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In situ nutrient degradation of conventional diets commonly fed to dairy cows in central Myanmar

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ABSTRACT

The determination of nutrient degradability is very important for the effective use of feeds in ruminant production. Therefore, this experiment was conducted to determine the nutrient degradability and energy protein synchronization of conventional diets commonly fed to dairy cows in the central Myanmar through the *in situ* method. The conventional diets are diet from Sin Tel (Diet-ST), diet from MyayNgu (Diet-MN), diet from Ta Pel (Diet-TP), and diet from Amarapura (Diet-AM). The roughage to concentrate ratio of conventional diets ranged from 53:47 to 72:28. The crude protein (CP) content of Diet-TP (17.96%) was significantly higher ($P < 0.05$) than those of other diets with the least CP obtained from Diet-AM (11.46%). Among the conventional diets, a wide variation of dry matter (DM) and organic matter (OM) disappearances were observed throughout the incubation times. The highest value ($P < 0.05$) was found in Diet-AM and the lowest ($P < 0.05$) was observed in Diet-ST and Diet-TP. The rapidly degradable fraction "a" and rate of degradation "c" of DM and OM of Diet-AM was significantly higher ($P < 0.05$) than those of other diets. The effective degradability of DM and OM were also highest ($P < 0.05$) in Diet-AM. In general, the lowest ($P < 0.05$) CP disappearance was observed in Diet-TP. The rapidly degradable fraction "a" of CP was highest ($P < 0.05$) in Diet-ST and the greater ($P < 0.05$) effective degradability was observed for Diet-AM. Moreover, the highest values ($P < 0.05$) of rumen degradable protein, rumen undegradable protein and energy protein synchronization were found in Diet-TP while the lowest value was observed in Diet-AM. Therefore, it was concluded that all conventional diets could be used as a ration for dairy cows; however, the best potential was found in Diet-AM because of its highest effective degradability of nutrients.

KEY WORDS: Conventional diets, *in situ* methods, nutrient degradability

INTRODUCTION

Quantification of the degradation characteristics of feeds consumed by ruminants is normally determined by the *in situ* methods. The determination of the degradability of dry matter (DM), organic matter (OM), and crude protein (CP) is very important to effective use of feeds (NRC, 2001). Synchronization is the provision of rumen degradable protein (RDP) (non-protein nitrogen and rumen-degradable true protein) and energy (ruminally fermentable carbohydrate) to the rumen so that microorganism can utilize both simultaneously. Microbial yield in rumen depends largely on the availability of carbohydrate and nitrogen (N) in the rumen. Nocek and Russell (1988) suggested that the efficiency of microbial protein production may be improved by balancing the overall daily ratio of ruminally available energy and N in the diet, which enhance rumen fermentation efficiency, thereby improving nutrient utilization and animal performance. Moreover, it is also crucial to determine the kinetic degradation and energy protein synchronization of conventional diets because feeding the synchronized diet to a ruminant animal is one of the considerable factors for production purpose. Therefore, this experiment was conducted to determine the nutrient degradability and energy protein synchronization of conventional diets commonly fed to dairy cows in the central Myanmar through the *in situ* method.

MATERIALS AND METHODS

Experimental Feeds

The conventional diets commonly fed to dairy cows in the central Myanmar were used as the experimental diets to determine their nutrient degradation and energy protein synchronization through *in situ* (nylon bag) method. The conventional diets are as follows:

1. Diet-ST: Common diet from Sin Tel village, Tatar U Township
2. Diet-MN: Common diet from MyayNgu village, Tatar U Township
3. Diet-TP: Common diet from Ta Pel village, Tatar U Township
4. Diet-AM: Common diet from Amarapura Township.

