Milk Production and Quality of Dairy Cow Fed Diet Containing Concentrate with *Durio zibethinus* Murr Seed Flour

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Abstract. The objective of this research was to evaluate *Durio zibethinus* Murr seed flour in different levels in substitution with rice bran in concentrate of diet on milk production and milk quality in lactating dairy cows. The rice bran/ durio seed flour ratios in concentrate were DC 1: 35/12.5, DC2: 27.5/20, DC 3: 20/27.5, and DC 4: 12.5/30. Experimental design used was Latin Square 4 x 4, four treatments and four 3 week periods. Results showed that milk production, milk quality, and feed efficiency of dairy cow fed diet containing concentrate with 20% rice bran/ 27.5% *Durio zibethinus* flour was found to be the optimal one.

1. Introduction

*Durio zibethinus* Murr is fruit that can be found mostly around Indonesia. Its production nationally is about 900 ton/yr [1] and 0.44% was harvested per year in Bengkulu province [2]. The by-product of this fruit, such as seed, is about 5-15% of the entire *Durio* [3]. Out of this, it can be converted as Durio seed meal that can be utilized as feed ingredient in concentrate for dairy ruminants or used for other purposes. *Durio zibethinus* seed meal contained 6.05% protein, 0.41% ether extract, and 1.82% crude fiber and it has been reported to have optimal level (1.5%) for stabilizer in ice cream [4].

Some positive research results showed that concentrate containing 5g of yeast and 20g of *Curcuma xanthorrhiza* Roxb powder was better for milk production and fat content in dairy goat [5]; while 45g roasted ground corn was considered good for milk production of dairy cows [6]. [7] reported that supplementation of plant extracts (cinnamaldehyde and eugenol) could improve dry matter intake and milk production in lactating dairy cows. The ingredients and supplements of feed will determine milk yield as well as milk composition.

The objective of this research was to evaluate *Durio zibethinus* Murr seed flour in different levels in substitution with rice bran in concentrate of diet on milk production and milk quality in lactating dairy cows.

2. Materials and Methods

The durio seeds were prepared physically, starting from slicing, drying, and grinding, becoming flour. It is then mixed in certain level as part of ingredient in concentrate. Concentrate was formulated containing of rice bran, 25% ground corn, 20% soy bean meal, 4% palm oil, 0.5% mineral mix, 0.5% NaCl, 0.5% yeast, 2% *Curcuma xanthorrhiza*. The rice bran/ durio seed flour ratios (in %) in concentrate (Durio concentrate, abbreviated as DC) were DC 1: 35/12.5, DC2: 27.5/20, DC 3: 20/27.5, and DC 4:
12.5/30. Diets were containing of 57.14% forage, 10.71% soybean tofu by-product, 22.85% on farm concentrate (Surya Feed), and 12.14% Durio meal-concentrate, on dry matter (DM) basis. As fed basis, the Durio concentrate was provided as much as 2kg, 1kg each fed in mornings and afternoons, throughout the experiment. Any leftover of feed was weighted in the morning daily to calculate the consumption diet. Samples of forage and feces collection were conducted at last 4 days, then were weighted, dried and weighted so that those were ready for nutrient analyses, such as dry matter content then it is calculated for dry matter intake (DMI). Water intake was provided ad lib and recorded daily.

Milk yield was recorded daily, in mornings and afternoons. Milk samplings were conducted in the last afternoon and composited with the last morning milkings in each period of experiment. Milk samples were analyzed for milk fat and milk protein. Formula of ECM is \((0.327 \times \text{k of milk}) + (12.95 \times \text{kg of milk}) + (7.20 \times \text{kg of milk protein})\) as cited by [8]; while, 3.5% FCM is \((0.4324 \times \text{kg of milk}) + (16.216 \times \text{kg of milk})\) according to [9]. Temperatures and humidity were recorded daily at 5 am, noon (12.00), and 5 pm.

Experimental design used was Latin Square 4 x 4, four treatments and four 3 week-periods. Four dairy cows (Fries Holland) were in early- mid lactation with average body weight of 448.81 ± 17.21 kg/head. Data obtained were analyzed for variance, any significant differences were then checked using Duncan Multiple Range Test (DMRT) according to [10].

### 3. Results and Discussion

Performance of dairy cows in dry matter intake, milk yield and milk efficiency, fed diet containing concentrate with Durio zibethinus flour is presented on Table 1. Dry matter intakes (DMI) of four treatments are relatively not affected, ranging from 22.32- 22.54kg/d. In average, this amount of DMI is about 5.04% of body weight. This quantity is about 2% higher than that of the required DMI for dairy cow with 450kg body weight and 15kg of milk, that is about 3% [11].

Milk yield in diet with 27.5% Durio seed flour (DC3) is about 1kg higher than that of with 20% Durio seed flour (DC2). This result showed that the higher the carbohydrate (as it is contained in Durio seed flour) provided in concentrate, the higher the milk produced. As it was reported in higher concentrate ratio 35- 65%, the higher milk produced (2.52kg/d) in dairy cows [12]. It is also supported by [13] that in low forage and high corn grain or high forage and high grain, milk production were found the highest, therefore the milk yield ratio to DMI were also high (1.21 and 1.25, respectively).

