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Restriction Feed and Refeeding Evaluation for Consumption, Feed Cost, Income Over Feed Cost, Percentage of Carcass and Meat Quality of Kacang Goat

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ABSTRACT: This study aims to determine the effect of restriction feed and refeeding for consumption, feed cost, income over feed cost, percentage of carcass and meat quality of Kacang goat. A total of nine male Kacang goats average age of 12 months with an average weight of 14.96 kg fed consisting of hay forage peanut (rendeng) and concentrate. Goats were divided into three treatment groups. Three goats control (P0) fed based on the needs of dry matter (DM) 3.5% of body weight, three goats feed restriction treatment 50% (P1) and three goats feed restriction treatment 60% (P2) of the requirement by BK for 30 day. The variables measured were intake of dry matter (DM), intake of organic matter (BO), feed cost, the percentage of carcass and meat quality. Data were analyzed by the method of completely randomized design (CRD) pattern unidirectional followed by least significant different (LSD). The result showed that restriction feed and refeeding significant effect on intake of dry matter (DM), intake of organic matter (BO), but did not affect feed cost, percentage of carcass and meat quality. It is concluded that with the effect of restriction feed and refeeding for consumption can produce a similar growth of male Kacang goats.

Keywords: feed restriction, refeeding, Kacang goat, feed cost, percentage of carcass

INTRODUCTION

Forage production usually depends on the season. Fluctuations on tropical countries, where the rainy season forage availability of abundant, but whereas during the dry season there is a shortage of forage. Constraint availability of feed, particularly forages can be a factor in the development problems of ruminants such as goats. Suwignyo, *et al*., (2012) stated forage fodder is one requirement that is integral in the development of livestock, especially ruminants. Utomo (2003) states forage supply constraints continuously throughout the season is a constraint in the development of animal husbandry. Consequently, many cattle are experiencing indigestion. The ability of an animal to consume feed depends on the type of forage, ambient temperature, body size livestock and animal physiology. Feed restriction management, based on research Aboelmaaty, *et al*. (2008) that the feed is not provided ad libitum, but restricted in accordance with the needs of feed restriction, followed by providing refeeding, causing a compensatory effect following growth or growth as a result of feed restriction.

MATERIALS AND METHODS

Materials

The materials used in the study was 9 Kacang goats with an average age of 12 months, with initial weight average of 14.96 kg. Cage-shaped stage experiments with individual plots measuring 1.5 m x 0.75 m are equipped with a feed and water place, with the cage floor height of 60 cm from the ground. Forage (60%) in the form of peanut hay (*rendeng*) and concentrates in the form of pellets (40%) *Gemuk* A. Drinking water provided *ad libitum*. The composition of forage and concentrates are presented in Table 1.

Table 1. The chemical composition of feed research

Feed material	Composition (%)				
	DM	Dust	Fat	CP	CF
Peanut hay (rendeng)	53.14	12.72	3.96	16.08	26.18
Concentrates	95.74	8.50	6.73	20.58	9.31

The tools used are scales sit EK3651 brand Camry models with a capacity of 5 kg sensitivity 1 g to weigh the feed given and the rest (forage and concentrates). Scales cattle brands Camry models EB9872 capacity of 150 kg with a sensitivity of 100 g to weigh goats. Willey mill with a hole diameter of 1 mm sieve to grind feed and feces samples. Digital analytical balance brands Denver instrument XL 410 with a capacity of 500 g and 0.001 g sensitivity that is used to weigh the feed and feces samples for analysis. A set of tools and a set of tools proximate analysis of physical and chemical testing of meat.

Pre-research

Pre-resarch was conducted during one month for the purpose of adaptation livestock. Nine goats were randomized to 3 treatment groups, 3 goats as a control (P0), 3 goat as a treatment 50% of feed restriction (P1) and 3 goats as a treatment 60% of feed restriction (P2). Goats weighed weight initially, placed in cages appropriate treatment plots. Feed with forage and concentrate with ratio of 40:60 is given twice a day, morning and afternoon at 07.00 a.m at 04.00. p.m.

Research stage

The research was carried out in two stages. Phase feed restriction for 30 days. Livestock are given 50% and 60% of the total daily requirement DM. The second stage of refeeding for 30 days where the feed was given ad libitum. The transition phase from stage to stage adaptations made gradual restriction, which is done gradually decrease in feed for one week. The same is done when changing from stage to stage refeeding restriction.

