EFFECT OF PRE AND POST-PARTUM SUPPLEMENTATION TO BUFFALOES ON BODY CONDITION, LACTATION AND REPRODUCTIVE PERFORMANCE

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ABSTRACT

The present study was to assess the effect of concentrate supplementation during pre-partum and post-partum on the performance of buffaloes. Twenty eight pre-partum buffaloes (10 to 12 weeks before calving) were randomly divided in two groups control (n=14) and treatment (n=14) to ascertain the effect of concentrate supplementation during pre-partum and post-partum and its influence on feed intake, body condition, lactation and reproductive performance in buffaloes. In control group, pregnant buffaloes were fed as per farmer's practices (0.5 to 1.0 kg concentrate), while in treatment group, pregnant buffaloes were given specially formulated concentrate mixture (CP 22%) 2.0 to 2.5 kg per day. After parturition the lactating buffaloes of treatment and control group were further divided into two sub groups (7 each) to receive either concentrate supplementation or as per farmers' practices. The basal diet of wheat straw was offered *ad libitum*. Concentrate supplementation during pre-partum significantly ($P<0.05$) improved total dry matter intake and body condition score of pregnant buffaloes as compared to control. Concentrate supplementation during postpartum period also appreciably improved feed intake, body condition, lactation and reproductive performance of buffaloes.

Keywords: supplementation, body condition, lactation, performance, buffaloes

INTRODUCTION

Most of the animals in developing countries including India are fed on agriculture by-products and low quality crop residues, which have got inherent low nutritive value and digestibility. Feeding on such poor quality roughages with imbalanced supplementation is the major reason for poor reproductive and production performance of buffaloes (Qureshi *et al*., 2002). Under the conventional farming system, diets are not formulated according to the requirements of individual animals, resulting in decreased production and poor health and reproduction (Qureshi, 1995). The lactating buffaloes are fed green fodders plus concentrate feeds but dry and pregnant buffaloes are considered uneconomical and are mostly fed only low quality green fodders. Consequently, animals which receive adequate nutrients have higher body condition scores, which enable them to produce higher quantities of milk and they also are bred earlier.

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High producing buffaloes in early lactation do not consume sufficient dry matter to support maximal production of milk (Goff and Horst, 1997). Demand for energy is very high during early stage of lactation but supply is not commensurate with demand due physiological stage or limited intake may affects production potential of animal in the whole lactation length (Sirohi *et al*., 2010). Hence, during early lactation, dairy animals are often forced to draw on body reserves to satisfy energy requirements (negative energy balance); this leads to substantial loss in body weight which adversely affects production, resulting in lower yield (Kim *et al*., 1993). So, proper pre-partum nutrition is required to maintain post-partum body condition and milk production in buffalo. Little information is available regarding the effect of pre-partum concentrate supplementation in field conditions which has practical applicability. Therefore an attempt was made to assess the effects of concentrate supplementation in the dry period and early lactation on body condition, lactation and reproductive performance in buffaloes.

MATERIALS AND METHODS

Experimental design and feeding

A set of 20 farm families, collectively owning 28 pre-partum (10 to 12 weeks) buffaloes in their 2nd to 4th parity, were selected for the on-farm trial and randomly divided into two equal groups control and treatment to ascertain the effect of pre-partum supplementation on feed intake, body condition, milk yield and composition and reproductive performance of buffaloes. All the buffaloes were maintained at the livestock owner's farms under field condition in Bareilly district of UP. In control group, pregnant buffaloes were fed as per farmer's practices (0.5 to 1.0 kg concentrate); while in treatment group, pregnant buffaloes were given specially formulated concentrate mixture (CP 22%) 2.0 to 2.5 kg/d. After parturition the lactating buffaloes of control group were further divided into two (7 each) sub groups, one fed as per farmers' practices (CC) while another strategically supplemented (CT). Similarly, lactating buffaloes of treatment group were divided into two (7 each) sub groups, one group fed as per farmers' practices (TC) and another group continued to receive the strategic supplementation (TT) during post-partum upto 120 days. The amount of farmers formulated or treatment group concentrate mixture was given individually to each animal 1 kg/2 litres milk production and adjusted fortnightly as per change in the milk yield in consultation with the farmers. The basal diet of wheat straw was offered ad libitum. A small amount of green berseem was also provided to animals to take care their vitamin A requirement. Dry matter (DM) content of feeds offered and leftovers was determined to calculate the daily DM intake of buffaloes.