In Situ Nutrient Degradation

The *in situ* nutrient degradation was carried out according to the procedure described by Mehrez and Orskov (1977). About 5 g of ground samples milled with 2 mm sieve were weighed into the nylon bags with 50 µ pore size and incubated in the rumen of fistulated bull for 1, 3, 6, 12, 24, 48, and 72 h. The fistulated bull (320 kg body weight) was fed twice a day on a 60% rice straw and 40% concentrate. After the incubation period, the nylon bags were thoroughly washed with running cold water until no further colored liquid could be extruded, and dried at 60°C for 48 h. The nutrient losses for each incubation time were determined. The kinetic degradations of nutrients were fitted to the exponential equation of Ørskov and McDonald (1979);

$$Y = a + b\,(1 - e^{-ct})$$

where,
Y = Disappearance of nutrient in rumen at time t
a = Rapidly degradable fraction
b = Slowly degradable fraction
c = The constant rate of degradation of b (h^{-1})

The effective degradability (Edg) of nutrients was calculated applying the equation of Ørskov and McDonald (1979);

$$Edg = a + (bc/(c + k))$$

Where; k is the rumen outflow rate of 2% per h which is at the maintenance level.

Chemical Analysis

Ground samples of feeds were analyzed for DM, OM, ether extract by the method described by AOAC (1990). Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were analyzed according to the method of Goering and Van Soest (1970). All feeds were analyzed for nitrogen (N) by using Kjeldahl method (Foss 2020 digester and Foss 2100 Kjeltec distillation unit), and CP was calculated as 6.25 × N (AOAC, 1990).

Statistical Analysis

The data were subjected to the analysis of variance, and the significance of differences between means was compared by Duncan's Multiple Range Test (Steel and Torrie, 1980) using SPSS (version 16.0) software.

RESULTS

Ingredient Compositions

The ingredient compositions of conventional diets are presented in Table 1. Accordance with the Table 1, rice straw, natural grass, and sorghum stover were used as the roughage source and cottonseed cake, and broken rice was used as the concentrate sources in most diets. However, sesame residue and butter bean residue were also used as roughage sources in some diets such as Diet-ST and Diet-MN. The roughage to concentrates ratio ranged from 53:47 to 72:28.

Chemical Compositions

The chemical compositions of conventional diets are shown in Table 2. The CP contents of conventional diets

Table 1: Ingredient compositions (%) of conventional diets

Conventional feedstuffs	Conventional diets			
	Diet-ST	Diet-MN	Diet-TP	Diet-AM
Rice straw	23	21	23	33
Sorghum stover	14	-	36	9
Sesame residue	25	-	-	-
Natural grass	-	17	-	11
Butterbean residue	-	34	-	-
Cottonseed cake	29	20	35	-
Broken rice	8	8	6	7
Chickpea mill	-	-	-	40
Roughage:Concentrate	63:37	72:28	59:41	53:47

All ingredient compositions are on DM basis. Diet-ST: Diet from Sin Tel, Diet-MN: Diet from MyayNgu, Diet-TP: Diet from MyayNgu, Diet-AM: Diet from Amarapura, DM: Dry matter

Table 2: Chemical compositions (%) of conventional diets

Chemical compositions	Conventional diets				SEM	*P* value
	Diet-ST	Diet-MN	Diet-TP	Diet-AM		
DM	58.94[a]	53.99[b]	41.69[d]	46.70[c]	2.05	0.001
OM	90.98[a]	90.27[a]	90.22[a]	88.12[b]	0.41	0.038
CP	16.09[b]	16.46[b]	17.96[a]	11.46[c]	0.74	0.001
NDF	60.62[bc]	59.07[c]	64.24[a]	61.26[b]	0.62	0.001
ADF	40.05[b]	34.74[c]	38.87[b]	47.98[a]	1.47	0.001
EE	1.94	2.06	2.02	1.78	0.05	0.112

[a,b,c,d]Means within the same row with various superscripts are significantly different. SEM: Standard error mean. All values except DM are on DM basis. Diet-ST: Diet from Sin Tel, Diet-MN: Diet from MyayNgu, Diet-TP: Diet from MyayNgu, Diet-AM: Diet from Amarapura, DM: Dry matter, OM: Organic matter, CP: Crude protein, NDF: Neutral detergent fiber, ADF: Acid detergent fiber, EE: Ether extract

were significantly different ($P < 0.05$) from each other. The highest CP value (17.96%) was observed in Diet-TP while that (11.46%) of the lowest value was found in Diet-AM. Among the conventional diets, the highest values for NDF and ADF were found in Diet-TP and Diet-AM whereas the lowest values of those two parameters were observed in Diet-MN.

