

Effect of Restricted and *Ad. libitum* Feeding during Late Pregnancy on the Performance of Crossbred Cows and Their Calves

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ABSTRACT : The present research was undertaken to monitor the effects of restricted and *ad. libitum* feeding during last trimester of pregnancy on the performance of crossbred dairy cows and their calves. For this purpose two groups of crossbred cows having eight animals in each group were put into two plane of nutrition during their last three months of pregnancy. Dietary energy level in one group was calculated as per Ministry of Agriculture, Fisheries and Food, (MAFF, UK) and the cows on other group received *ad. libitum* feeding (concentrate level similar to MAFF, recommendation+*ad. libitum* roughage). After calving, the cows of both groups were given same diet (*ad. libitum*) to study the effect of feeding during pregnancy on subsequent lactation performance of the cows. It was observed that during pre-calving period cows on *ad. libitum* feeding gained significantly ($p < 0.05$) more body weight than that of cows on restricted feeding (38.50 ± 6.04 vs 21.37 ± 8.04 kg/cow). There was no significant differences between the birth weight of calves of restricted (21.31 ± 2.18 kg) and *ad. libitum* (20.31 ± 3.27 kg) groups. Dietary energy intake of *ad. libitum* group (50.22 ± 4.24 MJ ME/d/cow) was significantly higher ($p < 0.01$) than that of restricted group (39.76 ± 1.03 MJ ME/d/cow). During lactation period cows that were on restricted feeding produced little more milk (3.06 lit/cow/day), than that of the cows on *ad. libitum* feeding (2.84 lit/cow/day). Although growth rate of the calves of restricted group upto one month (0.23 ± 0.09 kg/calf/d) was significantly ($p < 0.01$) higher than that of *ad. libitum* group (0.17 ± 0.08 kg/calf/d) but after four months the growth rate of the calves of two groups become nearly similar (0.35 ± 0.02 vs 0.37 ± 0.03 kg/calf/d) and difference between them was non-significant. During lactation period cows of restricted group gained little weight but cows of *ad. libitum* group lost significantly ($p < 0.05$) more weight. Per day metabolizable energy intake in both group during lactation period was nearly similar (67.54 vs 69.58 MJ ME). It is concluded that *ad. libitum* feeding during last trimester of pregnancy is neither economic for getting maximum milk yield nor for calf growth rate and MAFF, recommended level of dietary energy during that period could be applied on our pregnant crossbred dairy cows. (*Asian-Aust. J. Anim. Sci.* 2002, Vol 15, No. 9 : 1267-1272)

Key Words : Crossbred Cows, Pregnancy, Pre-calving Nutrition and Lactation, Feed Intake, Reproduction

INTRODUCTION

The relationship between food intake during pregnant periods of the life of a cow and her milk production and calf birth weight are of considerable practical importance in dairy cattle farming, since a sizeable portion of the food resources of any farm is usually devoted to the rearing of herd replacement and maintenance of dry cows. McDonald et al. (1985) reported that, if mother is severely underfed during the last three months of pregnancy, it might affect the young by causing death in utero or by reducing viability at birth. After birth, the young are still not free from the effects of nutrition of dam during pregnancy, since the latter's milk yield may be affected, sometimes, the death of foetuses may make itself apparent through abortion or still birth. On the other hand, high level of nutrition during pregnancy may reduce calf birth weight and the appetite of the cow after calving may be poor, resulting in poor milk

yield (Russel et al., 1979). Lodge et al. (1975) postulated that feed restriction during prepartum may act as a stimulant to improve feed intake after calving which would be desirable as the efficiency of conversion of nutrients to milk in a dairy cow has been shown to be better when the nutrients are directly converted to milk than when they are routed through body energy reserves (Moe and Tyrrell, 1972).

Cattle of Bangladesh may be classified as indigenous and crosses of indigenous with some foreign breeds like Sindhi, Sahiwal, Jersey and Holstein. Due to shortage of animal feed, attention should be given to obtaining more production from cows with minimum inputs. In Bangladesh, most of the nutrition research have been carried out on lactating cows, and very few have been done on pregnant cows. For this reason, there are limited information's on the nutritional requirement of pregnant cows. The farmer's have limited knowledge about feeding strategies of pregnant cows. As a result, when available, they are offering *ad. libitum* feed to their cows during the last trimester of pregnancy and thus misusing costly feeds. A sound late pregnancy-feeding program is a critical key to improve lactational performance of cows. Therefore, in order to find out nutritional requirement of our cows during pregnancy

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and lactation, and also to assess the feasibility of using MAFF, 1984, recommended dietary level on our crossbred dairy cows during late pregnancy, the present research was undertaken.

