EFFECT OF WHEAT POLLARD (*Triticum aestivum*) AND SOYBEAN MEAL (*Glycine max*) PROTECTED WITH CONDENSED TANNIN IN THE DIET ON FEED INTAKE AND DIGESTIBILITY OF LACTATION DAIRY COW

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ABSTRACT

The objectives of this study were to investigate the effect of wheat pollard (*Triticum* aestivum) and soybean meal (*Glycine max*) protected by condensed tannin (CT) on feed intake and organic matter digestibility of lactation Holstein-Friesian Crossbred cows. Twelfth lactation cows were divided into 4 groups based on the month of lactation and each group consist of 4 diet treatments which were supplemented by CT. The using of CT was 6% from total dry matter of wheat pollard and soybean meal depending on the feeding treatments. Feeding treatments consist of T1 : 65% corn leaves (*Zea mays*)+ 35% concentrate (control 0% CT); T2 : 65% corn leaves + 35% concentrate (soybean meal protected by 6% CT); T3 : 65% corn leaves + 35% concentrate (wheat pollard protected by 6% CT); T4 : 65% corn leaves + 35% concentrate (soybean meal and wheat pollard protected by 6% CT). Cows were allowed a week of adaptation period, 10 days of preliminary period and 30 days of data collection. Dietary supplemented by 6% CT did not affect feed intake and organic matter digestibility. These results suggest continuing the next experiment to determine the effect of CT on ruminant animals with higer level of CT and the other parameters.

Keywords : condensed tannin (CT), wheat pollard, soybean meal, feed intake, digestibility, lactation dairy cows

INTRODUCTION

Dairy cows need nutrients from the diet to support high production milk. Those dairy cows which only consume native grass was lacking in sufficient nutrients, so it needs other feedstuff such as concentrate. Concentrate is feed containing levels of nutrients such as protein or high amounts of carbohydrates but low levels of crude fiber of below 18%. Widyobroto, Budhi and Agus (2007) also said that protein supplementation on forage as basal diet could meet the amino acid requirements of cows, either for life or for production. Concentrate are often used as animal feed such as rice bran (*Oryza sativa*), corn bran (*Zea mays*), cassava (*Manihot utilisima*), wheat pollard (*Triticum aestivum*), soybean meal (*Glycine max*), coconut meal (*Cocos nucifera*) and peanut meal (*Arachis hypogaea*). As a high-energy feed, wheat pollard contain high level protein around 16%. Soybean meal also contains high level of protein around 44% and contains high enough energy.

Based on the content of these nutrients, wheat pollard and soybean meal become protein sources for ruminant animals. When the diet enters into the rumen, the rumen microbes will degrade all of the nutrients, including protein. Proteins are degraded to ammonia and used to meet the needs of microbial protein. However, the reform of the protein in the rumen needs to be reduced in order to increase the availability of amino acids in the small intestine that will be absorbed and utilized by the animal body. This can be done by protecting protein diet from rumen microbial degradation.

The using of CT in the high protein diet is one method to protect protein diet from rumen microbial degradation. Condensed tannin is polyphenolic compounds which capable to binds protein forming complex bond that is very unstable at pH <3.0 (acid pH) and pH> 8.0 (alkaline pH) (Jones and Mangan, 1977). It means that the conditions in the rumen (pH neutral) the complex bond between CT and protein compound will be stable, so that CT may protect the protein from rumen microbial degradation, and the amount of protein available in the small intestine will increase or referred to by pass protein.
Previous study reported that CT compounds increased the performance of dairy cows (Mashudi, 1996). Mashudi (1996) said that CT also increased the amount of by-pass protein in the animal body, so based on the above description can be concluded that the use of condensed tannins in the diet is very efficient to reduce protein degradation in the rumen.

MATERIALS AND METHODS

Animals, Experimental Design and Treatments

This experiment was conducted at the Koperasi SAE Pujon from 1st until 22nd October 2009 continues with proximate analysis at Animal Nutrition Laboratory, Animal Husbandry Faculty, University of Brawijaya, Malang. Twelfth Holstein-Friesian Crossbred with a mean milk yield 13 l/d and body weight 550-600 kg were used in this experiment. The diet consisting of forages and concentrates with dry matter ratio 65% (forage): 35% (concentrate). Corn leaves (*Zea mays*) was used as forage and SAE PRO FEED concentrate was produced by Koperasi SAE Pujon containing 15% crude protein (CP), <18% crude fiber (CF), 6-8% extract ether (EE) and 60% TDN. The composition of SAE PRO FEED concentrate is showed in Table 1. CT was obtained from mimosa extract production of South Africa.

