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EFFECT OF FEEDINGHIGH ENERGY DIET ON THE PLASMA BIOCHEMICAL PROFILE AND REPRODUCTIVE PERFORMANCE OF LACTATING CROSS BRED COWS

George Dominic[1]*, K. Ally[1], P. Murali[1], Maya Arun[1], K.S. Anil[1] and P. Gangadevi[1]

[1]*Department of Animal Nutrition,* [1]*University Livestock Farm and Fodder Research & Development Scheme, College of Veterinary and Animal Sciences, Thrissur - 680 651, Kerala (India)*
*e-mail: *georgedominicp@gmail.com*

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ABSTRACT

A study was conducted for 150 days to assess the effect of high energy diet on the performance of cross bred cows in early lactation. Crossbred cows were divided into 3 groups of 6 each. The cows in 2nd and 3rd groups were supplemented daily with 1 and 2 kg energy supplement (ground maize), respectively. Animal in all groups showed similar plasma biochemical profile *viz.*, blood urea nitrogen, plasma calcium, plasma inorganic phosphorus, plasma magnesium, iron and plasma copper; whereas plasma glucose was high in both maize supplemented groups. The animals supplemented with 1 kg maize attained post- partum heat earlier. Though supplementation of ground maize at 1 and 2kgcow^{-1} day^{-1} did not affect plasma biochemical profile or reproductive performance significantly. Supplementation of ground maize at 1 kg day^{-1} cow^{-1} resulted in higher plasma glucose and reduced the days to first post-partum service.

Key words: Conception rate, crossbred cows, early lactation, ground maize, plasma biochemical profile

INTRODUCTION

Nutritional status of high producing dairy cattle during transition period has significant impact on their productive and reproductive performances. During early lactation, the cows are unable to consume enough energy from the feed to meet their energy requirements for lactation. Thus, the body reserves are mobilized thereby leading to the negative energy balance which leads to higher risk of metabolic diseases, infections, suboptimal milk yield and infertility. Maximizing energy intake by increasing the energy density of diet is a logical feeding strategy for early lactating cows. Over past two decades a considerable research has been carried out to work out the strategies to be adopted in feeding transition dairy cows so as to minimize negative energy balance during early lactation (Huhtanen, 1987; Gowda *et al.,* 2009; Lounglawan *et al.,* 2011; Nawaz *et al.,* 2012; Wadhwa *et al.,* 2012). However, further studies are required to rectify the lacunas in feeding pattern of early lactating cows so as to maximize returns to the farmers. Hence, the present study was aimed to assess the effect of energy supplementation in the form of ground maize on the haematological parameters and reproductive performance of the early lactating cross bred dairy cows.

MATERIALS AND METHODS

Eighteen healthy Jersey crossbred cows, in early lactation (within 15 days of lactation), were selected from the ULF&FRDS, Mannuthy, Kerala and uniformly divided into 3 groups of 6 each with regard to age, parity, body weight, previous lactation yield and allotted randomly to experimental rations. All the experimental animals were fed with concentrate mixture containing 17% crude protein (CP) with 35% CP as undegradable protein (UDP) for 150 days. The composition of concentrate mixture included maize (33.5%), wheat bran (39.5%), soybean meal (15.5%), coconut cake (7.5%), dicalcium phosphate (1.5%), calcite (2%) and salt (0.5%). green grass (hybrid napiercv. CO3) was offered as sole roughage. The cows were fed as per ICAR (1998) feeding standard. The cows in 2nd and 3rd group were supplemented daily with 1 and 2 kg energy supplement (ground maize), respectively. Proximate principles of feed, green grass and dung were determined as per standard procedure (AOAC, 2005). The acid detergent fibre (ADF) and neutral detergent fibre (NDF) were estimated as per Van Soest *et al*. (1991). Gross energy of feed and fodder was estimated using bomb calorimeter (Parr Instrument Co., USA) as per Soren *et al.* (2004). Blood samples were collected at the start and end of the experiment to estimate plasma glucose (GOP-PAP method), blood urea nitrogen (modified Berthlot method) and inorganic phosphorus (Bernhart and Wreath, 1955) using standard kits supplied by Agappe Diagnostics, India). Plasma calcium, magnesium, copper and iron were analyzed using atomic absorption spectrophotometer (Perkin Elmer AAS Model 400). The animals were carefully observed for the signs of oestrus. The animals were inseminated from 2nd post-partum oestrus onwards. The data was statistically compared using one way analysis of variance (Snedecor and Cochran, 1994) using SPSS 16.0 (2008).

RESULTS AND DISCUSSION

The CP content of the concentrate mixture was 16.49% while that of fodder used for feeding was 8.68% on dry matter basis (Table 1). Ally *et al.* (2012) reported that a concentrate mixture of 17% CP is sufficient for lactating cattle producing 8-10 kg milk daily. The data on the haematological and biochemical parameters of the experimental animals collected at the end of the feeding period (Table 2). The initial values of the plasma glucose, BUN, plasma calcium, phosphorus, magnesium, iron and copper were 50.23 mg%, 19.25 mg%, 9.77 mg%, 4.55 mg%, 1.97 mg%, 3.30 ppm and 2.6 ppm, respectively.

