

Nutrient Digestibility of Ration Containing Concentrate with Seed Flour and Fermented Peel Flour of *Durio zibethinus* in Dairy Cow

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ABSTRACT

This research was conducted to compare the effect of feeding ration with concentrates containing *Durio zibethinus* seed flour and peel flour fermented by *Pleurotus ostreatus* on the digestibility of dry matter and organic matter as well as crude protein, crude fiber, and ether extract in lactating Fries Holland (FH) dairy cows. This study used a 4 x 4 Latin square design using 4 treatments, in 4 periods, and 4 lactating FH cows. The 4 treatments used were basal ration (BR) with forage and palm oil sludge as control, BR plus 27.5% Durio seed (DS) flour, BR plus 20% fermented Durio (FD) peel flour, and BR plus 27.5% Durio seed flour and 20% fermented Durio peel flour (DS-FD). The data obtained were analyzed by means of variance (Anova). Any significant effects were further analyzed using Duncan's Multiple Range Test (DMRT). The results showed that the provision of rations containing Durio seed flour had a significant effect ($P < 0.05$) on the intakes of dry matter (10.34 kg/d), organic matter (7.39 kg/d) and crude protein (1.75 kg/d) as well as on digestibility of crude protein digestibility (69.27%). Based on these values, the ration containing concentrate with 27.5% Durio seed flour was considered a better one. While the combination of Durio seed and fermented Durio peel flour tended to have higher crude fiber digestibility.

Keywords: Durio waste, nutrient digestibility, dairy cow.

1. INTRODUCTION

One kind of fruit, Durio (*Durio zibethinus*) is found all over provinces in Indonesia and its production is currently about 1,133, 195 Ton; in Bengkulu province is about 9,260 Ton in a year [1]. Its by-products contain seed (about 10%) and peel (about 65%) [2]. The seed flour contains protein (6.05%), ether extract (0.41%), and crude fiber (1.82%) [3]. These could be converted as feed ingredients with pretreatment such as seed flour and fermented peel flour.

Some previous research results on Durio by-products have been reported. It was found that fermented Durio peel flour with *P. ostreatus* improved its crude protein yet lower ether extract [4]; while its organic matter digestibility was enhanced in vitro [5]. Other fungi were used and reported by [6] that the addition of both Durio seed meal and peel meal

fermented with a mixture of *P. chrysosporium* and *N. crassa* improved nutrient content. The Addition of Durio seed flour at a certain levels of concentrate affects better in milk yield [7]; and nutrient and fatty acid contents, nutrient digestibility, and *in vitro* characteristics as reported by [8]. The fermented Durio peel flour in concentrate improved milk yield and nutrient digestibility [9].

In separate result of comparing the application of Durio seed flour, fermented Durio flour and their combination have been reported that the addition of the seed in concentrate showed about 1.5 kg higher in milk production compared to that of with fermented Durio peel flour or a mixed of both in dairy cow [10]. Therefore, the objective of this research was to compare and evaluate these previous findings and apply each of them to nutrient (dry matter, organic matter, crude

protein, ether extract, and crude fiber) digestibility in the dairy cows.

2. MATERIALS AND METHODS

2.1 Preparations of Durio seed flour, fermented peel flour, and concentrate

Durio seed flour was prepared to start from collecting, washing, slicing, drying under the sun, grinding as reported by [9]. Fermented Durio peel flour was prepared by collecting, cleaning, removing the outer part, slicing the inner part, drying, grinding twice as coarse flour. This Durio peel then was weighed to content about 85%, added 13% rice bran and 2% CaCO₃. All these ingredients were mixed by adding around a 1:1 ratio of water, composted for 48 hours.

These mixtures were put in baglogs in the size of around 500 g each, and then sterilized for 4 hours at 120°C. The baglogs were taken out to reduce the temperature, then inoculated with 0.5% of *P. ostreatus* and fermented for 14 days. The fermentation was ended by removing the substrates out of the baglogs, air dried,

then was ready to be mixed with other ingredients as concentrate. The formulas of the concentrate were displayed in Table 1.

