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Reproductive efficiency in lactating Murrah buffaloes supplemented with mustard oil

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Abstract
The study was aimed to investigate the effect of mustard oil supplementation on the reproductive efficiency of lactating Murrah buffaloes. Twelve advance pregnant Murrah buffaloes were selected 21 days pre-partum and divided in 2 groups of 6 each; CON as control and MO as mustard oil supplemented @ 200 ml/animal/day upto 90 days post-partum. The results revealed non-significant improvement in average birth weight of calves by 6.54%, first post-partum estrus by 12.34 days, service period by 14 days and time for the expulsion of placenta by 1.25 hrs. in MO as compared to CON. Both the groups shared similar first service conception rate (50.00%) and there were no positive cases of retention of placenta in MO however it was 16.66% in CON. This study affirms that the overall reproductive efficiency was better in MO than CON which is imperative to renew the lactation cycle and increase the longevity of dairy animals.

Keywords: Murrah, mustard oil, estrus, service period, conception, placenta

1. Introduction
Adequate nutrition is of extreme importance for successful reproductive functions. Insufficient dietary energy intake leads to lipolysis, depressed concentrations of glucose, reduced insulin levels, increased non-esterified fatty acids (NEFA) and β-hydroxybutyric acid (BHBA) that can adversely affect the reproductive efficiency of dairy animals. Under this condition, animals rely on their body reserves and witness poor body condition score and fertility problems [19]. To increase the energy density of the diet and to overcome the associated negative effects of cereal grains, fat is supplemented in the diet of high producing dairy animals. Fat supplementation has been shown to positively affect reproductive function at several important tissues, including the hypothalamus, anterior pituitary, ovary, and uterus [3]. The influence of fat supplementation during the transition period has led to the improvement in conception rate [2], pregnancy rate and service period [10]. It has been implied that rations containing fat, especially vegetable oils rich in unsaturated fatty acids, may stimulate follicular dynamics and the correct functioning of corpus luteum [11]. Among vegetable oils, mustard oil is one of the traditionally used cheaper sources of fat supplement that contains 60% MUFA and 21% PUFA [18]. But the exact information on the reproductive performances of dairy animals supplemented with mustard oil is still not known. Keeping the above facts in mind, an attempt was made to investigate the effect of mustard oil supplementation on the reproductive efficiency of lactating Murrah buffaloes.

2. Materials and methods
2.1 Place of work
The proposed work was conducted on 12 advance pregnant Murrah buffaloes from 21 days pre-partum to 90 days post-partum at Livestock Farm, Adhartal, College of Veterinary Science & A.H., Nanaji Deshmukh Veterinary Science University, Jabalpur (M.P.). The animals were selected on the basis of similarity in body weight, age, parity (1st to 3rd) and previous lactation yield and randomly assigned in 2 groups of 6 each; CON as the control without supplementation and MO as the mustard oil supplementation @ 200 ml/animal/day.

2.2 Feeding regime
The experimental animals were stall fed and maintained in a semi-intensive system of housing. The animals were fed total mixed ration according to their body weight and production as per

ICAR [6]. A fixed quantity of chaffed green fodder and wheat straw was offered to the animals. The concentrate consisting of 18 percent crude protein and 70 percent total digestible nutrients was offered at a scale of 1 kg per 2.0 kg milk production along with maintenance ration as per routine practices at the farm. The measured quantity of soybean oil was mixed daily in the concentrate of MO supplemented group at the time of feeding. The total required quantity of feed was offered daily at 5.30 am and 3.00 pm. The water was available to the animals round the clock. The experiment was approved by the Institutional Animal Ethics Committee.

2.3 Parameters studied were

2.3.1 Birth weight of calf: The birth weight of each calf was recorded with the help of electronic weighing balance.

2.3.2 First post-partum estrus: The first post-partum estrus was observed by the visual observation and acceptance of a male by the female, which is the most prominent and reliable symptom of estrus in buffalo.

2.3.3 Service period: The service period was calculated from the date of calving to the date of successful conception.

2.3.4 First service conception rate: The first service conception rate was calculated by the percentage of experimental buffaloes conceiving out of the total buffaloes at the first service.

2.3.5 Dystocia: Dystocia was calculated as follows:

$$\text{Dystocia (\%)} = \frac{\text{No. of assisted calvings}}{\text{Total no. of calvings}} \times 100$$

2.3.6 Time of expulsion of placenta: This is the period from end of the delivery of foetus to end of complete expulsion of placenta. After parturition, the buffaloes were kept under constant watch for recording the time of expulsion of placenta.

2.3.6 Retention of placenta: The buffalo that did not shed the placenta within 12 hours of parturition were considered as a positive case of retention of placenta.

2.4 Statistical analysis Data were analyzed using ANOVA [12] and the means showing significant differences in the ANOVA table were compared using the Duncan Multiple Range Test [15].

3. Results and discussion

3.1 Birth weight of calves

The mean±SE values of birth weight of calves are presented in table 1. The lowest and highest birth weight (kg) of calves throughout the study was 25.12 and 36.20 in CON and 29.12 and 37.20 in MO, respectively. The average birth weight (kg) of the calves varied non-significantly and the values were numerically higher in MO (31.94±1.44) by 6.54 percent as compared to CON (29.98±1.86). The calves born under MO had straight and glossy hairs as compared to CON with curly and rough hairs distributed over the body.

