PELLETED FIELD GRASS TO INCREASES THE JAVA THIN TAIL SHEEP PRODUCTIVITY

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Received October 25, 2011; Accepted November 28 , 2011

ABSTRAK

Penelitian ini dilakukan untuk mengkaji pengaruh pemberian rumput lapangan dalam bentuk pelet terhadap performans domba Jawa ekor kurus (JEK). Sebanyak 12 ekor domba JEK jantan dibagi dalam 3 kelompok, masing-masing terdiri atas 4 ekor sebagai ulangan. Terdapat 3 macam ransum sebagai perlakuan, yakni rumput lapangan (RL) segar (T0), RL dalam bentuk pelet (T1) dan kombinasi antara 85% RL segar dengan 15% dedak halus. Variabel yang diukur meliputi : konsumsi bahan kering (BK) pakan, kecernaan bahan kering (KcBK) dan kecernaan bahan organik (KcBO) secara *in vivo*, proporsi molar asam-asam lemak volatil ruminal dan pertambahan bobot badan harian (PBBH). Data yang terkumpul diolah dengan analisis varians (ANOVA), dalam rancangan acak lengkap (RAL). Hasil penelitian menunjukkan bahwa rataan konsumsi BK pakan oleh domba-domba yang mendapat RL dalam bentuk pelet lebih tinggi (P<0,05) daripada domba-domba yang mendapat RL segar (513 vs 393 g). Nisbah asam asetat: asam propionat ruminal pada domba-domba yang mendapat RL dalam bentuk pelet lebih rendah (P<0,05) daripada domba yang mendapat RL segar (2,53 vs 3,46). Rataan PBBH domba-domba yang mendapat RL dalam bentuk pelet tidak berbeda nyata dibandingkan dengan PBBH domba-domba yang mendapat pakan kombinasi 85% RL segar dan 15% dedak halus (masing-masing 69 dan 72 g), keduanya lebih tinggi (P<0,05) daripada PBBH domba-domba yang mendapat RL segar (52 g). Berdasarkan hasil penelitian tersebut dapat disimpulkan bahwa pemberian RL dalam bentuk pelet pada domba JEK jantan, menghasilkan konsumsi BK dan proporsi asam propionat ruminal lebih tinggi, dengan nisbah asam asetat : asam propionat lebih rendah daripada pemberian RL segar. Pemberian RL dalam bentuk pelet pada domba JEK jantan meningkatkan PBBH, hingga setara dengan PBBH yang dicapai dengan pemberian kombinasi 85% RL segar dan 15% dedak halus.

Kata kunci : Rumput lapangan, pelet, domba Jawa ekor kurus, performans

ABSTRACT

This investigation was conducted to study the influence of the pelleted field grass (FG) to performance of Java thin tail (JTT) sheep. Twelve heads of male JTT sheep were devided into 3 groups, consisted of 4 heads as replication, respectively. There were three kinds of ration as treatments, namely: fresh FG (T0), pelleted FG (T1), and combination between 85% FG and 15% rice bran (T2). The measured variables were: feed dry matter (DM) consumption, *in vivo* dry matter digestibility (IVoDMD) and *in vivo* organic mattter digestibility (IvoOMD), molar proportion of partial volatile fatty acids (VFAs), and daily body weight gain (DBWG). Data were analyzed by analysis of variance (ANOVA) in completely randomized design (CRD). Result of this investigation showed hat feed consumption by sheep received pelleted FG was higher (P< 0.05) than those received FG (513 vs 393 g). Ratio of acetic acid : propionic acid in sheep received pelleted FG was lower (P<0.05) than those in sheep received FG (2.53 vs 3.46). Feeding of the pelleted FG resulted in DBWG significantly differed from combination between FG and rice bran (69 and 72 g), and were higher (P<0.05) than feeding of FG (53 g). In conclusion, the feeding of pelleted FG resulted the higher DM consumption and ruminal propionic acid, the lower acetic acid : propionic acid ratio, than feeding of fresh FG. Feeding of pelleted FG to male JTT sheep increased the DBWG, equivalent to those by feeding of combination between 85% fresh FG an 15% rice bran.

