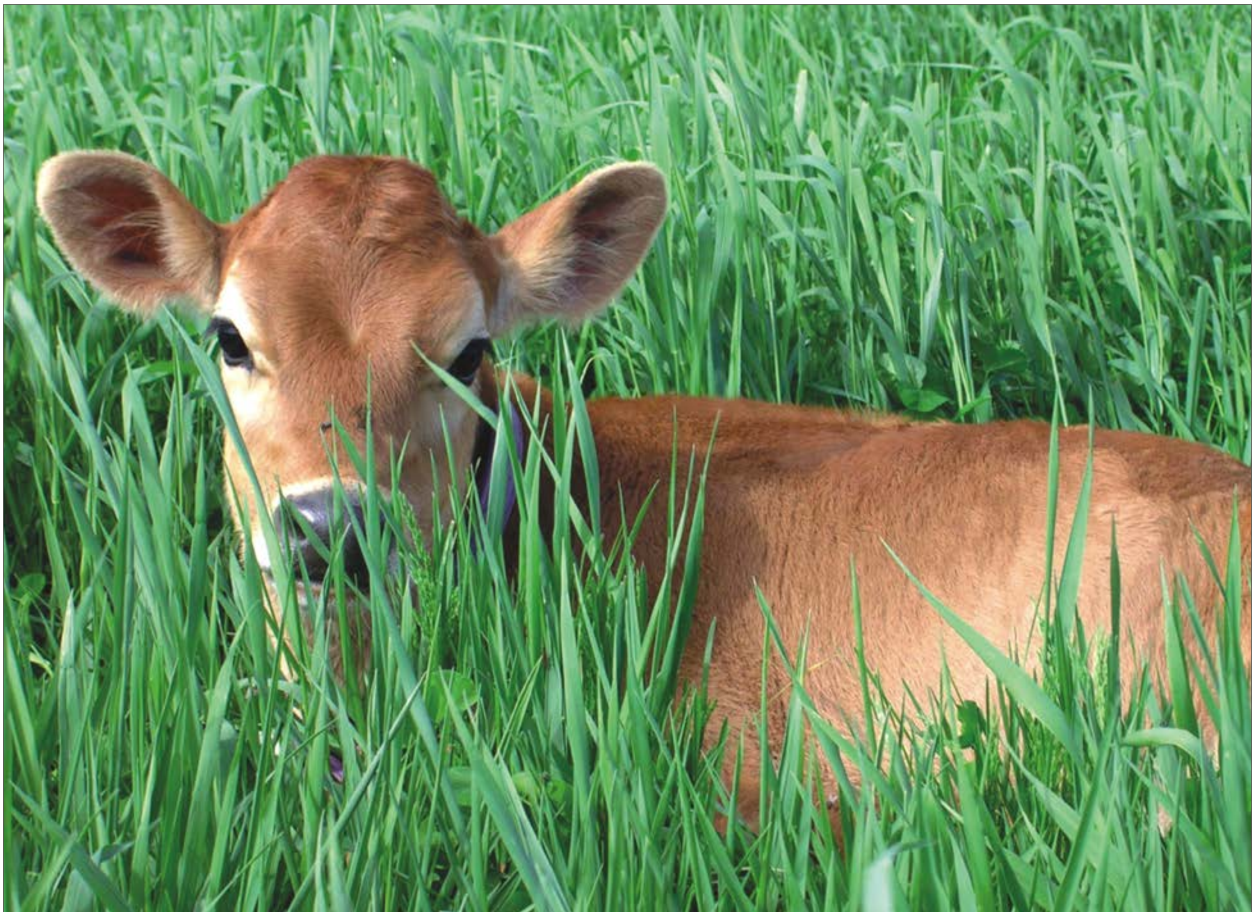

International Journal of

Dairy Science

ISSN 1811-9743

Academic
Journals Inc.

www.academicjournals.com

OPEN ACCESS International Journal of Dairy Science

ISSN 1811-9743
DOI: 10.3923/ijds.2017.73.80

Research Article
Effects of Different Feeding Methods on Feeding Behavior, Feed Intake and Digestibility of Lactating Dairy Cows

