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DRY MATTERS AND ORGANICS MATTERS DIGESTIBILITY, AMMONIA CONCENTRATION AND TOTAL VFA OF COMPLETE FEED

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ABSTRACT

In vitro study of complete feed silage was conducted from March 10th to June 20th 2015 in Animal Nutrition Laboratory, Faculty of Animal Science, Unsoed. The aim of this study was to evaluate the Dry Matter and Organic Matter Digestibilty, Ammonia level and total VFA of complete feed silage. The treatments evaluated were P1 (concentrate 26% + molasses 1,50% + urea 0,50% + salt 0,50% + mineral mix 1,50% + elephant grass 70%); P2 (consentrate 36% + molasses 1,50% + urea 0,50% + salt 0,50% + mineral mix 1,50% + elephant grass 60%); P3 (concentrate 46% + molasses 1,50% + urea 0,50% + salt 0,50% + mineral mix 1,50% + elephant grass 50%); P4 (concentrate 56% + molasses 1,50% + urea0,50% + salt 0,50% + mineral mix 1,50% + elephant grass 40%); P5 (concentrate 66% + molasses 1,50%% + urea 0,50% + salt 0,50% + mineral mix 1,50% + elephant grass 30%) which were placed in 20 fermentor tubes. Completely Randomized Design followed by orthogonal poynomial test was used to analyzed the data. The proximate analysis shows that crude protein and crude fiber are 13,14% - 16,57% and 33,10 -16,57%, respectively. In vitro test shows that the digestibilty of Dry Matter and Organic Matter are 68.78 — 79,90% and 68,86 — 81.53% and the the ammonia and total VFA content are 11.55 — 17.30 mM and 82 — 136.5 mM, respectively.

Keywords: *Complete Feed Sillage, My Matter, Organic Matter, ammonia, Vollatile Fatty Acid.*

INTRODUCTION

Economical, efficient and effective feeding practices are expected by farmers. In the United States, the use of complete feed (Total Mix Ration = TMR) has proven benefits for farm industry of dairy cows, beef cattle, dairy sheep and meat sheep. Feed containing 90% of concentrate and 10% forage in beef cattle often causes bloat and the feed cost is very expensive. This means high costs and low physiological. On the contrary, concentrate only 10% and 90% forage, the feed cost is low, but the performance of the ruminants is very low too; it is economical, but low physiological. Providing concentrate a while after forage causes problem, i.e. the rumen fluid is acid (pH of rumen content decreases below 6), many microbes die, resulting in decreased ruminants performance. To answer these problems, it is necessary to create the established conditions in the ruminants business, especially for local ram, i.e. the provision of complete feed silage (CFS). Feed in the form CFS is highly efficient, effective and beneficial to sheep and farmers. Efficient and effective for farmers, because it requires collecting forages only once to make CFS and it is sufficient to provide

one month feed. The benefits for sheep is that CFS is preferred because of the aroma, nutritionally complete, does not cause stomach bloating and fast growing. Demonstration plot of complete feed has been done by Suparwi and Sri Utami in 2010 in Tegal, in 2012 dan 2015 in Purbalingga, and in 2013 in Banyumas. CFS has very high palatability because of the aroma and crude protein content of 13.50%.

Complete feed silage is a single excellent ration due to the synchronized nutrients. The balance between carbohydrates and protein needs can be satisfied. Proportion of 50:50 between forage and concentrates based on dry matter gives the best effect on the performance of lactating dairy cows. Dry Matter ratio of 60:40 or 40:60 did not significantly affect the performance of lactating dairy cows because the digestibility of the ration is still high (Suparwi, 2015). The range of crude fiber content was 19-21% ADF and 25- 28% NDF (Kung, 2007).

Total Mixed Ration is widely used in the US and complete feed silage is the right choice, economical, does not cause sub-acute ruminal acidosis (SARA), and thus it increases the performance of ruminants, including sheep (Snowdon, 1991). Acidosis in ruminants is due to the rapid changes of feeding forage to concentrate. If the forage is mixed with the concentrate, it does not cause acidosis in the reticulo rumen (Norlund, 2003).

MATERIALS AND METHODS

In Vitro test was carried to determine dry matter digestibility (DMD), organic matter digestibility (OMD) according to the method of Telley and Terry (1963), and total VFA and ammonia levels using Conway microdiffusion method. The treatments are the following:

P1 = 26% concentrate + (1.50% molasses + 0.50% urea + 0.50% + 1.50% mineral mix; so called A) + 70% elephant grass; P2 = 36% concentrate + A + 60% elephant grass; P3 = 46% concentrate + A + 50% elephant grass; P4 = 56% concentrate + A + 40% elephant grass; P5 = 66 % concentrate + A + 30% elephant grass. The concentrate was composed of 5% rejected soy flour, 25% pollard bran, 25% coconut cake, 28% cassava, 15% rice bran, and 2% minerals. Based on the results of the proximate analysis the concentrate contains 78.09% dry matter, 15.27% crude protein, and 76.20% energy (TDN).