Keywords: Field grass, pellet, Java thin tail sheep, performance

INTRODUCTION

Main feed for sheep in Indonesia was field grass (FG), with various quality depending on soil fertility where those FG growth (Merkel and Subandriyo, 1997). According to Lubis (1992), field grass (FG) in Indonesia included *Gramineae* and *Cyperaceae* groups, which was dominated by *Paspalum conjugatu*m, and *Anastrophus compressus* with crude protein (CP) content about 8-10%. Widiyanto (2008) reported that the daily body weight gain (DBWG) of sheep fed FG at Tembalang region only 54 g per day. Preliminary investigation showed that mineral supplementation to sheep received FG with 12.23% CP content at farm developing region, Mijen, Semarang, resulted in DBWG only about 83.15 g per head. Those may be caused by the low of total digestible nutrient (TDN) content in FG. Investigation which conducted by Ranjhan (1981) resulted in DBWG about 102 g/day, by use forage with 64% TDN content. On the other hand, TDN content of FG which used by Widiyanto *et al*. (1999), and Widiyanto (2008) only about 53 – 57%. Tillman (1978) also stated, that TDN content in Indonesian FG was generaly low, namely about 51% only.

The low of TDN content occurs along with the high of neutral detergent fiber (NDF) and silica content (Van Soest, 1994). According to Wilsie (1982), the high of sun light intensity in the tropic caused the stem of plant became thicker, *xylem* more developed, shet of leaf smaller and thicker, *cuticula* and cell wall were thicker. Those caused the forages in the tropic were low in its digestibility and turn the low in TDN content.

The low of digestibility resulted in slow of escape the digesta from the rumen, in the other word retention time of digesta in the rumen was longer. The long of retention time caused the low of DM consumption because the long time of rumen distention was take placed,so that depressed the apetite (Van Soest, 1994). Combination between the low digestibility or TDN content and the low of TDN content resulted in the low of TDN intake in those animal (Preston and Leng, 1987). Impact of decreasing TDN intake became more serious along with the low of energy efficiency, because the high of heat increment (HI) and methane (CH4) production (Baldwin and Allison, 1983; Puchala *et al*. 2005; Mirzaei, 2008). Feed with high fiber content and/or low IVoDMD resulted in high of HI for digestion and rumination. The high fiber proportion resulted in the increasing of methan production, in the other word the high of energy loss (Banerjee, 1978; Waghorn, *et al*, 2002; Yurtseven *et al*., 2009. For example (Johnson *et al*., 2002), extrapolated the methane production to milk production (FCM) and showed that energy per kg CH_4 equivalent to 81.8 kg of milk.

Pelleting the roughage was alternative technology to solve the decreasing of DM consumption, TDN content and energy inefficiency problem to increase of ruminant productivity. Grinding process before pelleting, changed the physical form of roughage to small particles. Fisher (2002); Heinrichs *et al*. (2002) reported that grinding of low quality roughage increased the feed intake significantly. The increasing of feed intake could occur because change of roughage form to small particle increased the digesta rate of passage in the rumen (Zebeli *et al*., 2007). According to Van Soest (1994), the increasing of DM consumption as result of grinding process before pelleting, was caused by increasing of feed density because decreasing of particle measurement and breaking of cell wall structure. There was interrelationship between turn over time of digesta particle in the rumen and fermentation product. According to Preston and Leng (1987), if turn over rate increased, the digestibility slightly decreased because decreasing of retention time, but amount of fermentation product increased. Those take placed because of increasing of DM consumption along with increasing of digesta rate of passage. Jouany (1991) stated that increasing of fermentation product could occur because fermentation during early period after ingestion was higher than in following periode. Fermentation which occur in those period was rapid to readily degraded digesta component, so that in the following period was slowly and unfermented digesta component were rested. According to Singh and Schiere (1993), rate of passage rapidly allowed major part of the dificult and slowly fermented matter escaped from rumen rapidly, and those space would be rapidly filled by a new consumed feed. Those fenomenon drove the animal consumed more feed and thus more probability to obtain the benefit of early fermentation period (expecially nitrogen free extract fermentation), so that the amount of fermentation product which obtained also increased.

The increasing of nitrogen free extract (NFE) proportion from fermented feed DM, resulted in ruminal fermentation pattern toward increasing of molar proportion of propionic acid and/or decreasing of acetic acid (A) : propionic acid (P) ratio (Jouany, 1991; Chrustophersen *et al*., 2008). Decreasing of A/P ratio increased the ruminal energy metabolism efficiency. Those could occur because calory value of propionic acid was higher than acetic acid calory value. In addition, decreasing of A/P ratio also followed by decreasing of CH_4 production, in other word decreasing of the energy loss (Fellner, 2002; Newbold *et al*., 2005; McAllister *et al*., 2008). The energy metabolism efficiency in feeding of pelleted feed also occured because of decreasing of energy for digestion and rumination, so that heat increment (HI) decreased and net energy increased (Yang *et al*., 2006; Zebeli *et al*., 2007). Jouany (1991) reported that ruminating sheep increased heat production 1 kcal per minute per kg body weight, whereas cattle with 400 kg body weight fed hay and ruminating 8 hours per day, produced about 8 Mcal HI. The other benefit from pelleting process were protein denaturation and starch gelatinization occured, so that improved the efficiency of those nutrient utilization.