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Abstract

Objective: This study was aimed to evaluate the effect of different feeding methods on feeding behavior, feed intake and digestibility of lactating dairy cows. **Methodology:** Fifteen first-lactating Friesian-Holstein dairy cows in the third month lactation with an average of 515±61.5 kg b.wt., were used as the experimental animals. The cows were subjected to three different feeding methods namely Component Feeding (CF), cafetaria (cafe) and Total Mixed Ration (TMR) according to a completely randomized design with five replicates. **Results:** Results demonstrated that treatment affected ($p<0.05$) single meal time; afternoon feeding frequency and nocturnal rumination frequency, but did not affect rumination time during one day, in the afternoon and evening; single rumination time in 1 day and in the afternoon and afternoon rumination frequency. Digestibility of dry matter, organic matter and energy were not affected by treatments. **Conclusion:** Conclusively, lactating dairy cows fed with cafeteria feeding pattern took longer single meal time and less frequent afternoon feeding, while the component feeding take one time rumination and longer rumination in standing position and the total mixedration had more frequent daily and nocturnal rumination. The strategy of feeding with TMR resulted in a lower chewing time, tended to decrease feed intake but increase feed digestibility.

Key words: Feeding method, feeding behavior, digestibility, dairy cow

Received: July 17, 2016 Accepted: September 15, 2016 Published: December 15, 2016

Citation: Caribu Hadi Prayitno, Nurul Mukminah and Anuraga Jayanegara, 2017. Effects of different feeding methods on feeding behavior, feed intake and digestibility of lactating dairy cows. Int. J. Dairy Sci., 12: 73-80.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Feeding pattern of dairy cows may potentially affect their production performance. Feeding management by following the pattern of concentrate-first-forage-later may induce fluctuation in rumen pH and may cause acidosis. Previous studies had shown that such practice affected cow's feeding behavior (feeding time, feeding frequency and rumination time), nutrient digestibility (dry matter, organic matter and energy) and decreased productivity of lactating dairy cows[1]. Feeding of concentrate before forage may also affect rumen ecology. During concentrate intake, cellulolytic bacteria generally dwindle and amylolytic bacteria increase, provided that non-structural carbohydrate (from concentrate) intake produces acidic rumen pH. Further, it increased subclinical acidosis from 19-29% in lactating dairy cows with high concentrate intake[2].

Subclinical and clinical development of acidosis in cows involve interaction between feeding pattern, intake, feed composition and rumen microorganisms[3]. Initial concentrate intake will increase starch fermentation and glucose availability, stimulate rumen bacteria growth, increase VFA production and as a consequence of that, rumen pH decreases. Cellulolytic bacteria and protozoa are inhibited at pH under 6.0, while various microbes in the rumen mostly perishesat pH less than 5.2, leaving bacteria that are tolerant to acidity, i.e., *Streptococcus bovis* and *Lactobacillus* spp. This prolonged condition of low rumen pH in lactating dairy cows will cause static rumen, which negatively affects feeding behavior (feeding time and frequency, rumination time and frequency) and nutrient digestibility (dry matter, organic matter and energy). Low rumen pH makes cows reduce their consumption[4] probably to limit acid fermentation production and return rumen pH to normal condition[5].

The TMR feeding pattern bears optimum effect on feeding behavior and nutrient digestibility. Allen[6] reported that TMR was of significant benefit because the fast-fermented carbohydrate was effectively consumed with fiber, thus preventing sharp fall in rumen pH. This was further stabilized rumen ecology and increasing rumen microbial population and activity which led to the improvement of dry matter intake and nutrient digestibility. It is required for TMR pattern to consider the forage particle size in order to prevent cattle to select the provided feed and to optimize feeding behavior, nutrient digestibility (DM, OM and energy) and dairy cow productivity[7]. Although, different feeding methods considerably affect the productivity of dairy cows, there have been limited studies attempted to compare such methods. The present experiment therefore, aimed to evaluate different feeding methods, i.e., Component Feeding (CF), cafetaria (cafe) and Total Mixed Ration (TMR) on feeding behavior, feed intake and digestibility of lactating dairy cows. It is expected that the results of the present study may add a new insight on the most appropriate feeding method for lactating dairy cows under tropical environment.

MATERIALS AND METHODS

Fifteen FH dairy cows of first lactation period on the third lactation month with an average weight of 515±61.5 kg were alloted in permanent 2×3 m individual pens with separated feed and drinking container. The cafeteria treatment feed container was equipped with wood separator for concentrate and forage. Feed consisted of forage and concentrate 60:40 DM basis, with equal forage in all treatments. Chopped forage (±10 cm length) comprised of elephant grass and *Gliricidea sepium* leaves. Concentrate consisted of rice bran, corn, palm kernel meal, soybean meal, pollard, tapioca by product, mineral, salt and Urea Molasses Mineral Block (UMMB). Nutrient content of the experimental feeds is presented in Table 1.