Variables Observed

Variables observed during the study were feed consumption, body weight, carcass weight, carcass percentage, water holding capacity, cooking losses, tenderness and texture of meat.

Data Analyzis

This study uses data analysis in the form of completely randomized design (CRD) unidirectional pattern (Hanafia, 2010).

RESULT AND DISCUSSION

Nutrient Consumption

Consumption of nutrients in goat on stage feed restriction and re feeding shown in Table 2, is calculated based on the reduction of nutrients in the feed and food remains. Feed given as much as 3.5% of the body weight of goats. At this stage of feed restriction, there is no residual feed in the feed place. This also occurs at the stage of refeeding.

Table 2. Consumption of nutrients Kacang goat (g/kg/day)

Variabel	Goats		
	Control (P0)	Restriction 50% (P1)	Restriction 60% (P2)
Restriction stage			
DM Consumption	35.49 ± 1.63[b]	16.67 ± 0.64[a]	17.06 ± 6.01[a]
OM Consumption	32.05 ± 1.47[b]	15.05 ± 0.58[a]	15.59 ± 5.58[a]
Refeeding stage			
DM Consumption	36.65 ± 1.81[a]	37.93 ± 0.78[ab]	54.40 ± 14.33[b]
OM Consumption	33.09 ± 1.64[a]	34.25 ± 0.71[ab]	49.75 ± 13.49[b]

.) Values shown as mean ± standard deviation

[a, b] superscript in the same row indicate differences (P <0.05)

Based on the results of statistical analysis showed that treatment of feed restriction of 50% and 60% real impact on the consumption of DM and OM in Kacang goats. According to Arora (1995), feed consumption is fundamental that will determine the level of nutrients, function and response of cattle as well as the use of nutrients in feed for livestock body needs.

Dry matter intake

Consumption of DM in Kacang goats showed significantly different results between the control goats (P0) with goat restriction (P1 and P2). Table 2 shows the DM intake in goat's treatment decreased compared with control. DM intake goat P0 at restriction stage is 35.49 g/head/day, whereas P1 and P2 goat consumes DM as much as 16.67 g/head/day and 17.06 g/head/day. This difference occurs because the goat's clear treatment given amount of feed limited to 50% and 60% of the needs should be.

Feed consumption returns to normal when treatment is stopped the feed restrictions. P0 goat consumes DM as much as 36.65 g/head/day, whereas P1 and P2 goat feed consume as much as 37.93 g/head/day and 54.40 g/head/day. Increasing the number of feed consumption resulting in an increase in weight, resulting in an increased need for feed. Apart from the restrictions on the amount of feed given, the level of consumption of nutrients is influenced by several factors. According to Tillman, *et al.* (1998) the rate of digestion of feedstuffs in the digestive tract, the rate of spending the rest of feed consumed and the level of compliance with feed ingredient consumed nutrients affect the amount of consumption of feed materials on goats.

Consumption of organic materials

Consumption of OM in the control and treatment of goat shows the effect of feed restriction. In Table 2 shows that the consumption of OM per kilogram of body weight a goat is affected by the amount of DM intake, the higher the amount of DM intake, the higher the consumption of OM. Consumption of OM on the P0 goat feed restriction phase is 32.05 g/head /day, whereas P1 and P2 goat is 15.05 g/head/day and 15.59 g/head/day. The difference between the DM intake and OM at this stage is from 1 to 2 g, is the same difference between the control and treatment of goat. Increased consumption of OM occurs when feed restriction is stopped and feeding back according to need. At this stage, goat feed P0 consume as much as 33.09 g/head/day, whereas P1 and P2 goats consume OM as much as 34.25 g/head/day and 49.75 g/head/day. The difference in DM intake and OM at this stage is 3 to 5 g. According Chakra, *et al*. (2005) OM is part of the dry ingredients and contains the largest portion of the composition of DM, so that the consumption of OM is determined by the amount of DM intake.

Body Weight Changes

Changes in body weight of goats affected by the amount of feed consumed for each animal. As shown in Figure 1, goats P0 without limitation feed showed normal growth pattern indicated by weight gain continues to increase. Current consumption of livestock feed each restricted by 50% and 60% in goats P1 and P2 as a result of restriction feed, then the weight loss and when the feed is given back as normal by the method of ad libitum, feed consumption increase followed by compensatory growth or growth following a compensation of feed given to each goat. That is the treatment of feed restriction can reduce feed intake, thus saving feed requirements.

