7^{bcB}	46.13 ± 2.3^{bcC}	35.84 ± 1.20^{bcD}	27.36 ± 1.12^{bE}	23.60 ± 0.79^{aE}	22.70 ± 0.39^{aE}
T2	80.51 ± 3.51^{bA}	59.27 ± 2.85^{bB}	48.58 ± 0.91^{bC}	33.33 ± 1.88^{bD}	25.11 ± 0.39^{bcE}	23.85 ± 0.16^{aE}	22.53 ± 0.30^{aE}
T3	77.56 ± 2.71^{bcA}	58.69 ± 0.69^{bcB}	49.00 ± 2.08^{bC}	32.18 ± 1.42^{bD}	26.66 ± 0.38^{bE}	24.37 ± 0.33^{aE}	22.84 ± 0.32^{aE}
T4	78.02 ± 1.00^{bcA}	60.42 ± 1.48^{bB}	47.02 ± 1.24^{bC}	34.73 ± 1.52^{bD}	25.17 ± 0.47^{bcE}	23.85 ± 0.39^{aE}	22.42 ± 0.25^{aE}
T5	71.16 ± 0.52^{cA}	51.99 ± 1.12^{cB}	39.76 ± 1.98^{cC}	28.02 ± 0.63^{cD}	$23.49 \pm .074^{bE}$	21.82 ± 0.46^{bE}	20.26 ± 0.08^{bE}
C	90.01 ± 1.79^{aA}	$68.8\ 3 \pm 3.28^{aB}$	56.45 ± 3.95^{aC}	40.67 ± 2.00^{aD}	30.30 ± 1.76^{aE}	24.86 ± 0.43^{aEF}	23.10 ± 0.49^{aF}
Diameters of previously non-gravid (NG) uterine horn by USG (mm)							
T1	57.19 ± 1.71^{qP}	44.87 ± 2.20^{pqQ}	39.32 ± 2.12^{pR}	33.51 ± 0.77^{qS}	26.52 ± 0.76^{qT}	22.06 ± 0.64^{qT}	21.17 ± 0.32^{pqT}
T2	60.08 ± 1.54^{qP}	45.06 ± 1.75^{pqQ}	38.59 ± 0.93^{pR}	33.05 ± 1.20^{qS}	22.65 ± 0.74^{pqT}	22.83 ± 0.22^{qT}	21.43 ± 0.34^{pqT}
T3	59.01 ± 2.20^{qP}	43.82 ± 1.05^{qQ}	38.40 ± 0.75^{pR}	32.94 ± 0.88^{qS}	25.21 ± 0.81^{pqS}	23.12 ± 0.34^{qT}	22.20 ± 0.23^{pqT}
T4	57.61 ± 1.98^{qP}	44.19 ± 1.55^{qQ}	36.88 ± 0.12^{pqR}	31.80 ± 0.95^{qS}	22.06 ± 0.74^{pqT}	22.40 ± 0.37^{qT}	21.37 ± 0.27^{pqT}
T5	53.82 ± 1.25^{qP}	40.58 ± 0.60^{qQ}	34.46 ± 0.54^{qR}	26.43 ± 1.14^{qS}	22.17 ± 0.92^{rT}	20.29 ± 0.12^{rT}	19.63 ± 0.13^{qT}
C	69.66 ± 3.66^{pP}	49.08 ± 0.30^{pQ}	39.32 ± 1.40^{pR}	33.56 ± 0.96^{pS}	29.19 ± 0.81^{pS}	22.98 ± 0.19^{pT}	21.91 ± 0.48^{pT}

Means with different superscripts within group (A,B,C,D,E,F / P,Q,R,S,T) and between groups (a,b,c / p,q,r) differ significantly ($p < .05$).

Table 3: Previously gravid horn (PG) and non-gravid (NG) uterine diameters (cm) of CB cows during post-partum period by per rectal palpation (Mean ± SE)