Experimental design followed a completely randomized design and the treatments were different feeding methods as presented in Table 2.

Table 1: Nutrient composition of experimental feeds

		DM (%)						
Feed	Proportion (%)	CP	EE	CF	Ash	TDN	NDF	ADF
Concentrate	37	4.85	6.35	7.98	2.81	27.6	12.9	6.16
Elephant grass	57	6.45	3.03	17.5	2.77	32.3	37.0	26.2
Gliridicia	3	0.70	0.15	0.48	0.13	2.07	1.54	1.28
UMMB	3	1.10	0.15	0.26	0.27	2.67	0.51	0.30
Total	100	12.0	9.52	25.9	5.72	62.0	51.4	33.6

CP: Crude protein, EE: Ether extract, CF: Crude fiber, TDN: Total digestible nutrient, NDF: Neutral detergent fiber, ADF: Acid detergent fibre, UMMB: Urea molasses mineral block

Table 2: Experimental treatments provided to lactating dairy cows

Treatment	Administration time	Description
CF	Concentrate at 06.00, forage at 08.00, concentrate at 11.00, concentrate at 15.00, forage at 17.00	Concentrate and forage were separately provided at different time
Cafe	Feed was given at 06.00, 08.00, 11.00, 15.00 and 17.00	Concentrate and forage were separately provided simultaneously
TMR	Feed was given 06.00, 08.00, 11.00, 15.00 and 17.00	Mixed concentrate and forage were fed at the given times

Amount of feed consumed, refusal and feces per dairy cow were recorded. Analysis of dry matter, organic matter and energy on samples of feed, refusal and feces were conducted according to AOAC[8]. Such analyses were used to calculate Dry Matter Digestibility (DMD), Organic Matter Digestibility (OMD) and energy digestibility using total collection method by Schneider and Flaat[9]. Analysis of NDF of feed and refusal were conducted based on Goering and van Soest[10].

Feeding behaviour was observed continuously for 5 days by using CCTV camera with recording equipment. Parameters measured in relation to feeding behavior consisted of feeding time, meal time, feeding frequency, rumination time, single rumination time and rumination frequency.

Data obtained were subjected to analysis of variance (ANOVA) and followed by Tukey's test when the ANOVA results for a particular parameter showed significantly different at p<0.05. All the statistical analyses were performed by using SPSS software version 22.

RESULTS AND DISCUSSION

Feeding behavior: The present study demonstrated that treatments significantly affected (p<0.05) meal time and afternoon feeding frequency, but showed no significant effect on total 1 day feeding time, afternoon and evening feeding time, single afternoon and evening meal time (Table 3). The longest meal time was observed in cafe followed by TMR and CF (p<0.05) because the cafe cattle had access to choose feed (forage and concentrate) based on rumen condition. While cattle in cafe system chose feed more frequently, taking longer time to chew forage then moving to feed on concentrate. The TMR cattle only needed a shorter single duration because the forage had been chopped and mixed with the concentrate, therefore, limiting unnecessary movement. The CF system had the shortest duration because only concentrate was administered and no forage was provided as in cafe and CF system. Concentrate were physically soft, easily edible and induced lower rumen pH (into acid rumen pH). Accordingly, rumen condition experienced disorder so cattle reduced intake and eventually minimized single meal duration. The other factor of CF system shortest duration was because concentrate as energy-enriched feed induced fuller sensation inspite of the half-filled rumen, so cattle ceased to eat earlier. DeVries and von Keyserlingk[11] informed that cattle fed with TMR pattern required longer single meal duration compared to those with component feeding.