Table 1. Composition of SAE PRO FEED concentrate

No.	Feedstuff	Proportion (%)
1.	Soybean Meal (*Glycine max*)	4
2.	*Wheat pollard* (*Triticum aestivum*)	13
3.	*Wheat bran* (*Triticum aestivum*)	11
4.	Rice bran rough (*Oryza sativa*)	22
5.	Rica bran (*Oryza sativa*)	10
6.	Coconut meal (*Cocos nucifera*)	22
7.	Kapok Seed Meal (*Ceiba pentandra*)	3
8.	Nutshell (*Arachis hypogaea*)	5
9.	Premix	8
10.	Vitamin dan mineral	2
	Total	100

Source : Koperasi SAE Pujon

This study used *in vivo* method for measuring the digestibility. The method divided three periods: adaptation, preliminary period and data collection. The experimental design used was a randomized block design (RBD), which consists of 4 treatments and 4 groups of lactating dairy cows were divided by month of lactation. The treatments were as follows:

1. T1: 65% corn leaves + 35% concentrate (control 0% CT);
2. T2: 65% corn leaves + 35% concentrate (soybean meal protected by 6% CT);
3. T3: 65% corn leaves + 35% concentrate (wheat pollard protected by 6% CT);
4. T4: 65% corn leaves + 35% concentrate (soybean meal and wheat pollard protected by 6% CT).

The using of CT was 6% from total dry matter of soybean meal and wheat pollard based on preliminary study about the optimal level of CT to protect protein using *in vitro* method.

CT protection on soybean meal and wheat pollard protein was conducted by mixing soybean meal and wheat pollard with CT according to the treatment and then 25% water was added. After 24 hours it was intended to have a process of CT-binding protein. The bond between CT and protein of soybean meal and wheat pollard would be occurred after 24 hours.

In vivo Method

Adaptation period could adjust animals to their new place after grouped and also with the new formulation of diet until the milk production was stabilized. This period was implemented for a week. At this period the animal was grouped by month of lactation (G1, G2, G3, and G4). Then body weight of each animal was estimated for estimation of feed requirements. Animals were feeding twice a day. Concentrate was given at 06.00 am and 03:30 pm. Forage given after concentrate has been consumed. Meanwhile, drinking water provided *ad-libitum*. At the preliminary period, animals were given the feed treatment. This period was to eliminate the effect of previous feed. This stage was carried out for 10 days. The last period was data collection for 30 days. At the end of this period, re-estimation of animal body weight was carried out to determine the final body weight and body weight gain. During the data collection, feed and feces sampling were conducted for laboratory analysis.

Data, Sample Collection and Analysis

Approximately 2 kg (fresh weight) of corn leaves was sampled twice a day. The 500 g of concentrate was sampled once at the end of the experiment. Feces were sampled once a day. All of samples both forage and feces were composited at the end of experiment to the next chemical analysis.

The entire sample was ready to be analyzed both feed samples and feces samples of each cow. The samples were immediately taken to the laboratory for proximate analysis of dry matter (DM), crude protein (CP) and organic matter (OM).

Statistical Analysis

Data obtained from this study was analyzed using variant analysis in a randomized block design (RBD). If treatment has significant effect on the observed variables analysis followed by Duncan test.

RESULTS AND DISCUSSION

Feed Intake and Digestibility

The result of proximate analysis of diet treatments is showed in the Table 2.

Table 2. Nutrient composition of diet treatments in this experiment

Diet treatments	Presentage in the diet (%DM)	Nutrient content		
		DM (%)	OM* (%)	CP* (%)
Concentrate treatment 1	35	94.96	83.32	14.87
Concentrate treatment 2	35	92.33	83.16	14.27
Concentrate treatment 3	35	92.39	82.27	14.00
Concentrate treatment 4	35	82.48	82.60	13.36
Corn leaves (*Zea mays*)	65	27.00	88.17	10.50
Condensed Tannin	6	97.94	94.90	1.97

The result was analyzed in Animal Nutrition Laboratory, Faculty of Animal Husbandry, University of Brawijaya
* : as 100%DM

Nutrient intake is one of factor affecting nutrient digestibility. The amount of nutrient was not excreted and absorbed by the animal body was to determine the digestibility level of each feedstuff (Parakkasi, 1999).