Body weight and condition score

Body weight of the buffaloes was calculated from their heart girth and body length measurements by Shaffer's formula (Sastry *et al*., 1982). Body condition score of the buffaloes were performed fortnightly by using a procedure 5 points' scale (Edmonson *et al*., 1989).

Sample collection

The milk samples were drawn from individual buffaloes during both the times of milking in a day at fortnight intervals. After thorough mixing, a sample of 50 to 100 ml was taken by means of a dipper and transferred to a sample bottle with rounded corners (to avoid

lodging of the milk solids) up to 3/4th level, and then bottle was corked tightly by a rubber stopper. The sample bottles were labeled properly and dispatched to laboratory in an ice box. Immediately after estimation of fat content of milk, the samples (50 ml each) were stored at 4°C after adding 2 to 3 drops of potassium dichromate as a preservative, until further analysis. Milk samples were warmed in water bath at 38°C and mixed well for homogenous solution.

Chemical analysis

Representative samples of feed offered and residue left were processed and analyzed for proximate principles AOAC (2005). Neutral detergent fibre (NDF) and Acid detergent fibre (ADF) content of feeds and residues were estimated by the method of Van Soest *et al.* (1991). Milk samples were analyzed separately from each buffalo to determine the percentage of fat, protein, total solids and solids-not-fat (SNF) content. Fat percent of milk was determined by Babcock method as per procedure described by Agarwala and Sharma (1961). Protein was determined by using Kjeldhal Method as described in AOAC (2005). Oven drying method was used for determining Total Solids content of milk as described by Eckles *et al.* (1951).

Reproduction parameters

The signs of oestrus were detected from different signs such as bellowing, mounting over other animals, less interest in feed and vaginal discharge. Animals detected in estrus in morning were inseminated in the evening on the same day and those detected in heat in the evening were served next day in the morning. After 60 days of insemination, pregnancy diagnosis was carried out by rectal palpation of the uterus.

Statistical analysis

The data were analyzed statistically using standard methods (Snedecor and Cochran, 2004) for one way analysis of variance (ANOVA) using general linear model of SPSS version 17 and Duncan's multiple range tests was applied to test the significance. Significance was declared when P value is less than 0.05 unless otherwise stated.

RESULTS AND DISCUSSION

Pre-partum performance

The chemical composition (% DM basis) of concentrate mixture, wheat straw and berseem offered to buffaloes during experimental period is given in the Table 1. Pre-partum average DM intake expressed as (kg/d) or live weight (% LW) by buffaloes was significantly ($P<0.05$) higher in treatment group as compared to control group. Similarly, concentrate and crude protein intake (kg/d) was significantly ($P<0.05$) higher in treatment group. The dietary treatments had no influence on the body weight changes over the prepartum period (Table 2). The body condition score of pre-partum buffaloes was significantly ($P<0.05$) higher in treatment group as compared to control. Increasing the concentrate proportion of the diet is one method used to improve energy supply during the pre-partum period of the transition phase. Present results are in agreement with the findings of Kokkonen *et al*. (2004), who reported that supplying additional concentrate to cattle during pre-partum increases pre-partum DM intake. Similarly, Rabelo *et al.* (2003) reported that cows fed with high energy diet pre-partum consumed 19% more DM than the cows fed the low energy diet**.** Contrary to this Reynolds *et al.* (2004) does not support the conclusion that increasing

Table 1. Chemical composition of feeds offered (% DM basis).