Table 3: Feeding time and frequency of lactating dairy cows with different feeding pattern

Feeding parameter	CF	Cafe	TMR
Feeding time (min day^{-1})	427±38.4	422±51.6	385±58.7
Afternoon feeding time (min day^{-1})	370±24.2	371±34.6	342±55.5
Evening feeding time (min day^{-1})	57.6±23.2	51.6±25.7	43.0±15.4
Single meal time (min meal^{-1})	38.4±4.26^{a}	47.5±6.54^{c}	42.1±4.54^{b}
Afternoon meal time (min meal^{-1})	45.5±5.81	62.4±16.9	52.1±9.38
Evening meal time (min meal^{-1})	20.4±5.32	18.7±6.29	19.3±9.77
Feeding total frequency (time)	11.2±1.30	9.00±1.41	9.20±1.48
Afternoon feeding frequency (time)	8.20±0.84^{b}	6.20±1.30^{a}	6.60±0.55^{a}
Evening feeding frequency (time)	3.00±1.22	2.80±1.30	2.60±1.14
Chewing time (min)	919±35.0^{b}	913±41.4^{b}	870±41.3^{a}

CF: Component feeding, Cafe: Cafetaria, TMR: Total mixed ration, $^{a-c}$Means with different superscripts in the same row are different at p<0.05

Component feeding had the highest feeding frequency followed by cafeteria and TMR (p<0.05), because concentrate and forage were given at different time during afternoon and it caused fluctuation of rumen pH, therefore, forage was more preferable to component feeding cows. Increasing the feeding frequency was aimed to minimize the fluctuation of rumen pH and to stabilize rumen ecology[12]. On the contrary, concentrate and forage given simultaneously in cafetaria and TMR led to non-fluctuating rumen pH and more stabilized pH and eventually less feeding frequency compared to component feeding. The TMR had higher afternoon feeding frequency than cafetaria because concentrate mixed with forage increased palatability and feeding frequency. The study showed that active feeding time was in the afternoon then decreased in the evening as similarly reported by Niu *et al.*[13]. Daily, afternoon and evening feeding time compared to single afternoon and evening mealtime did not differ, presumably because of relatively similar DM and NDF consumption in all treatments. Feeding time was affected by DM and NDF consumption[14,15] which further correlated with feeding time.

The other factor was feeding frequency, 5 times a day and the minimum feeding frequency of dairy cow was 4 times. The more frequent feeding given, the less subclinical acidosis risk occurred[16]. Stabilized rumen pH caused a more "Comfortable" feeling to lactating dairy cow to feed because low rumen pH made some cows reduce feed intake in order to limit acid fermentation product and return rumen pH to stabilized and comfortable condition[17].

The short interval between feeding was assumed not to affect feeding time as in component feeding in which first concentrate was administered at 06.00 and the forage at 08.00. It returned rumen pH from acidic to comfortable/normal due to the forage feeding. Concentrate was given at 11.00. Observation foundremaining forage at 08.00; therefore, cows feed on concentrate at 11.00, then the remaining forage. This case minimized rumen pH fluctuation as well as subclinical acidosis risk. Concentrate was again given at 15.00, forage at 17.00 with similar condition to the morning feeding. Therefore, cafetaria and TMR patterns that simultaneously provided concentrate and forage were similar to that of component feeding because of short interval between feeding time.

Daily feeding frequency was equal in all treatments, presumably due to similar feed given to all treatments and equal DM and NDF consumption. Feeding frequency was assumed to cause similar frequency of daily feeding. Five-time feeding frequency could minimize rumen pH fluctuation, thus stabilizing the comfortable rumen condition in which cows were fed more often. Evening feeding frequency was not different, assumedly due to the slightly active cow feeding during the night. Cows therefore had more frequent feeding in the afternoon or more ruminating in the evening, which naturally minimized evening feeding frequency and intake.

Total feeding time in this study was from 385-427 min, higher than 223.4-224.9, 220-252, 332-352 and 219.0 min day^{-1} in multiparous MP and 234.3 min day^{-1} in primiparous (PP)[12,18,11,19]. In TMR pattern, Maltz *et al*.[20] reported 206.4-213 min/12 h eating time. Single meal time in this experiment ranged between 38.44 and 47.51 min meal^{-1}. Other researchers reported single meal time ranged from 40-46 min meal^{-1}, higher than 33-35.9 and 23.6 min meal^{-1} in MP and 23.3 min meal^{-1} in PP[11,21,19]. Daily feeding frequency ranged from 9-11.20 times, similar to DeVries and von Keyserlingk[11] presented 8.8-10.7 times day^{-1} with TMR pattern. Research result in all treatments showed that afternoon feeding time (342-371 min) was longer than the evening (43-57.6 min), because cattle spent more time during the day to feed and the night to rest and ruminate. All treatments further experienced higher frequency of afternoon feeding (6.20-8.20 times) compared to evening (2.60-3 times), because cattle spent more time during the day for feeding and the night for resting and ruminating (Table 4).