DM Disappearance and its Kinetic Degradation

The *in situ* DM disappearance of conventional diets at the incubation times are given in Table 3. At all incubation times, the DM disappearance of Diet-AM was highest ($P < 0.05$) among conventional diets. Up to 48 h, DM disappearance of Diet-MN was significantly higher ($P < 0.05$) than those of Diet-ST and Diet-TP, which were not different ($P > 0.05$). At 72 h, these three diets (Diet-ST, Diet-MN, and Diet-TP) did not differ from each other.

The kinetic degradation and effective degradability of DM for conventional diets are presented in Table 4. The rapidly degradable fraction "a" and rate of degradation "c" of DM for Diet-AM was significantly higher ($P < 0.05$) than those of other diets. The lowest values of "a" ($P < 0.05$) were found in Diet-ST and Diet-TP, which were not statistically different. However, slowly degradable fraction "b" of DM for all diets was not significantly ($P > 0.05$) different. The effective DM degradability was significantly different ($P < 0.05$) among the conventional diets. The highest value ($P < 0.05$) was found in Diet-AM (58.47%) and the lowest value was observed in Diet-ST (45.95%) and Diet-TP (46.05%).

OM Disappearance and its Kinetic Degradation

The OM disappearances of conventional diets at different rumen incubation times are shown in Table 5. There was an increase in OM disappearance associated with the increasing time of incubation. All the incubation times, OM disappearance for Diet-AM was significantly higher ($P < 0.05$) than those of other diets except 1 h incubation time for Diet-MN. At the 1 and 3 h incubation time, although OM disappearance of Diet-MN was significantly higher ($P < 0.05$) than those of Diet-TP and Diet-ST, which were not significantly different ($P > 0.05$) with each other. However, from 6 to 48 h of incubation times, OM disappearance of Diet-MN was significantly higher ($P < 0.05$) than those of Diet-ST and Diet-TP which were not significantly different ($P > 0.05$) from each other. At the incubation time of 72 h, the three diets except Diet-AM were not significantly different ($P > 0.05$) from one another for OM disappearance.

Table 3: Dry matter disappearance (%) of conventional diets at the different incubation times

Incubation times (h)	Conventional diets				SEM	*P* value
	Diet-ST	Diet-MN	Diet-TP	Diet-AM		
1	20.76^{bc}	21.84^{b}	20.22^{c}	25.40^{a}	0.63	0.001
3	22.11^{c}	23.69^{b}	21.65^{c}	27.88^{a}	0.75	0.001
6	24.11^{c}	26.38^{b}	23.75^{c}	31.44^{a}	0.94	0.001
12	28.00^{c}	31.45^{b}	27.84^{c}	38.03^{a}	1.26	0.001
24	35.43^{c}	40.41^{b}	35.59^{c}	49.31^{a}	1.73	0.001
48	49.11^{c}	54.53^{b}	49.59^{c}	65.90^{a}	2.06	0.001
72	61.73^{b}	64.73^{b}	62.06^{b}	76.85^{a}	1.97	0.001

^{a,b,c}Means within the same row with various superscripts are significantly different. SEM: Standard error mean, Diet-ST: Diet from Sin Tel, Diet-MN: Diet from MyayNgu, Diet-TP: Diet from MyayNgu, Diet-AM: Diet from Amarapura

Table 4: Kinetic degradation and effective degradability (%) of dry matter for conventional diets