There were several previous investigation result which showed the increasing of roughage utilization through grinding and pelleting process. Musofie (1984) reported the increasing of IVoDMD from 38.84% (fresh sugar cane top) to 65.62% (pelleted sugar cane top). Widiyanto *et al.* (2007) in investigation with PO beef cattle, showed that digestibility of acid detergent fiber (ADF) and NDF of sugar cane top processed by *Amofer* technology in pellet form were significantly higher than those without pelleting process (63 vs 66.89% and 61 vs 65.19%, respectively).

The objectives of this investigation were to study the influence of grinding and pelleting of field grass on feed DM consumption, IVoDMD, IVoOMD, ruminal fermentation pattern and energy metabolism. The influence of those on Java thin tail sheep performance was studied throughout this investigation.

MATERIALS AND METHODS

Materials

This investigation was conducted at Nutrition Biochemistry Laboratory and Animal Nutrition Laboratory of Animal Agriculture Faculty, Diponegoro University, Semarang. The aim of this investigation was to study the influence of feeding the pelleted roughage (FG) to performance of male Java thin tail sheep. Experimental materials were 12 heads of male Java thin tail (JTT) local sheep (about 12 months age), FG, and rice bran.

Methods

The 12 heads of sheep were devided into 3

Table 1. Nutrient Composition of Experimental Feed (DM basis)

Feed	CP	CF	Ethet extract	Ash	NFE	TDN
	....(%)			....		
Field grass	10.35	29.61	1.53	15.54	42.97	38.01
Rice bran	14.14	14.67	16.93	10.09	44.17	59.30

Table 2. Dry Matter Consumption, IVoDMD and IVoOMD of Experimental Feed

Treatments	DM Consumption (g)	IvoDMD (%)	IvoOMD (%)
T0	393[a]	58.66[b]	63.16[b]
T1	513[c]	50.37[a]	54.32[a]
T2	441 [b]	63.17[c]	67.58[c]

a, b, c : the different superscript in the same row, indicates significantly difference (P<0.05)
T0 : fresh field grass (fresh FG)
T1 : pelleted FG
T2 : 85% fresh FG + 15% rice bran

groups, consisted of 4 heads as replication. There were 3 kinds of treatment, namely feeding FG (T0), pelleted FG (T1), and combination between 85% FG and 15% rice bran (T2). This investigation was lasted for 3 months, with 10 days introduction and 80 days feeding trial period, included 14 days *in vivo* digestibility test. The antihelminth was applied in introduction period to controlled internal parasite. Vitamin-mineral mixture was fed free choice during this investigation. Roughage and water were fed *ad libitum*. Weighing of body weight was conducted each week to know body weight gain and estimated the quantity of ration which had to be fed. The measured variables were IVoDMD, IVoOMD by total collection method, molar proportion of partial VFAs by gas chromatography. Body weight gain was determined by calculated the empty body weight in final experiment minus those in the early experiment. The empty body weight was obtained by weighing sheep after fasting for 12 hours.

Data analysis

The collected data were analyzed statisticaly by analysis of variance (ANOVA) in completely randomized design (CRD), according to Stell and Torrie (1980).

The proximate analysis was conducted to determine the nutrient composition of experimental feed, those result were showed in Tabel 1.

RESULTS AND DISCUSSION

Dry Matter Consumption

Feed DM consumption in sheep fed T0, T1 and T2, were : 393; 513,and 441 g, respectively (Table 2). The physical form and ration composition influenced DM consumption rate ($P<0.05$). Consumption of T1 was higher ($P<0.05$) than those of T0. Grinding of feed became smaller particles and pelleting increased the density of feed. Increasing of feed density decreased rumen distension, so that feed consumption increased (Van Soest, 1994; Fisher *et al*., 2002). Feed grinding became smaller particles increased digesta rate of passage in digestive tract, so that accelerated escape of digestive tract content, and turn drove the animal to increase feed consumption (Fisher *et al*., 2002; Allen *et al*., 2005).

