IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 9, Issue 4 Ver. I (Apr. 2016), PP 18-23
www.iosrjournals.org

Performance of Growing Black Bengal Goat Fed Compound Pellet of Different Diameters

M.A. Rashid[1], M.J. Khan[2], M.A.M.Y. Khandoker[3], M.A. Akbar[2], M.M. Monir[1]
[1]*Department of General Animal Science and Animal Nutrition, Patuakhali Science and Technology University, Khanpura Campus, Barisal-8210, Bangladesh.*
[2]*Department of Animal Nutrition, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.*
[3]*Department of Animal Breeding and Genetics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.*

Abstract*: An experiment was conducted at Animal Nutrition Laboratory, Bangladesh Agricultural University, Mymensingh to observe the effect of different diameters of pellet diet on the performance of Black Bengal goat. Three diameter of a compound pellet diet such as D10, D8 and D6 (D10-10mm, D8-8mm and D6-6mm) were prepared according to NRC (1981) nutrient requirement and fed to goats of three groups. Insignificantly highest weight gain was observed in D10. Total Dry matter intake (kg), total crude protein intake (kg), metabolizable energy (MJ) intake (total, 100kg^{-1} LW d^{-1}, kg^{-1}W$^{.75}$ d^{-1}) and MEI/LWG (MJ/kg) were gradually increased with the decrease of pellet diameter but the difference of the parameters among the treatment groups were not significant (p>0.05). Both DM and CP intake (100kg^{-1}LW d^{-1}, kg^{-1}W$^{.75}$ d$^{-1)}$ were also increased with the decrease of diameter where D6 showed significantly (p<0.01) higher than other two groups. Insignificantly better FCR and PCR was observed in larger diameter pellet group. Digestibility of DM, OM, CP, EE, NFE, NDF and ADF was increased with the increase of pellet diameter where D10 and D8 showed significantly higher (p<0.05) DM, OM, NDF and (p<0.01) EE, NFE and insignificantly higher (p>0.05) CP and ADF digestibility value than D6. Digestibility of CF was highest in D8 but both D10 and D8 showed higher (p<0.01) digestibility than D6. Similarly nutritive value of CF, EE, NFE and TDN was significantly higher (p<0.01) in D10 and D8 and insignificantly higher (p>0.05) CP and D value in D10 and D8 than D6. Though nitrogen intake, outgo in feces and excretion in urine was highest in D6 and nitrogen retention was highest in D10 but the difference among the treatments was not significant (p>0.05). Dressing percentage, meat yield, price of meat, total sale price was insignificantly higher (p>0.05) in D10 and D8 and feed cost, total rearing cost, cost per kg weight gain and per kg meat yield was insignificantly higher (p>0.05) in D6. Highest profit was found in D10 and lowest in D6 and the difference was huge (Tk. 262.51) but did not differ significantly. It can be said that pellet with 10mm diameter may be used for economic goat production in stall feeding system.*

Kew words*: Goats, performance, digestibility, compound pellet, pellet diameter*

I. Introduction

Goat is a valuable and promising livestock species used mainly for meat production around the world (Barkley *et al*., 2012) [1]. Goats form an integral component of farming systems in the tropics and subtropics. In Bangladesh goats are used primarily for meat production, but their skin is a valuable by-product, which earns an appreciable amount of foreign exchange. More than 90% of the goat population in Bangladesh is the Black Bengal (Husain, 1993) [2]. Roughage is potential source of energy for livestock but it is insufficiently utilized by small ruminants because of high fibre content, low voluntary intake and deficiency of high soluble carbohydrate and mineral matter as well as poor digestibility of the fibrous fractions (Reddy and Reddy, 1989 [3] and Sharma and Singhal, 1986 [4]).The nutritive value and digestibility of the roughage could be improved by processing. Feeding system based on compound pellet feed is one of the processing method and promising for the establishment of goat industry. The main principle of this system is that all feed ingredients, both roughage and concentrate, are processed and mixed into a uniform blend, which is available in free choice to the animal and ensures the supply of diet containing same composition. This system also ensures the supply of balanced nutrients, reduces feed wastage and feed cost (Reddy and Reddy, 1981) [5]. So many works have been done on nutrient requirements and feeding systems of goat. Compound pellet feeding is one of the systems which is being used in many countries but limited or no information is presently available on the effect of diameter of pellet on growth performance and other characteristics of goat. The present study was therefore aimed to investigate the suitable diameter of pellet which may help in establishing profitable commercial goat farms as well as subsistence farming.

