Indian J. Anim. Nutr. 2020. 37 (3): 279-283
doi: 10.5958/2231-6744.2020.00044.4

Indian Journal of Animal Nutrition

Effect of Partial Replacement of Concentrate Feed with Moringa Leaves (*Moringa oleifera*) on Performance of Growing Pigs

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ABSTRACT

An experiment was conducted to study the effect of feeding *Moringa oleifera* leaves on growth performance, haematology and serum metabolite profile of growing SVVU T-17 breed of pigs. Twelve grower pigs of three months of age were divided into two groups of six each based on body weights (28 kg). Animals were fed with control (T_1) and treatment (T_2) diets for a period of 14 weeks. T_1 group pigs received 100% dry matter (DM) requirement as a standard pig grower (maize and soya based) feed while T_2 group pigs received only 70% of their daily DM requirement as grower feed and 30% of their requirements were met through fresh moringa leaves. There was no significant (P>0.05) effect of replacement of 30% of concentrate feed with moringa leaves on body weight gains, haematology and serum biochemistry of growing pigs. Cost per kg of body weight was reduced from ₹ 84.80 (T_1) to ₹ 64.78 (T_2) by replacing 30% concentrate with fresh moringa leaves. Thus, fresh Moringa leaves can be fed upto 30% in the diets of grower pigs for economic pig production.

Key words: Cost economics, Growth Performance, Moringa leaves, SVVU T-17 pigs

INTRODCTION

The critical constraint in profitable pig farming is the raising feed cost, which alone accounts for 70-80% of total cost of production. To reduce the feed cost piggery entrepreneurs are depending on alternative feed sources like vegetable waste, fruit waste and hotel waste. However, feeding of these wastes have issues related to health and welfare of pigs. *Moringa olifera* is a tropical tree originally from India commonly known as drumstick tree is a member of the Moringaceae family, and is grown in many tropical, subtropical countries. The leaves are highly nutritious, being a good source of protein, β-carotene, vitamins A, B, C and E, riboflavin, nicotinic acid, folic acid, pyridoxine, amino acids, minerals and various phenolics compounds and commonly consumed by humans as vegetable in many preparations (Khalafalla *et al.,* 2010). Fresh moringa leaves contains 20-23% of crude protein (CP), have an amino acid composition that is suitable for human and animal nutrition, and is rich in many micronutrients, growth promoters and antioxidants because of high phenolic contents. (Babiker *et al.,* 2017). In recent years feeding of moringa as leaves/ leaf meal is gaining popularity in animal production systems (Solvia *et al.,* 2005). Zhang *et al.* (2019) reported that feeding of Moringa leaf meal upto 6% in diets of finisher pigs improved the growth performance. However, most previous studies used leaf meal rather than fresh leaves. We hypothesized that a higher level of inclusion of fresh cut Moringa leaves may reduce the feed cost. Hence, the present study was undertaken to know the effect of feeding fresh cut moringa leaves which is most convenient way of feeding growing pigs on growth performance haematology, serology and cost economics.

MATERIALS AND METHODS

The experiment was conducted on twelve SVVU T-17 grower pigs of three months age (average BW 28 kg) and were divided into two groups of six each. Pig grower feed comprising of maize, soya bean meal

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(SBM), deoiled rice bran (DORB), salt, mineral mixture and lysine at 70, 3.5, 24, 2, 0.5 and 0.025 percent was formulated to fulfil their nutrient requirements according NRC, 2012). The ingredient composition of concentrate feed and its nutritive value is presented in Table 1. Control (T_1) group was offered 100% DM as standard pig grower feed (@ 3% BW) while animals of treatment (T_2) group received 70% DM as pig grower and 30% DM from fresh moringa leaves. Experimental animals were dewormed before the start of experiment and housed in the same shed where control and treatment groups received same managemental conditions throughout the experiment. Animals had free access to drinking water. Fresh moringa leaves were collected from silvipastoral system of Livestock Farm Complex (LFC), NTR College of Veterinary Science, were offered to T_2 group pigs everyday morning before offering concentrate feed. Concentrate feed was offered twice daily. Feeding trial was conducted for a period of 14 weeks. Amount of feed offered (concentrate and moringa leaves) was recorded daily to calculate the cost economics, and body weight was recorded at fortnightly interval. Proximate composition of moringa leaves and concentrate feed was analysed as per AOAC (2005) procedures and data are presented in Table 1.

