Nutrient Intake and Digestibility of Kacang Goat Received Rations Containing Solid Waste of Herbal Industry

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ABSTRACT

This study was aimed to determined the effect of substitution of king grass with solid waste of herbal industry (SWHI) in the rations on nutrient intake, digestibility and average daily gain (ADG) of kacang goat. The diet was basal ration for Kacang goat with forage to concentrate ratio (F:C)= 50:50. The experiment was designed in completely randomized design with 3 treatments: R0 = 50% king grass: 0% SWHI (control treatment), R20 = 30% king grass: 20% SWHI, and R30 = 20% king grass: 30% SWHI. The *in vivo* experiment showed that no differences of dry matter intake among treatments (P<0,05) but organic matter intake of kacang goat increased significantly (P <0.05) in line with the increasing of SWHI concentration. The ration containing SWHI decrease the digestibility of dry matter (DM), organic matter (OM) and crude protein (CP) (P <0,05) but no differences found in ADG between control. It was concluded that SWHI could be used as king grass substitution up to 30% in ration without decreasing nutrient intake and weight gain of kacang goat, although the level of ration digestibility was lower with the increasing of SWHI concentration.

Keywords: Solid waste of herbal industry, Nutrient intake, Digestibility.

INTRODUCTION

In addition to genetic and maintenance management factors, of course, feeding factors also play an important role to improve livestock performance. It takes a feed ingredient that has a balanced nutritional content and available throughout the season, but to obtain good quality feed ingredients requires a high cost. This is due to the limited availability of feed ingredients especially in the dry season so that feed prices fluctuate. One of the potential sources of feed ingredients from industrial wastes that can be developed is solid waste of herbal industry (SWHI) produced by herbal medicine industry. There are currently 1,247 herbal medicine industries spread in various regions in Indonesia, especially in Java (Anonymous, 2014). Instant herbal medicine industry produces waste in large enough quantities, for example PT. Sido Muncul produces SWHI as much as 17 tons per day (Amir and Lestari, 2013). The waste will pollute the environment if not treated properly.

Solid waste of herbal industry was derived from the rest of the extraction of herbal plants still contains high enough nutrients such as carbohydrates, protein, fiber and fat that can be used as animal feed. Solid waste of herbal industry also contains various plant secondary metabolites such as phenol, tannin, saponin, flavonoids, alkaloids and essential oils (Kisworo *et al*., 2016). The plant secondary metabolites content of SWHI makes the SWHI also has potentcy as a livestock feed supplement, since in general this plant bioactive can affect the fermentation and digestibility of feed ingredients in the rumen, increase immunity,

improve the performance and carcass quality (Durmic and Blache 2012, Geracia *et al*., 2012; Nanekarani *et al*., 2012). Currently only view *in vivo* research using solid waste herbs that contain a variety of plant secondary metabolites as livestock feed ingredients. To know its potency as animal feed ingredients to substitute grass forage, it is necessary to know the effect of SWHI in livestock ration on nutrient intake, digestibility and livestock performance. This study uses kacang goat as experimental animal because it is a native Indonesian livestock known to have a good adaptability to local environtment and prolific (Syawal, 2010).

MATERIALS AND METHODS

Sample of Solid waste of herbal industry was obtained from PT. Deltomed Laboratories, Wonogiri. King grass was obtained from a grass cultivator in Imogiri sub-district. Animal experiments consisted of 15 female goat breeds ages 1 to 1.5 years old with an average body weight of 14 kg / head. The goat was obtained from a farmer in Gunungkidul District, Yogyakarta.

The equipment used was a 40 kg weight hanging scales, digital scales of 3 kg capacity, analytical scales, willey mill, plastic mats, plastic bags, newspaper mixer bags, ovens, freezers, refrigerators, pH meters and proximate analysis tools.

Treatment rations were prepared with the same energy level based on the standard requirements of small breed goats for the tropics with 80 g/day of average daily gain (ADG) (Ranjhan, 1981). The diet was basal ration for Kacang goat with forage to concentrate ratio (F:C)= 50:50. Experiment was designed in completely randomized design with 3 treatments: R0 = 50% king grass: 0% SWHI (control treatment), R20 = 30% king grass: 20% SWHI, and R30 = 20% king grass: 30% SWHI. The composition of treatment rations (in grams DM) was presented in Table 1.

Table 1. Ingredient, nutrient composition and plant secondary metabolites content of feeding ration for experimental kacang goats with initial body weight of 15 kg.