The study used 20 tubes fermentor and inoculums from sheep rumen fluid to test the 5 different complete feed silage: P 1 , P2, P3, P4 and P5. The experiment used completely randomized design (CRD) (Steel and Torrie, 1989); the treatments was 5 complete feed silage with 4 replicates.

After 21 days, 1 kg of complete feed silage samples was taken from each barrel for proximate analysis and in vitro test. The parameters measured were the DMD, OMD, ammonia and total VFA. Data were analyzed using analysis of variance (ANOVA). To compare the effect of the concentrates and forage levels in complete feed silage, Orthogonal Test Polynomial was carried out.

RESULTS AND DISCUSSION

The average of dry matter, organic matter, ammonia and total VFA are presented in Table 1.

Table 1. Mean digestibility of dry matter, organic matter, ammonia and total VFA

Treatments	DMG,%	OMD,%	Ammonia (mM)	Total VFA (mM)
P1	**68.78a**	**68.86a**	**11.55a**	**82.0a**
P2	**71.08^{b}**	**70.84^{b}**	**13.48^{b}**	**98.8^{b}**
P3	**71.86c**	**75.99c**	**13.98c**	114.3c
P4	*71.91^{d}*	*77.17^{d}*	*16.0^{d}*	**120.8^{d}**
P5	**79.90e**	**81.53e**	**17.3e**	**136.5e**

Different superscripts in the same column indicates significantly different (P <0.05).

The results showed that the digestibility of dry matter and organic matter, ammonia and total VFA were significantly different between treatments (P<0.05). The higher the concentrate concentration, the higher was the percentage of digestibility and ammonia and total VFA. Level of 30% concentrate with 70% of forage is still able to obtain 68.78% digestibility of dry matter. Feed is said to be good if it has a minimum of 60% digestibility. This digestibility strongly supports the rumen microbial growth and ruminants performance. Digestibility of dry matter and organic matter are closely related, because the nutrients contained in organic matters are also in the dry matters. The organic matter is the most component of dry matter. The digestibility follows the regression equation Y = 31.766625 + 0.6336875 X (r2 = 84.74%). The lowest organic matter digestibility was 68.86%, following the regression equation Y = 10.6209 + 0.491425 X (r2 = 64.19%). The ammonia levels ranged between 11.55 to 17.30 mM. These ammonia levels are sufficient to support the growth of rumen microbes and synthesis of microbial protein. Normally the concentration of ammonia in the rumen fluid is between 4-12 mM (8 mM in average). Ammonia concentration of more than 30 mM will result in increased ammonia concentration in the blood and symptoms of poisoning can occur when ammonia concentration in the blood reaches 0.5 mg/100 ml (Hungate, 1966). Ammonia concentrations from in vitro test follows the regression equation Y = 8.15 + 0.109 X (r2 = 28.59%). The total VFA levels ranged from

82.0 to 136.5 mM. The concentration of total VFA in rumen fluid to support the growth of rumen microbes is around 80-160 mM (average 120 mM). The results of this experiment are very good, since the average total of 110.5 mM VFA is still able to support microbial growth and synthesis process of the microbial protein. The total VFA concentration follows the regression equation Y = 44.95 + 1.31 X (r2 = 93.79%).

Dry Matter Digestibility

The results showed that the digestibility of dry matter CFS ranges from 68.78 to 79.90% which is statistically significant different ($P<0.05$). This digestibility value is considered quite high. This dry matter digestibility is sufficient to support microbial rumen growth. The dry matter digestibility increased from 68.78% to 79.90%. Dry matter is digested through two phases, i.e. fermentative digestive and hydrolytic digestive process. Fermentative digestive process is carried out by rumen microbes and then followed by hydrolytic digestive process. The more CFS fermented the less is residue produced, as a consequence the higher is the dry matter digestibility. The process of dry matter digestion highly requires feed protein as essential nutrients source for animals and its sufficient availability may enhance the growth and activity of microbes, so that the process of digestion increases. Growth and activity of cellulolytic microbes desperately need source of energy, nitrogen, minerals and vitamins. Source of protein from feed is partially hydrolyzed into peptides and amino acids by rumen microbes. Some amino acids are degraded into organic acids, ammonia and carbon dioxide. Protein digestion in the rumen is done by rumen microbes which affect dry matter digestibility of feed. For optimum growth, rumen microbes require N-NH3 of 4-12 mM (average 8 mM) and VFA of 80-160 mM (average 120 mM) (Figure 1).