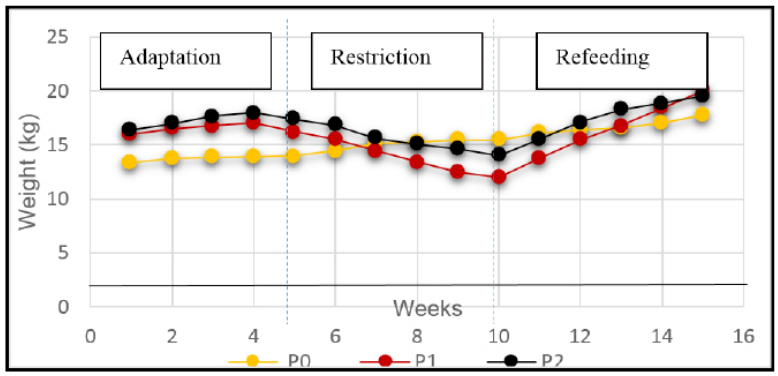

Figure 1. Graph of body weight of Kacang goats

Weight loss P1 goat average 21.91 g per day, while the P2 goats decreased an average of 16.19 g per day. Weight loss occurs as a result of feed restriction is done. Figure 1 shows that 50% of feed restriction treatment is better than 60% of feed restriction treatment. Which is expected to supply the nutritional needs of the feed are not fulfilled for various purposes livestock activities of the body, resulting in weight loss goat P1 and P2. Factors that lead to a decrease in body weight gain during periods of food restriction among other things because of the limited supply of nutrients and energy to support the growth of the network, so the cattle need to be taken from the body of livestock activity itself. As a result of cattle being thin (Hornick, *et al*. 2000).

Carcasses Percentage

The resulting carcass of a Kacang goat treated controls and restrictions feed shows the results are not much different. Table 3 shows the data cut weight, carcass weight and carcass percentage goats.

Table 3. The weight cut, weight and percentage of Kacang goat carcass

Variabel	Goat's		
	Control (P0)	Restriction 50% (P1)	Restriction 60% (P2)
Weight cut ^{ns}	16.85 ± 4.87	20.30 ± 2.62	20.90 ± 1.31
Weight carcass ^{ns}	07.47 ± 2.90	09.42 ± 1.73	09.91 ± 0.90
Carcass persentation ^{ns}	43.67 ± 4.56	46.25 ± 3.40	47.38 ± 1.75

.) Values shown as mean ± standard deviation

^{ns} not real or non significant

Goats treated feed restriction has a slightly superior carcass percentage when compared with control. Control goat carcass percentage is 43.67%, while the goat carcass P1 and P2 is 46.2% and 47.38%. Even statistically relatively equal or no real difference, but if the note contained carcass percentage difference between control and treatment restriction is 3% to 4% means goat carcass treated feed restriction has advantages when compared with controls.

The greater the weight cut, the greater the resulting carcass weight. Goats by feeding on a limited basis will experience slow growth or stop, but after getting enough fodder, goats will grow back faster than normal growth rate. According Soeparno (2009) growth is called compensatory growth, or growth that is followed. According Triyantini, *et al.* (2002) administration of two different types of feed at different conditions on Kacang goat carcass can produce almost the same percentage.

Meat Quality

Meat quality determined from before and after the animal was cut. Statistical tests showed no significant difference in cooking shrinkage testing, tenderness and Water Holding Capacity (WHC), while at pH testing there is a real difference. Table 5 shows the results of physical tests Kacang goat meat treated controls and restrictions.

Tabel 4. Physical test of meat

Variabel	Goat's		
	Control (P0)	Restriction 50% (P1)	Restriction 60% (P2)
Cooking lose^{ns}	33.59 ± 9.57	36.55 ± 3.90	33.07 ± 5.06
Tenderness^{ns}	06.48 ± 0.83	07.85 ± 6.29	06.50 ± 3.70
WHC^{ns}	30.00 ± 0.01	31.00 ± 0.01	30.00 ± 0.00
pH	06.36 ± 0.24^{ab}	06.25 ± 0.19^{a}	06.55 ± 0.16^{b}

) Values shown as mean ± standard deviation

$^{a, b}$ Superscript in the same row indicate differences (P <0.05)

^{ns} Not real or non significant

Treatment of feed restriction made on goat not be the determining factor for the quality of the meat based on the results of this study. According to Martin, *et al*. (2004) the quality of the meat is affected by two factors, first downstream factors that included the technology before and after the cutting process, the content of nutrients and microbial content of the meat and the second is the upstream factors include livestock genetics, physiology and nutritional feed.

