Nutrient intake of lactating dairy cows during the wet and dry seasons in Sleman, Yogyakarta

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Abstract. This study was conducted to determine the nutrient intake of lactating dairy cows in the wet and dry seasons in Wukirsari, Cangkringan, Sleman, Yogyakarta. The experiment was conducted using forty lactating Friesian Holstein cows selected from dairy group farms, with average body weight 421.77±28.60 kg, and in 1st to 3rd lactation, housed in permanent pen models stanchion barn with cement floors and rubber mat with feed and drink water. They were fed twice daily, morning and afternoon and drinking water was given ad libitum. Feed samples were taken and analyzed in the Laboratory of Dairy Science and Milk Industry, Faculty of Animal Science UGM. The observed variables were feed availability and nutrients intake. The comparison results between the two conditions (wet and dry seasons) were tested using independent t-test analysis. The result indicated that intake of dry matter, organic matter, crude fiber and total digestible nutrient were not differ significantly. However, intake of crude protein (2.52±0.37 vs. 2.22±0.43 kg DM/head/day) was differ significantly (P<0.05) between wet and dry seasons. It was concluded that nutrient intake of lactating dairy cows in the wet season was better than the dry season, especially the intake of crude protein.

1. Introduction

Indonesia as a tropical region has a population of 550,141 head dairy cattle, with the largest population being on the Java Island [1]. The production system for dairy cattle is generally traditional and the majorities are raised under smallholder system. The locations for raising dairy cattle were both on the highlands and lowlands. This condition is very beneficial because Indonesia has two seasons, i.e. dry and wet seasons.

The difference in the season has an impact on the feed availability and feeding of cattle, which subsequently affect nutrient intake. Dairy farmers in Yogyakarta are mostly categorized as smallholder dairy farmer groups, which are independent. The farms are either in the highlands and or the lowlands, and most of which are incorporated in the dairy cooperative. The government of Indonesia is committed to assisting the farmers in managing their dairy cattle, under unfavorable environmental conditions, and unstable dairy cattle productivity and socioeconomic status of dairy farmers [2].

Therefore, it is necessary to establish the feed availability and natural feed resources both in the dry and wet seasons to increase the productivity of dairy cattle in the dairy smallholder's in Yogyakarta,
particularly in relation to the nutrient content. The objective of this study was to determine the nutrient intake of lactating dairy cows during the wet and dry seasons.

2. Material and methods

2.1. Time and place of study
This study was conducted at dairy farmers group in Wukirsari, Cangkringan, Sleman, Yogyakarta during the wet and dry seasons in 2018 to 2019. Analysis of feed samples was conducted in the Laboratory of Dairy Science and Milk Industry, Faculty of Animal Science, Universitas Gadjah Mada.

2.2. Animal and material study
The study was conducted using forty lactating Friesian Holstein cows during wet and dry seasons, with body weight 421.77±28.60 kg, and 1st to 3rd lactation. They were housed in permanent pen models stanchion barn with cement floors and rubber mat where they were fed and drink water. The cows were fed twice daily, morning and afternoon by giving forages and concentrates separately and drinking water was given *ad libitum*. The proximate composition of feed sample (forage, by-products and concentrates) and feed refusal were measured for their moisture content, dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), extract ether (EE), and total digestible nutrients (TDN) using AOAC method [3]. In all analysis, the chemical composition was performed in three replicates for each sample.

2.3. Statistical analysis
The data obtained were examined by t-test analysis using Statistical Program for Social Science or SPSS version 24.0.

3. Results and discussion

3.1. Feed availability on the wet and dry season
In general, the supplies of forage, agricultural by-products, concentrates ingredients and commercial concentrates were consistent throughout the year, although the amount was barely sufficient. Table 1 showed that in the region of Yogyakarta, many dairy smallholder farmers use agricultural by-products and plantation residues as additional feed for livestock. However, the use of new technology to improve the quality of the feed material has not been practiced by the farmer. In addition, farmers also rarely apply forage conservation in the long term to cope with the needs of feed in the dry season. According to Handayanta et al. [4] problems arise when utilizing dry land for a dairy farm and planting forages; it is generally nutrient-poor, less water and infertile, so it is less productive to produce or source of food and feed. Therefore, the availability of forage feeds which can cause fluctuations in the productivity of cattle and periodically always happens every year between dry to the wet season. The quantity, quality and continuity of forage supply are not guaranteed throughout the year and thus animal production can’t be optimal.