Shorter chewing time in TMR in this study was assumedly due to the optimum activity of rumination. Total chewing time in other findings was 710-841, 917-848, 677-738 and 410.6-507 min day^{-1}, this study supported by Shepherd *et al*.[17] Kargar *et al*.[22], Bhandari *et al*.[23], Maulfair *et al*.[24], Kahyani *et al*.[25] and Yang and Beauchemin[15]. Day and evening meal frequency in TMR was lower than that in component and cafeteria feedings. Shorter chewing time in TMR decrease energy loss for rumination. The optimum rumination for the TMR was indicated by the increase of NDF intake (8.96 vs 8.3 kg day^{-1}) (Table 5) and the tendency of higher digestibility on DM, OM and energy (Table 6).

Experiment result demonstrated that treatments significantly affected ($p<0.05$) single evening rumination time and 1 day rumination frequency, but did not affect rumination time in 1 day, afternoon and evening, single rumination and afternoon time; afternoon rumination

Table 4: Rumination time and frequency of lactating dairy cows with different feeding pattern

Rumination parameter	CF	Café	TMR
Daily total rumination time (min)	492±31.6	491±31.3	485±23.8
Afternoon rumination time	105±31.9	116±29.1	96.8±31.4
Nocturnal rumination time	387±12.2	375±29.4	388±34.2
Daily single rumination time (min)	35.8±2.51	35.3±4.22	31.0±4.01
Single afternoon rumination time	24.3±6.41	29.1±4.87	24.9±7.81
Single evening rumination time	41.5±4.41^{a}	37.8±4.29^{b}	33.1±4.12^{c}
Single lying rumination time	29.6±2.89	38.1±5.99	33.1±5.11
Single afternoon rumination time	26.1±11.7	34.7±7.82	24.7±10.9
Single standing rumination time	26.6±8.05	20.4±5.68	18.3±11.2
Single afternoon standing rumination time	22.2±5.50^{b}	9.10±5.92^{b}	117±11.1^{a}
Single evening standing rumination time	32.6±11.1	21.1±12.6	18.9±11.4
Afternoon standing rumination time	52.8±14.3^{a}	12.2±11.5^{b}	31.0±23.5^{a}
Evening rumination time	387±12.2	375±29.4	388±34.2
Daylight rumination	105±31.9	116±29.1	96.8±31.3
Lying evening rumination time	311±37.9	345±79.4	348±29.1
Lying afternoon rumination time	52.6±25.5	104±23.5	65.8±52.2
Total frequency of daily rumination (times)	13.8±1.09^{a}	14.0±1.22^{a}	15.8±1.30^{b}
Afternoon rumination frequency	4.40±1.14	4.00±0.71	4.00±1.22
Nocturnal rumination frequency	9.40±0.89^{a}	10.0±1.22^{b}	11.8±0.84^{c}
Frequency of standing rumination	4.20±1.09	3.00±1.87	3.00±1.87
Frequency of nocturnal standing rumination	1.80±1.30	2.00±1.41	1.60±1.14
Frequency of napping time of rumination	2.40±0.55^{a}	1.00±0.71^{b}	1.40±0.89^{b}
Frequency of nocturnal rumination	7.60±1.67^{b}	8.00±1.87^{b}	10.2±1.64^{a}
Total frequency of lying rumination	9.60±2.07	11.0±1.87	12.8±2.68

CF: Component deeding, Cafe: Cafeteria, TMR: Total mixed ration, $^{a-c}$Means with different superscripts in the same row are different at $p<0.05$

Table 5: Dry matter, organic matter, energy and NDF intake of lactating dairy cows with different feeding pattern

Nutrient intake	CF	Cafe	TMR
Dry matter (kg day^{-1})	16.40±1.16	16.70±0.61	16.20±0.94
Organic matter (kg day^{-1})	6.66±0.50	6.47±0.31	6.98±0.20
Energy (kcal day^{-1})	58.90±3.25	58.40±3.99	56.30±2.91
NDF (kg day^{-1})	8.16±0.65^{a}	8.50±0.35^{a}	8.96±0.52^{b}

CF: Component deeding, Cafe: Cafeteria, TMR: Total mixed ration, ^{a,b}Means with different superscripts in the same row are different at $p<0.05$

Table 6: Rumen pH and digestibility of dry matter, organic matter and energy of lactating dairy cows with different feeding pattern