Nutrient analyses of the concentrate including dry matter (DM), crude protein (CP), ether extract (EE), and crude fiber (CF) were determined by procedures based on [11]. Based on these analyses, nutrient intakes can be counted. Nutrient contents are presented in Table 2.

2.2 Application of concentrate, experimental design, and data analysis

Ration given were forage and palm oil sludge as basal (BR), concentrates were applied accordingly following the plotting of treatment on each dairy cow in each period as mentioned in Latin Square design. The treatments application during 40 days experiment were

- BR : forage and palm oil sludge as basal
- DS : BR + 2kg DS concentrate
- FD: BR + 2kg FD concentrate
- DS-FD: BR + 2kg DS – FD concentrate.

The design used in this experiment was Latin Square

Table 1. Concentrates containing Durio seed flour, fermented Durio peel or their combination

Ingredients	Composition (%)		
	DS	FD	DS-FD
Rice brand	30	30	10
<i>Durio</i> seed flour (DS)	27.5	-	27.5
Fermented <i>Durio</i> peel (FD)	-	20	20
Ground corn	14.5	22	14.5
Soy bean meal	18	18	18
Palm oil	3.5	3.5	3.5
Mineral mix	0.5	0.5	0.5
NaCl	0.5	0.5	0.5
Yeast	1	1	1
Curcuma powder	1	1	1
CaCO ₃	1	1	1
TSP	0.5	0.5	0.5
Urea	2	2	2
Total	100	100	100

Source: Modified from [10].

Table 2. Nutrient contents of tofu by-product, corn stover and palm oil sludge as basal ration

Ingredients	Dry matter (%)	Organic matter (%)	Crude protein (%)	Ether extract (%)	Crude fiber (%)
Tofu by-product ^a	13.11	11.20	19.09	7.84	18.16
Corn stover ^b	20.14	12.69	12.27	8.03	27.50
Palm oil sludge ^c	45.60	40.66	11.66	7.12	18.34

Note: a.[18] , b. [9] , c. [13].

4 x 4, with 4 treatments and 4- 10 day periods, and 10 days as pretreatment time. Therefore, there were 50 days altogether for collecting data on 4 dairy cows (Fries Holland) with an average body weight of 402.36 ± 27.62kg/head that was in early- mid lactation. Data obtained were analyzed for variance, any significant differences were then checked using Duncan’s Multiple Range Test (DMRT) according to [12].

Variables measured were nutrient intakes and nutrient digestibility. Data of forage and concentrate consumptions were collected daily during the morning and afternoon feedings. Data for calculating nutrient digestibility was feces collecting conducted in the last 4 days of each period. Feces samples were taken as much as 10%, dried by the sun, composted then analyzed for nutrient contents (dry matter, moisture, ash, crude protein, ether extract, and crude fiber). Nutrient digestibility can be calculated using this formula:

$$\text{Nutrient digestibility} = \frac{\sum \text{nutrient consumed} - \sum \text{nutrient in feces}}{\sum \text{nutrient consumed}} \times 100\%$$

3. RESULTS AND DISCUSSION

3.1 Nutrient Contents of the Concentrates and Other Feedstuffs

Nutrient contents of concentrates containing Durio seed flour and fermented Durio peel flour as well as other feedstuffs composing the ration were displayed in Table 3. Dry matter (DM), organic matter (OM), and crude protein (CP) contents of Durio seed concentrate (DS) were high in quantity compared to those in fermented Durio peel concentrate (FD) and their combination (DS-FD) concentrate. Yet, the DS concentrate contained low crude fiber (4.91%); while FD concentrate had high fiber.

The combination (DS-FD) concentrate had high ether extract (14.70%). Among these three types of concentrate, it seemed that the DS concentrate was considered the good one in terms of high DM, OM, CP and low CF; while, the combination concentrate was in between. It was due to the fermentation process of *Durio* peel flour with added *Durio* seed that could improve CP, ether extract (EE) and lower the crude fiber contents.