MATERIALS AND METHODS

Experimental animals

Sixteen crossbred cows of approximately same age, body weight, body condition and lactation number during their last three or four months of pregnancy were selected from Bangladesh Agricultural University (BAU) Dairy Farm. The cows were divided into two similar groups having 8 cows in each group. One group was treated as restricted group and another *ad. libitum* group. The body weight and body condition score of restricted group was 282.75 ± 30.10 kg, 2.90 ± 0.27 and for *ad. libitum* group 278.80 ± 32.27 kg, 2.90 ± 0.33 respectively.

Diets used in the experiment

Two levels of feeding were used in this experiment. Cows of one group received the Ministry of Agriculture, Fisheries and Food (MAAF, 1984) recommended level of dietary Metabolizable energy (39.76 MJ ME) and another group received *ad. libitum* diet, (50.22 MJ ME, concentrate was same as MAAF, 1984 recommendation and roughage was given *ad. libitum* basis) during their last trimester of pregnancy. Both rations consisted of straw, green grass, wheat bran, oil cake and molasses. The composition of ration and approximate level of nutrient content are shown in Table 1, 2 and 3.

Trial procedure

All cows were kept at maternity barn of Bangladesh Agricultural University dairy farm during their last part of pregnancy and they were given experimental diets in individual pan at least 15 days before starting experiments. All cows were fed and milked twice a day. Clean and fresh drinking water was always *ad. libitum* to them. Their body weight was taken every fortnightly. Weighing was carried out on the same day at approximately same time, usually before offering diet in the morning.

Immediately after calving, body weight of cows and calves were recorded. Pregnancy diets were withdrawn from both groups and *ad. libitum* feeding was practiced (Table 5) in both groups during lactation to evaluate the

pregnancy feeding effects on lactation performance of dairy cows. After calving cows were transferred from maternity barn to milking shed for lactation study, which was continued for a period of 120 days. From birth to seven days postpartum calves were allowed to drink colostrum and milk freely from their mother. After one week calves from all groups were separated from their mother and were allowed to drink milk just after morning and evening milking of the cows. Besides this all calves were fed whole milk at the rate of 1 lit. per 10 kg body weight upto 21 days, after whole milk, high quality concentrate mixture and green grass were introduced gradually and both groups were given same diets and all other management facilities were same for both groups.

The parameters studied in this experiment were, voluntary intake of DM and ME of crossbred pregnant cows (from *ad. libitum* group) during the last trimester of pregnancy, body weight changes of cows during pregnancy, birth weight of calves at calving.

During lactation parameters studied were, body weight changes of cows, voluntary intake of DM and ME of cows during early lactation, growth rate of calves, milk yield of cows, time required from calving to first heat, conception rate, service per conception and calving interval.

Statistical analyses

Data collected from the experiment were statistically analyzed as per Steel and Torrie (1980) by using Completely Random Design (CRD). Analysis of Variance was done to find out the significant difference between treatment means.

RESULTS

Performance of cows during pregnancy

Body weight changes of cows : Weight changes were calculated in two ways, one from start of the trial to just before calving and the other from start of the trial to post calving. Cows that were on *ad. libitum* diets gained more weight (38.50 kg) during pre calving period than the cows that were on restricted diets (21.37 kg). This difference was significant ($p < 0.01$). Body weight changes of the cows from initial to post calving period showed that the cows on restricted group lost weight but *ad. libitum* group gained weight (-28.37 vs 11.68 kg). Weight loss was significantly higher ($p < 0.01$) for the restricted diets.

Birth weight of calves : Mean birth weight was 21.31 kg for restricted group and 20.31 kg for *ad. libitum* group. There was no significant effect of dietary energy level on calf birth weight.

Performance of cows during lactation : Body weight changes of cows during 120 days of lactation are presented in Table 5. Cows which were on *ad. libitum* energy diets

Table 1. Chemical composition of feeds used in the experiment

Ingredient	DM (g/kg)	MJ (ME/kg DM)	CP (g/kg DM)
Straw	870	6.5	35
Wheat bran	880	10.7	160
Oil cake	885	11.0	270
Molasses	697	12	-
Green grass	170	10.5	80

Table 2. Composition of diets and estimated value of DM, ME during pregnancy

Ingredients	Restricted group			<i>Ad. libitum</i> group		
	DM (kg/day)	MJ (ME/day)	CP (g/kg)	DM (kg/day)	MJ (ME/day)	CP (g/kg)
	Intake	Intake	Intake	Intake	Intake	Intake
Straw	3.19	20.74	111.65	4.76	30.98	166.60
Wheat bran	0.88	9.42	140.80	0.88	9.42	140.80
Oil cake	0.44	4.84	118.80	0.44	4.87	118.80
Molasses	0.14	1.68	-	0.14	1.67	-
Green grass	0.29	3.08	23.20	0.31	3.28	24.80
Total	4.94	39.76	394.45	6.53	50.22	451.00