Cooking shrinkage

The test results show that the shrinkage cook P0 is 33.59%, while the cooking shrinkage goat P1 and P2 are 36.55% and 33.07%. Cooking shrinkage values between control and treatment restriction is no real difference. Cooking too long or high temperatures during cooking resulting in greater levels of meat lost fluid levels, thus lowering the quality of meat produced. According Soeparno (2009), shrinkage cookware is an indicator of nutritional value of meat associated with higher levels of meat juice, which is the amount of water that is bound within and between muscles. The meat juice is a component of the texture that will determine the tenderness of meat. Widiati, *et al*., (2002) adds that the discharge of meat due to the occurrence of muscle shrinkage during cooking and heating.

Tenderness

Based on testing performed, the value of goat meat tenderness P0 of 6.48, while mutton P1 and P2 are 7.85 and 6.50. Kacang goat meat tenderness value has no real difference. The smaller the value of tenderness, the more tender the meat produced, expressed by Forrest, *et al*. (1975). Goat tenderness value P0 to P2 only has a difference of 0.02, which means that the more a minimum of feed, can produce quality that is superior tenderness. Treatment restrictions feed on livestock is not a major factor in deciding the value of tenderness, expressed by Soeparno (2009),

that the tenderness of meat is influenced by factors before and after cutting, factors before cutting includes genetic, species, race, type of animal, sex, age when cut, the nutrients contained in the feed and livestock stress conditions. After cutting factors include methods of withering, electrical stimulation, a method cooking, pH carcass and meat.

Water Holding Capacity (WHC)

The value of the test result value WHC on goat's meat P0 is 30.00, while the goat meat treated with P1 and P2 are 31.00 and 30.00. These results indicate that goat meat control and treatment had no significant difference. Value WHC is one of the factors that will determine the delicacy and meat in consumer acceptance. Treatment restrictions that do not feed into a major factor in deciding the value of WHC, but a decrease in the pH value becomes the deciding factor WHC values. According to Lawrie (2003), a decrease in WHC of meat proteins caused by a decrease in pH and as a result of damage sarcoplasmic proteins. Soeparno (2009) argues that WHC is affected by pH, the pH is higher or lower than the point isoelectric proteins of meat, and WHC will increase.

pH value

pH value has real difference between the value of goat meat P0, P1 and P2. P0 goat meat has a pH value of 6.36, while goat's meat treatment P1 and P2 has a pH value of 6.25 and 6.55. The pH value of the smallest owned by goat's meat P1, then P0 and P2. Factors that because the size of the pH value is a factor before and after cutting. The pH value of the test results higher than normal pH value of carcass and meat goats. According to the research Sunarlim and Setiyanto (2005), the average pH value of carcass and meat Kacang goat is 5.53. Soeparno (2009), argued that the normal pH is 5.4 to 5.8.

Feed Cost

Table 5. Economic analysis of restriction and refeeding to feed the Kacang goats

Variabel	Goat's		
	Control (P0)	Restriction 50% (P1)	Restriction 60% (P2)
Feed convertion	10.15±3.09	9.89±1.11	16.46±6.58
Feed Cost/Gain (IDR)^{ns}	48,542.66±9,591.83	44,529.78±4,116.32	56,441.71±8,779.02

.) Values shown as mean ± standard deviation

$^{a, b}$ Superscript in the same row indicate differences (P <0.05)

^{ns} Not real or non significant

Feed conversion

Feed conversion ratio (FCR) or conversion of the feed is obtained by dividing the ration dry matter intake with an average body weight gain. Average feed conversion for each treatment and control, restriction of 50%, 60% restriction is 10.15; 9.89; 16.46. Based on these values, the values of feed conversion of the treatment of the most good at 50% restriction. At the 60% restriction resulted in higher feed conversion due to body weight gain is relatively small. The feed conversion rate means to increase body weight by 1 kg, requiring ration respectively to control as much as 10.15 kg, 9.89 kg for a restriction to 50%, and 16.46 kg of 60% restriction. According to Hadi (2008), the smaller the feed conversion rate, the more efficient utilization of feed by livestock (conversion rate of about 4-6).