II. Materials And Methods

2.1 Experimental goats

Fifteen castrated male Black Bengal goats of about six months of age and average body weight 9.98 kg to 10.20 kg were collected from local farm. The goats were randomly divided into three equal groups, tagged and housed in a well ventilated shed and allowed two weeks to adapt with the housing conditions and experimental diets. The goats were vaccinated against Peste des petits ruminants (PPR) after allowing seven days of quarantined. After ten days of PPR vaccination, the animals were treated with antihelmintic to control gastrointestinal parasites. The initial live weight of each goat was taken at the beginning of the experiment for three consecutive days before offering feed at morning and the mean weight of individual goat was recorded as initial weight. Thereafter, goats were weighed individually prior morning feeding in every 7 days interval throughout the experimental period. Final live weight of each goat was also taken for three consecutive days at the ending point of the experiment. Live weight gain was calculated from the data. The experimental goats were reared for 100 days under identical care and management and thereafter slaughtered to know the dressing percentage.

2.2 Experimental diets

Napier grass (*Pennisetum purpureum*), cultivated in fodder field of Animal Nutrition Department of Bangladesh Agricultural University, was selected as basal feed. The green grass was cut, chopped, dried and ground by electric grinder using 1mm diameter sieve. Concentrate feed ingredients were purchased from local market. The sample of grass and other ingredients were analyzed for proximate components before using for pellet preparation. Compound pellets of three different diameters (D10, 10 mm; D8, 8 mm and D6, 6 mm), according to the NRC (1981) [6] nutrient requirements, were prepared for goats belonging to three groups with the ground grass and concentrate feed ingredients in a ratio of 60:40 (Table 1).

Table 1 Composition (% DM basis) of experimental diets (D10, D8, D6)

Ingredients	Amount (kg)
Napier grass	60
Wheat bran	10
Rice polish	4
Mustard oilcake	6
Soybean meal	12
Maize	2
Wheat	3
Molasses	1
Di-calcium phosphate	1
Common salt	1

D10, D8, D6 = 10, 8, 6 mm pellet diameter, respectively

2.3 Feeding the goats

Fifty percent of the allocated (@ 3% of the body weight) compound pellet for a day was supplied to the respective group at every 8:00 am and the goats were allowed for grazing from 9:30 am to 11:30 am and then confined in pen. The rest of the portion of pellet was supplied at 4:00 pm. Grazing length was shortened and feed allocation increased gradually. After seven days grazing was fully stopped and experimental diet was supplied @ 5kg DM/100kg body weight. In the whole experimental period goats were kept in a paddock for exercise at 6:30 am and returned to pen at 8:00 am. One half of compound pellets were supplied to the goats of respective group at every 8.00 am and another portion at 4.00 pm. Every morning before supply of feed, left-over of all groups, if any, were collected, weighed and daily feed intake was calculated. Fresh drinking water was supplied for 24 hours.

2.4 Metabolic trial

A conventional metabolic trial was conducted for a period of 10 days at the ending point of feeding trial to know the digestibility of feed nutrients and nitrogen balance. The goats were placed in metabolic crate at 84^{th} day of experiment and allowed for 7 days for adaptation. Then a conventional metabolic trial was performed for a period of 10 days. Amount of daily feed intake, voided feces and excretion of urine were recorded and sample was taken for proximate analysis.