Table 3. Composition of diets and estimated value of DM, ME during lactation

Ingredients	Restricted group			<i>Ad. libitum</i> group		
	DM (kg/day)	MJ (ME/day)	CP (g/kg)	DM (kg/day)	MJ (ME/day)	CP (g/kg)
	Intake	Intake	Intake	Intake	Intake	Intake
Straw	3.73	24.25	130.55	3.67	23.86	128.45
Wheat bran	2.20	23.24	352.00	2.31	24.67	369.60
Oil cake	0.44	4.84	118.8	0.55	6.04	148.50
Green grass	1.42	14.91	113.60	1.43	15.01	114.40
Total	7.79	67.54	714.95	7.96	69.58	760.95

Table 4. Effect of different levels of feeding during pregnancy on the performance of crossbred dairy cows

Parameter studied	Restricted group		<i>Ad. libitum</i> group		Level of significance
	Mean±SD		Mean±SD		
	No. (8)		No. (8)		
Average initial body weight (kg/cow)	282.75±30.10		278.80±32.27		NS
Weight just before calving (kg /cow)	304.13±23.53		317.31±34.51		NS
Total weight changes from start to just before calving period (kg /cow)	21.37±8.04		38.50±6.04		**
Weight just after calving (kg /cow)	254.38±24.85		286.0±29.44		*
Total weight changes (from start to post calving) kg/cow	-28.37±8.70		11.68±12.57		**
Birth weight of calves (kg)	21.31±2.18		20.31±3.27		NS
Feed intake kg (DM) /day/cow	4.96±0.14		6.55±0.65		**
Energy intake (MJ ME)/day/cow	39.76±1.03		50.22±4.24		**

** $p < 0.01$, * $p < 0.05$. NS=Not significant.

group during pregnancy lost about 13.63 kg body weight during early lactation but cows that received restricted diets during pregnancy period, gained 0.18 kg body weight during early lactation (120 days). This difference was significant ($p < 0.05$).

Milk yield : There was no significant effect of pre-calving dietary energy level on milk yield of cows during early lactation. cows that were on restricted level of feeding during pregnancy produces slightly more milk than the cows that were on *ad. libitum* diets during pregnancy (3.06 vs 2.84 lit/d/cow).

Calf growth rate : From birth to one month of age there was highly significant difference ($p < 0.01$) in calf growth rate. During that time growth rate of restricted group was higher than *ad. libitum* group but from birth to 4 month of age there was no significant difference in calf growth rate.

Mean calf growth rate from birth to one month of age per day per calf was 0.23 kg and 0.17 kg for restricted and *ad. libitum* group respectively. From birth to four month of age the same was 0.35 kg and 0.37 kg, respectively.

Feed intake : Feed intake on the basis of dry matter for restricted group per day per cow was 7.79 kg and for *ad. libitum* group was 7.96 kg per day per cow. The difference was not significant. According to 100 kg body weight feed intake was 3.07% for restricted group and 2.92% for *ad. libitum* group.

Reproductive performance of the cow

Time required for calving to first heat and time required for calving to conception was 206. 244 days for restricted group and 174, 223 days for *ad. libitum* group. There were no significant differences between diets with calving to first

Table 5. Effect of pregnancy feeding on lactation performances of crossbred dairy cows

Parameter studied	Restricted group	<i>Ad. libitum</i> group	Level of significance
	Mean±SD No.(8)	Mean±SD No.(8)	
Average cows weight at the end of lactation (kg/cow)	254.56±17.08	272.37±29.34	NS
Weight changes from calving to end of lactation study (kg/cow)	0.18±12.82	-13.63±12.40	*
Milk production/ day/ cow (lit.)	3.06±0.34	2.84±0.46	NS
Calf growth rate from birth to one month (kg/day/calf)	0.23±0.09	0.17±0.08	**
Calf growth rate from birth to 4 month (kg/day/calf)	0.35±0.02	0.37±0.03	NS
Feed intake (DM) kg/day/cow	7.79±0.25	7.96±0.60	NS
Energy intake (MJME)/day/cow	67.54±1.66	69.58±4.63	NS
Time required for calving to first heat days	206±84	174±122	NS
Time required for calving to conception (days)	244±96	223±128	NS
No. of service per conception	2.0	2.1	NS
Conception rate (CR) %	50.00	47.06	NS
Calving interval (days)	524±97	502±129	NS

** p<0.01. * p<0.05. NS=Non significant.

heat and calving to conception. Although statistically it was not significant but biologically important by reducing the number of days after calving. It was observed that cows given *ad. libitum* diet group exhibited estrous and conception sooner after calving than did the restricted group. Service per conception and conception rate was 2.0 and 50% for restricted diet and 2.1 and 47% for *ad. libitum* group. These differences also were not significant. Calving interval for restricted and *ad. libitum* group was 524 and 502 days, which were not significant.

