

DYNAMICS OF MILK PRODUCTION OF LATE LACTATION DAIRY GOAT FED PUFA-DIET SUPPLEMENTED WITH YEAST, *C. xanthorrhiza* Roxb, and THEIR COMBINATION

Endang Sulistyowati^{1,2*}, Asep Sudarman¹, Komang G. Wiryawan¹, Toto Toharmat¹, and Sigit Mujiharjo³

¹ Department of Feed and Nutrition Science, Bogor Agricultural University, Bogor 16680, Indonesia

² Department of Animal Science, University of Bengkulu, Bengkulu 38371, INDONESIA

³ Department of Agriculture Technology, University of Bengkulu, Bengkulu 38371, INDONESIA

*Email : ensulistyowati@yahoo.com

Abstract

This article is a dynamics synthesis of milk production data of dairy goat fed diet containing concentrate supplemented with PUFA (polyunsaturated fatty acid), yeast and curcuma. Twenty (20) dairy goats of Ettawa crossbred in late lactation phase were grouped into five of four goats to receive five treatments in in Randomized Complete Block design. The treatments were no supplement (PD0), 3 tablets of Asifit (PDA), 5g/d yeast (PDY), 20g/d curcuma (PDC), and a mix of 5g/d yeast and 20g/d curcuma (PDM). The concentrate contained of PUFA sources (roasted ground corn, roasted soy bean meal, and corn oil), soybean by-product; roughage provided was King Grass. Milk yield was recorded daily, pre, treatment, and post then calculated all the way from pre to post treatment. Milk yield were higher significantly ($P < 0.05$) in PDA (538.7 g/d) and PDY (522.3 g/d) compared to PD0 (336.3 g/d), PDC (322.3 g/d) and PDM (392.0 g/d). Average temperature and relative humidity in the farm were $26.94 \pm 2.28^{\circ}\text{C}$ and $78.83 \pm 7.34\%$. Yeast supplementation either solely or in combination with curcuma is considered better in milk production dynamics in pre, treatment, post.

Key words: milk production, dynamics, curcuma, yeast, PUFA-diet, dairy goat

BACKGROUND

Milk production in Indonesia is increasing yearly, however, it has not fulfilled milk demand. In 2011, milk production in was $926 \cdot 10^3$ tons, while total demand of milk and milk product is $3,903 \cdot 10^3$ tons (DGLAH 2011). The lack of this milk demand would be imported for about 76.27% a year; with an International milk price of \$400/ton, it would cost around \$1,190,800,000/yr. On the other hand, with $17,483 \cdot 10^3$ population of goat in 2011, supposed 0.5% is dairy goat and 30% of them is in lactation with 0.5 kg/d milk production, in one lactation period would be producing milk about 1,967 tons. There might be a potential alternative of milk production as much as 0.05%/yr to supply National milk demand (Sulistyowati, 2014). This huge gap of milk consumption and milk production should be narrowed. At the same time, the quality of the milk needs to be improved as well. For these purposes there has to be nutrition manipulation that could be applied to the dairy ruminants, such as dairy goat.

Yeast, mostly mentioned as *Saccharomyces cerevisiae* in any forms, dried or liquid, is widely used as rumen enhancer or fermenting feed supplement with variable effects on dry matter and organic matter digestibility, ruminal microbes, and ruminal fermentation activity

(pH rumen, VFA, lactate, milk production, and fatty acid) as described by Desnoyers *et al.* (2009). Yeast supplementation of 20g/d in diet containing cassava meal reported increased milk production in Holstein cow (Sulistyowati *et al.*, 2010).

Sulistyowati *et al.* (2011) found that 15 g curcuma/kg concentrate was the right level for milk production in dairy cow. Meanwhile, the optimal dose (160 ppm) of curcumin extract of *C. domestica* increased energy digestibility of ration, reduced rate of passage of the feed in the digestive tract so that its absorption improved in pig as reported by Sinaga *et al.* (2011).

Based on these data, an experiment has been conducted to investigate the effects of different additives, yeast, *Curcuma xanthorrhiza*, Roxb, and their combination were added in concentrate containing PUFA sources (roasted ground corn, roasted soybean meal, and corn oil) on milk yield of dairy goat.

