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Augmentation of postpartum reproductive efficiency in crossbred cattle by supplementation of ragi (*Eleucine coracana*) grain during transition period – A field study

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Postpartum reproductive problems during lactation are one of the major contributing factors for losses to the dairy farmer in India. Nutritional mismanagement during the transition period (1 month before parturition and 1 month post-parturition) of dairy cow results in postpartum reproductive inefficiency. Negative energy balance and increased urea nitrogen levels are the common phenomenon in postpartum cows, which lead to reproductive abnormalities. Sudden increase in the demand for energy due to the onset of lactation in early lactating animal, body energy reserves are mobilized since the animal cannot meet this sudden increase in the energy demand through feed intake alone. This leads to increased non-esterified fatty acid (NEFA) levels, which is another typical characteristic of the early postpartum cattle (Joritsma *et al*. 2003).

Ragi (finger millet), widely used for human consumption in the southern states of India, is a good energy source and consists of higher proportion of bypass protein, which can be supplemented in animal diet. The feeding of finger millet grain had significantly reduced the high blood urea nitrogen levels and corrected the reproductive abnormalities like delayed puberty, anoestrous and repeat breeding in crossbred cattle (Gupta *et al*. 2008). However, there are no detailed reports available on the effect of feeding ragi grain on the postpartum reproductive efficiency. Hence, the study was designed to test the potency of the finger millet grain in augmenting the postpartum reproductive efficiency in crossbred (Holstein Friesian × Zebu) cattle when fed during the first month postpartum i.e. transition period.

Holstein Friesian crossbred cows (21) in advanced stage of gestation, being reared by the local farmers of the adopted village were selected. They were being fed with compound feed (@2kg/100kg B.Wt/day) and ragi straw *ad lib*. Among these, 12 cows (treatment group) were supplemented with additional energy in the form of locally available grain i.e. finger millet (*Eleusine coracana*) as an additional energy source during the first month postpartum (starting on the third day postpartum). Another group comprising 9 cows, which were not supplemented additional grain, was used as the control group. Morning milk samples (12–15 ml) were collected once in 15 days, from all the animals starting from first week postpartum to 7 months of post partum period. Milk yield per day in all the animals was recorded. Milk urea nitrogen (MUN) was estimated by enzymatic urease method using diagnostic kits. Milk total protein (biuret method) was also estimated using diagnostic kits. Milk progesterone was estimated by radioimmunoassay using kits. Magnitude of effect size (μm) was studied to determine the % of variance in the study parameters between groups while analyzing the effect of feeding of ragi on the occurrence of first postpartum heat. Fisher extract test was used to analyze the effect of feeding on the day of conception. Observation on one of the animals in treatment group on first postpartum heat was not considered for statistical analysis as it happened to be an outlier.

The day of occurrence of first estrus after calving in the control group and treatment group was 89.44±17.09 and 67.36±3.31 days postpartum, respectively. Effect size statistical analysis revealed that the positive effect of feeding ragi on the occurrence of first postpartum estrus was moderate (effect size i.e. d=0.5). Only 55% of the animals came to estrus within 3 months postpartum in control group, whereas in the treatment group 92% of the animals came to estrus within 3 months postpartum. However, Moore and Campos da Rocha (1983) reported that Gir cows fed on low postpartum energy diet returned to oestrus as early as those fed a high energy diet (59 vs 54 days, respectively). The difference in the observations may be due to the difference

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Table 1. Percentage of Animals with >1 ng/ml progesterone

	<10 weeks	<12 weeks	<14 weeks	<16 weeks
Control	11.1	11.1	22.2	33.3
Treatment	25.0	25.0	33.3	33.3

in the management conditions, where the earlier workers had conducted the study. The mean number of inseminations that failed in terms of conception in control and treatment groups were 1.75±0.75 and 1.47±0.43, respectively. The % effectiveness of ragi feeding in ameliorating reproductive problem of repeat breeding in the postpartum crossbred cattle was 67% as revealed by the Fisher extract test. Luteal activity is assumed to have initiated when the plasma progesterone levels are above 1 ng/ml. During the early postpartum period, the animals of treatment group had better progesterone profile compared to that of control group. In treatment group, 25% of the animals had >1 ng/ml of progesterone, compared to only 11% in case of control group (Table 1), which showed that additional energy supplementation during early postpartum period hastened the commencement of postpartum luteal activity.