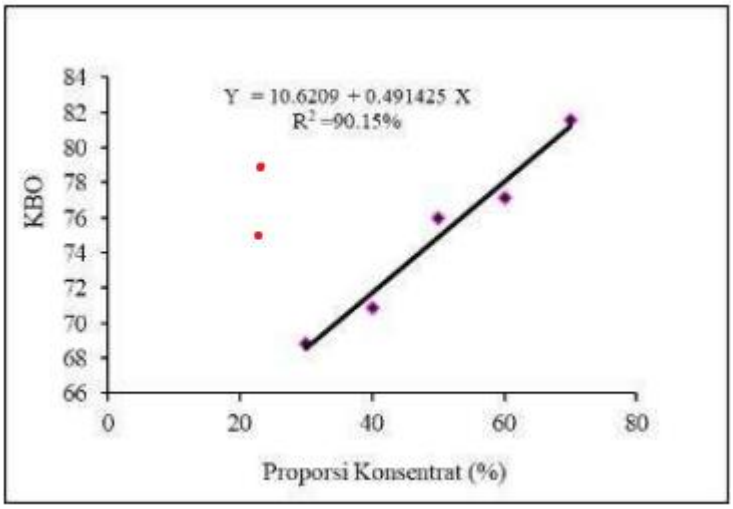

Figure **2.** Graph of Organic Matters Digestibility

Levels of N-NH_3

The results of the study showed that the average concentration of N-NH_3 of CFS was significantly different between treatments ($P<0.05$). These results are in agreement with that of Sutardi et al (1993) which reported that the optimum concentration of N-NH_3 needed to support microbial growth is 4-12 mM (average 8 mM). The high concentration of N-NH_3 is due to the sufficient crude protein and the soluble carbohydrate of CFS. This is in line with the total VFA fermentation product, and is due to the increased amount of CFS crude protein, so that the growth and activity of microbes to degrade CFS is increasing. As a result, the fermentation products, such as N-NH_3 is increasing. Types of feed, chemical composition and the non-structural carbohydrate fractions in the feed stuffs greatly affect the levels of N-NH_3. Besides its high crude protein content, CFS is also source of non-structural carbohydrates, so that it is easy to digest, resulting in increased levels of N-NH_3. These results are enough to support microbial synthesis process. Ammonia concentration of more than 30 mM in rumen fluid will result in increase in blood ammonia concentration and symptoms of poisoning can occur when blood ammonia level reaches 0.5 mg/100 ml (Hungate, 1966). In the case of poisoning, blood ammonia increases by 0.9 mg/100 ml within 60 minutes. The results of this study showed that ammonia levels are very good to support growth and synthesis process of microbial protein, and does not cause poisoning.

Based on the results of Slyter Satter (1974), this ammonia concentration is enough, because microbes need is met with ammonia level concentration 5 mg% or ± 4 mM. However, Preston and Leng (1987) showed that the digestibility continues to increase until

the ammonia concentration of 200 mg/L or ± 12 mM, and even the consumption is still increasing up to the ammonia levels of 250 mg/L or ± 15 mM.

It is highly likely that the optimum concentration of ruminal ammonia is 8 mM. Some researchers have reported, to get the most efficient use of ration for growth in dairy bulls at ammonia rumen of 8 mM, whereas for lactating cows, the highest efficiency of energy use for milk production occurs at rumen ammonia level of 9 mM (Widyawati et al., (1992) and the highest efficiency for the N use for sheep growth can be achieved in the rumen ammonia level of 7 mM (Muktiani, 1994) (Figure 3).