METHODS

Basal diet contained of rice bran (18.42%), ground corn (15.79%), soy bean meal (7.89%), cassava meal (7.89%), soy bean- byproduct (tofu- byproduct) (27.49%), corn oil (2.11%), minerals (0.53%), King grass 19.88%), then this is designated as control PUFA- diet (PD0). There were then treatments as PDA (PUFA- diet added with 3 ASIFIT tablets); A commercial supplement containing *Sauropus androgynus* extract to boost lactation for lactating woman. Yeast (0.5%) was added into the basal diet as PUFA- diet yeast (PDY); *Curcuma* powder (2%) was supplemented into basal diet as PUFA- diet curcuma (PDC); then both yeast (0.5%) and curcuma (2%) were added into basal diet, as PUFA- diet mixed (PDM) as reported previously by Sulistyowati *et al.* (2013), Sulistyowati *et al.* (2014) and Sulistyowati *et al.* (2015). The Ground corn was half roasted; while soy bean meal was all roasted in 80°C for about 20 minutes. These ingredients together with corn oil were designated as PUFA sources in the diets. Curcuma powder was processed through slicing, drying, grinding, and powdering of the fresh tuber. Yeast was self prepared regarding to Pusbangtepa (1981).

Nutrient contents of the diets showed that the highest crude protein (15.33%) was found in PDC (PUFA- diet with Curcuma); while the lowest (14.11%) found in PDY (PUFA- diet with yeast). In PDC also contained the highest crude fiber (18.60%) and the highest ADF or Acid Detergent Fiber (48.18%) ; while PDM (PUFA-diet with mix Curcuma and yeast) contained the highest Ca/P (2.90%) as reported in previous report (Sulistyowati *et al.*, 2013).

These five treatments were applied in randomly block design with four replications so that there were 20 late lactation dairy goats used in this research. Goat assignment for each treatment was done randomly. Goats were Ettawa crossed breed, in late lactation (average of 4.6 ± 0.55 months), with body weight of 46 ± 5.34 kg. Data of milk production were analyzed across time and blocks for each treatment (Lentner and Bishop, 1986).

Milk production was measured daily in morning and afternoon milkings, hand milked twice (at 06.00 am and 02.00 pm) and recorded in each individual stall. Temperature and moisture around the housing in the upper land of Bogor, west Java, were recorded in the Temperatures and moistures were recorded three times a day using Hygrometer at mornings (6.00), noons (12), and afternoons (15.00).

RESULTS

Dynamics of Milk Production across Times and Blocks of All PUFA-diets

The dynamics of milk production across times and blocks of all PUFA-diets are shown on Table 1. In post treatment, the basal diet (PD0) and Curcuma diet (PDC) were decreasing significantly deep ($P < 0.05$) compared to those Asifit (PDA) and yeast (PDY); while the mix

diet (yeast and Curcuma, PDM) showed better in post treatments and across the time (pre, during and post treatments).

Table 1. Dynamics milk production across the time and blocks of all PUFA-diets

Variables	PDO	PDA	PDY	PDC	PDM
Average milk production from pre through treatment and post (g/d)	336.3 ^a	538.7 ^b	522.3 ^b	322.3 ^a	392.0 ^a
Average milk production post treatment (g/d)*	105 ^a	572 ^b	526 ^b	90 ^a	324 ^{ab}

Sulistyowati *et al.* (2014). PUFA- concentrate and soybean by- product without supplements designated as (PDO), added with 3 tablets/dairy goat of ASIFIT (PDA), 0.5% or 5g yeast (PDY), 2% or 20g curcuma powder (PDC), mix of 5g yeast and 20g curcuma powder (PDM).

Out of the five PUFA-diets in all blocks of dairy goat (Figure 1), PDA and PDY showed shallow curves of milk production; in contrast, PDO and PDC had plunging curves beginning at the fourth weeks; RPC (PDM) was in between. Across the blocks, milk production of goat fed RPO (PDO) were all decreasing, except for block 1 goat which was in between (Figure 2).