The use of rice bran in T2 ration increased the ration quality that reflected in CP and TDN content, also in IVoDMD and IVoOMD. The increasing of CP and TDN content increased metabolic rate and then drove feed consumption (Van Soest, 1994). Increasing of feed comsumption due to enhancing of concentrate proportion in the ration also reported by Tolkamp (2002), which showed that the lactating cows received high concentrate ration (50%) consumed the DM higher than those received low concentrate ration (25%), namely 23.6 vs 17.8 kg/head/day, respectively. The differences of feed comsumption were caused by the different of nutrient suplay especially energy, protein and fibre (Forbes 2003). Increasing of digestibility will decrease the retention time of digesta in digestive tract, so that feed consumption increased. Those fenomenon resulted in DM consumption in T2 group that was higher than those in T0. Field grass proportion which was still high in T2 caused DM consumption rate in those treatment group could not competite the influence of bulkyness and increasing of digesta rate of passage in T1, so that DM consumption in T2 was lower than T1 ($P<0.05$).

Dry Matter and Organic Matter Digestibility

Dry matter and organic matter digestibility (IVoDMD and IVoOMD) in sheep receiving T0, T1 and T2 were : 58.06; 50.7,and 63.17%, respectively (Table 2.). Dry matter digestibility of pelleted FG was lower ($P<0.05$) than that of fresh FG. Decreasing of those digestibility was due to forage grinding to small particles, so that digesta rate of passage in the digestive tract increased. The increasing of digesta rate of passage decreased the retention time of digesta in the digestive tract, so that its digestibility decreased (Van Soest, 1994). Those fenomenon also reported by Yuangklang *et al*. (2005) in beef cattle which showed that IVoDMD of chopped sugar cane top was 68.80% whereas pelleted sugar cane top was 63.37%.

T2 resulted in highest IVoDMD than the other treatments. Rice bran had lower CF content and higher NFE content than FG (Table 1), so that its combination with FG resulted ration with lower CF content and higher NFE content. Crude fiber was slowly fermented DM component, whereas NFE was readily available carbohydrate (Jouany, 1991). The increasing of IVoDMD also found in sheep fed with Atriplex numularia combined with 15% of concentrate (barley). The increasing of barley up to 30-45% did not show further enhanching of that (Baan *et al*., 2004).

The higher CP content in rice bran than those

Table 3. Molar Proportion of Partial VFAs, A/P ratio and Daily Body Weight Gain (DBWG)

Treatment	Acetic Acid (%)	Propionic Acid (%)	Butyric Acid (%)	A/P	DBWG (g)
T0	71.32[c]	20.61[d]	8.07	3.46[c]	53[a]
T1	65.80[b]	25.92[b]	8.28	2.53[b]	69[b]
T2	62.41[a]	29.03[c]	8.56	2,15[a]	72[b]

Explanation :
a,b,c : the different superscript in the same row, showed the signicficantly difference (P<.05).

in FG (14.4 vs 10.35%) also caused CP intake of T2 ration was higher than those in T0 and T1. It was supposed account for the higher IVoDMD and IVoOMD of T2 ration than T0 and T1 (Table 2). Protein was one of main nutrient for rumen microbes proliferation. The increasing of ration CP level, thus will increase ruminal fermentation capability, so that the ration digestibility also increased (Hungate, 1966; Banerjee, 1978; Hanafi *et al*., 2012). Gendley *et al.* (2002) also showed the increasing of sugarcane-top utility which supplemented with wheat bran in beef cattle.

Molar Proportion of Partial Volatile Fatty Acids

Ruminal acetic acid proportion in T0, T1 and T2 were 71.32, 65.80, and 62.41%, respectively (Table 3.). The low of ruminal acetic acid proportion in T2 treatment group occured among others due to the decreasing of CF content and increasing of NFE content as result of combination between FG and rice bran. Decreasing of IVoDMD and IVoOMD (Table 2) in T1, due to increasing of feed particle rate of passage, expecially occur on slowly fermented DM component, namely CF (Banerjee, 1978). In *in situ* experiment on Iranian sheeps by Alamouti *et al.* (2009) also showed that the degradability variables of ration was more depending on roughages/forages portion rather than RAC.Those caused molar proportion of acetic acid in T1 was lower than T2 (P<0.05). Decreasing of CF content and increasing of NFE content in consumed T2 ration, along with rice bran feeding, supposed caused the lower (P<0.05) molar proportion of acetic acid in T0 and T1 treatment groups (Flachowsky *et al.*, 2006). Chen *et al.* (2012) reported that the increasing of concentrate level from 20 to 50% in the ration decreased the molar proportion ruminal acetic acid from 68.45 to 66.22%. This condition supported the argumentation about the decreasing of acetic acid molar proportion which caused by the increasing of NFE level in the ration. The same phenomenon also reported by Cummins *et al.* (2009) in beef steer. The result showed that the feeding forage ensilage produced the ruminal acetic acid 32 g/kg volatile corrected-DM. Whereas its combination with concentrate in level of 25% produced those of 15 g/kg volatile corrected-DM

