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Milk Quality of Etawa Dairy Goat Fed Palm Kernel Cake, Tithonia (*Tithonia diversifolia*) and Sweet Potato Leaves (*Ipomoea batatas* L)

Arief, N Jamarun, B Satria and R Pazla

[1]Department of Animal Production, Faculty of Animal Science, Andalas university, Padang, 25163, Indonesia. E-mail: aarief@ansci.unand.ac.id

Abstract. This research aims to evaluate the milk quality of Etawa Crossbreed Dairy Goat (ECDG) fed palm kernel cake concentrate (PKCC), tithonia (*Tithonia diversifolia*) and agiculture waste (sweet potato leaves, Ipomoea batatas L.). The design used was a completely randomized design (CRD) with 5 treatments of rations and 4 replications. Treatment A = 100% tofu waste + tithonia, B = 75% tofu waste + 25% PKCC + (tithonia + sweet potato leaves), C = 50% tofu waste + 50% PKCC + (tithonia + sweet potato leaves), D = 25% tofu waste + 75% PKCC + (tithonia + sweet potato leaves), E = 0% tofu waste + 100% PKCC + (tithonia + sweet potato leaves). The ratio of concentrate and forage is 40:60. Comparison of titonia and sweet potato leaves is 50:50. Data were analyzed by ANOVA and DMRT (Duncans Multiple Range Test) according to Steel and Torrie (2002). The measured parameters are the quality of milk consisting of protein, fat, solid nonfat (SNF) and dry matter (Kjheldal Method). The results showed that the treatment had no significant effect (P> 0.05) on protein, fat, solid non fat (SNF) and dry matter. The conclusion of this study is the use of PKCC up to level 100%, titonia and sweet potatoes are able to replace ration without reducing the quality of milk.

1. Introduction

Palm kernel cake is a by-product of the palm oil industry which is very potential to be used as concentrate feed for ECDG [1]. Nutrient content of palm kernel cake is dry matter (DM) 91.83%, organic matter (OM) 91.41%, crude protein (CP) 12.36%, crude fiber (CF) 26.68% and total digestible nutrient (TDN) 65.40% [2]. The use of concentrates containing palm kernel cake in ECDG showed good milk quality as reported by Ref. [3] who received milk protein 4.39%, milk fat 8.23% and SNF 9.01%.

The titonia plant is a shrub plant that is highly favoured by ECDG [4]. Protein content of tithonia is quite high at 22.98% [5]. The use of tithonia as a source of forage in ECDG is able to increase milk production and milk quality [3]. A part from the tithonia plant, sweet potato leaves are also very potential to be used as forage. [6] stated that sweet potato leaves contain roughly 24-29% crude protein Ref. [7] states that sweet potato leaves contain high crude protein, which is 26-35%, with good mineral content and also vitamins A, B2, C, and E. The chemical composition of sweet potato leaves based on dry ingredients is 88.46% DM, 25.51% CP, 14.22% Ash, 24.29% CF, 15% extract ether, ingredients extract without nitrogen is 34.70%, calcium (Ca) 0.79% and Phosphorus (P) 0.38% [8].

Etawa dairy goat (ECDG) is indigenous livestock goat of Indonesia especially for dairy goat. ECDG comes from crossing of etawa goats from India with local Indonesian goats. The Etawa goat is an alternative livestock to meet the milk needs of the community aside from dairy cows. Several studies have been carried out stating that goat milk is quite popular, this is caused by the fat globules found in goat milk having a smaller and homogeneous size. According to [2] adding the use of unconventional feed given probiotics can increase the productivity of dairy goats both in the form of protein and energy.

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Based on the description above, a study was conducted to see the effect of the use of rations containing palm kernel cake, titonia and sweet potato leaves on the milk quality of ECDG.