Feed cost per gain

Feed cost per gain value is calculated based on the cost of feed and the resulting weight. Price feeder goats were used for fattening is IDR 30,000/kg live weight, the price of concentrate feed IDR 5,500/kg, the price of hay peanut IDR 750/kg and the price for the goats that had been fattened is IDR 54,500/kg of live weight. Statistical analysis between the control treatment, restriction of

50% and 60% restriction does not show significant differences. The average feed cost per gain (IDR) generated in this study respectively for the control, restriction of 50% and 60% restriction is 48542.66 ± 9591.66; 44529.78 ± 4116.32; 56441.71 ± 8779.02. Results of the study indicated that restriction and refeeding can produce feed cost per gain was not significantly different ($P < 0.05$). Although in general, restriction and refeeding can produce feed cost per gain cheaper than without treatment. Therefore, restriction and refeeding can be used as an alternative to solve the problem during the dry season.

CONCLUSIONS

Based on the results of research that has been done, it can be concluded that the restriction of feed (feed restriction) and refeeding (compliance with feed back) significantly affected the rate of consumption of dry matter (DM) and organic matter (BO). However, the percentage of carcasses, quality of goat meat between the controls feed cost of feed restriction treatment with 50% and 60% not significant.

REFERENCES

Aboelmaaty, A.M., M.M. Mansour, O.H. Ezzo and A.M. Hamam. 2008. Some reproductive and metabolic response to feed restriction and re-feeding in egyptian native goats. Global Veterinaria. 2 (5): 225-232.

Forrest, C.J., E.D. Aberle., Hendricle, M.D. Judge, and R.S. Merkel. 1975. Principles of Meat Science. 2nd. Ed. Kendall / Hunt Publishing Co. Dubuque, Iowa.

Hadi. R. F 2008. Effect of protein supplementation on feed intake and digestibility of nutrients basal peanut hay. Bachelor Thesis Ranch. Faculty of Animal Husbandry. Gadjah Mada University. Yogyakarta.

Hanafia, KA 2010. Design of Experiments, Theory and Applications. Rajawali Press, Jakarta.

Hornick JL, C. van Eenaeme, Gerard O., I. Dufrasne and L. Istasse. 2000. Mechanisms of reduced and compensatory growth. Domest. Anim. Endocrinol. 19: 121-132.

Lawrie, RA, 2003. Meat Science Edition V, translation Aminuddin Paraksasi, University of Indonesia, Jakarta.

Martin, B., Priolo, A. Valvo, D. Micol and JB Coulon. 2004. Effects of grass feeding on milk, cheese and meat sensory properties. mediterraneennes options. 67: 213-223.

Soeparno. 2009. Meat Science and Technology, fifth edition. Yogyakarta: Gadjah Mada University Press.

Sunarlim, Roswita and Setiyanto, H., 2005. Pieces peanut male goat carcass commercial and local sheep ram against the carcass physical composition, physical properties and nutritional value of meat. Center for Postharvest Research and Development of Agriculture. Bogor.

Suwignyo, B., B. and D. Soetrisno Suhartanto. 2002. Differences in the quality of the corn crop is characterized by brown midrid resistance of low and high plateau in the Yogyakarta area. Buana Science 12 (1): 87-92.

Tillman, DA, Hartadi, H., Soedomo, R., Suharto, and Soekanto, L. 1998. Livestock Food Science Basis. Mold to five. Gadjah Mada University Press. Yogyakarta.

Triyantini, R. Sunarlim, H. Setiyanto, B. and M. Martawidjaja Setiadi. 2002. Studies on comparison of the characteristics of carcass components and cross-bred goats Beans (Boer X Nuts) at different feeding conditions. Pros. Husbandry National Seminar and Veterinary Technology. Bogor, 17 to 18 September 2001. The Center for Animal Husbandry, Bogor. p. 165-169.

Utomo, R. 2003. The provision of the feed in the tropics; problems of continuity, and quality. Inauguration speech Position Professor. Faculty of Animal Science, University of Gadjah Mada. Yogyakarta.

Widiati, U.S., and A. H. Purnomo Luxiawan. 2002. Quality of jerked beef in terms of protein content, water activity and the organoleptic quality of the cooking and the old system of different boiling. Partners Academic Journal 10 (3): 28-29.