Descriptive	Conventional diets				SEM	*P* value
	Diet-ST	Diet-MN	Diet-TP	Diet-AM		
a (%)	19.74^{c}	20.89^{b}	19.34^{c}	24.13^{a}	0.59	0.001
b (%)	80.27	71.16	80.67	74.12	1.77	0.140
c (h-1)	0.0097^{c}	0.0136^{b}	0.0099^{c}	0.0174^{a}	0.001	0.001
EDMdg	45.95^{c}	49.33^{b}	46.05^{c}	58.47^{a}	1.56	0.001

^{a,b,c}Means within the same row with various superscripts are significantly different, a: Rapidly degradable fraction of dry matter, b: Slowly degradable fraction of dry matter, c: Rate of dry matter degradation, EDMdg: Effective dry matter degradability, SEM: Standard error mean, Diet-ST: Diet from Sin Tel, Diet-MN: Diet from MyayNgu, Diet-TP: Diet from MyayNgu, Diet-AM: Diet from Amarapura

Table 5: Organic matter disappearance (%) of conventional diets at the different incubation times

Incubation times (h)	Conventional diets				SEM	*P* value
	Diet-ST	Diet-MN	Diet-TP	Diet-AM		
1	18.60^{bc}	21.04^{ab}	17.26^{c}	23.95^{a}	0.88	0.006
3	20.10^{bc}	23.09^{b}	18.99^{c}	26.68^{a}	0.98	0.002
6	22.29^{c}	26.04^{b}	21.54^{c}	30.59^{a}	1.15	0.001
12	26.56^{c}	31.53^{b}	26.43^{c}	37.76^{a}	1.45	0.001
24	34.64^{c}	41.06^{b}	32.15^{c}	49.89^{a}	2.19	0.001
48	49.17^{c}	55.47^{b}	51.09^{c}	67.26^{a}	2.14	0.001
72	61.97^{b}	65.38^{b}	64.13^{b}	78.30^{a}	2.04	0.001

^{a,b,c}Means within the same row with various superscripts are significantly different. SEM: Standard error mean, Diet-ST: Diet from Sin Tel, Diet-MN: Diet from MyayNgu, Diet-TP: Diet from MyayNgu, Diet-AM: Diet from Amarapura

The kinetic degradation and effective degradability of OM for conventional diets are shown in Table 6. Although the rapidly degradable fraction "a" and rate of degradation "c" of OM for Diet-AM was significantly higher ($P < 0.05$) than those of Diet-ST and Diet-TP, there were no statistically differences ($P > 0.05$) between Diet-MN and Diet-AM. However, the slowly degradable fractions "b" of OM for all diets was not significantly different ($P > 0.05$) from each other. For the effective OM degradability, the Diet-AM was significantly ($P < 0.05$) higher than those of other diets and the lowest was observed for Diet-ST and Diet-TP.

CP Disappearance and its Kinetic Degradation

The *in situ* CP disappearances of conventional diets at the incubation times are shown in Table 7. Among the conventional diets, Diet-ST had the higher CP disappearance ($P < 0.05$) from 3 to 6 h of incubation times. At 12 h incubation time, no significant difference ($P < 0.05$) for CP disappearance was observed among the conventional diets except Diet-TP, which was significantly lower ($P < 0.05$) than those of other diets. After 12 h of incubation time, the higher ($P < 0.05$) disappearance of CP was found in the Diet-AM. At 24 and 48 h incubation times, the lowest CP disappearance was observed in Diet-TP.

The kinetic degradation and effective degradability of CP are shown in Table 8. The rapidly degradable fraction "a" of CP for Diet-ST was significantly higher ($P < 0.05$) than those of other diets while no differences were found among other three diets. However, slowly degradable fraction "b" and rate of degradation "c" for CP were not significantly different ($P > 0.05$) in all diets. For the effective CP degradability of diets, Diet-AM was significantly higher ($P < 0.05$) than those of other diets and the lowest was observed in Diet-TP.