2.5 Proximate analysis

The samples of feed, left-over and feces were analyzed for nutrient content following the methods of AOAC (2012) [7]. Digestible crude protein (DCP) was calculated according to the methods of McDonald *et al.*

(1988) [8]. Acid detergent fibre (ADF) and neutral detergent fibre (NDF) content of samples were determined by Fibertec™ system (VELP Scientifica, EU) following the procedure of Van Soest *et al.* (1991) [9]. Energy value of whole diet was estimated from digestible organic matter (DOM) as ME (MJ/kg DM) = 0.16 × D value (MAFF, 1984) [10]. D value (DOMD) of the diets was calculated as gm of digested OM in each kg DM of diet multiplied by 1000.

2.6 Slaughtering and carcass weight of the goats

Goats were individually weighed after overnight fasting and slaughtered according to Mohammadian (Halal) method at 100th day of experiment. Worm carcass weight was recorded immediately after complete dressing (removal of head and skin with feet) and evisceration. The dressing percentage was calculated from the carcass weight divided by the slaughtered weight then multiplied by 100 **(**Devendra, 1988) [11].

2.7 Statistical analysis

Data were analyzed by completely randomized design using the GLM procedure of SAS version 9.1 (SAS Institute Inc., Cary, N.C.) to determine the effect of diameter of pellet on performance of Black Bengal goat.

III. Results And Discussion

3.1 Growth performance

Goats of dietary group D6 intake highest amount of pellet (63.67kg) and lowest by D10 group. The difference of dry matter intake (DMI) by goats of different dietary groups was insignificant (*p>0.05*). Daily DMI (kg/100kg LW and g/kg $W^{0.75}$) was highest in lower diameter pellet group (D6) and lowest in D10. The differences of D6, D8 and D10 was significant *(p<0.01).* Ingredient composition did not affect on DMI because same ingredients were used in three diameter pellet but pellet size was the cause of the difference of DMI. Smaller diameter pellet require less time for degradation, digestion and passage through alimentary tract. Reddy and Reddy (1983) [12] observed that grinding and pelleting help the animals to consume the coarse stemmed parts of the grass along with other parts of higher digestibility and helps in quick passage of pelleted digesta through the reticulo-rumen. Crude protein intake (kg) by group D6 was insignificantly (*p>0.05*) highest and lowest in group D10. Crude protein intake (kg/100kgLW and g/kg$W^{0.75}$) was also highest in group D6 and lowest in group D10 and the value of CPI in D6 group was significantly higher *(p<0.01*) than group D8 and D10. As protein content in three pellets was same so higher DM intake by smaller diametered pellet group resulted higher CP intake. Total MEI, MEI/100kgLW/day and MEI/kg$W^{0.75}$ was insignificantly higher in D6 and lower in D10. Higher dry matter intake by lower diametered pellet group was the main cause of higher ME intake. Final live weight of goats in different groups showed very little difference (*p>0.05*) and ranged from 16.29 to 16.91 kg. Weight gain (total and daily) was sequentially higher (Table 3.1) in sequentially higher diametered pellet group but the differences among the groups was not significant *(p>0.05).* It indicates that more CP was utilized by higher diametered group. Insignificantly better FCR and PCR were also observed in higher diameter pellet group. Comparatively higher weight gain and lower feed intake by higher diameter group was the result of better FCR and PCR.

Table 3.1 Growth performance of Black Bengal goat fed on different dietary groups

Parameter	Dietary groups			LS
	D10	D8	D6	
DM intake				
Total (kg)	57.56±4.278	59.51±2.547	63.67±7.341	NS
kg/100kgLW/d	4.71^{b}±0.011	4.81^{b}±0.040	4.98^{a}±0.054	**
g/ kg$W^{.75}$/d	149.21^{b}±0.366	152.31^{b}±1.283	157.55^{a}±1.730	**
CP intake				
Total (kg)	9.19±0.682	9.50±0.407	10.17±1.171	NS
kg /100kg LW/ d	0.75^{b}±0.002	077^{b}±0.006	0.79^{a}±0.009	**
g /kg$W^{.75}$/d	23.83^{b}±0.057	24.32^{b}±0.204	25.16^{a}±0.275	**
ME intake				
Total (MJ)	528.66±39.683	538.36±27.475	553.34±59.699	NS
MJ /100kgLW/d	43.37±1.008	43.52±1.017	43.65±1.566	NS
MJ /kg$W^{.75}$/d	1.37±0.031	1.37±0.031	1.37±0.049	NS
Performance of kid				
Initial live weight (kg)	9.98±0.833	9.98±0.580	10.20±1.264	NS
Final live weight (kg)	16.91±0.881	16.83±0.356	16.29±1.373	NS
Total weight gain (kg)	6.92±0.238	6.85±0.371	6.08±0.180	NS
Average daily gain (g/ d)	69.20±2.380	69.51±3.710	60.80±1.80	NS
Nutrient efficiency for gain				
Feed conversion ratio (FCR)	8.34±0.859	8.70±0.708	10.44±1.158	NS
Protein conversion ratio (PCR)	1.33±0.104	1.38±0.113	1.66±0.183	NS