	Days post-partum						
GP	*D12*	*D17*	*D22*	*D27*	*D32*	*D37*	*D40*
Diameter of previously gravid (PG) uterine horn by P/R examination (cm)							
T1	8.41 ± 0.23^{bA}	6.91 ± 0.35^{abB}	5.50 ± 0.34^{bC}	3.16 ± 0.16^{bcD}	2.83 ± 0.10^{bcD}	2.75 ± 0.11^{bD}	2.66 ± 0.10^{D}
T2	8.08 ± 0.35^{bA}	6.66 ± 0.21^{abB}	5.33 ± 0.16^{bC}	3.58 ± 0.15^{bcD}	2.91 ± 0.20^{bcE}	2.91 ± 0.15^{bE}	2.66 ± 0.10^{E}
T3	8.25 ± 0.21^{bA}	6.58 ± 0.35^{abB}	5.16 ± 0.35^{bC}	3.66 ± 0.16^{bD}	3.08 ± 0.08^{bE}	2.83 ± 0.10^{bE}	2.66 ± 0.10^{E}
T4	8.25 ± 0.42^{bA}	6.66 ± 0.27^{abB}	5.08 ± 0.20^{bC}	3.58 ± 0.08^{bcD}	3.16 ± 0.16^{bE}	2.75 ± 0.11^{bE}	2.66 ± 0.10^{E}
T5	7.25 ± 0.28^{bA}	6.00 ± 0.12^{bB}	4.08 ± 0.08^{cC}	3.33 ± 0.10^{cD}	2.58 ± 0.08^{cE}	2.83 ± 0.10^{bE}	2.58 ± 0.08^{E}
C	10.58 ± 0.61^{aA}	8.83 ± 0.16^{aB}	6.91 ± 0.20^{aC}	4.66 ± 0.21^{aD}	3.83 ± 0.21^{aE}	3.25 ± 0.11^{aE}	2.83 ± 0.10^{E}
Diameter of previously non-gravid (NG) uterine horn by P/R examination (cm)							
T1	5.66 ± 0.16^{qP}	4.75 ± 0.17^{qQ}	3.75 ± 0.25^{qR}	$2.91 \pm .23^{pqS}$	2.25 ± 0.11^{pqT}	$2.16 \pm .10^{pT}$	2.08 ± 0.08^{pT}
T2	6.01 ± 0.51^{qP}	4.83 ± 0.24^{qQ}	3.75 ± 0.17^{pqR}	$2.83 \pm .21^{pqS}$	2.58 ± 0.15^{pqS}	$2.16 \pm .10^{pT}$	2.08 ± 0.08^{pT}
T3	6.08 ± 0.23^{qP}	4.50 ± 0.28^{qQ}	3.75 ± 0.11^{pqR}	$3.08 \pm .15^{pqS}$	2.66 ± 0.16^{pqT}	$2.25 \pm .17^{pT}$	2.16 ± 0.16^{pT}
T4	5.83 ± 0.33^{qP}	4.91 ± 0.23^{qQ}	3.83 ± 0.16^{pqR}	$3.25 \pm .11^{pqS}$	2.41 ± 0.08^{pqT}	$2.41 \pm .08^{pT}$	2.08 ± 0.08^{pT}
T5	$5.16 \pm .024^{qP}$	4.25 ± 0.17^{qQ}	3.25 ± 0.11^{qR}	$2.66 \pm .16^{qS}$	2.33 ± 0.10^{qT}	$2.33 \pm .10^{pT}$	2.16 ± 0.10^{pT}
C	7.50 ± 0.36^{pP}	5.58 ± 0.23^{pQ}	4.16 ± 0.10^{pR}	$3.58 \pm .08^{pS}$	2.75 ± 0.11^{pT}	$2.41 \pm .08^{pT}$	2.25 ± 0.11^{pT}

Means with different superscripts within group (A,B,C,D,E,F / P,Q,R,S,T) and between groups (a,b,c /p,q,r) differ significantly ($p < .05$).

Further, the PG and NG horns reached to pelvic brim in T1, T2, T3, T4, T5, and control on 23.00 ± 1.26, 23.50 ± 1.02, 22.00 ± 1.68, 22.00 ± 0.92, 22.00 ± 1.09 and 25.50 ± 0.92 days post-partum, respectively, and a non-significant difference was observed in all groups. Our findings were in accordance with Čengić *et al.* (2012). In another study, reduction in uterine horn diameter was from 45.50 ± 0.09 mm on day 10 to 25.13 ± 0.82 mm on day 30 post-partum in methyl ergometrine treated groups, and also a significant and rapid reduction was noticed from 2nd to 30th day post-partum (Alagar *et al*., 2016).