Parameter	Concentrate mixture		Wheat straw	Berseem
	Control[I]	Treatment[II]		
Dry matter	90.94±0.38	90.57±0.29	90.25±0.45	18.40±0.33
Organic matter	91.27±0.06	93.25±0.07	94.53±0.22	87.15±0.15
Crude Protein	16.48±0.11	22.18±0.10	3.25±0.10	18.90±0.57
Ether extract	4.17±0.10	2.85±0.06	1.43±0.13	3.27±0.10
Total ash	9.73±0.06	6.75±0.07	5.47±0.22	12.85±0.15
NDF	37.89±0.36	25.06±0.29	78.25±0.91	37.54±0.92
ADF	13.28±0.14	10.78±0.08	50.89±0.71	24.99±0.89

[I]Composed of Wheat bran (62%), Rice polish (20%), Mustard cake (15%), Mineral mixture (2%), Salt (1%).

[II]Composed of Wheat bran (50%), Rice polish (20%), Deoiled Soyabean meal (27%), Mineral mixture (2%), Salt (1%).

Table 2. Mean daily feed intake (kg DM basis) and body weight changes of experimental buffaloes during the pre-partum period.

Attributes	Control	Treatment	SEM	P Value
Feed (DM) intake				
Concentrate, kg/d	0.66[a]	2.01[b]	0.14	<0.01
Roughage, kg/d	10.97	11.52	0.30	0.37
Total, kg/d	11.63[a]	13.53[b]	0.376	0.01
DMI, %BW	2.37[a]	2.72[b]	0.04	<0.01
CPI, g/d	543.79[a]	962.05[b]	40.27	<0.01
Body weight changes (kg)				
Initial (60 d prepartum)	491.72	496.88	13.06	0.84
Final (before parturition)	521.24	542.63	13.21	0.43
Net gain during prepartum	29.51[a]	45.75[b]	1.74	<0.01
BCS (60 d prepartum)	2.59	2.69	0.03	0.15
BCS at calving	3.34[a]	3.51[b]	0.04	0.03

[ab]Mean values with different superscripts with in a row differ significantly (P<0.05).

Table 3. Effect of strategic supplementation on post-partum body condition and voluntary feed intake.

Attributes	CC	CT	TC	TT	SEM	P-value
Average weight (kg) just after calving	469.66	494.21	464.36	511.59	13.17	0.58
Average weight (kg) at the end of lactation	442.90	490.67	453.60	512.02	13.90	0.26
BCS at one month of lactation	2.65[a]	2.70 [a]	2.85[ab]	2.97[b]	0.04	0.03
BCS at two month of lactation	2.17[a]	2.23[a]	2.37[b]	2.38[b]	0.03	0.04
BCS at three month of lactation	2.12[a]	2.13[a]	2.28[ab]	2.38[b]	0.03	<0.01
BCS at the end of trial (120d)	2.28[a]	2.35[a]	2.45[ab]	2.55[b]	0.03	<0.01
Concentrate DMI, kg/d	1.63[a]	2.34[b]	2.52[b]	3.57[c]	0.16	<0.01
Roughage DMI, kg/d	10.10	10.42	9.88	10.22	0.21	0.96
Total DMI, kg/d	11.73[a]	12.76[ab]	12.40[ab]	13.78[b]	0.27	0.04
Total DMI g/kg$W^{0.75}$	122.60	125.01	127.84	130.41	1.66	0.39
Total DMI,% BW	2.62	2.73	2.77[a]	2.82	0.05	0.85
CPI, g/d	792.54[a]	1134.87[b]	1117.67[b]	1399.79[c]	48.15	<0.01

[abc]Mean values with different superscripts with in a row differ significantly (P<0.05).

Table 4. Effect of strategic supplementation on milk yield and composition in buffaloes.