D10, D8, D6 = 10, 8, 6 mm diametered pellet, respectively; NS = Non significant, ** $p<0.01$, $^{a, b}$ mean values having different superscripts in a row differ significantly, LS = Level of significance

3.2 Feeding value of diets

3.2.1 Apparent Digestibility

Digestible coefficient of dry matter (DM) and neutral detergent fibre (NDF) in D8 was almost similar to D10 and D6 but the significant differences ($p< 0.05$) of DM and NDF digestibility was observed in D10 and D6. Goats of dietary group D10 and D8 showed similar digestibility value of OM, CF, EE and NFE but significantly greater ($p<0.05$) value of OM and significantly greater ($p<0.01$) value of CF, EE and NFE was observed in both D10 and D8 than in D6. Digestibility of CP and ADF was decreased in smaller diametered pellet. Insignificantly highest digestibility of CP and ADF was observed in D10 and lowest in D6. Quick passage of smaller diametered pellet from rumen may be the main cause of lower digestibility of nutrients. This result agreed with the finding of Church (1972) [13]. He observed that digestibility of DM, OM and CP was highest in 3 cm diameter pellet followed by 2 cm diameter pellet then 1 cm diameter pellet in beef steer and concluded that grinding changed the property of roughage by decreasing the particle size which has been known to increase rate of passage and decrease rumen retention time.

3.2.2 Nutritive Value

Digestible crude protein (DCP) in group D10, D8 and D6 was 11.56, 11.48 and 10.98, respectively. The differences among the groups was not significant ($p>0.05$). Digestible crude fibre, ether extract and nitrogen free extract was highest in D10 but almost similar to D8 and both the groups showed significantly higher ($p<0.01$) value than the value observed in D6 (Table 3.2). D value was gradually decreased and D6 group showed insignificantly ($p>0.05$) lower value than other groups. TDN in group D10 was highest and the value of TDN in group D10 and D8 was statistically similar but significantly higher ($p<0.01$) than D6. Nutritive value of CP and D value were insignificantly and other nutrients and TDN were significantly decreased with the decrease of dietary pellet diameter because digestible coefficient of the nutrients was decreased in smaller diametered pellet. Since the percentage of the nutrients of the three diets was same and digestibility of the nutrients were higher in bigger diametered pellet and nutritive value of the nutrients is the result of multiplication of percentage of nutrients and its digestibility, so the nutritive value of the nutrients were higher in bigger diametered pellet group.

3.2.3 Nitrogen Balance

Nitrogen intake (g/d) by the goats of dietary groups D10, D8 and D6 was almost similar and differed insignificantly ($p>0.05$). Nitrogen outgo through feces and urine in D6 was insignificantly ($p>0.05$) highest and lowest value was found in D10. Daily retention of nitrogen was higher in D10 diameter pellet but the value did not differ significantly from the value of other groups. Higher dry matter intake by the goats of group D6 was the only cause of higher nitrogen intake (g/d) by goat. Prompt passage of pellet from rumen and small intestine in smaller diameter pellet group resulted higher nitrogen in feces. Insignificantly higher nitrogen retention in D10 was the result of insignificantly higher digestibility of crude protein.

