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SUPPLEMENTATION OF LACTATING COWS GRAZING STARGRASS (*Cynodon nlenfuensis var. nlenfuensis*) WITH CONJUGATED LINOLEIC ACID: EFFECTS ON PERSISTENCY AND ESTIMATED NET ENERGY BALANCE

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Abstract

Thirty crossbread cows grazed stargrass (*Cynodon nlenfuensis var. nlenfuensis*) receiving 4kg/d of a supplement formulated to provide 115% of metabolizable protein requirements from the 4th to the 11th week of lactation. The cows received either 150g/head/day of Megalac (Control) or 150g/head/day of a Ca-protected conjugated linoleic acid (CLA, Church & Dwight). Residual effects of treatment were evaluated in weeks 12th and 13th. Milk production increased in CLA treated cows ($P<0.05$). CLA decreased milk fat content ($P<0.0001$) and yield ($P<0.01$). Protected CLA increased protein content ($P<0.01$) and yield ($P<0.01$). The CLA residual effect on milk fat ends within one week after withdrawal but the benefits on milk yield and total solids production continued, due to the increased persistency. The estimated energy balance and intake were not greatly affected by treatment, as treated cows had higher milk volume and had higher protein productions.

Keywords: lactation, cows, pasture, milk composition, persistency, conjugated linoleic acid, energy

Introduction

The interest in conjugated linoleic acid (CLA) has increased greatly in recent years due to the benefits to human health related to the ingestion of the c9, t11 CLA isomer. In addition, another CLA isomer, the t10, c11 is a potent nutrient partitioning agent. Supplementing lactating cows with CLA mixtures containing both isomers can be of great advantage for, besides improving fatty acids profile, the gross composition of milk can be manipulated. Reducing fat content can decrease energy requirements of lactating cows. This can be beneficial to cows under the challenging conditions such as tropical pastures and near peak of lactation. The objective of this study was to determine the effect of long-term supplementation with CLA on milk composition, yield, persistency and net energy balance and intake.

Material and Methods

Thirty Zebu X Holstein cows rotationally grazed stargrass (Cynodon nlenfuensis var. nlenfuensis). The grazing period was 2 days and the grazing cycle was 28 days. Cows received 4kg/d of a high-protein supplement formulated with corn (59.00%), soybean meal (5.75%), wheat middlings (5.50%), fishmeal (25.00%) and minerals to provide 115% of estimated metabolizable protein requirements. Supplement was fed from the 4th to the 11th week of lactation, twice a day. The two treatments were either 150g/head/day of Megalac (Control) or the same amount of a Ca-protected CLA mixture (60% CLA, Church & Dwight). The treatments were randomly assigned to cows in each of the 15 blocks (2 cows per block). Blocking criteria were: previous milk production, parity, body condition score and weight. After 56 days of CLA supplementation the residual effects were evaluated during weeks 12th and 13th. In this period, a conventional protein supplement was used. Milk yield was recorded daily. Milk samples were collected 3 times a week and analyzed using an automated infra-red spectrometry equipment. The animals were weighed for 3 consecutive days each week, when 2 independent observers evaluated body condition score. The energy content of milk was calculated by the equation proposed by Perrin (1958) using the average fat, protein and lactose contents for each cow. Net energy output was calculated by the mean week production and the milk energy concentration. As there was practically no weight or condition score change, the net energy for lactation plus the net energy of maintenance were used to estimate net energy intake.

Results and Discussion

Results are summarized in Table 1. CLA supplementation significantly increased milk yield ($P<0.05$). Milk fat content was depressed (-25.9%) in CLA treated cows ($P<0.001$). This effect was observed within one week of treatment when cows were with less than 30 days in milk, which may be related to the source of substrates for fat synthesis in the mammary gland of these low producing cows (i.e. acetate through the *de novo* pathway). Inversely, the protein content of milk from treated cows increased 11,8% ($P<0.001$). As a result of the greater milk production of treated cows, difference in the yield of protein (kg/day) for treated cows was magnified (+19.4%). The amount of fat produced was decreased by 20% by CLA supplementation. The remarkable increase in protein production was greater than observed by Giesy et al (1999). This difference may be explained because we formulated the diet with an additional amount of metabolizable protein to provide for the increased amino acid requirement. Lactose content was unchanged and the rise in protein partially compensated the fat depression in CLA treated cows, but Total Solids content was higher for Control cows ($P=0.058$). Milk energy concentration (MJ/kg) was significantly altered by treatment with CLA cows producing milk with less energy ($P<0.001$). Milk energy output was not significantly affected by treatments, as cows compensated the decreased energy content by secreting more milk and more protein. The data suggest that CLA effects on cows that are in a challenging environment (i.e. one providing energy intake below what is necessary for cows to attain their genetic potential) allow for the same energy secretion, but with milk containing more protein and less fat. The increased milk production with CLA supplementation is probably due to reduced energy demands, as a less caloric milk was produced. Milk fat depression ceased to exist within one week after the removal of CLA from the diet. During the residual period CLA treated cows produced 10.5% more milk. This greater milk production by CLA cows after the withdrawal of CLA is probably due to the higher peak milk production attained by CLA treated cows. There was a significant improvement in lactation persistency (Figure 1), with lactation curves slopes significantly different ($P<0.05$). Surprisingly, milk protein content of CLA treated cows remained greater than control in the residual period ($P<0.01$). CLA although reducing the energy density of milk did not alter total milk energy output. As maintenance requirements were almost the same and there was practically no weight gain or change in condition score, the estimated energy intake (net energy or metabolic energy) was estimated to be the same for both groups.