Digestibility (%)	CF	Cafe	TMR
Rumen pH	6.05±0.08	6.04±0.06	6.04±0.02
Dry matter	73.10±1.34	72.40±2.04	74.30±1.72
Organic matter	92.00±0.79	92.20±0.75	92.40±0.93
Energy	69.60±1.65	70.00±2.03	70.50±1.97

CF: Component deeding, Cafe: Cafeteria, TMR: Total mixed ration

frequency (Table 4). Component feeding had the longest single rumination time, followed by cafeteria and TMR ($p<0.05$), presumably because at 17.00 cows given component feeding only fed on forage with higher NDF content than those of cafeteria and TMR who consumed few forage and concentrate that affected evening NDF consumption, leading to longest duration component feeding of evening meal. Aikman *et al.*[26] stated that rumination time was affected by NDF intake.

The TMR had the highest daily rumination frequency, followed by cafetaria and component feeding ($p<0.05$), while cafetaria and component feeding were not different. Component feeding cows were the least daily ruminating because of initial concentrate intake that accelerated rumen microorganism growth and thus increased forage intake. Component feeding shared common mechanism with cafetaria in the concentrate-first-forage-later pattern, regarding the stabilization of rumen microorganism by concentrate, therefore, cafetaria and component experienced similar daily rumination frequency. While, mixed concentrate and forage as in TMR caused rumen microorganism unreadily degrade the incoming forage due to lack of microorganism growth in the rumen. Component feeding further demonstrate the least frequent nocturnal rumination followed by cafetaria and TMR ($p<0.05$) because of the stabilized rumen microorganism when forage was given at 17.00 owing to the previously given concentrate at 11.00 and 15.00 that triggered microorganism growth. Cafeteria, conversely performed more frequent nocturnal rumination compared to component feeding because of simultaneous intake of forage and concentrate in separated container. The TMR had the highest frequency of nocturnal rumination because mixed forage and concentrate caused rumen microorganism unready upon processing forage. Afternoon rumination frequency was not different because cows performed more feeding by then.

Daily, afternoon and nocturnal rumination time, single daily and afternoon ruminations were similar in all treatments, presumably due to similar DM and NDF content. Rumination time was affected by DM and NDF consumption, which further correlated with rumination time[14,15,26-28]. Total time of daily rumination in this research ranged from 485-492 min, similar to 428.3-482.6, 474-573 and 489.6-547.9 min day^{-1} with TMR pattern[21,11,19]. The results demonstrated that afternoon rumination time in all treatments (96.8-116 min) was less than that at night (374.60-388.40 min), because cows were more active to feed during the day but to rest and ruminate during the night. Research findings also showed that all treatments shared higher nocturnal rumination frequency (9.40-11.8 times) than in the afternoon (4.00-4.40 times), because cows ruminated more at night and feed more in the afternoon. Schirmann *et al.*[29] informed that in period of high feeding times and intake, cows spent more time ruminating. Periods of rumination were also associated with time spent for lying down.

Feed intake and digestibility: The experiment result showed that all treatments did not significantly affect dry matter, organic matter, energy, but significantly affected NDF intake of lactating dairy cows ($p<0.05$, Table 5). Factor contributing to similar nutrient consumption intake was assumedly the stabilized and 'Comfortable' rumen pH in all treatments. Brown *et al.*[4] reported that some cows cut down intake when rumen pH was low (acidic pH) probably due to limit acid fermentation production and to return rumen pH condition to comfortable state. The other factor was the high palatability of the type of feed given, which was favorable to cattle. Consumption reflects the palatability or to what extent the feed is favorable to cattle. Mantysaari *et al.*[30] reported no effect of feeding frequency on the DMI was found in primiparous cows (18.7 vs 18.1 kg dry matter day^{-1}), whereas, the multiparous cows ate 1.5 kg day^{-1} more DM once a day (23.1 vs 21.6 dry matter day^{-1}) than the multiparous cows fed 5 times a day. The NDF intake was higher in TMR feeding relative to that in component or cafeteria feeding. The impact of higher NDF intake was longer rumination time, especially at noon (at the time), rumination time was indicator of dry matter intake in lactating dairy cows[31].