### Table 1. Dry Matter Intake, Milk Yield And Milk Efficiency Of Dairy Cow Fed Diet Containing Concentrate With Durio Zibethinus Flour

| Variable                  | DC1  | DC2  | DC3  | DC4  |
|---------------------------|------|------|------|------|
| DMI, kg/d                 | 22.50| 22.32| 22.41| 22.54|
| Milk yield, kg/d          | 15.75| 15.28| 16.30| 15.31|
| ECM, kg/d                 | 17.05| 16.93| 18.25| 17.36|
| 3.5% FCM, kg/d            | 17.75| 15.60| 17.97| 16.56|
| Milk yield/DMI, kg/kg     | 0.70 | 0.68 | 0.73 | 0.68 |
| ECM/DMI, kg/kg            | 0.76 | 0.76 | 0.81 | 0.77 |
| FCM/DMI, kg/kg            | 0.79 | 0.70 | 0.80 | 0.73 |
| Water intake, kg/d        | 27.48| 25.61| 24.01| 19.76|

DC 1 (35% Rice bran/12.5% Durio seed flour), DC2 (27.5% Rice bran/ 20% Durio seed flour), DC 3 (20% Rice bran/ 27.5% Durio seed flour) and DC4 (12.5% Rice bran/ 35% Durio seed flour)

The production efficiency indicators, milk yield, FCM, and ECM ratios to DMI results in this study were considered low, as they were all under 1, is not efficient. In other experiments, adding plant extract (encapsulated cinnamaldehyde and eugenol) as supplement in dairy cows, these indicators were around 1.75- 1.85; around 1.63- 1.68 with corn silage hybrids were found in dairy cow diets [14].
Water intake decreased about 7.73 kg/d with increasing Durio seed flour from 12.5 to 35% with decreasing rice bran from 35 to 12.5%. It is on the opposite from the results with the increasing concentrate in diets, that is 70.29 kg/d compared to 52.68 kg/d in low concentrate or high forage [12].

In our research, the highest level of Durio seed flour (35% in DC4), the milk yield decreased about 1 kg than that of in 27.5% Durio seed flour (DC3). This might due to the crude fiber content of the skin on seed that was not peeled out during the preparation, together with rice bran in diet, affected the metabolism of the carbohydrate within the seed flour, which in turn decreased biosynthesis of milk that eventually affected milk quality.

On the other hand, milk fat content was significantly (P<0.05) affected by the level of Durio seed flour in the concentrate, as presented on Table 2. The higher (from 12.5 to 27.5%) the seed flour in diet, the higher the fat content in the milk. Milk protein yield was also found the highest in diet with 27.5%.

Table 2. Milk Quality Of Dairy Cow Fed Diet Containing Concentrate With Durio Zibethinus Flour

| Variable             | DC1  | DC2  | DC3  | DC4  |
|----------------------|------|------|------|------|
| Milk fat, %          | 3.45a| 3.83b| 4.01ab| 4.03ab|
| Milk fat yield, kg/d | 0.54 | 0.61 | 0.62 | 0.61 |
| Milk protein, %      | 4.31 | 3.67 | 4.13 | 4.01 |
| Milk protein yield, kg/d | 0.67b | 0.55a | 0.67b | 0.61ab |

DC 1 (35% Rice bran/ 12.5% Durio seed flour), DC2 (27.5% Rice bran/ 20% Durio seed flour), DC 3 (20% Rice bran/27.5% Durio seed flour) and DC4 (12.5% Rice bran/35% Durio seed flour). Averages with different superscript, significantly different (P<0.05).

This meant, in coincidence with the higher amount of the seed flour (up to 27.5% in DC3), the milk production, milk fat, and milk protein were found the highest. This result was in accordance with the result of diet containing low forage and corn grain in which its milk yield and fat content are optimal compared to others; however, the highest milk yield and lowest milk fat was found in diet with low forage and high grain [13]. This suggested that carbohydrate will affect milk production and crude fiber will determine milk fat content.

Production performance is affected not only by nutrient intakes but also the environment where the dairy cows lived. Comfortable zone of dairy cow, such as Fries Holland, a Bos Taurus cow is between 10-20°C [15]; under 10°C will cause cold stress, above 20°C can experience heat stress slightly or severely depending upon how high temperature is around the dairy cow. The temperatures around housing in dairy farm in Kabawetan, Kepahiang, Bengkulu during the experiment was about 20°C in the mornings and slightly above 20°C at noon and 5 pm are presented on Table 3.

Table 3. Temperatures And Humidity Around Dairy Farm In Kabawetan, Kepahiang, Bengkulu Throughout The Experiment In January- March 2018

| Items          | January     | February    | March       |
|----------------|-------------|-------------|-------------|
| Temperatures (°C) |             |             |             |
| At 5 am        | 20.13 ± 1.26| 20.68 ± 0.68| 19.37 ± 5.51|
| At noon        | 24.27 ± 1.52| 20.11 ± 1.45| 23.06 ± 5.21|
| At 5 pm        | 22.00 ± 1.31| 23.25 ± 1.86| 22.28 ± 4.38|
| Humidity (%)   |             |             |             |
| At 5 am        | 98.78 ± 3.27| 99.75 ± 0.93| 96.03 ± 19.81|
| At noon        | 87.08 ± 9.13| 87.43 ± 7.79| 81.70 ± 21.76|
| At 5 pm        | 97.76 ± 4.56| 92.89 ± 6.73| 92.66 ± 18.57|

This area is located in upland of Bengkulu, is about 1200 m asl [16], considered a suitable place for rearing dairy cows. Humidity in this area is considered high, however, this condition is safe as the temperatures are considered mild, so there is no heat stress found in the dairy cows. Therefore, the production performance of the dairy cow is optimal in this area.
4. Conclusion
We conclude that milk production, milk quality, and feed efficiency of dairy cow fed diet containing concentrate with Durio zibethinus flour in substitution with rice bran found the highest, was in 20% Rice bran/27.5% Durio seed flour.

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