In conclusion, CLA has a remarkable effect on milk composition and increases milk production in the challenging environment of tropical pastures, including an improvement in persistency, which was maintained after CLA supplementation was discontinued. In addition to the powerful metabolic effect of CLA in decreasing fat content, we observed an important increase in protein content and production. The resulting altered milk composition helped cows to cope with the demanding nutritional/management environment of tropical grazing conditions.

References

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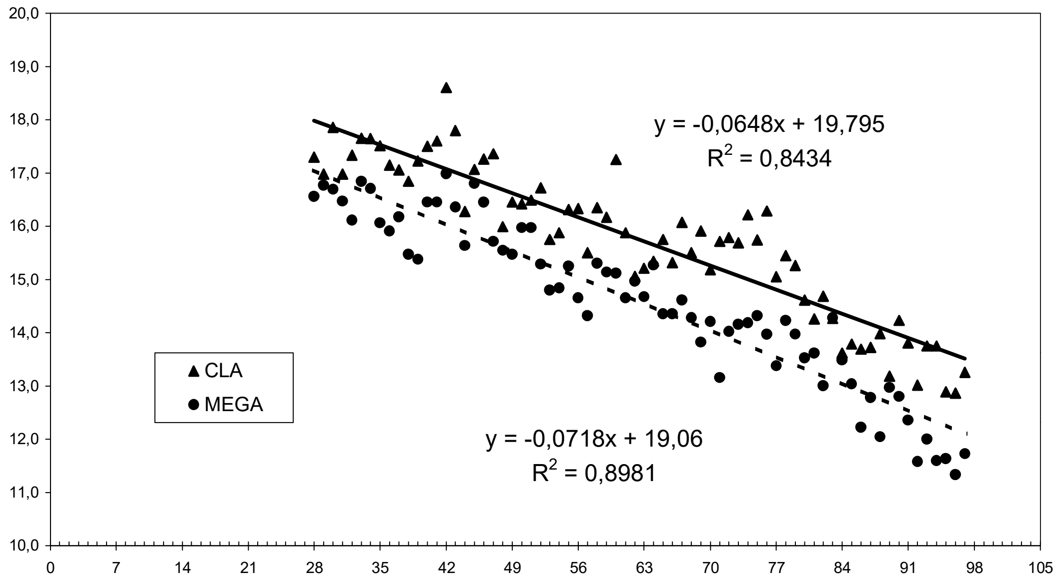

Figure 1 – Control cows (----●---- MEGA) and Treated cows (—▲— CLA) average milk production, regression, equations and determination coefficient.

Table 1 – Milk yield, composition, energy concentration, energy output, live weight and body condition score as affected by CLA treatment during supplementation for 8 weeks (Treatment) and for 2 weeks without supplementation (Residual)

	Treatment Control	Treatment CLA	Residual Control	Residual CLA	CV (%)
Milk Yield (kg/d)	15.15	16.30	12.25	13.54	7.79
Fat Content (%)	2.89	2.14	3.23	2.78	7.23
Protein Content (%)	2.79	3.12	2.81	3.09	2.40
Lactose Content (%)	4.56	4.45	4.47	4.38	2.36
Total Solids Content (%)	10.98	10.50	11.19	11.13	2.27
Fat Yield (kg/d)	0.436	0.348	0.391	0.383	8.79
Protein Yield (kg/d)	0.422	0.504	0.343	0.417	7.64
Lactose Yield (kg/d)	0.726	0.691	0.549	0.592	7.76
Total Solids Yield (kg/d)	1.661	1.716	1.369	1.502	7.67
Milk Energy Density (MJ/kg)	2.498	2.272	2.594	2.494	5.78
Milk Energy Output (MJ/d)	37.78	36.89	31.87	33.99	7.39
Live weight (kg)	451	439	469	443	1.79
Body Condition Score[a]	3.9	4.1	3.7	4.0	22.11