Within 3 months of calving 20% of the animals in the treatment group conceived while none of the animals from control group conceived. Fisher extract test indicated that the animals in the treatment group were 3 times more likely to get conceived compared to the control group. The mean postpartum day of conception was 182.3±22.12 and 200.0±15.31 days in treatment and control groups, respectively. It appeared that the conception took long time in the village under the study due to lack of timely insemination facilities and in some cases, the farmers' least interest to opt for insemination at an early date after parturition. Due to this reason, the positive effect of feeding ragi might have got subdued. However, as mentioned above the positive effect was quite evident in the occurrence of postpartum heat. The beneficial effects on the postpartum fertility observed in the present study due to the feeding of ragi might be due to the merit of ragi as not only an energy supplement but also its higher proportion of rumen un-degradable protein fraction (Sampath *et al*. 1999).

Relationship between the milk yield and post partum estrus and conception was also studied (Figs 1, 2). The daily average milk yield during the first 6 months postpartum

Table 2. Correlation coefficients of milk yield with day of first postpartum heat and conception

	Day of first postpartum heat	Day of conception
Control	– 0.03	0.09
Treatment (ragi fed)	– 0.03	0.47*
	– 0.00	0.38*

* P <0.05.

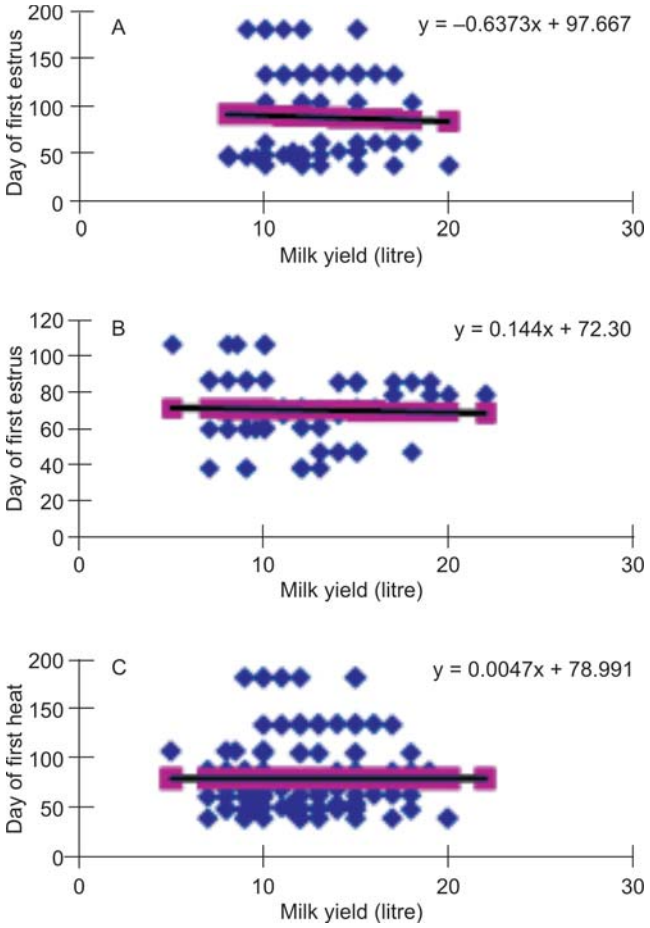

Fig. 1. Relation of milk yield with day of first postpartum heat. A: Control; B: treatment; C: pooled.

period in control and treatment groups was 11.80±0.28 and 11.39±0.33 litres, respectively, which was not significantly differed between the groups. Correlation analysis revealed that though the milk yield did not have significant correlation with the occurrence of first postpartum heat in either group, there was a significant positive correlation between the milk yield and the day of conception in the treatment group (Table 2). Perea-Ganchou *et al*. (2005) found that the levels of milk yield in crossbred cows in tropics did influence the first service conception, which decreased from 66.7% and 61.0% for milk yields of < 1500 kg and between 1501 and 2000 kg to 46.0% in milk yields > 2000 kg (P< 0.01).