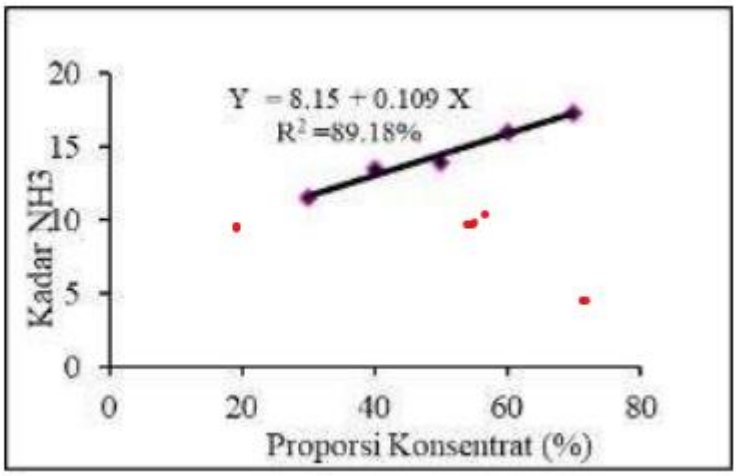

Figure 3. Graph of ammonia levels

Levels of VFA Total

The results showed that the average levels of total VFA of CFS are 82- 136.5 mM and it is significantly different between treatments (P<0.05). VFA levels increase with increasing percentage of concentrate in the in vitro CFS. These results are in agreement with that of Sutardi et al (1993) which states that the optimum concentration of VFA needed to support microbial growth is 80-160 rnM. The high concentration of total VFA level reflects high crude protein and soluble carbohydrate of CFS. This is because the amount of CFS crude protein is increasing, so that the growth and activity of microbes to degrade CFS are increasing. This results in the fermentation products, such as total VFA to increase. Types of feed stuffs, chemical composition, and the non-structural carbohydrate fraction in the feed stuffs greatly affect the levels of total VFA. Complete feed silage does not only have enough crude protein content, but also is as a source of nonstructural carbohydrates, so thus it is easy to digest, resulting in increased total VFA concentration (Figure 4).

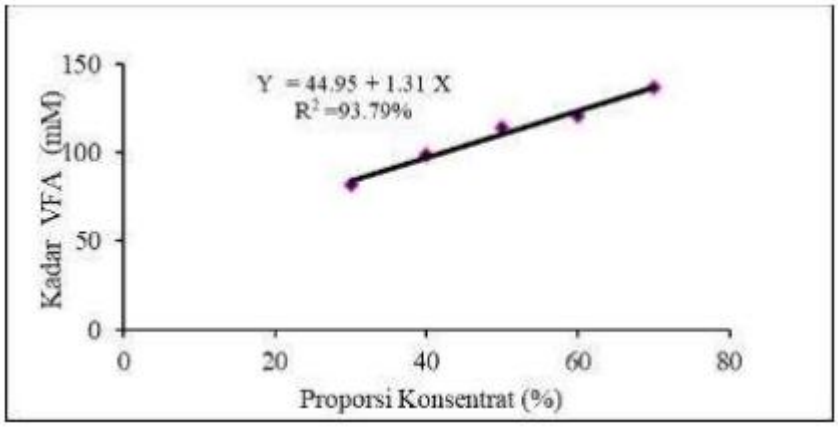

Figure 4. Graph of total VFA concentration

CONCLUSION

Composition of concentrates feed and forages in complete feed silage starting from 30% concentrate + 70% forage to 70% concentrate + 30% forage can result in average dry matters digestibility of 72.71%, average digestibility of organic matters of 74.88%, average ammonia level of 14.46 mM and average total VFA level of 110.5 mM.

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REFERENCES

Hungate, R.E. 1966. *The Rumen and Its Microbes.* Academic Press, New York.

Kung, **L.** 2007. The Role of Fiber in Ruminant ration Formulation. http://ag.udel.edu/anfs/faculty/kung/articles_of_fiber in ruminant ration.htm. Diakses tanggal 26 Nopember 2012.

Norlund, K. 2003. *Factors that Contribute to Subacute Ruminal Acidosis.* University of Wisconsin, School of Veterinary Medicine, 2015 Linden Drive, Madison, WI 53706.

Ranjhan, J.K. 1981. *Animal Nutrition in Tropic.* Second Edition. Vicas Publishing House PVT Ltd, New Delhi.

Snowdon, M. 1991. Livestock Nutrition. http://www.gnb.ca/0170/01700007-e.asp. Diakses tanggal 25 Januari 2011.

Suparwi dan S. Utami. 2010. Teknologi Complete Feed untuk Meningkatkan Produktivitas Ternak Kambing di Kelompok Peternak Mugi Rahayu, Tegal. *Laporan PKM.* Fakultas Petemakan Unsoed, Purwokerto.

Sutardi, T., Sutardi, A.S., Tjakradidjaja, S.H. Dilaga dan Jalaludin. 1993. Penggunaan Pod Coklat dan Leguminosa Pohon serta Suplementasi Analog Hidroksi Metionin dan Defaunasi pada Ruminansia. Dipresentasikan dalam Forum Komunikasi Hasil Penelitian Bidang Peternakan di Yogyakarta, 23-25 Nopember 1993.

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