Energy Protein Synchronization

The values and inclusion level of RDP and undegradable protein (UDP) and energy protein synchronization in diets are shown in Table 9. Among the conventional diets, the higher values ($P < 0.05$) of RDP and UDP were observed in the Diet-TP (RDP: 9.66 and UDP: 8.30) and the lowest value ($P < 0.05$) was found in the Diet-AM (RDP: 6.93 and UDP: 4.53). However, the inclusion level of RDP and UDP (RDP: UDP) in all diets were in the range of 60:40. Significantly differences ($P < 0.05$) were found in the rumen degradable nitrogen (RDN) (g)/organic matter digested in rumen (OMDR) (kg), energy protein synchronization, among the conventional diets. The Diet-TP had the highest value (37.37 g RDN/kg OMDR), and the lowest value (21.31 g RDN/kg OMDR) was found in Diet-AM.

DISCUSSION

Although the optimum range for the roughage to concentrate ratio was 40:60, those ratios for the conventional diets ranged from 53:47 to 72:28. In all conventional diets, the higher inclusion level of roughage and lower inclusion level of concentrate were found;

Table 6: Kinetic degradation and effective degradability (%) of organic matter for conventional diets

Descriptive	Conventional diets				SEM	*P* value
	Diet-ST	Diet-MN	Diet-TP	Diet-AM		
a (%)	18.51^{bc}	19.99^{ab}	15.84^{c}	22.55^{a}	0.83	0.006
b (%)	81.64	68.51	78.16	75.23	1.97	0.085
c (h^{-1})	0.0099^{c}	0.0158^{ab}	0.01267^{bc}	0.0189^{a}	0.0012	0.007
EOMdg (%)	45.40^{c}	49.53^{b}	45.85^{c}	59.03^{a}	1.68	0.001

[a,b,c]Means within the same row with various superscripts are significantly different, a: Rapidly degradable fraction of organic matter, b: Slowly degradable fraction of organic matter, c: Rate of organic matter degradation, EOMdg: Effective organic matter degradability, SEM: Standard error mean, Diet-ST: Diet from Sin Tel, Diet-MN: Diet from MyayNgu, Diet-TP: Diet from MyayNgu, Diet-AM: Diet from Amarapura

Table 7: Crude protein disappearance (%) of conventional diets at the different incubation times

Incubation times (h)	Conventional diets				SEM	*P* value
	Diet-ST	Diet-MN	Diet-TP	Diet-AM		
1	37.17^{a}	32.49^{b}	29.83^{b}	30.74^{b}	0.92	0.001
3	38.20^{a}	34.40^{b}	31.38^{c}	33.05^{bc}	0.81	0.001
6	39.73^{a}	37.12^{b}	33.62^{c}	36.36^{b}	0.69	0.001
12	42.70^{a}	42.06^{a}	37.87^{b}	42.45^{a}	0.62	0.001
24	48.34^{b}	50.28^{b}	45.52^{c}	52.71^{a}	0.84	0.001
48	58.56^{c}	61.85^{b}	57.92^{c}	67.42^{a}	1.19	0.001
72	67.61^{b}	69.21^{b}	67.25^{b}	76.81^{a}	1.29	0.002

[a,b,c]Means within the same row with various superscripts are significantly different. SEM: Standard error mean, Diet-ST: Diet from Sin Tel, Diet-MN: Diet from MyayNgu, Diet-TP: Diet from MyayNgu, Diet-AM: Diet from Amarapura

Table 8: Kinetic degradation and effective degradability (%) of crude protein for conventional diets

Descriptive	Conventional diets				SEM	*P* value
	Diet-ST	Diet-MN	Diet-TP	Diet-AM		
a (%)	36.67^{a}	31.50^{b}	29.05^{b}	29.55^{b}	0.99	0.001
b (%)	63.34	53.39	66.91	64.65	2.39	0.197
c (h^{-1})	0.0088	0.0198	0.0118	0.0188	0.0019	0.074
ECPdg (%)	56.00^{bc}	56.33^{b}	53.80^{c}	60.47^{a}	0.78	0.001