Table 3 showed the increasing (P<0.05) of ruminal propionic acid molar proportion due to pelleting (25.92% in T1 vs 20.61% in T0). Decreasing of digestibility in relation to pelleting occur on slowly fermented DM, namely CF, whereas NFE was not influenced by pelleting process (Krause *et al.*, 2003). Increasing of DM consumption resulted in increasing of digestible NFE proportion to digestible CF, so that ruminal propionic acid proportion also increased. The digestible NFE proportion in T2 much higher than T1 and T0 because the use of rice bran, therefore molar proportion of propionic acid in T2 higher than T1 and T0. The higher of propionic acid molar proportion in T2 than T0 and T1 also assumed due to the decreasing of fibre degradability because of the combination between forage and concentrate. Rustomo *et al.* (2005) stated that concentrate, in this case, RAC decreased the ruminal pH and cellulolytic activities and turn to decrease the fiber degradability. The rule of concentrate and increasing of ruminal propionic acid also reported by Serment *et al.*(2011) which showed that the increasing of concentrate level from 35 up to 70% in the ration increased the ruminal propionic acid from 18.0 to 24.1 mol/100 mol during 10 weeks of investigation.

Butyric acid molar proportion in T0, T1 and T2 treatment groups were 8.07, 8.28 and 8.56%, respectively (Table 3.). Butyric acid molar proportion in T0, T1 and T2 treatment groups were 8.07, 8.28 and 8.56%, respectively (Table 3). Butyric acid molar proportion which tends increased due to pelleting as well as combination with rice bran, reflected the increasing of reoxidation the reduced cofactor to support microbial fermentation capability (Yokoyama and

Johnson, 1988).

Ratio of acetic acid : propionic acid reflected the relative nutritif value which generaly increased if CF level increased opposite to NFE (Yokoyama and Johnson, 1988). Ratio of acetic acid: propionic acid in T1 was lower ($P<0.05$) than those of T0, namely 2.53 vs 3.46 (Table 3), because decreasing of digestible CF proportion and increasing of digestible NFE proportion as result of pelleting. Increasing of digestible NFE proportion also occured because of starch gelatinization along with heating in pelleting process (Hatfield and Wilson, 1973). Increasing of digestible NFE proportion was so much high, because combination with rice bran, which reflected on the lowest ratio of acetic acid: propionic acid in T2, namely 2.15.

Daily Body Weight Gain

Daily body weight gain of experimental sheeps in T0, T1, and T2 treatment groups were : 53; 69 and 72 g (Table 3.). The increasing of daily body weight gain ($P<0.05$) occured along with decreasing of acetic acid : propionic acid ratio.

Pelleting increased the digesta rate of passage, decreased rumination, increased fermentation product per time unit and increased the ruminal pH. All of those factors decreased hydrogen availability for methanogenesis. The decreasing of methanogenesis in other word was decreasing of carbon and hydrogen which loss through methanogenesis and then were used for propionic acid synthesis (Yokoyama and Johnson,1988). Those fenomenon drove the increasing of metabolizable energy (ME) from consumed feed which in turn increased daily body weight gain. Furthermore, the increasing of propionic acid production which reflected in decreasing of acetic acid : propionic acid ratio in T2 resulted in higher daily body weight gain compared to the other treatment groups. Those fenomenon differed from the result of investigation by Babiker *et al*. (2009) which reported that feeding pelleted bagase did not result the significant body weight gain compared to unpelleted bagase (1.26 vs 1.23 kg) with not significantly different in DM consumption (4.72 vs 3.69 kg/head/day). Those occurred because in that investigation the roughage proportion only 15% of the ration, whereas in this research the forage (FG) was dominant portion in the ration namely 85%.

CONCLUSION

Feeding field grass in pellet form for male Java Thin Thin sheep resulted in higher DM consumption than fresh field grass. Those also increased the ruminal propionic acid molar proportion and decreased ruminal ratio of acetic acid : propionic acid.Feeding pelleted field grass increased daily body weight Conclusion should be writtgain, so that equivalent to feeding combination between 85% field grass and 15% rice bran.

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