2. Materials and Method

The material used in this study were 20 ECDG during lactation 1 and originating from the Rantiang Ameh dairy goat farm, Canduang, Agam Regency, West Sumatera. This research was conducted with an experimental method using a completely randomized design (CRD) with 5 treatments and 4 replications in the form of concentrates and forages. The treatment ration is:

A = 100% tofu waste (4 kg) + forage (tithonia) (5 kg)
B = 75% tofu waste (3 kg) + 25% PKCC (300 g) + forage (tithonia 2.5 kg + sweet potato leaves 2.5 kg)
C = 50% tofu waste (2 kg) + 50% PKCC (600 g) + forage (tithonia 2.5 kg + sweet potato leaves 2.5 kg)
D = 25% tofu waste (1 kg) + 75% PKCC (900 g) + forage (tithonia 2.5 kg+ sweet potato leaves 2.5 kg)
E = 0% tofu waste (0 kg) + 100% PKCC (1200 g) + forage (tithonia 2.5 kg + sweet potato leaves 2.5 kg)

Palm Kernel Cake Concentrate (PKCC) consists of 30% PKC), 9% corn, 20% rice bran, 40% tofu waste and 1% Mineral and protein contents of ration is 12% and TDN 65 – 70%. The ratio of concentrate and forage is 40:60. Comparison of titonia and sweet potato leaves 50:50. The mathematical model of a completely randomized design (CRD) is used according to [9]. The measured parameters are the quality of milk consisting of protein, fat, solid non fat (SNF) and dry matter of milk (DMM). Milk quality measured by Kjeldhal Method.

3. Result and Discussion

Table 1 shows the treatment gives no significant effect (P> 0.05) on all milk quality parameters (Protein, fat, SNF and DM). This shows that the response of ECDG to the ration consisting of a combination of PKCC, titonia and sweet potato leaves is quite good, there is no difference in the quality of milk (Protein, fat, SNF and DM) despite an increase in the level of PKCC to level 100%.

Table 1. Milk Quality of ECDG Fed PKCC, Tithonia and Sweet Potato Leaves.

Parameters (%)	Treatments				
	A	B	C	D	E
Protein	4.73	4.38	4.93	4.68	5.34
Fat	5.89	5.65	5.77	5.33	5.65
Solid Non Fat	7.48	7.58	8.00	7.32	7.21
Dry Matter	14.88	14.12	14.65	14.11	15.39

3.1. Milk Protein

In this study it can be seen that there is no significant difference (P>0.05) in protein from the five types of rations (rations A, B, C, D and E rations) because the quality of the five rations is relatively good, so increasing levels of PKCC, titonia and sweet potato leaves do not have a significant effect in the chemical composition of milk. This illustrates that in terms of protein sufficiency, rations with protein content from feed ingredients that are high in protein sources are sufficient to meet the protein requirements of livestock so that they do not affect the level of milk protein produced.

Palm kernel cake, Titonia and sweet potato leaves have a good enough content to be used as feed. PKC contains crude protein 12.36 with TDN of 65.40% [2]. Titonia contains crude protein 21.14% [10], while sweet potato leaves contain PK 25.52% [8]. Although statistically the addition of PKC in the concentrate did not significantly influence the increase in milk protein levels, the results obtained were still within the standard normal range of goat milk.

The protein content of ECDG milk obtained in this study was higher when compared with the results of [11] and [4] who obtained milk protein levels by feeding feed concentrates based on Palm Oil waste were 2.95% and 3.68%. The unreal difference between the treatment ration and the control was also caused by the nutrient content of the control concentrate was also not different from the nutrient

content of the treatment concentrate. This is in accordance with the opinion of Ref. [12] giving concentrates will increase milk protein so that the density of milk increases. with additional concentrates, more energy is available for the formation of amino acids derived from microbial proteins. Increasing the availability of these amino acids will contribute to increasing milk protein synthesis.

3.2. Milk Fat and Solid Non Fat

The average milk fat levels of treatments are A, B, C, D, and E were 5.89%, 5.65%, 5.77%, 5.33%, and 5.65% (Table 1). These results did not show significant differences (P> 0.05) on milk fat levels. The level of milk fat treated was higher than that of [1] and lower than that obtained by [3]. This difference occurs because the type of forage in the ration is given. Although all treatments in this study produced the same fat content, the results were still at normal limits. According to SNI (2011) [13] the quality of good milk contains a minimum fat content of 3.0%.