The present result is similar with the findings of [13] who reported higher plasma progesterone concentration and lower insulin level on the fat supplementation. The higher progesterone level might have provided better nourishment to the foetus in the final stages of pregnancy whereas; [16] reported that the dietary fat breaks into fatty acids and glycerol, where glycerol forms glucose, which in insufficiency of insulin is not utilized by the cells. This lower insulin level has glucose sparing effect that might have diverted the spared energy towards the foetal growth. Therefore, the birth weight of calf was higher in the supplemented group.

3.2 First post-partum estrus

The mean±SE values of first post-partum estrus are presented in table 2. The results revealed non-significant improvement in the first post-partum estrus in MO (42.83±6.00) by 12.34 days in comparison to CON (55.17±6.15).

The result is similar with the finding of [3] who reported that the increased linoleic acid content in the mustard oil acts as a substrate for $PGF_{2\alpha}$ synthesis. Linoleic acid can be desaturated and elongated to form arachidonic acid which is a precursor of $PGF_{2\alpha}$. The increase in $PGF_{2\alpha}$ reduces progesterone concentration which consequently changes the oestradiol: progesterone ratio and thus, induces modifications in the secretory pattern of gonadotrophin hormones. This leads to the development of an ovulatory follicle which stimulates return to the ovarian cycling. The result is further in compliance with the findings of [4] who reported reduction in onset of cyclicity by 18 days in fat supplemented group and stated that fat supplementation in early lactation reduces the negative energy balance allowing the animals to resume estrus cyclicity earlier after parturition and therefore exhibit better reproductive performance.

3.3 Service period

The mean±SE values of service period are presented in table 2. The results revealed non-significant improvement in service period in MO (58.00±8.17) by 14 days in comparison to CON (72.00±7.68).

The result is supported by the findings of [14] who stated that the feeding of supplemental fat may increase the blood cholesterol concentration. Pregnanolone, which is a cholesterol derivative acts as the precursor of progesterone and the regulatory enzyme required for this conversion is 3β-hydroxysteroid dehydrogenase. This increase in progesterone concentration helps in improving the fertility in lactating Murrah buffaloes.

3.4 First service conception rate

The percent values of first service conception rate are presented in table 2. Out of 6 animals in each group, 3 animals each in CON and MO conceived in their first service and exhibited 50% conception rate, respectively.

There was no effect of fat supplementation on conception rate in the present study. Similar to the present results, [1] in beef cows supplemented with fish meal @ 450 g/d and [17] in crossbred cows supplemented with bypass fat @ 2.5 percent also recorded no difference in conception rate.

3.5 Dystocia

There were no positive cases of dystocia among the groups of lactating Murrah buffaloes raised under different treatments during the experimental trial.

3.6 Time for expulsion of placenta

The mean±SE values of time for the expulsion of placenta

(hrs) are presented in table 2. The result interpret that CON (7.33±2.28) exhibited non-significant delay in the expulsion of the placenta by 1.25 hrs in comparison to MO (6.08±1.07). An investigation by [5] supported the present result and reported that feeding buffalo on high energy diet had significantly positive effect on the normal time needed from calving to release of placenta. [8] resembled the findings and concluded that time to expel placenta in Holstein cows supplemented with protected fat @ 3-5 percent was reduced by 3.60 and 3.10 hrs.

3.7 Retention of placenta (ROP)

The percent values of positive cases of ROP are presented in table 2. The results indicate that out of 6 animals in CON, 1 animal suffered from ROP (16.66%; n=6) meanwhile no such incidence was observed in MO (0.00%; n=6).

An investigation by [9] stated that the higher milking animals with a greater degree of NEB pre-partum and higher NEFA concentrations are 80 percent more likely to suffer from ROP. In addition to it, the serum cholesterol concentration declines 2 weeks pre-partum until 1-2 weeks post-partum and is the primary cause for ROP as reported by [7]. The present result is supported by the given findings. This was not the case with MO as animals were maintained in positive energy balance and the cholesterol concentration during pre and post-partum feeding period .

Table 1: Average birth weight (kg) of calves in different treatment groups (Mean±SE)

S. No.	CON	MO
1	25.12	29.16
2	25.22	29.12
3	30.40	30.24
4	36.20	37.20
5	31.16	35.58
6	31.90	30.34
Average	29.98±1.86	31.94±1.44

Table 2: Effect of mustard oil supplementation on the reproductive performances in lactating Murrah buffaloes (Mean±SE)

S. No.	Particulars	CON	MO
1	Average first post-partum estrus (days)	55.17±6.15	42.83±6.00
2	Average service period (days)	72.00±7.68	58.00±8.17
3	Average first service conception rate (%)	50.00	50.00
4	Dystocia (%)	0.00	0.00
5	Average time for expulsion of placenta (hrs)	7.33±2.28	6.08±1.07
6	Retention of placenta (%)	16.66	0.00

4. Conclusion

One of the goals of dairy management programs is to improve the reproductive efficiency and in comparison to CON, the MO supplementation has non-significantly improved the reproductive efficiency of lactating Murrah buffaloes viz. advanced birth weight, early first post-partum estrus and service period, shorter time to expel placenta and no incidences of ROP. There were no positive cases of dystocia between the groups and the first service conception rate was found similar in both the groups. This strategic approach is a better alternative for solving negative energy balance and improving health status of animals and thus, it could be recommended during transition period and early lactation to get maximum benefits to the farmers by improving reproductive performances and ultimately production of dairy animals.

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