Substitution of Concentrate by Protein Source Forage for Growing Heifer of Friesian Holstein (FH)

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ABSTRACT: The best weight of Friesian Holstein (FH) heifer used for replacement stock at first matting is above 300 kg at 15 months old. To achieve that weight, the animals must at least grow for 600-700 g/day after weaning period (11 months of age). High quality diet is required to maintain the high growth rate. Leguminous leaves, *Gliricidia sepium* is high protein sources feed contains amino acids that can support high growth rate as well as development of female reproductive organs. A study was undertaken to investigate the effect of concentrate subtitution by Gliricidia leaves on performance of young FH heifer. Three Rations with similar metabolize energy level of 11 MJ/kg, were investigated by using Complete Block Design. Ration A: King grass (RR)+consentrate(Con); Ration B: RR+Con+Gliricidia (L1=16%) and Ration C: RR+Con+Gliricidia(L2=31%). The study measured feed intake, body weight gain for 5 months, blood metabolite concentration, and progesterone concentration profile. Results indicated that growth rate of animals in three groups were below the body weight gain targeted in the beginning of experiment. At 15 months old, the weight of heifers fed Ration A was 272 kg; Ration B was 270 kg and Ration C was 255 kg. Plasma urea and glucosa concentration in animals fed Ration A were lower (9.8 mg/dl and 70.4 mg/dl) than those of animals fed Ration B (10.98 mg/dl and 71.1 mg/dl) and Ration C (11.13 mg/dl and 72.4 mg/dl) (P>0.05). The concentratrion of progesteron at a peak was 11.6 ng/ml; 12.71 ng/ml and 11.71 ng/ml for animals in group Rations A, B and C, respectively (P>0.05). It is concluded that subtitution of concentrate by Gliricidia leaves up to 31% has no negative effect on intake, urea and glucose concentration and progesterone concentration profile, but affected the live weight gain of young heifer FH.

Keywords: Heifer, Gliricidia, body weight, blood metabolite.

INTRODUCTION

The purpose of a rearing program in dairy cattle industry is to get healthy heifers that can grow well to achieve ideal live weight at first mating time. Heifers that can attain an ideal body weight will have good fertility and milk production. For heifer FH, the ideal weight at the first mating is between 300-350 kg at the age of 15-16 months (Morran, 2005). To achieve that ideal weight, young heifer with 200 kg at 10 months of age must have average daily gain of 600-700 g/day during the 5-6 months of period. In order to achieve a targeted weight gain of 600-700 g/day, the animal needs to consume 48-51 MJ ME/day with the ration protein content of about 17% (NRC, 1989). Therefore the minimum ME contained in the ration is about 11 ME/kg DM. However, young heifer with that weight, could not achieve an ideal growth if only consume grass as single diet due to a small of rumen capacity as well as low quality of grass (7-8% ME/kg). Therefore, improving the quality of grass is required to increase the ration quality. One strategy is suplementation using high quality feed, such as concentrate. The ME and crude protein content of concentrate must above 13% and 19%. The price of this type of concentrate is very expensive), thus will has an effect in increasing feed cost. Substitution of concentrate by high protein forage

(containing 22-24% protein) is expected to reduce feed costs as well as can fulfill the need of nutrient for the animals. Therefore, the purpose of study presented in this paper was to investigate the effect of concentrate subtitution by high protein forage (Gliricidia) on growth of young heifer of FH.

MATERIALS AND METHODS

The study used 18 heads of young heifer (10-11 months of age) with average live weight 196.8 + 5.40 kg. The animals were divided into three groups based on live weight by using complete blok design based on live weight to test three type of rations. Each ration containing similar ME but have different material composition.

1. Ration A with ME 11 MJ/kg DM. The composition of ration in DM base was 47% King grass : 53% concentrate.
2. Ration B with ME 11 MJ/kg DM. The composition of ration in DM base was 48% King grass : 36% concentrate:16% Gliricidia.
3. Ration C with ME 11 MJ/kg DM. The composition of ration in DM base was 50% King grass : 19% concentrate:31% Gliricidia.

