EFFECT OF ENCAPSULATED LYSINE AND METHIONINE ON THE PERFORMANCE OF BUFFALO CALVES

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ABSTRACT

The effect of encapsulated lysine (Lys) and methionine (Met) on the performance of buffalo calves was investigated. Fifteen male buffalo calves were used in this study. Calves were weaned early at 45 days of age. At weaning, the animals were divided into three groups similar in number and weight. Three groups were fed the same starter meal, but the second and third groups were supplemented with encapsulated Lys and Met. The second group was supplemented with four levels of lysine only (0.0, 7.5, 11.5 and 14.5 g/d), while the third group was supplemented with the same levels of Lys plus 3.5 g Met. Digestibility and nitrogen balance trials were carried out on three animals from each group at the seventy-day of the age. The results showed that daily gain and feed efficiency of the supplemented calf groups with Lys and Lys plus Met were higher than that of calves in control group. Dry matter and crude protein digestion and nitrogen balance of the supplemented groups were higher than the control group. Our results suggested that Lys and Met addition led to improve the performance of early-weaned buffalo calves.

Key words: buffalo, calves, lysine, methionine, performance and digestibility.

INTRODUCTION

Increasing the world population resulted in shortage in meat and milk required for human beings. Many efforts were made to increase meat and milk production. One of these is using an early weaning system or milk replacers or both to feed calves up to the weaning age. Their dam's milk can be separated for human consumption and increase the meat production by improving the body weight gain of calves through feeding them on well-balanced diets. Few studies concerning the amino acids requirements of buffalo calves under the early weaning system were conducted. Feeds of corn origin are low in lysine (Lys) and higher in methionine (Met), while legume and animal-derived proteins are low in Met and higher in Lys (Ainsile *et al.*, 1993 and Schwab, 1995). Lysine is first-limiting when corn and corn by-products provide most of the undegradable protein (UDP) for growing cattle and lactating dairy cows, whereas Met is first-limiting when

little UDP is fed or when most of the UDP is provided by legume or animal-derived proteins (Schwab, *et al.*, 1992). Direct evidence, which is provided by abomasal or duodenal infusion studies, indicated that Lys and Met are generally the two most limiting amino acids for protein synthesis in growing ruminants (Merchen and Titgemeyer, 1992) and lactating dairy cows (Robinson, *et al.*, 1999). Many researchers proposed that increased amino acids flow to and absorption in the small intestine could explain the improved performance (Richardson and Hatfield, 1978; Barry *et al* 1982; Gill and Beever, 1982; Storm and Ørskov, 1984; and Merchen and Titgemeyer, 1992). In addition, MacRae and Ulyatt (1974) showed that increased amino acids absorption was positively correlated with weight gain. The present investigation is undertaken to determine the essentiality and requirements of lysine in calf's diets under early weaning system.

MATERIALS AND METHODS

Fifteen, one day male buffalo calves were used in this study. The total of experimental period was four months. Calves were housed in individual cages and bedded on slatted wooden beds, covered with rice straw, which was changed daily. Calves were weaned early at 45 days of age. The early weaning and feeding system as described by Nasser *et al.*, (1989). Cooked starter I and hay were offered to calves at the fourth day of age. The composition of concentrate starter rations is presented in Table (1). At weaning, the animals were

Table (1): Composition of the experimental starters

Ingredients	Starter	
	I	II
Maize grain	60	-
Barley	10	-
Soybean meal	20	-
Decorticated cottonseed meal	-	30
Extracted rice bran	-	60
Molasses	8	8
Calcium carbonate	1.5	1.5
Vit. AD3	0.5	0.5
Mineral Mix.	0.2	0.2
TDN	76.6	58.36
DP	13.2	14.81

divided into three groups similar in number and weight. Three groups were fed the same starter meal, but the second and third groups were supplemented with encapsulated Lys and Met. The second group was

supplemented with four levels of lysine only (0.0, 7.5, 11.5 and 14.5 g/d), while the third group was supplemented with the same levels of lysine plus 3.5 g Met. Calves were fed twice daily at 8 a.m. and 3 p.m. and watered after one hour of feeding. Animals weights weekly were recorded until the end of the experiment. Digestibility and nitrogen balance trials were carried out on three animals from each group at the seventy-day of the age. After nine days of introducing the amino acid to animals faeces and urine were collected for five days in plastic bags and were mixed thoroughly and weighed. Faecal samples were sprinkled with citric acid solution (10% w/v) to prevent the escape of ammonia during drying (Owen, 1967). It was then dried, ground and kept in tightly closed plastic containers. The urine was collected from the animals by fitting the calves with rubber funnels connected with plastic containers containing 10 ml concentrated sulfuric acid to avoid ammonia losses. The volume of urine was measured daily. Samples of the feed offered were taken daily, dried, ground and kept for analysis. The collection period was repeated four times on the same animals with the other levels of amino acid and nine days as preliminary period between each two-collection period.