The fluctuation of feed availability is also due to the cropping pattern and the time of harvest of agricultural crops [5]. Therefore, the development of ruminant production at the farm level is related to the availability of feed resources and socio-economic community. Supply of animal feed derived from plants (forage, agricultural by-products and plant leaves tree) is limited to land availability [6] and cropping system [5]. Table 1 shows that at the beginning of the wet season grasses and legumes were available in sufficient amounts, mid-season production was more than sufficient, and then decreased at the end of the wet season and as the dry season progressed. For agricultural waste, plantation residues, concentrates and commercial concentrates it appeared that the supply was stable over both wet and dry seasons. In dry-land agricultural crops harvest between one another was not the same, so the availability of forage derived from agricultural by-products vary from time to time. During harvesting crops, agricultural by-products which can be used as animal feed was abundant and a large proportion was not used for animal feed and usually left to rot or burn. On the other hand during the dry season the supply of forages was hardly able to meet the needs of animal [4].
Table 1. Accessibility of feed and by-products to farmers during wet and dry seasons

| Feed Type                  | Wet Season | Dry Season |
|----------------------------|------------|------------|
|                            | Early      | Mid        | End | Early | Mid | End |
| Diet types:                |            |            |     |       |     |     |
| Grasses                    | 3          | 4          | 3   | 3     | 2   | 2   |
| Legumes                    | 2          | 2          | 2   | 2     | 2   | 2   |
| Weeds                      | 2          | 3          | 3   | 2     | 2   | 2   |
| Agricultural by-products   | 3          | 3          | 3   | 3     | 2   | 2   |
| Average feed availability  | 3          | 3          | 3   | 3     | 2   | 2   |

0 = No access to feed; 1 = < 25% farmer have access to feed; 2 = 25 - 50% farmers have access to feed; 3 = 51 - 75% farmers have access to feed; 4 = > 76% farmers have access to feed.

3.2. Chemical composition of feed

Chemical composition of forage (*Pennisetum purpureum* and *Panicum maximum*) and commercial concentrate was presented in Table 2. Collecting of samples was conducted daily during study. Forage obtained from Mt. Merapi slope and commercial concentrate from cooperation.

Table 2. Chemical composition of forage and commercial concentrate

| Nutrients Composition | P. purpureum | P. maximum | Commercial Concentrate |
|-----------------------|--------------|------------|------------------------|
| Balance: 1. Wet season (%) | 57.00 | - | 43.00 |
| 2. Dry season (%) | - | 56.40 | 43.60 |
| Dry matter (%) | 26.88 | 32.87 | 85.57 |
| Organic matter (%) | 87.19 | 90.22 | 92.09 |
| Crude protein (%) | 7.01 | 5.22 | 21.84 |
| Crude fiber (%) | 34.87 | 33.64 | 27.66 |
| Extract ether (%) | 1.96 | 0.92 | 0.11 |
| Total digestible nutrients (%) | 50.98 | 55.14 | 60.87 |
| Neutral detergent fiber (%) | 66.70 | 70.11 | 44.39 |
| Acid detergent fiber (%) | 37.59 | 40.29 | 12.62 |

3.3. Nutrient intake of lactating dairy cows

The average intake of dairy cows during the study period is presented in Table 3. The result indicated that the intake of DM, OM, CF, and TDN did not differ significantly between wet and dry seasons. However, intake of crude protein was significantly higher (P<0.05) in the wet season compared to the dry season. [7] stated that the most important factor that affects the feed consumption is feed quality. The consumption of OM is positively correlated with dry matter intake (DMI).

Table 3. Nutrient intake of lactating dairy cows between wet and dry season

| Nutrient Intake (on DM basis) | Wet season (n = 20 head) | Dry season (n = 20 head) |
|-------------------------------|--------------------------|-------------------------|
| Dry matter (kg/head/day)      | 18.72±3.73a             | 19.06±2.69a             |
| Organic matter (kg/head/day)  | 16.72±3.28a             | 17.33±2.44a             |
| Crude protein (kg/head/day)   | 2.52±0.37a              | 2.22±0.43b              |
| Crude fiber (kg/head/day)     | 5.94±1.26a              | 5.97±0.85a              |
| Total digestible nutrient (kg/head/day) | 10.35±1.97a | 10.93±1.54a |

ab Different superscripts within rows indicate significant differences (P<0.05).

The DMI has special importance to meet the nutrient requirement of freshening cows to maintain their health and production. [8] and [9] reported that low DMI and deficiency in nutrient supply, especially protein and amino acids has led to immunosuppression and incidence of metabolic disorders in cows. Thus, diets that have higher levels of CP and undegraded protein are effective in maintaining production and body condition score (BCS) [10].
Dietary CF had no influence on OM intake in this trial. Commonly, an increase in dietary CF can be achieved by increasing the level of forages. In this study, dietary concentrate:forage ratio on the wet season (43.0:57.0) and dry season (43.6:56.4) (Table 2) were not differ. Results of the study are comparable with those obtained by [11] and [12], who found no effect of dietary concentrate:forage ratios (30:70 and 70:30) on OM intake in both goats and sheep fed above maintenance. The differences in CF of the diets were mainly due to the variance in CF concentrations. However, Allen [13] noted that no effect of CF ranging from 25 to 40% was found on DMI in dairy cows, although feed intake generally decreases with increasing CF. This means that the intake of forages was low, the negative effect on the digestive process did not happen since the concentrates given had reasonably high structural carbohydrates. This condition could be used as a reference by farmers, especially in the dry season where the forages were difficult to get and relatively expensive. Energy could affect the efficiency of the ration used, and excess energy in the ration will be caused decrease ration efficiency used and tended to be accumulated in the body fat.

4. Conclusion
It was concluded that the nutrient intake of lactating dairy cows during the wet season was higher than that in the dry season, especially on the intake of crude protein, probably due to the higher availability of concentrates and less forages supplied to the cows.

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