The high level of milk fat from this study from the minimum recommended by Indonesian Nasional Standard of milk [13] is caused by the provision of forage feed containing CF is quite high, 24.29% sweet potato leaves and 18.17% tithonia, and forage fat content of sweet potato leaves and tithonia is 1.88% and 3.49%. While the crude fat content of tofu waste and PKCC concentrates were 4.08% and 6.28% respectively. According to Ref. [12] the content of crude fiber and crude fat in feed is very influential on the fat content in milk. CF in the form of cellulose will be digested fermentatively by rumen microorganism and produce acetic acid, propionate and butyrate. Coarse fat will be hydrolyzed by the rumen into long-term fatty acids and glycerol. Acetic acid and butyric acid are converted into short chain fatty acids in udder epithelial cells, then acetic acid enters the blood and then enters the cells of udder secretions and becomes milk fat.

Concentrate feed of tofu wate and PKCC have quite high CF content, respectively 16.77% and 18%. According to Ref. [12] livestock fed with additional concentrated feed will reduce milk fat levels and feed which consists only of forages having higher fat content than feed added with concentrate. Concentrate serves as a feed source of soluble carbohydrates and the protein escapes degradation, so that the concentrate can increase VFA especially propionate acid. These fatty acids are an energy source for goat rumen microbes and as a source of glucose for raw materials for milk synthesis [14].

The average SNF levels of treated milk A, B, C, D, and E were 7.48%, 7.58%, 8.00%, 7.32%, and 7.21% respectively (Table 1). These results did not show significant differences (P> 0.05) on milk SNF levels. The results of this study are relatively the same as the results obtained by Ref. [15] with an average ranging from 7.07% -8.55%. This can be influenced by the quality of feed proteins that have the same protein content. Addition of protein sources can increase milk SNF levels because it is followed by an increase in milk protein levels [16]. Good feed quality will affect SNF levels which will be related to milk protein [17]. If the levels of lactose and milk protein are high, the milk SNF will increase.

3.3. Dry Matter of Milk

The average levels of dry matters of treated milk A, B, C, D, and E were 14.88%, 14.12%, 14.65%, 14.11%, and 15.39% (Table 1). These results did not show a significant difference (P> 0.05) on the level of milk dry matter. The results of this study are relatively similar to the results of the study obtained by [18] in Boncah Raya Animal Husbandry with a dry matter average of 14.06%. While [19] obtained an average dry matter of 13.39%. Unreal differences in the average dry matter of milk occur because the composition of food substances in the ration is also almost the same so that it will affect the level of dry matter of milk. [20] mentions the dry matter content of milk depending on the food substances consumed by livestock and their use which are then used as precursors for the formation of dry matter or milk solids.

In addition, the carbohydrate content contained in PKCC and titonia and sweet potato leaves provided are also precursors of glucose which in the fermentation process by rumen microorganisms that will produce VFA, including acetic acid as the formation of milk fat, consequently the VFA formed increases with increasing fat level. This is reinforced by a statement from Ref. [21] which states that changes in milk components including dry matter depend on the lactation period of the animal, the highest composition of dry matter, fat, protein and dry matter which is within one month after giving

birth and slowly decreases in the following months. Milk Quality of ECDG Fed with PKCC, Tithonia and Sweet Potato Leaves can be seen in Figure 1.

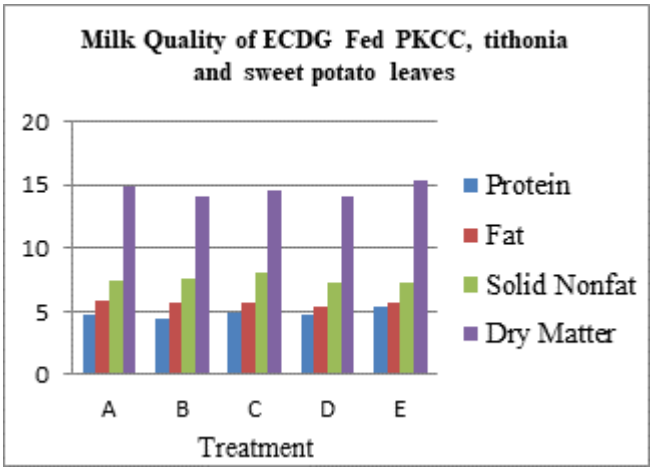

Figure 1. Milk Quality of ECDG Fed with PKCC, Tithonia and Sweet Potato Leaves

4. Conclusion

From the results of research that has been done it was found that the use of concentrate feed made from Palm kernel cake can replace the use of tofu waste without reducing the quality of milk and the use of a combination of tithonia and sweet potato leaves can be recommended as an alternative forage feed for ECDG

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