RESULTS AND DISCUSSION

Effect of encapsulated lysine (Lys) and methionine (Met) on the performance of the early-weaned buffalo calves are shown in Table 2. Total body weight gain and daily gain of calves in the second and third groups, which were supplemented with Lys only or Lys plus Met, were significantly higher ($p \leq 0.01$) than those of calves in the first group (control). Tzeng and Davis (1980) reported that the addition of lysine-HCl (0.28 g lys./d/kg body weight) increased the daily gain and N-retention of calves than the control. Oke, *et al.*, (1986) found that steers, average weight 247 kg, fed diets containing 0.19% rumen protected Met + 0.11% rumen protected Lys had greater daily gain than those fed diets containing no supplemental amino acids. Han *et al.*, (1996) found that when rumen-protected lysine was supplemented at 0 (group 1), 0.2 (group 2) and 0.4 (group 3) of total dry matter intake and fed to sheep, the average daily gain and feed efficiency for the third group were significantly higher than the first and second groups, while feed intake was not affected by the addition. The present results indicated that conversion rate was better for the second and third groups. There were no significant differences between the first and second groups, but the third group was significantly higher than both groups. Also, the present study showed that TDN intake was higher for calves supplemented with lysine alone or Lys plus Met (treated groups) than control (untreated

group) (Table 2). Campbell *et al.*, (2003) showed that dry matter intake was higher for steers supplemented with 13 grams/day of amino acids than for those supplemented with urea or 26 grams/day of amino acids. On the other hand, Robinson *et al.*, (1995) observed that no difference in DM intake for cow's fed ruminally protected lysine (9.5 g/d) and methionine (6.5 g/d) than those fed on untreated-amino acids. Also, Bremmer *et al.*, (1997) showed that DM intake for Jersey cows was unaffected by ruminally protected amino acids.

Table (2): Daily gain, relative weight and feed efficiency for early-weaned buffalo calves from birth to four months of age.

Items	Groups		
	1	2	3
Number of calves	5.00	5.00	5.00
Age of weaning (days)	45.00	45.00	45.00
Duration of experiment (days)	120.00	120.00	120.00
Average initial weight (kg)	38.26	38.5	39.25
Average final weight (kg)	89.5	97.76	107.26
Total gain (kg)	51.24	59.26*	68.01**
Average daily gain (kg)	0.43	0.49	0.57
Relative weight	2.34	2.54	2.73
Intake of TDN (kg)	125.28	131.15	130.10
Conversion rate (kg TDN/kg gain)	2.44	2.21	1.91**

*: $p \leq 0.05$ **: $p \leq 0.01$ by means of t-test

Digestion coefficients of dry matter, crude fiber, crude protein and nitrogen balance are shown in Tables 3, 4, 5, and 6. The results showed that the addition of Lys or Lys plus Met improved the digestibility of dry matter and crude protein and nitrogen balance, but the differences of early-weaned buffalo at both zero level or 14.5 g of Lys were not significant Table 3 and 6. The results indicated that the addition of amino acids at the second and third levels have significantly ($p \leq 0.05$) improved the digestibility of crude protein and nitrogen balance (Table 4 and 5). The present study showed that the addition of encapsulated Lys plus Met at 11.5 and 3.5 g/d significantly improved calves performance and digestibility. Foldager *et. al.*, (1977) found that dietary methionine improved the digestibilities of dry matter and crude protein, and nitrogen balance of Holstein calves (6-24 days of age) fed milk replacer. Nasser *et. al.*, (1989) showed that dry matter and crude protein digestibilities and nitrogen balance of the calves fed cooked starter diet with addition of protected methionine (mepron) were significantly higher than those of the calves fed the uncooked starter diet without mepron supplementation. Christensen *et. al.* (1994) reported that increased apparent digestibilities of dry matter, organic matter, ADF, NDF and energy in the total digestive tract for cows fed diets containing ruminally protected amino acids than cows fed non protected amino acids. Hill *et al.* (1980) suggested

that retention of nitrogen was increased in steers (230 kg BW) abomasally infused with Lys (24.0 g/d) or the same level of Lys in combination with Met (8.0 g/d). Oke, *et. al.* (1986) showed that lambs fed 0.03 % of the diet rumen protected methionine + 0.05 % rumen protected lysine had 0.33% increase in N-retention compared with lambs fed no supplemental Met and Lys. Komarek and Jandzinski (1978) reported a significant increase in lamb N-retention when rumen-protected methionine was supplemented at 0.02 to 0.024% of the diet. The present study showed that the addition of encapsulated lysine and methionine has improved the daily gain, conversion rate, digestibility of crude protein and nitrogen balance of early-weaned buffalo calves.