Variable	Ration		
	R0	R20	R30
Ingredient (%)			
King grass	50.00	30.00	20.00
Solid waste of herbal industry	0.00	20.00	30.00
Soy bean meal	15.37	15.74	15.93
Pollard	16.11	16.11	16.30
Molasses	4.63	4.26	4.26
Cassava flour	13.89	13.89	13.52
Nutrien Composition			
OM	90.40%	91.77%	93.12%
CP	16.79%	16.52%	16.41%
CF	20.52%	18.41%	17.37%
TDN	66.65%	69.17%	70.39%
Lignin	2.70%	5.12%	6.33%
Ca	0.45%	0.50%	0.52%
P	0.53%	0.60%	0.63%
Plant secondary metabolites (%)*			
Total Fenol	0.00	2.30	3.45
Flavonoid	0.00	0.37	0.56
Tanin	0.00	0.94	1.41
Saponin	0.00	0.66	0.98
Alakaloid	0.00	0.69	1.03
Essential oils	0.00	0.04	0.06

Note: * = % Of plant secondary metabolites in the total rations given (g secondary metabolite / 540 g DM ration x 100%)

Adaptation period was carried out for 15 days in stage cage followed by 60 days treatment period. During the treatment period, feed intake, feces and urine were measured and sampled on days 31 to 44 (14 days). The content of dry matter (DM), organic matter (OM) and crude protein (CP) from rations and feces sample were then analyzed. Urine sample at each treatment was collected in a bucket that had been given 10% H_2SO_4, cooled to then analyzed the N content.

The variables measured were weight gain, feed intake, dry matter intake, crude protein intake, feed efficiency, dry matter digestibility (DMD), organic matter digestibility (OMD) and crude protein digestibility (CPD). The digestibility analysis was conducted according to Harris (1970).

Fed intake, weight gain, feed efficiency, and feed digestibility were analysis statistically using analysis of variance (ANOVA) with complete randomized design of direct pattern using SPSS 16 software. If there were differences between treatments followed by Duncan Multiple Range Test (DMRT) (Steel and Torrie, 1991).

RESULTS AND DISCUSSION

Tabel 2. Feed Intake, daily weight gain and feed efficiency in goat beans under various treatments

Parameter	Treatments		
	R0	R20	R30
Feed intake (g)	1,926.2±361.58[a]	1,423.9±165.61[b]	1,276.1±156.51[b]
Dry matter intake (g)	520.0±46.91[a]	521.8±31.66[ab]	552.8±66.83[b]
Organic matter intake (g)	440.9±63.26[a]	457.8±47.05[ab]	506,4±60.99[b]
Crude protein intake (g)[ns]	93.9±12.80	93.9±9.66	100.6±12.66
ADG (g)[ns]	81.9±17.97	78.3±14.19	77.2±12.29
DM Efficiency (%)[ns]	16,2±1,50	15,2±2,78	13,8±1,30
OM Efficiency (%)[ns]	17,75±2,06	16,8±3,03	15,0±1,41
CP Efficiency (%)[ns]	84,5±9,68	82,2±14,36	75,6±7,23

Note: R0 (control ration, 50% concentrate : 50% king grass); R20 (50% concentrate : 30% king gras : 20% SWHI), R30 (50% concentrate : 20% king gras : 30% SWHI); [ab]Means in the same row with different superscripts differ significantly ($P<0.05$).[ns] non significant.

Feed intake of kacang goat showed a significant difference ($P <0.05$) between treatments. The consumption of control rations (0% SWHI) was highest compared to treatment rations. The higher the SWHI content, the smaller the ration volume. Control rations are composed of fresh king grass without SWHI substitution. King grass in this research contains high moisture content (83.8%), while the sun dry SWHI was only 10.5%, so the substitution of the king grass with SWHI will significantly reduce the volume and mass ration, which further affects the weight of the ration Consumed.

DM and OM intake of kacang goat increased significantly ($P<0.05$) in line with the increasing of SWHI concentration (Table 2). This was thought to be caused by the lower SWHI water content than the king's grass, so in the same volume, the amount of dry matter ration containing SWHI was higher than ration containing king grass. According to Arora (1995) bulky nature (filling ability) of forage also affect the level of consumption. Furthermore Putra (1992) states that, high bulky forage (its ability to fill the stomach) causes the cattle will eat less, because the stomach quickly feels full. Smaller SWHI particle size (1-5 mm) was also thought to cause faster feed flow rate in the rumen than the king's grass. It makes the rate of rumen emptying increases and ration intake increases. According to Orskov

(2001) livestock ruminants will reduce feed intake if feed retention time increases so as to reduce the rumen capacity to accommodate feed. The subsequent increase in DM intake also led to an increase in OM intake. The consumption of CP was statistically not significantly different (P> 0.05), although there was a tendency of increasing CP intake by the increasing of SWHI percentage.