Treatments did not significantly affect the rumen pH, digestibility of dry matter (DMD), organic matter (OMD) and energy of lactating dairy cow (Table 6). The range of dry matter digestibility of this study was 73.1-74.3%, while the

OMD was 92.0 up to 92.4%. Data indicated that the methods of feedings, i.e., component, cafeteria or TMR did not disturb the activities of rumen microbes. Niu *et al.*[13] found that DMD in dairy cattle feed on corn silage was between 72.2 and 73.1%. Factors presumably affecting similar DMD, OMD and energy digestibility value was the relatively similar and stabilized rumen pH in all treatments that stabilized rumen ecology and improved rumen microorganism activity, thus resulting in similar digestibility value.

The other determining factor of rumen pH was the sufficient and appropriate fermentable carbohydrate of feed. Some studies demonstrated faster rumen pH degradation when fermentable carbohydrate was included in feed[32-34] because the increasing starch fermentation might affect and deteriorate rumen pH[33,35]. Fermentable carbohydrate-enriched feed such as sugar, dissolve fiber and some starch served in rumen pH decrease within relatively short time (1-5 h)[34,35].

Feed digestibility was influenced by feed nutrient composition, feed energy availability, feed retention period in digestive tracts and the intake amount[27,36-39] and the presence of plant secondary compounds such as tannins or saponins[40-42]. Factors influencing equal DMD, OMD and energy digestibility were the similar feed nutrient composition, energy feed availability, DM, OM and energy consumption. Widyobroto *et al.*[5] reported that ration with high energy content gave higher microbial protein synthesis than that with low energy, thus affecting DMD, OMD and energy digestibility.

Feeding frequency and interval in this study was assumed to affect the similar digestibility. Component feeding pattern had 5 time frequency with short interval where concentrate was initially given at 06.00 followed by forage at 08.00. This changed the previously acidic rumen pH when consuming concentrate into normal pH due to forage intake. Concentrate was again given at 11.00. The observations noticed remaining morning forage which was later consumed by cow after feeding on concentrate at 11.00. The consumed forage reduced rumen pH fluctuation and maintain the stabilization of rumen ecology. Concentrate was given at 15.00 then forage at 17.00, inducing rumen microbe activity thus resulting in equal DMD, OMD and energy digestibility. While, simultaneous forage and feed administration in cafeteria and TMRwas assumed to stabilize rumen pH and rumen ecology. Accordingly, cafeteria and TMR were almost similar with component feeding regarding feeding frequency and short interval.

Cafeteria feeding pattern required regular feeding time because it affected rumen pH change and degradation of cattle physiology. Increasing feeding frequency from normally 4-5 times a day could reduce rumen pH fluctuation and might cut down subclinical acidosis risk[16]. Cafeteria and TMR pattern with adequate 1-2 times a day had stabilized rumen pH, rumen ecology and cattle physiology. This was strongly related to the less effective feeding frequency in cafeteria and TMR compared to component feeding by not affecting rumen pH stability and cattle physiology.

Dry Matter Digestibility (DMD) in this study ranged from 72.4-74.3%, higher than 63.2-65.1% by Yang and Beauchemin[15]. The TMR pattern had 74.3% DMD, higher than 64.4-66.4% by Kahyani *et al.*[25] and 60-62.8% by Nikkhah *et al.*[43]. Organic Matter Digestibility (OMD)[15] ranged from 92.0-92.4%, higher than 65.4-66.6%, while energy digestibility was 69.6-70.5%. High DM digestibility values in treatment feed indicated easily digestible ingredients (feed stuff components). Digestibility values were statistically similar but TMR showed the highest DMD, OMD and energy digestibility compared to CF and cafe. Feeding optimization in TMR was by well-mixed concentrate and forageso cows could not separate and choose the given feed. The TMR could reduce rumen pH fluctuation, stabilize rumen ecology and increase rumen microbe activity and eventually improve digestibility.

CONCLUSION

The study results concluded that lactating dairy cows fed with cafetaria pattern required longer duration on single meal and less frequent intake during afternoon. Component feeding pattern took longer single rumination and single standing rumination and Total Mixed Ration (TMR) had more frequent daily or nocturnal rumination. The strategy of feeding with TMR resulted in a lower chewing time, tended to decrease feed intake but increase feed digestibility.

ACKNOWLEDGMENTS

The authors are grateful to Directorate General of Higher Education, Ministry of Research, Technology and Higher Education of the Republic of Indonesia for funding the research. All authors contributed equally to the manuscript. The authors declare that there is no conflict of interest.

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