The plasma glucose levels of the animals fed three experimental rations were 51.12, 63.40 and 59.96 mg dL^{-1}, respectively at the end of trial. Statistical analysis showed that the plasma glucose level in both maize supplemented groups was significantly

Table 1: Chemical composition (% dry matter) of concentrate mixture fed to animals

Item	Concentrate mixture	Fodder (Hybrid napier)
Dry matter	92.9	17.08
Organic matter	90.35	8.68
Crude protein (CP)	16.49	34.69
Crude fibre	7.14	3.05
Ether extract (EE)	2.91	10.75
Total ash (TA)	9.65	17.08
Gross energy (kcal kg^{-1})	3556.47	2801.01
Undegradable protein (UDP)*	5.984	-
Total digestible nutrients (TDN)*	67.90	-
Non-fibre carbohydrate (NFC)$^{+}$	34.79	42.83
Nitrogen free extract	63.81	1.85
Acid insoluble ash	1.08	74.37
Neutral detergent fibre (NDF)	36.16	45.77
Acid detergent fibre	16.84	45.77
Calcium	1.13	0.63
Phosphorus	0.93	0.30
Magnesium	0.37	0.60

*****Calculated from ingredients reference value (NRC, 2001)
$^{+}$NFC (%) = 100- (CP%+NDF%+EE%+TA%)

Table 2: Plasma biochemical parameters of the animals at 150th day maintained on various experimental rations

Parameters	Group I	Group II	Group III
Glucose (mg %)	51.12^{a}±2.71	63.40^{b}±2.99	59.96^{b}±2.92
Blood urea nitrogen (mg %)	22.14±1.04	21.72±0.67	22.76±0.66
Plasma inorganic phosphorus (mg %)	4.78±0.26	4.96±0.05	5.04±0.13
Plasma calcium (mg %)	9.01±0.46	9.72±0.52	9.91±0.54
Plasma magnesium (mg %)	1.87±0.26	1.96±0.15	1.95±0.07
Plasma copper (ppm)	2.69±0.08	2.9±0.04	2.78±0.16
Plasma iron (ppm)	3.68±0.23	4.14±0.45	3.19±0.14

Means within the same row with different superscripts differ significantly (P<0.05)

higher than (P<0.05) that of control group. The results are in agreement with those of Garcia-Bojalil *et al.* (1998) who noticed increase in plasma glucose levels in lactating cows supplemented with Ca-LCFA. Similarly, Liu *et al.* (2009) and Lien *et al.* (2010) noticed increase in plasma glucose level when lactating cows were supplemented with propylene glycol. However, the finding is in disagreement with that of Augustine (2008) who found that there was no significant difference in the plasma glucose concentration when early lactating crossbred cows were supplemented with energy in the form of ground maize (1 kg day^{-1}) or rumen protected fat (100 g day^{-1}).

The plasma urea nitrogen concentrations on 150th day of the animals fed three dietary treatments are given in Table 2. Statistical analysis showed no significant difference (P>0.05) in the plasma urea concentration between the treatments. Similar observations have been made by West and Hill (1990) and Erickson (1992) who reported that plasma urea nitrogen showed no significant difference in plasma urea nitrogen when lactating cows were supplemented with bypass fat as an energy supplement. In contrast, Garcia-Bojalil*et al.* (1998) reported an increase in plasma urea nitrogen in lactating cows upon supplementing Ca-LCFA. However, Delahoy *et al.* (2003) reported a decrease in the plasma urea nitrogen level when cows were fed high energy diet.

The plasma mineral status of animals in different dietary treatment is mentioned in Table 2. No significant difference was seen between the treatments. All the plasma mineral levels were within normal levels specific for cows. This is in agreement with Augustine (2008) who supplemented early lactating crossbred cows with energy in the form of ground maize or rumen protected fat. The average numbers of days from calving to 1st artificial insemination of cows of 3 groups were 105.17±23.45, 74.17±15.46 and 99.17±22.03, respectively. The differences were insignificant. The animals supplemented with 1 kg maize attained post-partum heat earlier than other groups. Four animals in 2nd group (66.7%) conceived during the experimental period and 3 animals each in 1st and 3rd group (50%). The results are in line with Augustine (2008) who reported that 1st post-partum heat was earlier by 16 days in maize supplemented (1 kg day^{-1}) group. Tyagi *et al.* (2010) found that the time required for the onset of cyclicity and service period were reduced in cows supplemented with 2.5% bypass fat as compared to control diet. In agreement with our findings they also found that energy supplementation had no significant effect on reproductive parameters like days to 1st post-partum heat, days to 1st post-partum service, days open or pregnancy loss (Mandebuvu *et al.*, 2003; Ballard *et al.*, 2001; Bork *et al.*, 2010). It may be concluded that the supplementation of ground maize @ 1 and 2 kg cow^{-1} day^{-1}had no significant effect on plasma biochemical profile or reproductive performance. However, supplementation of ground maize @ 1 kg day^{-1} cow^{-1}gave better performance and reduced the days to 1st post-partum service; so may be considered as a nutritional strategy to improve the reproductive performances of dairy cows.

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