The mean milk urea nitrogen (MUN) levels in different cows around conception (–2 weeks to 2 weeks of successful insemination) ranged from 12.21 mg% to 17.72% in control group and from 11.83 mg% to 17.48% in treatment group. The overall mean MUN levels were 14.04±0.92% in control group and 14.26±0.73 mg% in treatment group. All the animals, both in control and treatment group had optimum MUN levels (12 to 18 mg%) around conception and the levels were not significantly different (P>0.05) between the groups around conception. The mean milk urea nitrogen levels over

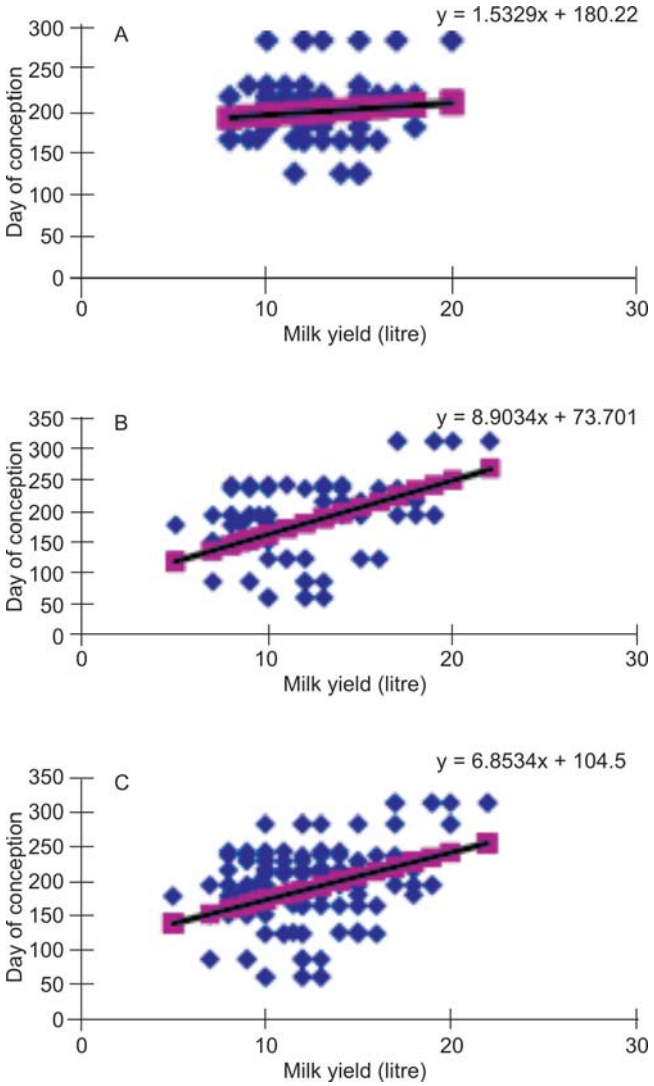

Fig 2. Relation of milk yield with day of conception. A: Control; B: treatment; C: pooled.