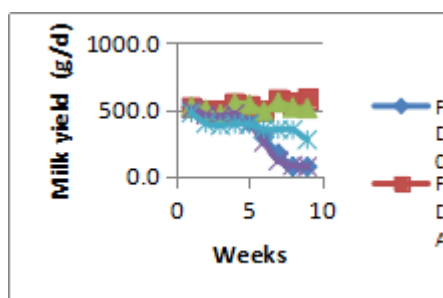


Figure 1. Milk production along the time In all treatment in dairy goat

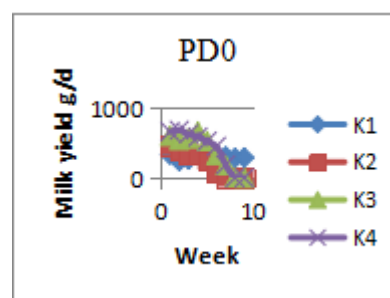


Figure 2. Milk production of PDO in all blocks of dairy goat

Milk production of PUFA-diet- Asifit (PDA) goats in general were maintained stable for all blocks of goat, meaning that Asifit tablet containing *Sauropus androginus* and rich in vitamin B was effective in maintaining milk production along the progressing lactation (Figure 3). The milk production curves of PUFA-diet- Yeast (PDY) (Figure 4), PUFA-diet- Curcuma (PDC) (Figure 5), and PUFA-diet- Mix of Curcuma and Yeast (PDM) (Figure 6) were mostly plunging deeply across blocks, except for block 2 goats. Among these three PUFA-diet treatments, the PDM milk production across the blocks was the most stable one.

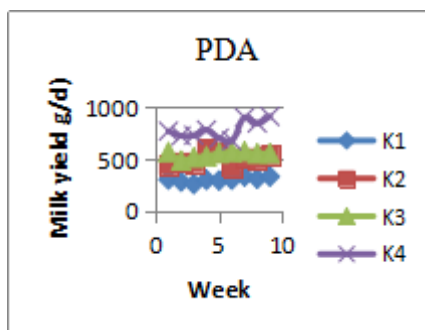


Figure 3. Milk production of PDA in all blocks of dairy goat

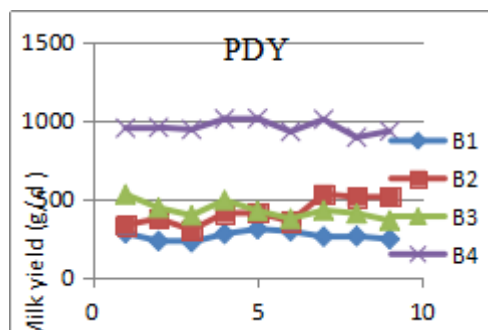


Figure 4. Milk production of PDY in all blocks of dairy goat

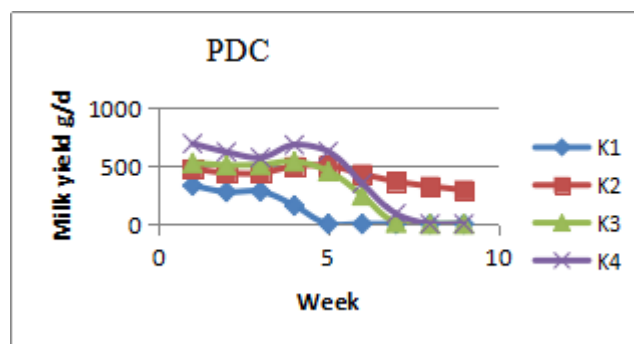


Figure 5. Milk production of PDC in all blocks of dairy goat

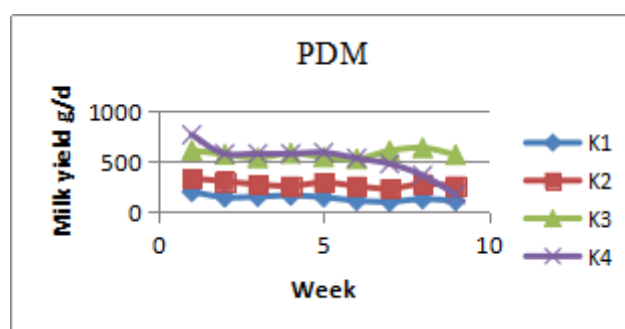


Figure 6. Milk production of PDM in all blocks of dairy goat

Suggesting that the yeast was manipulating fermentation process in the rumen more effectively such that more precursor available for milk production. At the same time, curcuma would decompose unwanted microbes such as protozoa that at the end the rumen metabolism would work more efficiently. Therefore, there was a synergic relationship between yeast and curcuma in improving rumen metabolism in the process of producing milk.

Curcuma supplementation, in combination with yeast in this present study produced more milk than that in Curcuma only. Crossbred goat with high polyherbal combination reduced milk yield significantly as reported by Mirzaei and Prasad (2011), meaning that the level in our treatment was four times higher that could have been too high for an optimal level in producing milk yield of the goat.

Temperature and Relative Humidity at Dairy Goat Farm

The average temperature and moisture during the experiment were 26.9°C and 78.8%, respectively. Average temperature in the morning was lower than the noon, afternoon, and along the day; with the opposite moisture levels, as those can be seen in Table 2.