Table 3.2 Apparent digestibility, nutritive value and nitrogen balance of different pellet diets

Nutrients	Dietary groups			LS
	D10	D8	D6	
Digestibility (%)				
DM	60.10^{a}±1.160	58.89^{ab}±1.242	56.20^{b}±1.168	*
OM	64.05^{a}±1.043	64.00^{a}±1.083	59.89^{b}±1.109	*
CP	72.37±0.833	71.92±1.721	68.77±1.357	NS
CF	58.28^{a}±1.946	59.89^{a}±1.207	51.38^{b}±1.465	**
EE	66.65^{a}±0.967	64.97^{a}±1.054	60.79^{b}±1.046	**
NFE	63.80^{a}±1.016	61.23^{a}±1.259	56.64^{b}±1.138	**
Acid Detergent Fibre (ADF)	55.64±.199	55.42±2.567	51.32±.269	NS
Neutral Detergent Fibre (NDF)	59.86^{a}±1.377	58.92^{ab}±1.259	56.02^{b}±0.670	*
Nutritive value				
DCP (%)	11.56±0.133	11.48±0.275	10.98±0.217	NS
DCF (%)	8.80^{a}±.293	9.04^{a}±0.183	7.75^{b}±.220	**
DEE(%)	5.21^{a}±0.076	5.08^{a}±0.082	4.75^{b}±.081	**
DNFE (%)	29.65^{a}±0.472	28.45^{a}±0.584	26.32^{b}±0.528	**
D value	57.47±1.419	56.48±1.155	54.72±1.505	NS
TDN	61.73^{a}±1.008	60.42^{a}±1.198	55.76^{b}±1.103	**
Nitrogen balance (g/d)				
N-intake	18.38±1.448	18.69±1.927	18.72±1.782	NS
Faecal nitrogen excretion	4.94±0.358	5.14±0.565	5.27±0.565	NS
Urinary nitrogen excretion	4.08±1.122	4.20±0.158	4.57±0.164	NS
Nitrogen retention	9.36±1.374	9.35±1.420	8.88±1.168	NS

D10, D8, D6 = 10, 8, 6 mm diametered pellet, respectively; NS = Non significant, ** $p<0.01$, * $p<0.05$,
[a, b, ab] = mean values having different superscripts in a row differ significantly, LS = Level of significance

3.3 Economic assessment

Weight gain and dressing percentage of dietary group D10 was higher than other groups but the value did not differ significantly ($p>0.05$). Meat yield, its selling price and total price was insignificantly ($p>0.05$) highest in group D10 and lowest in group D6. Total feed cost, rearing cost, and cost for one kg weight gain and for one kg meat production was gradually increased in lower diametered pellet group. The differences of the parameters among the groups was insignificant ($p>0.05$) though the highest cost was observed in D6 and lowest in D10. Profit (Tk.) of group D10, D8 and D6 was 920.95, 863.10 and 658.44, respectively. There was a huge difference of profit (Tk. 262.51) between the groups D10 and D6 but the difference was not statistically significant ($p>0.05$).

Table 3.3 Economics of different diametered pellet fed to Black Bengal goat for 100 days

Attribute	Dietary groups			LS
	D10	D8	D6	
Carcass traits				
Slaughter weight (kg)	16.91±0.881	16.83±0.356	16.29±1.373	NS
Weight gain (kg)	6.92±0.238	6.85±0.371	6.08±0.160	NS
Carcass weight (kg)	8.50	8.41	8.13	
Dressing %	50.27±0.688	50.02±0.667	49.96±0.796	NS
Meat yield(kg)	3.48±0.163	3.426±0.265	3.04±0.098	NS
Economics of feeding				
Price of meat (@Tk.430/kg)	1499±70.152	1473±114.006	1307.92±42.357	NS
Price of skin, head, GI tract	300	300	300	-
Total return (Tk.)	1799±70.152	1773±114.006	1607.92±42.357	NS
Price of feed(Tk./kg)	10.24	10.24	10.24	-
Feed cost (Tk.)	653.54±48.567	678.24.±29.030	724.83±83.570	NS
Labour cost (Tk.)	200	200	200	-
Other cost (Tk.)	27	32	25	-
Total rearing cost (Tk.)	880.54±48.567	910.24.±29.030	949.83±83.570	NS
Cost /kg weight gain(Tk.)	127.31±7.886	131.97±9.728	155.96±13.085	NS
Cost(Tk.) /kg meat yield	253.44±16.191	266.46±26.102	312.24±26.404	NS
Net Profit(Taka/animal)	920.95±75.195	863.10±130.046	658.44±65.969	NS