Attributes	CC	CT	TC	TT	SEM	P-value
Milk yield						
Whole milk (kg/d)	3.62[a]	5.10[b]	5.58[b]	7.88[c]	0.35	<0.01
4 % FCM (kg/d)	5.45[a]	7.40[b]	8.15[b]	10.90[c]	0.33	<0.01
ECM (kg/d)	5.58[a]	7.67[b]	8.41[b]	11.50[c]	0.37	<0.01
Fat yield (g/d)	266.5[a]	356.7[b]	394.4[b]	517.0[c]	20.94	<0.01
Protein yield (g/d)	132.10[a]	193.58[b]	206.83[b]	310.43[c]	14.29	<0.01
Total milk yield (kg)	431.25[a]	610.00[b]	666.25[b]	943.75[c]	41.78	<0.01
Peak yield (kg)	4.08	5.92	6.42	8.83	0.39	<0.01
Milk composition (%)						
Fat	7.34[c]	7.02[b]	7.13[b]	6.60[a]	0.07	<0.01
Protein	3.67[a]	3.81[ab]	3.73[a]	3.95[b]	0.02	<0.01
Lactose	4.81	4.87	4.72	4.61	0.04	0.15
Ash	0.77	0.77	0.74	0.76	0.01	0.25
SNF	9.27	9.46	9.18	9.33	0.04	0.12
Total Solid	16.62	16.48	16.32	15.91	0.08	0.21

[abc]Mean values with different superscripts with in a row differ significantly (P<0.01).

Table 5. Effect of strategic supplementation on reproductive performance of buffaloes.

Attributes	CC	CT	TC	TT	SEM	P-value
No. of Buffaloes	7	7	7	7	-	-
First postpartum oestrus (days)	115[b]	110[b]	99.6[a]	92[a]	2.35	<0.01
No. of Buffaloes showing oestrus	3	5	5	6	-	-
No. of inseminations per conception	1.33	1.20	1.20	1.17	0.10	0.96
Conception rate (%)	42.85	71.42	71.42	85.71	-	-
Service period (days)	122[b]	122.6[b]	112.20[b]	96.4[a]	3.37	<0.01

[ab]Mean values with different superscripts with in a row differ significantly (P<0.01).

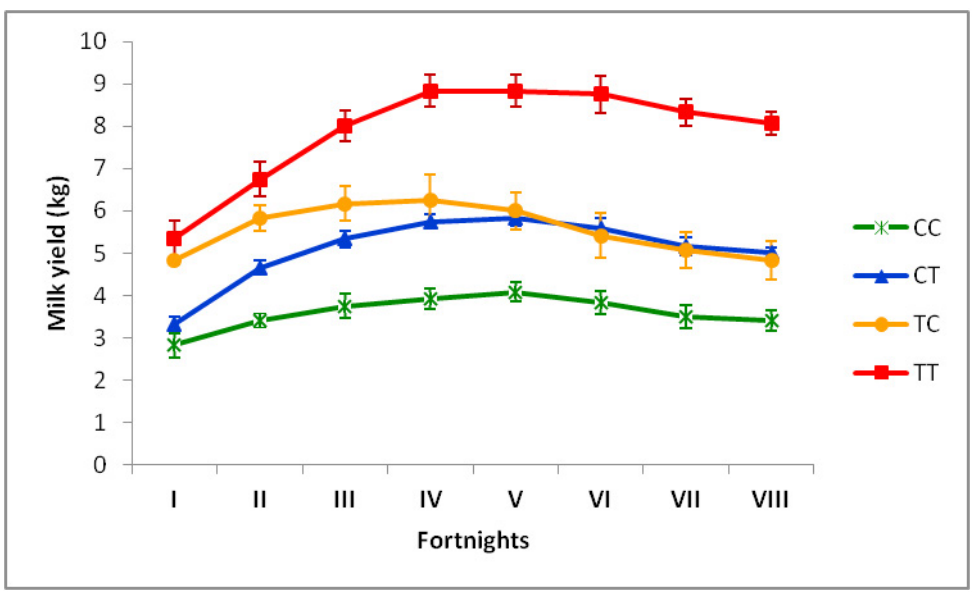

Figure 1. Effect of strategic supplementation on lactation performance of buffaloes.