Other feedstuffs used in the basal ration, tofu by-product had high crude protein (19.09%); however, it showed low DM, OM, and CF. This feedstuff was given in fresh condition, meaning its water content was high. Therefore, its dry matter and organic matter were low. Palm oil sludge had high DM and OM as it is in the form of pressed decanter therefore its moisture was relatively low. Corn stover contained high crude fiber as it was in the state of mature plants after harvesting the corn. Fiber is needed at a certain level for maintaining

Table 3. Nutrient contents of the Durio seed flour and fermented Durio peel concentrate

Ingredients	Dry matter (%)	Organic matter (%)	Crude protein (%)	Ether extract (%)	Crude fiber (%)
Durio seed concentrate (DS) ^a	86.51	79.50	22.57	8.19	4.91
Fermented Durio peel concentrate (FD) ^a	83.99	75.07	18.83	8.64	15.35
Durio seed- fermented Durio peel concentrate (DS-FD) ^a	82.64	75.93	19.22	14.70	12.20

Note: a. Proximate analysis at PAU Laboratorium, Institut Pertanian Bogor, Bogor (2020).

Table 4. Averages of intake and digestibility of dry and organic matters of dairy cows fed a ration with concentrates containing Durio seed flour, fermented Durio peel or their combination

Items	BR	DS	FD	DS-FD
Dry matter				
Intake (kg/d)	8.46 ^a	10.34 ^b	10.00 ^b	9.78 ^b
Feces (kg/d)	3.75 ^b	3.07 ^a	3.82 ^b	3.73 ^b
Digestibility (%)	62.08	65.76	58.40	64.55
Organic matter				
Intake (kg/d)	6.09 ^a	7.39 ^b	7.27 ^b	6.96 ^b
Feces (kg/d)	2.75 ^b	2.21 ^a	2.74 ^b	2.71 ^b
Digestibility (%)	58.52	65.21	58.73	62.04

Note: Averages with a different superscripts in different columns, differ significantly (P<0.05); the ones with no superscript, no significant differences (P>0.05).

Table 5. Averages of intake and digestibility of dry and organic matters of dairy cows fed a ration with concentrates containing Durio seed flour, fermented Durio peel or their combination

Items	BR	DS	FD	DS-FD
Crude protein				
Intake (kg/d)	1.24 ^a	1.75 ^b	1.59 ^b	1.63 ^b
Feces (kg/d)	0.55	0.53	0.70	0.62
Digestibility (%)	54.47 ^a	69.27 ^b	54.29 ^a	61.41 ^b
Ether extract				
Intake (kg/d)	3.01	3.32	3.12	3.30
Feces (kg/d)	0.02 ^a	0.03 ^{ab}	0.03 ^{ab}	0.04 ^b
Digestibility (%)	99.19	99.02	99.16	98.66
Crude fiber				
Intake (kg/d)	2.36	2.58	2.64	2.63
Feces (kg/d)	0.53	0.52	0.55	0.47
Digestibility (%)	77.10	78.96	77.55	81.66

Note: Averages with a different superscripts in different columns, differ significantly ($P < 0.05$); the ones with no superscript, no significant differences ($P > 0.05$)

the fat content of milk produced by a dairy cows. Feeding 5- 10% crude glycerin in concentrate improved efficiency of 4% FCM (fat-corrected milk) production when dairy cows were given corn silage-based diets; however, milk fat decreased when cottonseed hull-based diets were provided [14].

3.2 Nutrient Digestibility

Dry matter and organic matter of basal rate and three concentrates are presented in Table 3. Dry matter intake (DMI) and organic matter intake (OMI) of three concentrates were significantly different ($P < 0.05$) from those in basal ration. However, among these three concentrates, they were not different significantly on DMI and OMI. On average, DMI in this research was around 2.0 % of body weight. While, [15], recommended for a dairy cow with body weight of 400 kg was 2.7 % - 3.2 %. Therefore, this result was considered under the requirement. Other research results reported that DMI of dairy cows fed in low or high- digestibility *ad libitum* was around 25.5 kg/day [17].