[a,b,c]Means within the same row with various superscripts are significantly different, a: Rapidly degradable fraction of crude protein, b: Slowly degradable fraction of crude protein, c: Rate of CP degradation, ECPdg: Effective CP degradability, SEM: Standard error mean, Diet-ST: Diet from Sin Tel, Diet-MN: Diet from MyayNgu, Diet-TP: Diet from MyayNgu, Diet-AM: Diet from Amarapura

Table 9: Inclusion level of RDP and UDP in the diets and energy protein synchronization of conventional diets

Descriptive	Conventional diets				SEM	*P* value
	Diet-ST	Diet-MN	Diet-TP	Diet-AM		
RDP (% of total diet)	9.01^{b}	9.27^{b}	9.66^{a}	6.93^{c}	0.32	0.001
UDP (% of total diet)	7.08^{b}	7.19^{b}	8.30^{a}	4.53^{c}	0.42	0.001
RDP:UDP (% of total CP)	56:44	56:44	54:46	60:40	-	-
RDN (g)/kg OMDR	34.95^{b}	33.18^{c}	37.37^{a}	21.31^{d}	1.87	0.001

[a,b,c,d]Means within the same row with various superscripts are significantly different, RDN: Rumen degradable nitrogen, OMDR: Organic matter digested in rumen, SEM: Standard error mean, Diet-ST: Diet from Sin Tel, Diet-MN: Diet from MyayNgu, Diet-TP: Diet from MyayNgu, Diet-AM: Diet from Amarapura, RDP: Rumen degradable protein, UDP: Undegradable protein

however, the nutritive values of these diets met the level recommended by NRC (2001) for the dairy cows. It might be due to the high quality of roughage (sesame residue, natural grass, and butter bean residue) were used in the formulation of the conventional diets. The variations of chemical compositions for the conventional diets could be due to the different percentage of ingredient composition included in the diets. The highest (17.96%) and the lowest (11.46%) CP contents were found in Diet-TP and Diet-AM because the different concentrates, cotton seed cake (37.25% CP) and chickpea mill (16.00% CP) were used in the formulation of those diets, respectively.

Among the conventional diets, a wide variation of DM and OM disappearances were observed throughout the incubation times. The highest value was found in Diet-AM, and the lowest was in Diet-ST and Diet-TP (Tables 3 and 5). Moreover, the amount of rapidly degradable fraction "a" and rate of degradation "c" for slowly degradable fraction "b" of DM and OM of conventional diets were also significantly different from each other (Tables 4 and 6). The Diet-AM had the higher value of these parameters in compared with other diets. Moreover, the highest values of effective degradability of DM and OM were observed in Diet-AM among the conventional diets. It might be due to the different types of carbohydrate fraction contained in the conventional diets. Many researchers reported that the degradability of feedstuffs was influenced by the type of carbohydrate (soluble and insoluble carbohydrate). Maghsoud *et al*. (2008) presented that higher DM effective degradability could be achieved by the feedstuffs or feed contained lower NDF content and a higher degradable fraction.

Tatli-Seven and Cerci (2006) pointed out that CP level and OM degradability were positively correlated for forages using the nylon bag technique. Riasi *et al.* (2008) also attributed that the factors such as low ash and high NDF content could reduce the DM degradability of the feedstuffs. However, although Diet-AM had the higher level of ash and fiber (NDF and ADF) content (Table 2), the higher level of DM and OM degradability was observed (Tables 4 and 6). It might be due to the different sources of protein contained in the diet composition. Among the conventional diets, chickpea mill for Diet-AM and cotton seed cake for other three diets (Diet-ST, Diet-MN, and Diet-TP) were used as protein source in the diets composition (Table 1). The different sources of protein resulted different degradation pattern (rapidly and slowly degradation) which affect the microbial activity. The DM and OM degradability may vary due to different microbial activity in the nylon bag (Lindberg *et al*., 1984; Nocek, 1988; Michalet-Doreau and Cerneau, 1991).

