The effect of concentrate supplementation during pregnancy on calving performance in oil palm-cattle integrated system

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Abstract. To reduce production costs, cows should be maintained extensively in the pasture all or half day. Concentrate addition is needed especially for the last period of pregnancy. The study evaluated the performance of cows maintained semi-intensively with concentrate addition. Fifteen Bali cows ca. 3 years old in 6-7 months of pregnancy were divided into two groups. P1 was given forage grown under oil palm trees with addition 1 kg concentrate/head/day, P2 were given 3 kg/head/day. During the research, cows were grazing in the pasture from 6:00 to 17:00, then put in a cage at night with additional 1 or 3 kg concentrate. P2 group resulted 17.48% and 15.8% higher DMD and OMD, respectively, compared with P1 (P<0.05). DM and OM consumption increased 52.23% and 50.87%. Addition of 1 kg or 3 kg did not show differences in cow performances, including cow body condition score, birth weight, calf score, except for birth weight. It was concluded that the addition of 1 or 3 kg of concentrate at the end of pregnancy did not give any effect; from the economic point of view, it is recommended to add only 1 kg concentrate during the last period of pregnancy.

1. Introduction
Grass has a high crude fiber leading to low digestion in the rumen. The provision of single grass feed has not been able to meet the nutritional needs of both rumen microbes and animals, thus, other feed ingredients are still needed as a supplement [1]. Giving concentrate and supplementation treatment is an effort to balance the degradation of carbohydrates with protein degradation. The microbial fermentation process in the rumen is very important for the supply of animal nutrition. For this reason, efforts must be made to maximize nutrient utilization by optimizing microbial growth in the rumen [2]. Feed ingredients that have been known has a good quality can be used as feed optimally by conducting trial in vivo [3]. In this study, cow’s productivity was evaluated from consumption, digestibility, birth weight, body condition score, calf score and calf vigor.

2. Material and methods
The in vivo study was conducted at PTPN V Sie Rokan Riau, from August 2017 to July 2018.

2.1. Experimental livestock
This study used twenty Bali cows at 6 months of pregnancy with average body weight 250 kg. Material. The material used is forage under palm oil shade, palm waste-based concentrate with
constituent consists of bran, corn, palm kernel meal content CP 16.06% and TDN 63.56% and multivitamins.

2.2. Methods
The in vivo study was carried out in PTPN V Riau for 5 to 6 months. Proximate analysis was performed at the Laboratory of Biochemistry at the Faculty of Animal Husbandry at Gajah Mada University, Yogyakarta. The feed was given at 2.5% of body weight (base of dry matter) [4]. Pregnant Bali cows 6 months is maintained for 3 months (until calving) with a period of adaptation to feed for 2 weeks. During adaptation livestock were given a multivitamin injection of 10 cc/head. Treatment groups were: P1 = forage + 1 kg concentrate and P2 = forage + 3 kg concentrate. Each feed experimental unit used a cow sample with 5 replications (r = 5). The forage was chopped then given 3 times a day, namely at 7:00, 12:00 and 17:00. Water were given ad libitum. Feeding was carried out until the cows give birth. Feces collection was carried out every day during the collection period. The feces were weighed and then 10% samples were taken, then sprayed with 10% formalin solution to avoid decomposition and loss of N feces, then sun-dried. The 5% samples were taken from the collected feces were milled with a 1 mm diameter willey mill and analyzed. Parameters observed were consumption and feed digestibility, body condition score (BCS), calving weight, calf score, and calf vigor. The data was analyzed statistically using the t-test [5]. Statistical analysis was conducted using the SPSS program ver. 22.

| Nutrients          | Forage Under Oil Palm | Palm Oil Waste Concentrate |
|--------------------|-----------------------|----------------------------|
| Dry matter (%)     | 22.29                 | 90.61                      |
| Ash (%)            | 11.53                 | 9.60                       |
| Crude protein (%)  | 10.67                 | 16.06                      |
| Ether extract (%)  | 4.26                  | 8.61                       |
| Crude fiber (%)    | 36.85                 | 20.25                      |
| ETN (%)            | 36.69                 | 45.48                      |
| TDN (%)            | 54.37                 | 63.56                      |

3. Result and discussion
3.1. Forage consumption and digestion with addition of concentrate
The consumption of DM and OM in P2 was higher than P1 (P <0.05). Consumption of DM with 3 kg concentrate addition was higher than the addition of 1 kg (5.37 vs 3.53 kg) or increased by 52.23%. This means that consumption of DM continues to increase to the limit of the maximum DM requirement, but still less than the recommended requirement of 6.6 kg [4]. The DM consumption of Bali cows of 6 - 9 months pregnancy is 5.69 kg / day [6].