Feed efficiency of DM, OM and CP were not significantly different between treatments (P> 0,05). The feed efficiency was related to the dry matter intake of feed and the increasing of live weight produced by livestock, because the efficiency of feed is the ratio between the increase of live weight and the amount of feed consumed. Especially in ruminants including goats, the efficiency of feed use is influenced by the quality and biological value of feed, the increase in the weight of life and the value of the digestibility of the feed (Simanihuruk et al., 2008). Although there was a tendency of feed efficiency to decrease with the increasing of SWHI concentration in the ration, the average daily gain (ADG) of kacang goat between treatments was not significantly different (P> 0.05), this indicates the nutritional need for growth has been met from the three experimental rations, so it can be said that up to 30% SWHI in the ration does not negatively affect the digestibility and growth of kacang goat in this research.

The observations on the physical condition of kacang goat during the experiment showed symptoms of fur fall in early to mid-trial, but this did not reduce the appetite of the goat. Most fur loss in R30 treatment, but then regrowth at the end of the study (2nd month), and the fur looked shiny. This causes of fur loss and regrowth was unknown, but the results of this study are similar to the study of Min *et al* (1998) which use low concentrations of condensed tannin (CT) in Lotus corniculatus (20-40g / kg DM) could increased wool growth (15%) in grazing sheep.

The digestibility experiment for 14 days resulted in significantly different digestibility of DM, OM and CP (P <0,05). The DM digestibility of R0 was significantly higher than R20 and tends to be higher than R30, while the OM and CP digestibility of R0 were significantly higher than R20 and R30. This shows that although the OM and CP of SWHI are higher than the king grass but it's more difficult to digest in the rumen and post rumen, so even though the intake of OM and CP from rations contain SWHI equal to or higher than the control rations (without SWHI) but the nutrition which can be utilized were lower.

Tabel 3. The digestibility of kacang goat obtained SWHI in its rations

Parameter	Treatments		
	R0	R20	R30
DMD (%)	69,3±1,53[a]	61,4±6,31[b]	63,5±4,92[ab]
OMD (%)	78,6±4,92[a]	72,5±1,60[b]	72,5±2,95[b]
CPD (%)	82,6±1,66[a]	76,5±1,85[b]	76,1±3,57[b]

Note: R0 (control ration/50% concentrate : 50% king grass); R20 (50% concentrate : 30% king gras : 20% SWHI), R30 (50% concentrate : 20% king gras : 30% SWHI); [ab]Means in the same row with different superscripts differ significantly (P<0.05).

This was presumably due to the content of tannins and lignins in SWHI which was able to bind to feed proteins and carbohydrates, make it difficult to digest, so the higher the content SWHI in the ration, the digestibility of feedstuffs is lower. The chemical composition of the ration in table 2 shows that the higher the concentration of SWHI in the ration, the higher lignin and plant secondary metabolites, although crude fiber content of the ration was lower. According to (Tangendjaja *et al*., 1992) tannins can not be digested and have antinutrition effects. In the digestive tract, tannins will form strong bonds with the protein and

its derivatives (enzyme), carbohydrates, vitamins, and minerals that can not be absorbed and then excreted with feces, further according to Makkar (2003) condensed tannin can not be degraded by the rumen microbial and will bind to Fiber and protein fractions in the gastro intestinal tract. Condensed tannins are not absorbed into the bloodstream, resulting in normal physiological conditions that will not damage organs such as liver and spleen.

Presumably saponin content in SWHI also causes a decrease in rumen protozoa as had been demonstrated in *in vitro* studies. Protozoa are known to play a role in the digestion of crude fiber. The decline in protozoan population leads to a decrease in the ability to digest crude fiber so that the digestibility of feed ingredients is also lower. According to William and Coleman (1992), protozoa contribute to degrade 1/4 to 1/3 feed fibers in the rumen. Consistent defaunation treatment leads to decreased fiber degradation, in addition protozoa have a synergetic relationship with fibrocytic bacteria in degrading fibers, thus providing greater benefits in the fibrolysis process. Another allegation that causes the lower level of digestibility of rations containing SWHI than rations without SWHI (R0) was the smaller size of SWHI particles than the king grass. This was thought to cause the faster flow of rations in the digestive tract, so that the of stay duration in the digestive tract is shorter and cause the digestibility of the ration to decrease.

CONCLUSIONS

Kacang goat were able to consume more SWHI-containing rations than control rations, and resulted in equivalent feed efficiency and weight gain to control rations, although the ration digestibility was lower as SWHI concentration increases.

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