Concerning the CP disappearance of conventional diets, at the early incubation time, up to 6 h, the greater value was observed in Diet-ST and for the later time, after 12 h, Diet-AM had the higher level of CP disappearance. In most of the incubation times, the lowest CP disappearance was observed in Diet-TP (Table 7). Although the higher level of rapidly degradable fraction "a" of CP was found in Diet-ST, slowly degradable fraction "b" and rate of degradation "c" were not statistically different. The greater effective degradability was observed for Diet-AM (Table 8). Therefore, it could be assumed that the levels of rapidly degradable fraction "a" and rate of degradation "c" for slowly degradable fraction "b" were influenced the effective degradability of nutrients. For the variation of protein degradability, the researchers, Harrison *et al.* (1975) and Hemsley (1975), expressed that while the rate of protein degradation was a function of the rate of proteolysis as well as retention time in the rumen, retention time appeared to be less important than proteolysis. However, the time that protein was exposed to enzymatic action influences the degree of degradation. Any factor, such as inter-animal variation, species differences, particle size, and quantity of feed that affects retention time will affect the degree of protein degradation (Warner, 1981).

The highest values of RDP, UDP, and RDN (g)/OMDR (kg) were found in Diet-TP (9.66, 8.30, and 37.37, respectively), while the lowest value was observed in Diet-AM (6.93, 4.53, and 21.31, respectively). However, the inclusion level of RDP and UDP (RDP: UDP) in all diets were in the range of 60:40 (Table 9). The Diet-TP had the lowest protein degradability and the higher synchronization level (RDN [g]/OMDR [kg]). Conversely, the highest protein degradability and the lower synchronization were observed in the Diet-AM. It might be due to the amount of protein (RDP and UDP) entered into the rumen and type of carbohydrate (soluble and insoluble carbohydrate) which are degraded in the rumen.

In Diet-TP, the ruminal nitrogen level was greater because of a higher amount of RDP. At this time, the supply of energy to utilize the ruminal N was moderate because of its lower OM degradability. However, in Diet-AM, the lower ruminal nitrogen level and higher supply of energy were observed because it had a little amount of RDP and higher degradability of OM. Therefore, the energy protein synchronization of Diet-TP was higher than the maximal optimum level (32 g of RDN/kg of OMDR) recommended by Sinclair *et al*. (1991) and those of Diet-

AM was lower than the minimal optimum level (25 g of RDN/kg of OMDR) recommended by Czerkawski (1986). The optimum synchronization achieved by energy and ruminal N supplementation resulted in a positive effect on microbial protein synthesis (MPS) (Lardy *et al.*, 2004; Elseed, 2005). Improved efficiency of MPS was considered as the most important target to maximize MPS while synchronization of carbohydrate and protein supply in the rumen had been suggested as one possible solution to achieve this (Kaswari *et al.*, 2006). MPS was influenced by many dietary and animal factors, which include nitrogen concentrations, nitrogen sources, rates of nitrogen and carbohydrate degradation, the carbohydrate in the diets, DM intake, and synchronization of nitrogen and energy (Karsli and Russell, 2002).

CONCLUSIONS

The highest values of DM and OM disappearances were observed in Diet-AM, and the lowest values of those parameters were found in Diet-ST and Diet-TP. In general, the lowest CP disappearance value was observed in Diet-TP throughout incubation times. The effective degradability of DM, OM, and CP was highest in Diet-AM, and the lowest values were found in Diet-ST and Diet-TP. For the energy protein synchronization, the highest value was found in Diet-TP, and the lowest was observed in Diet-AM. Therefore, it was concluded that all conventional diets could be used as a ration for dairy cows; however, the best potential was found in Diet-AM because of its highest effective degradability of nutrients.

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