D10, D8, D6 = 10, 8, 6 mm diametered pellet, respectively; NS = Non significant, LS =Level of significance

Only difference of DM intake among the groups made the variation. Quick passage of nutrients from rumen and intestine of D6 made lower utilization and hence performance of the group. Lower weight gain and dressing percentage and higher feed cost of smaller diametered pellet group resulted insignificantly higher cost for per kg weight gain and per kg meat yield of the group.

IV. Conclusion

Growth performance, digestibility, nitrogen balance, dressing percentage, meat yield and total selling price were increased with the increase of diameter of pellet in stall feeding system and higher feeding cost in lower diameter pellet group lowered the net profit than higher diameter pellet group. So, on the economic point of view and growth performance it can be concluded that 10 mm diameter (D10) pellet may be used for commercial goat farming in stall feeding system.

References

[1]. M. E. Barkley, K. Knoll, L. F. Kime and J. K. Harper, Meat Goat Production. Penn State Extension, The Pennsylvania State University, 2012.

[2]. S. S. Husain, A Study on the productive performance and genetic potentials of Black Bengal Goats. PhD Dissertation, Department of Animal Breeding and Genetics. Bangladesh Agricultural University, Mymensingh, Bangladesh, 1993, 163-165.

[3]. S. K. Reddy and M. R. Reddy, Utilization of wheat straw/berseem hay and poultry droppings in the development of complete feeds for crossbred bulls. Indian Journal of Animal Sciences 59, 1989, 981-985.

[4]. D. D. Sharma and K. K. Singhal, Efficiency of complete feeding system in ruminants. Proceedings of 5th Animal Nutrition Research Workers' Conference on "Crop residues as livestock feeds: factors limiting their utilization with special reference to anti-quality factors and their amelioration" held at M. L. Sukhadia University, Udaipur, India, July 14-17, 1986, 166-175.

[5]. D. N. Reddy and M. R. Reddy, Complete rations for sheep utilizing crop residues and agro-industrial by-products. Indian Journal of Animal Sciences 51, 1981, 455-457.

[6]. NRC (National Research Council), Nutrient Requirements of Domestic Animals. No. 15. Nutrient requirements of goats; Angora, dairy and meat goats in temperate and tropical countries. National Academy Press, 1981, Washington, D.C., USA.

[7]. AOAC. Official Methods of Analysis (19th edn). Association of Official Analytical Chemists, Washington, D.C., USA: AOAC International; 2012.

[8]. P. McDonald, R. A. Adwards, J. F. D. Greenhalgh and C. A. Morgan, Animal Nutrition (Addison Wesley Longman, Edinburgh Gate, 1988, United Kingdom.

[9]. P. J. Van Soest, Nutritional Ecology of the Ruminant (2nd edn). Cornell University Press, 1991, Ithaca, NY.
[10]. MAFF (Ministry of Agriculture, Fisheries and Food), Energy allowances and feeding systems for ruminants, Reference Book 433. Her Majestry's Stationary Office, 1984, London, UK.
[11]. C. Devendra, Nutrition and meat production. In: Goat Meat Production in Asia. Tando Jam, Pakistan, 13-18 March, 1988. Proceedings series/IDRC- 268e, pp. 30-43.
[12]. G. E. K. Reddy and M. R. Reddy. Complete pelleted rations for sheep utilizing agro-industrial by-products and crop residues. Indian Journal of Animal Sciences 53 (3), 1983, 266-270.
[13]. D. C. Church. Digestive Physiology and Nutrition of Ruminants. Nutrition (2nd edn.) O & B Books Inc. 1979, Corvallis, Oregon, USA.