In line with DM consumption, the OM consumption also differs between feed additions of 1 kg and 3 kg, because OM is part of DM. The OM consumption increased by 50.87%, the increase would also increase the consumption of nutrients needed by pregnant Bali cows. If DM consumption was low in livestock, the OM consumption also low and vice versa [7]. The P2 yielded higher DM and OM digestibility (P <0.05) by 17.48% and 15.8%, respectively, than P1. The DM digestibility above 60% can be categorized as high digestibility [8]. High digestibility shows the amount of nutrients distributed to livestock, while low digestibility indicates that the feed ingredients have not been able to provide nutrients for livestock either for maintenance or for production [9]. The DMD and OMD values are lower than previous observation using feed from oil palm plantations, namely palm fronds and palm kernel meal, that is 68.8% and 73.9% for DMD and OMD, respectively [6].
Table 2. Forage consumption and digestibility by adding concentrates

| Parameter                          | Concentrate 1 kg     | Concentrate 3 kg     |
|------------------------------------|----------------------|----------------------|
| Dry matter consumption (kg)        | 3.53±0.32           | 5.37±0.27           |
| Organic matter consumption (kg)    | 3.12±0.29           | 4.71±0.24           |
| Dry matter digestibility (%)       | 55.86±6.57          | 65.62±4.42          |
| Digestion of organic matter (%)    | 57.87±6.61          | 67.01±4.25          |

a,b Different superscripts at the same line showed significant difference (P<0.05)

3.2. Reproductive performance of pregnant Bali cows

The reproductive performance of Bali cows given forage feed from palm oil plantations with concentrate addition is presented in Table 3. The initial BCS (age 5 to 6 months of pregnancy) was not differ between P1 and P2. The BCS score used the values 1 to 5, where number 1 indicates the condition of the parent cow which is very thin and number 5 indicates very fat cows [10]. The average BCS in the 3 kg concentrate supplement feed was slightly initially lower than 1 kg addition, but at the end of pregnancy or before giving birth, BCS added 3 kg of concentrate was higher. Optimum BCS value for cow reproduction or early pregnancy is between 3.0 to 3.5 (scale 1 to 5) [11]. The higher BCS in the feed with the addition of 3 kg concentrate indicates that high DM and OM consumption, caused high BCS (fat condition).

Table 3. The performance of the parent Bali cow when the calf is given forage feed with addition of concentrate

| Parameter                  | Concentrate 1 kg | Concentrate 3 kg |
|----------------------------|------------------|------------------|
| Number of cows (head)      | 8                | 6                |
| Initial BCS (1-5)          | 3.2              | 3.1              |
| Final BCS (1-5)            | 4.2              | 4.5              |
| Calf birth weight (kg)     | 15.54±0.45       | 16.08±1.38       |
| Calf score (1-4)           | 1                | 1                |
| Calf vigor (1-6)           | 1                | 1                |

a,b Different superscripts on the same line showed significant difference (P<0.05)

The birth weight of calves was different between the addition of 1 kg concentrate and 3 kg (P <0.05). The addition of feed 3 kg concentrate resulted higher birth weight 16.08 kg compared to the addition of 1 kg concentrate (15.54 kg) with an increase in birth weight of 3.5%. All calves are born by natural mating. Feed parameters that cause high birth weight in feed additions of 3 kg concentrate, such as: consumption of nutrients (kg/head/day): DM: 5.1-5.9; OM: 4.51 to 5.18 and nutrient digestibility: DM 57.11 to 69.76%, OM: 58.68 to 70.77%. Cattle raised in limited dry area such as East Nusa Tenggara and West Nusa Tenggara had only 12 and 13 kg/head of calf birth weight [12] and the birth weight of Bali cow in Sumbawa is around 14.2 kg [13]. This means that if the Bali cow is fed with sufficient nutrient quality, it produces a fairly high birth weight, so that later calf growth will be faster. The main food source in fetal development is carbohydrates in the form of glucose, glucose sources derived from feed, glycogen and parent fat depots, lactic acid, amino acids and acetic acid, and all amino acid needs originating from the substrate supplied by the cow [14].

4. Conclusion

The DM and OM feed consumption and digestibility added with a concentration of 3 kg are higher than the addition of 1 kg concentrate. Addition of 3 kg concentrate resulted 53.23% and 50.87% higher DM and OM than addition of 1 kg concentrate. Similarly, addition of 3 kg concentrate resulted 17.48% and OM 15.8% than addition of 1 kg concentrate. Addition of 3 kg concentrate produced higher calf birth weight than the addition of 1 kg.
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