Averages of intake and digestibility of dry and organic matters of dairy cows fed a ration with concentrates containing Durio seed flour, fermented Durio peel or their combination are presented in Table 4. Crude protein intakes (Table 5) of three concentrates were significantly higher ($P < 0.05$) than those of basal ration. While, its crude protein digestibility in DS and DS- FD concentrate were not significantly different. Ether extract and crude fiber intakes as well as their digestibility were not different in averages. Based on these results, seemed that numerically the crude fiber digestibility of DS-FD digestibility tends to be higher.

Digestibility of dry matter and organic matter were not significantly different among treatments. However, among those, Durio seed flour (DS) concentrate tended to have high digestibility in DM (65.76%) and OM (65.21%). These results were slightly lower than those of DM and OM apparent total tract digestion in diet with low -fiber digestibility corn silage in restricted DMI and ad-lib which were around 69.4 and 70.7% in DM, and 72.1 and 72.8% in OM, respectively [17]. While, DMI in dairy cows fed with conventional forage fiber diet was about 24.4 kg/day as reported by [16].

4. CONCLUSION

Based on the average values, the ration containing concentrate with 27.5% Durio seed flour [DS] was considered a better one; since it showed high in dry matter, organic matter, and crude protein digestibility. While the combination of 27.5% Durio seed flour and 20% of fermented Durio [DS-FD] flour was better in crude fiber digestibility.

AUTHORS' CONTRIBUTIONS

Endang Sulistyowati, as first Author, was responsible for the whole research including the proposal, research activity, and writing report as well article for publication. Irma Badarina was helping with data analysis. Bintang Satria Mandala and Ahmad Fauzi were the former students preparing the concentrates, applying them for the cows and collecting data.

ACKNOWLEDGMENTS

This research was carried out under the grant of Research Based Community Activity with contract no of SP DIPA- 023.017.2.677529/2020 supported by

LPPM University of Bengkulu. Authors would like to appreciate this support. We would also like to thank Mr. Mursalim who allowed us to conduct this research at his dairy farm, Sepakat II, in Mojorejo, Selupu Rejang, Rejang Lebong, Bengkulu, Indonesia.