The ration offered to each animal was 3% of live weight in dry matter base. Daily ration was divided into two part, one was offered at 08.00 am and another part offered at 15.00 pm. Measurements were undertaken on feed consumption, live weight gain, progesterone concentration profile and plasma urea and glucose concentration. Feed consumption was determined by deducted feed offered with feed residue after 24 hours of feeding time. The animals were weighed every two weeks to determine the live weight changing of the animals during the experimental period. Blood sample from each animal was collected every 3 days in a period of 30 days to determine progesteron concentration profile. Blood for urea and glucose concentration analysis were taken from each animal at the end of experimental period. Concentrations of progesteron in blood plasma were analysed using a commercial Kit Progesterone and determined by radioimmunoassay technique. All data collected was analyzed using IBM SPSS statistics ver. 20 following the complete blok design (Steel and Torrie, 1980)

RESULTS AND DISCUSSION

Data on feed consumption during the 5 months of experimental period is presented in Table 1. The feed consumption of animals in three groups was increased as live weight increased. Subtitution of concentrate by Gliricidia leaves up to 31% did not significantly affect the feed consumption. Althought stastictically the feed consumption (DM, CP and ME) similar for all the groups, the pattern indicated that animals fed Ration A consumed more DM, CP and ME during the experimental period. However, all the animals consumed adequate DM, CP and ME as required for young heifer. According to NRC (1989), young heifer required EM consumption about 48-51 MJ/day to achieve live weight gain of 600-700 gram/day. In the experiment presented, the animals could not achieved the live weight gain recommended, eventhought the animals consumed adequate amount of energy metabolism. It might due to the different climate where the experiment undertaken. The experiment was undertaken in the area with the daily temperature of 28-29 ^{o}C, while the upper critical temperature (UCT) for FH is between 25-26oC (Berman *et al.,* 1985). Temperature above the UCT causes heat stress resulting in an increase of heat production as a consequence of a rise in body temperature (Yousef, 1985; Kadzere, 2002, Turnpenny, 2000).

Table 1. Consumption of dry matter (DM), crude protein (CP), and metabolizable energy (ME) by animals fed Rations A, B and C during 5 months of experimental period.

		experimental period (month)				
		1	2	3	4	5
Ration A	DM (kg/day)	4.94 + 0.3	4.85 + 0.8	5.4 + 0.40	6.09 + 0.3	6.35 + 0.5
	CP (g/day)	648 + 15.3	630 + 14.8	679 + 18.5	740 + 18.6	764 + 19.4
	ME (MJ/day)	55.4 + 4.8	54.5 + 2.7	60.8 + 3.8	68.7 + 4.4	71.7 + 7.1
Ration B	DM (kg/day)	4.57 + 0.2	5.04 + 0.4	5.17 + 0.3	6.39 + 0.2	6.12 + 0.3
	CP (g/day)	622 + 14.7	728 + 13.8	691 + 12.3	850 + 11.2	764 + 15.1
	ME (MJ/day)	51.9 + 4.2	57.6 + 4.1	59 + 7.7	73.1 + 5.6	69.8 + 10.5
Ration C	DM (kg/day)	4.33 + 0.2	5.36 + 0.3	5.51 + 0.3	5.27 + 0.4	5.84 + 0.3
	CP (g/day)	624 + 12.6	640 + 11.5	753 + 16.3	734 + 12.3	760 + 11.8
	ME (MJ/day)	50.7 + 3.8	62.3 + 5.3	64.8 + 4.6	78.3 + 6.1	68.8 + 7.2

Data on live weight changing during the 5 months of experimental period is presented in Figure 1

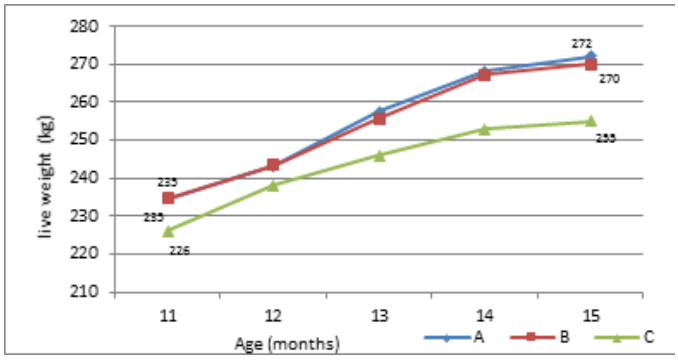

Figure 1. Live weight changing of young heifer fed Rations A, B and C during 5 months of experimental period.