the concentrate proportion of the pre-partum diet improves DMI during the prepartum portion of the transition period. The increased BCS in treatment group was due to the higher nutrients (energy and protein etc.) availability to pre-partum buffaloes. Similar findings were also observed by Khan *et al.* (2004), who reported that BCS for both low and high energy group increased during the pregnancy period but the increment was more for the cows that were kept on high level of energy. Similarly, Mee *et al.* (2000) reported that cows fed silage and concentrates prepartum had significantly (P<0.05) higher BCS at calving than cows fed silage and straw.

Post-partum performance

Feed intake

The overall total DM consumption (kg/d) by lactating buffaloes was 11.73, 12.76, 12.40 and 13.78 in CC, CT, TC and TT groups, respectively, which was significantly (P<0.05) higher in TT group than CC group, while CT and TC had an intermediate position between TT and CC groups. Similarly DMI when expressed as g/kg$W^{0.75}$ or % BW did not differ significantly (P>0.05) among the treatment groups (Table 3). The concentrate intake (kg/d) was significantly (P<0.01) higher in TT group followed by comparable intake between CT, TC and CC, respectively, however, roughage moiety did not differ significantly (P>0.05) among the treatment groups. The intake of CP was significantly (P<0.01) higher in TT group followed by comparable intake between CT, TC and CC groups, respectively. The concentrate supplementation of the buffaloes was based on the milk production and there was significant (P<0.01) differences in milk yield of the buffaloes under the four groups hence the DMI through concentrate was significantly (P<0.01) higher in TT group followed by comparable intake between CT, TC and CC, respectively. The results of present study are in consistency with the findings of Rabelo *et al.* (2003), who reported that cows fed high energy density diet (1.63 Mcal NE_L/kg, 25% NDF and 47% NFC) had higher DMI and energy intake for the first 20 d of lactation as compared to cows fed low energy density diet (1.57 Mcal NE_L/kg, 30% NDF and 41% NFC). They further reported that increasing concentrate level of the diet immediately postpartum instead of delaying the increase until d 21 postpartum is related with a higher rate of increase in milk yield and DMI. Similarly, some earlier reports (Dann *et al*., 1999; Mashek and Beede, 2000; Doepel *et al*., 2002) also indicated that increased DMI or energy intake during the close-up period improves post-partum intake and performance of cows.

Body weight changes and condition score

The post-partum initial and final body weights of dairy buffaloes did not differ significantly (P>0.05) among treatment groups (Table 3). The mean BCS during 3rd to 4th month of lactation was significantly (P<0.01) higher in TT group as compared to CT, CC, however, TC group had an intermediate position. Similar to present results, Singh *et al.* (2003) reported that average live weights of crossbred cows up to 3rd fortnight decreased at different plane of nutrition, indicating that the stress of pregnancy followed by initiation of milk secretion lead to body weight losses during early lactation. As the stress reduced, animals started gaining weight and the animal fed at higher plane of nutrition (20% above NRC during pre-partum or both during pre-partum and post-partum) gained more weight as compared to those fed as per NRC during 4 to 8th fortnight. Kokkonen *et al.* (2004) reported that supplying additional

concentrate pre-partum improves postpartum BCS of the animal. Body condition is a reflection of the body fat reserves carried by the animal. These reserves can be used by the buffalo in periods when she is unable to eat enough to satisfy her energy needs.