REFERENCES

- [1] BPS. Biro Pusat Statistik. Produksi Tanaman Buah-buahan 2020. <https://www.bps.go.id/indicator/55/62/1/produksi-tanaman-buah-buahan.html>. Accessed on 11 September 2021.
- [2] Suhaidi, I. Pemanfaatan limbah biji Durio sebagai bahan pakan ternak ayam pedaging. Repositori Institusi Universitas Sumatera Utara (RI-USU), 2004. <http://repository.usu.ac.id/handle/123456789/6603>
- [3] Sistanto, E. Sulistyowati, Yuwana, Utilization of Durio (*Durio zibethinus* Murr) Seeds by- Product as a Stabilizer of Dairy Cow Milk Ice Cream, *Jurnal Sain Peternakan Indonesia* 12 (1), 2017, pp 9- 23. <https://doi.org/10.31186/jspi.id.12.1.9-23>
- [4] H. Suciyanti, E. Sulistyowati, and Y. Fenita, Evaluasi nutrisi limbah kulit Durio (*Durio zibethinus*) yang difermentasi jamur tiram putih (*Pleurotus ostreatus*) pada masa inkubasi yang berbeda, *Jurnal Sain Peternakan Indonesia*, 10 (2), 2015, Pp 77-86. <https://doi.org/10.31186/jspi.id.10.2.77-86>
- [5] R. Hartono, Y. Fenita and E. Sulistyowati, *In Vitro* Dry Matter Digestibility, Organic Matter Digestibility and N-NH₃ Production of Durio (*Durio zibethinus*) Fermented with White Rod (*Pleurotus ostreatus*) in Different Incubation Time, *Jurnal Sain Peternakan Indonesia*, 10 (2), 2015, pp 87- 94. <https://doi.org/10.31186/jspi.id.10.2.77-86>
- [6] A. D. Nuraini, & M. E. Mahata, Improving the nutrient quality of Durio (*Durio zibethinus*) fruit waste through fermentation by using *Phanerochaete chrysosporium* and *Neurospora crassa* for poultry diet. *Int. J. Poult. Sci*, 14, 2015, pp 354-358.
- [7] E. Sulistyowati, E. Soetrisno, S. Mujiharjo, D. E. Lorence, E. Gustia, S. Meisella, Milk production and quality of dairy cow fed diet containing concentrate with *Durio zibethinus* Murr seed flour, IOP Conf. Series: Earth and Environmental Science **347** 012011. IOP Publishing, 2019^a, DOI:10.1088/1755-1315/347/1/012011
- [8] E. Sulistyowati, I. Badarina, S. Mujiharjo, Sistanto, I. R. Dhani, R. Putri, E. Terimasari, A. Proyogi, B. Al Iman, and S. Fanhar, Performance of dairy cows fed diet containing concentrate with fermented *Durio* peel, *Jurnal Ilmu-Ilmu Peternakan* 30 (1), 2020, pp 29-39. Doi: 10.21776/ub.jiip.2020.030.01.0
- [9] E. Sulistyowati, I. Badarina, S. Mujiharjo, T. Simbolon, I. R. Purba, Diet with Concentrate Containing *Durio zibethinus* Murr Seed Meal: Nutrient Contents, Fatty Acid Profiles, *In Vitro* Characteristics, and Nutrient Digestibility in Dairy Cows, *Buletin of Animal Science* 43 (4), 2019^b, pp 218- 224. DOI:10.21059/buletinpeternak.v43i4.44606
- [10] E. Sulistyowati, B. S. Priyono, D. Titania, Y. Setiaji, dan A. Rahayu, Feeding Concentrate Containing Seed Powder and Fermented Rind of *Durio zibethinus* on Milk Production, Milk Quality and MIOFC of Dairy Cows, *Jurnal Sain Peternakan Indonesia* 16 (1), 2021, pp 49- 54. <https://doi.org/10.31186/jspi.id.16.1.49-54>
- [11] AOAC, Official method of Analysis. 18th ed. Association of Officiating Analytical Chemists, Washington DC, Method 935.14 and 992.24, 2005.
- [12] M. Lentner and T. Bishop, *Experimental Design and Analysis*, Valley Book Co. VA, 1986.
- [13] A.D. Zega, I. Badarina, dan Hidayat, Kualitas gizi fermentasi ransum konsentrat sapi pedaging berbasis lumpur sawit dan beberapa bahan pakan lokal dengan bionak dan EM4. *Jurnal Sain Peternakan Indonesia* 12 (1), 2017, pp 38-46.
- [14] J. H. Shin , D. Wang , S. C. Kim , A. T. Adesogan , and C. R. Staples, Effects of feeding crude glycerin on performance and ruminal kinetics of lactating Holstein cows fed corn silageor cottonseed hull-based, low-fiber diets. *J. Dairy Sci.* 95, 2012, pp 4006–4016, <http://dx.doi.org/10.3168/jds.2011-5121>.
- [15] [NRC] National Research Council, *Nutrients Requirement of Dairy Cattle*. Sixth Revised Edition Update. National Academy press. Washington DC (US), 1989.
- [16] A. W. Tebbe, M. J. Faulkner, and W. P. Weiss. "Effect of partitioning the nonfiber carbohydrate fraction and neutral detergent fiber method on digestibility of carbohydrates by dairy cows." *Journal of dairy science* 100, no. 8, 2017, pp 6218-6228.

- [17] F. Lopes , D. E. Cook , and D. K. Combs, Validation of an in vitro model for predicting rumen and total-tract fiber digestibility in dairy cows fed corn silages with different in vitro neutral detergent fiber digestibilities at 2 levels of dry matter intake. *J. Dairy Sci*, 98, 2015, pp 574–585.
- [18] E. Sulistyowati, I. Badarina, S. Mujiharjo, Milk Production and feed efficiency of dairy cow fed concentrate containing *Durio zibethinus* peel flour fermented with *Pleurotus ostreatus*. The 4th International Seminar on animal Industri Bogor, August 28-30, 2018, pp: 86-90