Table 3. Feed Intake, digestibility, digestible nutrient intake

Parameters	Treatments			
	T1	T2	T3	T4
Nutrient intake				
- DM (% BW)	2.78[a] ± 0.41	2.86[a] ± 0.17	3.10[a] ± 0.30	3.01[a] ± 0.40
- DM (g/kg $BW^{0,75}$)	137.37[a] ± 18.93	138.58[a] ± 8.94	148.85[a] ± 14.8	142.96[a] ± 19.58
- OM (g/kg $BW^{0,75}$)	121.25[a] ± 16.53	123.29[a] ± 8.01	132.38[a] ± 13.12	133.37[a] ± 17.93
- CP (g/kg $BW^{0,75}$)	17.88[a] ± 2.18	17.21[a] ± 1.11	18.79[a] ± 1.74	18.74[a] ± 2.26
Feed digestibility				
- DM (%)	50.13[a] ± 2.04	52.20[a] ± 8.68	53.11[a] ± 5.38	50.243[a] ± 10.15
- OM (%)	52.93[a] ± 1.92	55.08[a] ± 8.18	51.52[a] ± 2.37	58.15[a] ±7.33
- CP (%)	79.87[a] ± 2.57	81.61[a] ± 2.52	80.24[a] ± 2.37	82.40[a] ± 3.50

The same superscript in the same row indicates no significant different (P>0,05)

According to Scalbert (1991); McAllister et al. (1994); McMahon et al. (2000) were cited by Frutos et al. (2004), the degradation mechanism of tannins in reducing nutrient cannot be explained completely. This was thought to be due to enzyme inhibitors or inhibiting the feed degradation and the existence of a direct reaction of rumen microorganisms as tannins may alter the permeability of the cell membranes of microorganisms. Makkar (2003) stated that CT is easily capable of inhibiting the activity of enzymes in digesting fibrolitic hemicellulose and cellulose.

Data nutrient digestibility results of this study have been presented in Table 3 above. From the table it can be concluded that the average digestibility of DM per treatment P1 to P4 are respectively 50.13%; 52.20%; 53.11% and 50.243%. While OM digestibility row is 52.93%; 55.80%; 51.52% and 58.15% and digestibility CP row is 79.87%; 81.61%; 80.24% and 82.40%. Hartutik (2001) states that dairy cow treated by kapok seeds in the concentrate has a DM digestibility : 62.76%; 58.36% and OM digestibility : 61.81%, 66.81%; 61.28% and 64.35% and CP digestibility : 63.24%; 62.18% and 68.16%.

Based on the previous study conducted by Widyobroto et al. (2007) DM digestibility of dairy cows that received 4 treatments of undegraded protein have DM digestibility : 75.07%; 80.40%; 72.15% and 78.23%, and OM digestibility : 76.97%; 82.73%; 74.99%

and 82.26%. Hartutik (2004) stated that based on her research with different concentrate levels in the diet, DM digestibility were respectively 61.51%; 61.57% and 61.73% with an average of 61.63%. While OM digestibility were 69.42%; 69.97% and 70.38 with an average of 69.92%. As compare to the several studies above, DM and OM digestibility in this study is lower but CP digestibility in this study tended to be higher when compared with the results of the research Hartutik (2001) above.

The DM, CP and OM digestibility are very affected by rumen microbial activity (Tillman et al., 1991). The other factor is chemical composition of feedstuff and the treatment that giving to the animals (Parakkasi, 1999). Frutos et al. (2004) stated that several studies have shown tannins can reduce the level of feed digestibility. Tannins in this case was able to increase the protein digestibility of tannin but on the other hand a negative effect on the digestibility of feed nutrients other components. Tannins affect carbohydrate and crude fiber digestibility, which is more specifically, includes hemicellulose, cellulose, starch and pectin. For a long time, tannins give the anti-nutritional effects of the degradation of the carbohydrate and crude fiber. Some studies suggest that the degradation of crude fiber can fall dramatically when the diet containing tannins.

Frutos et al. (2000) reported that the using of CT with level 13% and 20% of the soybean meal in the diets of sheep showed a positive effect on protein digestibility. The study showed no significant difference to the nutrient digestibility of feed, but the digestibility tended to increase when compared with the ration using CT levels 0, 1, 4, 7 and 9% in these studies. The research also proved that the levels are not too high, the treatment CT was able to provide a positive effect on feed degradation by rumen microbes and nutrient digestibility of feed.

CONCLUSION

Protection of proteins with CT as much as 6% of DM wheat pollard (*Triticum aestivum*) and soybean meal (*Glycine max*) as concentrate did not give significant effect ($P > 0.05$) on consumption and digestibility of DM, OM and CP of lactation dairy cows. Based on these results, the use of CT with those levels, equivalent to 0.074% of the DM diet, still need to be investigated considering the use of CT is the optimal level of 2-4% of the DM diet (Min et al., 2006).

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