During the 5 months of experimental period, application of three experimental Rations (A, B and C) resulted in significantly higher live weight gain for animal fed by Ration A (37.4 kg) compared to those of animals fed Ration C (29.0 kg) ($P<0.05$), but similar with those of animals fed Ration B (35.3 kg). These results were paralel with the feed consumption of animals in each group. The average dry matter consumption of animals fed Ration A was the highest (2.37% live weight) compared to those animals fed Ration B (2.44% live weight) and only 2.13% live weight for animals fed Ration C. At the end of experiment, the ideal live weight targeted for young heifer at 15 months of age (300 kg) could not be achieved, athought the animals received adequate amount of DM, CP and ME for daily ration. It seems that differences in environment temperature caused un-optimun energy utilization by the animals. The explanation of this reason has been mentioned above. Figure 2 shows the urea (a) and glucose (b) concentration in the blood plasma of animals fed experimental rations

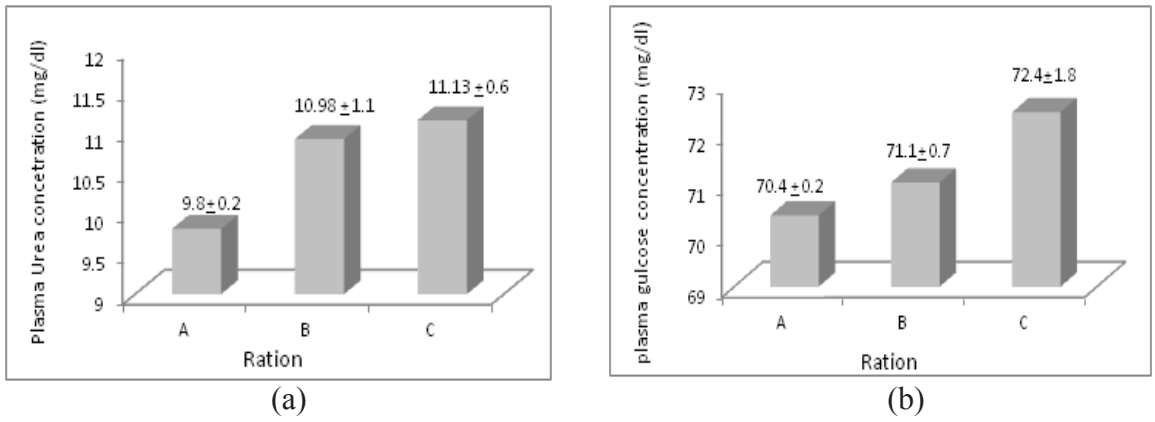

Figure 2. Concentration of blood plasma (a) urea and (b) glucose taken from young heifer of FH

Althought the plasma urea and glucose concentration were not significantly affected by subtitution of concentrate by Gliricidia leaves up to 31%, the data recorded indicated that the plasma urea and glucose concentration of animal fed Ration A was 13.57% and 2.8% higher than that of taken from animals fed Ration A and only 1.37% and 1.8% higher than those of animals fed Ration B. While the plasma urea and glucose concentration of animal fed Ration B was 12.04% and 1% higher than those of animal fed ration A. These results indicated that differences in the sources of protein resulting in differences in urea and glucoses concentration in the blood, eventhought the protein and energy metabolism contained in the three Rations were similar. Most of dietary protein in Ration A was supplied from grain contained in concentrate, while dietary protein in Ration B and C partly come from Gliricidia leaves. Protein contained in leguminouse leaves (Gliricidia) reported more degradable than those protein in grain (Widiawati, 2004). Protein degraded in the rumen produces ammonia that converted to urea when absorbed from rumen wall to blood stream. The more protein degraded in the rumen the higher urea concentration in the blood. Legumes leaves also reported rich of amino acids compared to protein of grains. Some amino acids are potentially as precursore for gluconeogenesis to produce glucose (Di Pasquale, 2007). Therefore animals fed Rations B and C that contain 16% and 31% Gliricidia have more glucose in their blood plasma.

Progesterone concentration pattern found on different sampling days were as expected for normal profile of young heifher for all the animals in three groups of treatment. Substitution of concentrate by Gliricidia leaves up to 31% has no negative effect on progesteron concentration profile of young heifer FH. The highest concentration in group Ration A was 11.6 (ng/ml) with the lowest concentration was 0.8 ng/ml. While in animals fed Ration B and C, the highest concentration was 12.71 ng/ml and 11.71 ng/ml, respectively with the lowest concentration for animals in both groups was 1.89 ng/ml and 1,71 ng/ml, respectively. The lowest concentration of progesteron recorded for all animals in three groups was similar with reproted by Hittinger *et al.,* (2004) and Jose Nelio *et al.*, (2011).

CONCLUSION

It is concluded that subtitution of concentrate by Gliricidia leaves up to 31% has no negative effect on intake, urea and glucose concentration and progesteron concentration profile, but affected the live weight gain of young heifer FH.

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