Milk yield and composition

The daily milk yield, 4% FCM, ECM (kg/d), fat and protein yield (g/d) and total milk yield (kg) were significantly (P<0.01) higher in lactating buffaloes of TT group followed by comparable yield between buffaloes of CT, TC and CC groups, respectively (Table 4). Fortnightly changes in milk yield are depicted in Figure 1, which showed that daily milk yield and peak yield were higher in TT group as compared to other three groups throughout the study period. Present results are in agreement with the findings of McNamara *et al.* (2003). They fed three pre-partum diets containing grass silage and straw, grass silage alone and grass silage with 3 kg/d of additional concentrate, respectively. Cows fed the pre-partum diet containing silage and straw had lower milk yield than cows fed the silage or silage and concentrate treatments. It appears that additional concentrate pre-partum improves lactation performance when dietary energy is limiting. Similarly, Narang *et al.* (2012) reported considerable improvement in productivity in terms of total and daily milk yield (kg), and 4% FCM (kg) through strategic supplementation in pre-partum buffaloes. Sihag *et al.* (2009) reported that by increasing 10% CP in the prepartum diet, milk yield and 4% FCM yield increased significantly (P<0.05). The milk composition is presented in Table 4. Milk fat % was significantly (P<0.01) higher in CC group followed by comparable fat level between CT, TC and TT groups, respectively. Crude protein % of milk was significantly (P<0.01) higher in TT as compared to CC, TC groups, however, CT group had an intermediate position. The percent total solids, SNF, lactose and ash in milk did not differ significantly (P>0.05) among treatment groups. Similar to present results MacRae *et al.* (1988) reported that additional protein feeding to lactating cows increases milk and milk protein output. Kokkonen *et al.* (2004) reported that rapid increase of concentrate tended to increase milk and milk component yields during the first 5 weeks of lactation but at the expense of decreased efficiency of energy utilization. In addition, milk fat content decreased with increased proportion of concentrate in the prepartum diet. Similarly, Murphy (1999) observed that feeding cows more than normal before calving produces milk with slightly high protein content. Singh *et al.* (2003) reported that the higher level of feeding during pre-partum period alone or both during pre-partum and post-partum period had improved the quality of milk significantly.

Reproductive performance

Overall reproductive performance of buffaloes was better in supplemented group during pre-partum and post-partum (TT) than that of three other groups. Time required (days) from calving to first oestrus was significantly (P<0.01) lower for the buffaloes of TT and TC groups than that of CT and CC groups. The days required for calving to conception (service period) was significantly (P<0.01) lower for the buffaloes of TT as compared to comparable days among TC, CT and CC groups. Number of service per conception did not differ significantly (P>0.05) among different groups. Conception rate after insemination was 85.71% in TT group followed by 71.42% in TC and CT and 50% in control (CC) group, respectively. Present results are in agreement with the earlier report of

Singh et al. (2003), they reported that first post-partum estrus was observed much earlier ($P<0.05$) in crossbred cows fed at higher plane of nutrition during pre-partum or during pre as well as post-partum periods than the animals fed as per NRC standard. It might be attributed to body weight loss, which might have affected the initiation of ovarian activity after calving. Negative energy balance and rate of mobilization of body reserve appeared to be directly related to the post-partum interval to first ovulation and lower conception rate (Butler and Smith, 1989). Hence, the poor reproductive performances of buffaloes of CC group could be associated to a low BCS. Spitzer *et al.* (1995) reported that increase in pre-partum BCS was associated with reduced post-partum interval to first estrus (PPI) in beef heifers. This association is explained by the positive relationship that exists between pre-partum BCS and post-partum LH. Luteinizing hormone is responsible for final follicular maturation and ovulation, and ovulation failure is the primary cause of prolonged PPI (Wright *et al*., 1992). Hassein and Abdel-Raheem (2013) reported that reduction in DMI below NRC recommendations (50%) impairs reproductive performance in terms of reduced folliculogenesis, prolongs the period for attaining puberty, and reduce the pregnancy rate in buffalo heifers. Wongsrikeao and Taesakul (1984) also observed that improved nutrition reduced the post-partum service period in Swamp buffaloes and increased the growth rate in their calves as observed in the present study.

From the present results, it can be concluded that considerable improvement in nutrient intake and body condition could be achieved through strategic concentrate supplementation in pre-partum buffaloes. Concentrate supplementation during post-partum period also appreciably improved overall performance of lactating buffaloes.

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