The genital tract never returns fully to its former pregravid state, especially after first parturition. In T5, the reduction of cervical and uterine horns (PG and NG) diameters was faster as compared to other groups due to the combined effect of various supplements since calcium, and phosphorus affects the maintenance of uterine musculature contractibility, vitamin A causes re- epithelization of the endometrial lining, Vit. D acts synergistically with calcium on uterine contraction (Elmetwally, 2018), Vit. E prevents oxidation (McNaughton and Murray, *2009*), ceftiofur eliminates bacterial infection (Kaufmann *et al*., 2010) and methyl ergometrine has ecbolic effect (Solanki *et al.,* 2019). Fastest reduction of uterine size from day 12 to 27 was observed in T5 followed by T3 group. Kawashima *et al.* (2018) documented significant decline in uterine diameter from 3.0-2.3 cm during 2nd to 4th week post-partum and then it remained constant till 6th week.

The correlation was estimated between findings of ultrasonography and per rectal palpation for cervical and uterine (PG and NG) diameters. Significant ($p < 0.01$) positive correlation coefficients (r) of 0.693, 0.755, and 0.556 were observed for cervical, PG and NG uterine horn diameters, respectively, between two methods. Honaparkhe *et al.* (2004) also observed a positive linear correlation (r = 0.87) in the measurements of genital organs by USG and per rectal palpation. These correlations suggested that though there were differences in diameters measured by USG and per rectal palpation, the observations were in the same direction.

Uterine Involution Estimation by USG and Per Rectal Palpation

By USG examination, uterine involution was estimated in days when both horns (PG & NG) were of same size and no further change in diameter was observed. While in per rectal examination, along with above two criteria, the day, when uterus reached to pelvic brim, was also considered for complete uterine involution.

Initially, the uterus and cervix were not palpable completely by hand till day 10th post-partum. The reduction was very fast from day 2 to day 10 and the bifurcation was not clear till day 10th post-partum. Both horns were palpable on day 10 to 12, but the previously gravid horn (PG) was longer than the non-gravid horn (NG). Shwetha (2016) also could palpate genitalia per rectum by 8 to 10 days and it reached to the pelvic brim by day 19 ± 5 post-partum. Days required for complete uterine involution was earlier by per rectal examination as compared to ultrasonography. While in T1 and T5 the uterine involution was same by both methods. Uterine involution was earlier in methyl ergometrine treated cows as compared to control when assessed by both methods. The present findings were in close agreement with Čengić *et al.* (2012), who observed uterine involution from day 38-45 post-partum, in normally calved cows. In an earlier study (Solanki *et al*., 2019), uterine involution was complete on 28.67 ± 1.12, 35.83 ± 1.49 and 41.00 ± 1.46 days

post-partum in PGF2α, methyl ergometrine, and untreated cows, respectively. Resum *et al*. (2018) observed it on 37.81 ± 1.37 days in methyl ergometrine, Se and Vit. E-treated cows compared to control (65.40 ± 2.34 days) concurred with the present findings.

Days required for complete uterine involution in methyl ergometrine, PGF2α, uterovet and untreated cow were 25.67 ± 0.88, 28.17 ± 0.95, 32.83 ± 1.28 and 37.67 ± 1.30 days, respectively (Patel *et al.,* 2015). A rapid uterine involution was also observed from day 2 to 30 in oxytocin treated as compared to untreated cows (Alagar *et al.,* 2016). On the contrary, a non-significant effect on uterine involution, resumption of cyclicity, the prevalence of reproductive disease or reproductive performance was observed in ecbolics like oxytocin and PGF2α treated compared to untreated cows (Stephen *et al.,* 2019).

Involution is considered completed when certain parameters are achieved, *i.e.,* complete expulsion of lochial fluid, elimination of bacteria, return of genitalia in pelvic brim with no further significant reductions in diameters, and regeneration of endometrial epithelium (LeBlanc *et al.,* 2011). Enhanced uterine involution in methyl ergometrine as well as other chemical supplemented than separate treatment and control group, might be due to ecbolic effect of methyl ergometrine (Resum *et al*., 2018), antimicrobial activity of cetiofur (Sheldon, 2004), enhanced uterine contraction due to calcium and phosphorus, regeneration of epithelium by Vit. A, synergistic effect on calcium uptake and action by Vit. D and antioxidant property of Vit. E.

Conclusion

Methyl ergometrine in combinations with Ca, P, Vit. A D E and ceftiofur showed a faster reduction of cervical and uterine diameters as compared to the control group and their separate individual use. Hence it is concluded that methyl erogmetrine action is potentiated with these combinations on uterine involution process. Assessment of uterine involution was found earlier by per rectal method as compared to ultrasonography.

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