DISCUSSION

Cows

All the cows at the beginning of the experiment were in good condition. The average weight during pregnancy period for restricted and *ad. libitum* group was 282.75 kg and 278.8 kg, respectively. The average body weight, pregnancy status, age, breed, number of lactation and previous milk production etc. were almost same in both groups. The effects of pre-partum nutrition on cows live weight changes during lactation are in general agreement with the findings of many workers (Hight, 1966; Jordan et al., 1967; Drennan and Bath, 1976; Garnsworthy and Jones, 1987) who reported that those animals which lost weight or gained least weight during pregnancy had the highest weight gain during lactation. Milk production data showed that different energy treatments had no significant effect on milk production. Cows that were on restricted diet during pregnancy period were lighter at birth than that of the *ad. libitum* group. However, it was observed that although milk production during lactation were not statistically

significant but lighter cows (restricted group) produce slightly more milk (about 8%) than that of the *ad. libitum* group. Milk yield results confirm the results of previous workers, who reported that cows which were fatter at calving produce less than the cows which were thinner at that time (Garnsworthy and Topps, 1982; Treacher et al., 1986; Garnsworthy and Jones, 1987). Garnsworthy and Jones (1987) indicated that cows which are thin at calving are biologically more efficient because they produce more milk directly from the food support rather than from the mobilization of body fat.

Calves

There was no significant effect of treatments on calf birth weight, but calves from the cow's of *ad. libitum* diet were about 1 kg lighter than restricted feeding group. Corah et al. (1975) found that there was no significant effect of pre-calving nutrition on calf-birth weight but cows that were on lower level of nutrition produced slightly smaller calves. Anderson et al. (1981) also did not find any significant effect of treatments on calf birth weight but their low plane cows produced calves that were lighter at birth than those for high plane cows. Anthony et al. (1986) observed no significant effect of low or high pre-partum nutrition on calf birth weight but high plane calves were slightly heavier than low plane calves. Hight (1966) observed a significant effect of pre-calving nutrition on calf-birth weight. In the present study calf birth weight was slightly higher in restricted group but the difference between two groups was not significant. This might be due to the fact that *ad. libitum* diet had created pressure on calf during pregnancy and for this reason calf did not get enough

space for development. As a result calf weight was slightly lower in *ad. libitum* group. The results of birth weight agrees with the findings of Russel et al. (1979) who mentioned that very high level of diet during pregnancy may lead to reduction in calf birth weight. Although calves of both groups were given the same diet during lactation but it was found that from birth to one month growth rate was significantly higher ($p < 0.01$) in restricted group, where milk production was higher than that of the *ad. libitum* group. This might be due to consumption of more milk by suckling their mother just after two times of milking. On the other hand when growth rate was calculated from birth to four month no significant difference was observed. This was probably due to *ad. libitum* feeding of concentrate and green grass.

Feed intake

Feed intake on the basis of dry matter during pregnancy period was significantly higher for *ad. libitum* group but during lactation per day per cow feed intake was not significantly different. During lactation on the basis of body weight, feed intake for restricted group was 3.06% and for *ad. libitum* group was 2.92%. It was observed that cows that had consumed more feed during late pregnancy ate less feed during early lactation and the cows, which ate less feed during late pregnancy, consumed more feed during early lactation. The result of this study agrees with the work of Garnsworthy and Jones. (1987) who reported that cows that had lost body weight during pregnancy period consumed more feed during lactation period.

Reproductive performances

Although the reproductive performances were slightly better in *ad. libitum* group but the effect was not significant. There was no detectable effect of dietary treatments on the reproductive performance of the cows. Usually if a cow is severely underfed during her last trimester of pregnancy, then it might have tremendous effect of on reproductive performance (McDonalds et al., 1985). But in the present study cows on restricted group were not underfed, they were fed according to MAFF (1984) during pregnancy and *ad. libitum* during lactation. For this reason no significant effect of nutritional treatment was observed on the reproductive performance of the cows. The results of this experiment agrees with the findings of Ducker, 1980; and Ducker and Morant 1984, who did not find any effect of dietary treatment on the reproductive performance of cows.

CONCLUSION

From the result of this experiment it is clear that *ad. libitum* feeding during the last trimester of pregnancy is

not suitable for our crossbred dairy cows. Cows, which deposited more fat and gain weight during pre-calving period, produce less milk during post-calving period. Milk yield of cows have some positive effects on the growth rate of calves upto one month of post-calving period, thereafter, growth becomes similar among the calves of all groups upto four months of study period. Considering all these observations it is suggested that dietary level of restricted group which was calculated as per MAFF, 1984, could be given to our crossbred dairy cows during their last trimester of pregnancy.

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