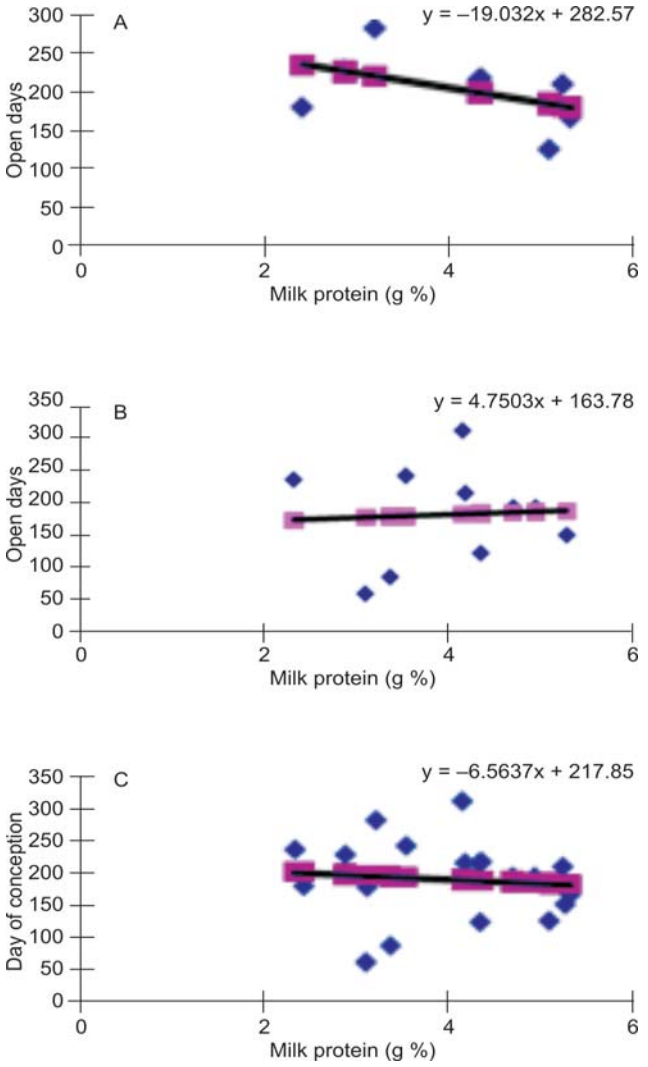

Fig 3. Relation between milk protein concentration and open days. A: Control; B: treatment; C: pooled.

a period of 2 weeks before failed insemination to 2 weeks after the insemination were calculated. Gowda *et al*. (2009) reported that feeding of ragi reduced the MUN levels in lactating crossbred cows. In this study, there was no significant difference in the mean MUN levels between the control and the ragi fed group of animals.

The milk protein concentration during the early lactation is said to indicate the postpartum reproductive performance (Patton *et al*. 2007) and hence in this study the relation between milk protein concentration and conception was studied (Fig. 3). There was an inverse relationship of milk protein concentration and open days in the control group whereas the relationship was direct in treatment groups. So, this study could not establish any concrete relationship between the milk protein concentration and the conception rates. In an earlier study, cows with higher milk protein concentration had shown better postpartum fertility (Morton 2001). However, Harris and Pryce (2004) opined that the selection for protein % is unlikely to have a large effect on reproductive performance in cattle. Studies conducted by Patton *et al.* (2007) indicated that milk protein content and plasma IGF-I concentration in early lactation may be useful indicators of reproductive efficiency in Holstein-Friesian cows. Further studies are required on this aspect to come to conclusion about the relation of milk protein concentration and the conception rates.

The authors found no earlier reports on the effect of supplementation of grains during the transient period on the postpartum reproductive efficiency. The present study clearly indicates the beneficial effect of ragi supplementation as an energy source during the transition period of postpartum on reproductive performance in village conditions.

Supplementation of ragi during the transition period advanced the onset of luteal activity and estrum. It had also

reduced the open days, which indicated that the feeding of ragi during transition period can augment the postpartum reproductive efficiency in the crossbred cows in the field condition.

SUMMARY

Ragi grain (@ 50gm/kg body wt/day) in a semi ground form was supplemented to 12 postpartum crossbred cows (treatment group) during the first month postpartum in an adopted village. Another 9 animals of the same village, which were not supplemented, formed the control group. Observations on the onset of estrum, conception rate, repeat breeding, milk yield, milk protein and milk urea nitrogen (MUN) and progesterone were made. Effect of supplementing ragi on different milk parameters and their relation with the reproductive efficiency was also studied. Supplementation of ragi during the transition period advanced the onset of luteal activity and estrum. It had also reduced the open days, which indicated that the feeding of ragi during transition period can augment the postpartum reproductive efficiency in the crossbred cows in the field condition.

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