Table 2. Average temperature and relative humidity at dairy goat

Time	Temperature (°C)	Relative humidity (%)
Morning (06.00)	24.6 ± 1.3	82.0 ± 5.9
Noon (12.00)	28.1 ± 1.6	77.2 ± 7.9
Afternoon (15.00)	28.1 ± 1.8	77.3 ± 7.3
Along the day	26.9 ± 2.3	78.8 ± 7.3

This average temperature is much higher compared to that of in upper land Bengkulu (900- 1400 m above sea level) that is about 18- 26°C, which is suitable environment for dairy cattle production (Sulistyowati *et al.*, 2016).

CONCLUSION

Based on milk production recorded that PUFA-diet with mix 5 g yeast and 20 g curcuma/day showed in higher yield across the time in late lactation dairy goat.

ACKNOWLEDGEMENT

This research was granted by HIBAH STRANAS with contract No:134/SP2H/PL/DIT.LITABMAS/V/2013. We would like to highly appreciate for this grant. We thank you to Cordero Farm Owner and coworkers in Ciapus Bogor, west Java for providing the dairy goats and helping together during the research.

REFERENCE

- [DGLAH]. Directorate General of Livestock and Animal Health 2011. Livestock and Animal Health Statistics. ISBN 978-979-628-019-3. Ministry of Agriculture of Republic of Indonesia.
- Lentner M, Bishop T. 1986. Experimental Design and Analysis. Valley Book Co. VA.
- Mirzaei, F and S. Prasad. 2011. Influence of dietary phytoadditive as polyherbal combination on performance of does and respective litters in cross bred dairy goats. *Asian- Aust J Anim Sci.* 24 (10): 1386-1392.
- Pusbangtepa. 1981. Ragi Tape. Pusat Penelitian dan Pengembangan Teknologi Pangan. IPB. Bogor. Indonesia.
- Sinaga, S, D.T.H. Sihombing, M. Bintang, and Kartiarso. 2011. The effect of ration containing curcumin (extract turmeric/*Curcuma domestica*) in pigs rations to replace antibiotic synthetic as growth promoter). *Forum Pascasarjana.* 33 (2): 123-131.
- Sulistiyowati, E., I. Badarina, and E. Soetrisno. 2010. Supplementation of Starbio probiotic and yeast on milk production and nutrient digestibility of lactating Holstein cows fed a ration containing cassava meal. *J Dairy Sci.* 93. E- Suppl. 1: 860.
- Sulistiyowati E, Santoso U, Badarina I. 2011. Supplementation of concentrate with different levels of temulawak (*Curcuma xanthorrhiza* Roxb) on milk production of lactating Frisien Holland cows. *Proceedings: The 2nd International Symposium on Temulawak- the 40th Meeting on National Working Group on Indonesian Medicinal Plant.* ISBN: 978-979-25-1209-0. Pp: 116- 120.
- Sulistiyowati, E., A. Sudarman, K.G. Wiryawan, and T. Toharmat 2013. Quality of Milk Fatty Acid during Late Lactation in Dairy Goat Fed on PUFA-Diet Supplemented with Yeast and *Curcuma xanthorrhiza* Roxb. *JITAA.* 38 (4): 247-256.
- Sulistiyowati, E. 2014. Ruminal Fermentation, Production And Fatty Acid Quality Of Milk Of Late Lactation Dairy Goat Fed PUFA-Diet Supplemented With Yeast And Temulawak (*C. xanthorrhiza* Roxb). Dissertation. Graduate School. IPB. Bogor.
- Sulistiyowati, E., A. Sudarman, K.G. Wiryawan, and T. Toharmat. 2014. Milk Production of Late Lactation Dairy Goat Fed PUFA-Diet Supplemented with Yeast and *C. xanthorrhiza* Roxb. Proceeding The 2nd Asian- Australasian Dairy Goat Conference. Pp: 223- 226. ISBN: 978-602-96530-3-8.
- Sulistiyowati, E., A. Sudarman, K.G. Wiryawan, and T. Toharmat. 2015. The Nutritive Values of PUFA- Concentrate Supplemented with Yeast and *Curcuma xanthorrhiza*, Roxb Stored in Several Weeks. *JITAA.* 40 (1): 11-22.
- Sulistiyowati, E., S. Mujiharjo, B.S. Priyono, E. Haryanti, and Sistanto. 2016. Preferences and Economic Analysis of Specific Location Dairy Products. *JSPI.* 11 (2): 118- 125.