Table (3): Digestibility's of dry matter (DM), crude fiber (CF), crude protein (CP) and nitrogen balance of early weaned buffalo calves at the first level addition (no amino acids supplement).

Items	Groups		
	1	2	3
Number of calves	3.00	3.00	3.00
Digestibility (%),			
DM	82.38	83.91	84.45
CF	75.67	73.34	75.95
CP	80.63	80.57	80.38
Nitrogen (g),			
Intake	38.16	40.96	40.88
Feces	7.39	7.96	8.02
Urine	9.34	10.20	9.95
Digested	30.77	33.00	32.86
Balance	21.43	22.80	22.91

Table (4): Digestibility's of dry matter (DM), crude fiber (CF), crude protein (CP) and nitrogen balance of early weaned buffalo calves at the second level of addition (7.5 g/d of lys).

Items	Groups		
	1	2	3
Number of calves	3.00	3.00	3.00
Digestibility (%),			
DM	81.62	82.45	84.28
CF	72.30	72.49	72.09
CP	79.32	80.60	83.50*
Nitrogen (g),			
Intake	48.59	49.86	52.02
Feces	10.05	9.67	8.58
Urine	8.87	9.55	9.72
Digested	38.54	40.19	43.44
Balance	29.67	30.64	33.72

**: $p \leq 0.05$ by means of t-test

Table (5): Digestibility's of dry matter (DM), crude fiber (CF), crude protein (CP) and nitrogen balance of early weaned buffalo calves at the third level of addition (11.5 g/d of lys).

Items	Groups		
	1	2	3
Number of calves	3.00	3.00	3.00
Digestibility (%),			
DM	84.55	84.40	85.73
CF	75.78	74.89	76.41
CP	81.65	82.37	84.93*
Nitrogen (g/d),			
Intake	69.59	64.15	73.44
Feces	12.77	11.31	11.07
Urine	14.80	9.74	15.76
Digested	56.82	52.84	62.37
Balance	42.02	43.10	46.61*

**: $p \leq 0.05$ by means of t-test

Table (6): Digestibility's of dry matter (DM), crude fiber (CF), crude protein (CP) and nitrogen balance of early weaned buffalo calves at the fourth level of addition (14.5 g/d of lys).

Items	Groups		
	1	2	3
Number of calves	3.00	3.00	3.00
Digestibility (%),			
DM	82.27	84.11	84.47
CF	73.57	76.46	76.39
CP	81.11	82.24	83.02
Nitrogen (g/d),			
Intake	58.04	57.08	58.18
Feces	10.96	10.14	9.88
Urine	11.74	11.01	11.15
Digested	47.08	46.94	48.30
Balance	35.34	35.93	37.15

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الملخص العربى

تأثير كبسولات الليسين و الميثايونين علي أداء العجول الجاموس المفطومة مبكرا

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تأثير كبسولات الليسين و الميثايونين علي أداء العجول الجاموس المفطومة مبكر تم دراستها في هذه الدراسة و لقد أستخدم ١٥ عجل جاموسي. العجول تم فطامها عند عمر ٤٥ يوم. عند الفطام قسمت العجول الي ثلاثة مجموعات متماثلة في العدد و الوزن. غذيت المجموعات الثلاثة علي نفس البادئ لكن تم إعطاء المجموعتين الثانية و الثالثة كبسولات من الليسين و الميثايونين. أعطيت للمجموعة الثانية ٤ مستويات من كبسولات الليسين فقط (صفر - ٧،٥ -١١،٥- ١٤،٥ جرام/يوم) بينما المجموعة الثالثة أعطيت نفس المستويات من الليسين بالإضافة إلى كبسولات ميثايونين (٣،٥ جرام/يوم). أجريت تجارب الهضم و الاتزان الازوتي علي ثلاث عجول من كل مجموعة عند اليوم السبعين من العمر.

أوضحت النتائج أن معدلات النمو و الكفاءة الغذائية للعجول في المجموعتين المعاملين بكبسولات الليسين و الميثايونين كانت أفضل من عجول المجموعة الضابطة. نتائج تجارب الهضم و الاتزان الازوتي أوضحت تفوق عجول المجموعتين المعاملين في معامل هضم البروتين الخام و الاتزان الازوتي.

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