Peripheral blood samples were collected from anterior venacava on days 0, 30, 60 and 90 of the experiment. Anticoagulant containing vials were used for collection of blood Red blood cell (RBC) count, white blood cell (WBC) count, platelet count (PLT), haemoglobin (Hb) concentration, MCV and haematocrit (HCT) values were measured by using automatic hemoanalyser (Mindray, China). Blood for serum collection was collected in vials with clot activator and the serum was separated by centrifugation at 2000 rpm for 10 min after 2 h of collection. Serum samples were stored at -18°C until further analysis of glucose, total

Table 1. Ingredient and chemical composition of concentrate feed and moringa leaves

Ingredients	**Parts per 100**	
Maize	70.0	
Soya bean meal (SBM)	24.0	
Deoiled rice bran (DORB)	3.5	
Mineral mixture	2.0	
Salt	0.5	
Lysine	0.025	
	Chemical composition (% DM basis)	
	Pig grower feed	**Moringa leaves**
Dry matter (DM)	89.54	14.11
Organic matter (OM)	87.83	88.12
Total ash (TA)	12.17	11.88
Crude protein (CP)	17.58	21.07
Ether extract (EE)	2.69	4.77
Crude fiber (CF)	3.83	24.44
NFE	63.73	38.83
Calcium	0.58	3.11
Phosphorus	0.41	0.51
*Metabolizable energy (kcal/kg)	3050	2080
**Protein: energy	1:173.5	1:100

Calculated values as per BIS 1986

protein, albumin, cholesterol, blood urea nitrogen (BUN) and calcium by using automatic biochemical analyser by using Erba kits. The data obtained were subjected to independent two sample T test in IBM SPSS Ver. 20.0 for windows.

RESULTS AND DISCUSSION

The chemical composition of concentrate feed and fresh moringa leaves was analysed. The CP content of pig grower feed and moringa leaves used in the present study was 17.5% and 21.7%, respectively (Table 1). Data pertaining to the average body weight of pigs at the start and end of the experiments are presented in Table 2. There was no significant (P>0.05) effect of replacing 30% of concentrates with fresh moringa leaves on body weight gain of grower pigs. The present findings are in agreement with Acda *et al.* (2010) who reported that there was no significant effect of feeding moringa leaf meal (MLM) in starter pig diets upto 10% level of inclusion on body weight gain. Mukumbo *et al.* (2014) also reported no significant effect of feeding *Moringa oleifera* leaf meal (MOLM) to finisher pigs upto 7.5% level of inclusion on average daily weight gains. However, Serem *et al.* (2017) reported significantly (P<0.05) increased body weight gains in grower pigs fed with 3% MOLM. Babeker and Bdalbagi *(*2015) observed improvement in performance in terms of ADG of Nubian goats fed with 20% fresh moringa leaves. However, Ruckli and Bee (2016) reported significant (P<0.05) reduction in body weights of pigs fed 15% moringa leaf meal. Non-significant change in body weight was observed in the present study which could be attributed to high protein content of moringa leaves and ait also indicates the ability of grower pigs to digest fiber present in moringa leaves. Further feeding of fresh moringa leaves without drying might have resulted in increased supply of nutrients like minerals and vitamins which aids in growth.

From the data presented on Table 3 it is evident that there was no significant effect of feeding moringa leaves on haematological parameters (RBC count, WBC count, PLT, Hb concentration, MCV and HCT). Serem *et al.* (2017) observed an increase in RBC count and Hb concentration with feeding of MOLM at lower level (upto 6%), however, RBC count and Hb level decreased at higher level of inclusion (12% MOLM) in the concentrate diets of growing pigs. Babeker and Bdalbagi *(*2015) also observed increase in RBC count, Hb concentration, MCV and reduced WBC count in Sudan Nubian goats fed with 20% fresh moringa leaves along with sorghum hay. Serem *et al. (*2017) attributed the increase values of RBC count, Hb concentration and HCT values to higher iron and folic acid content of Moringa leaves, which improves erythropoiesis. Though there was a numerical increase in RBC count, Hb concentration and HCT values in treatment group compared to control group, the non-significant affect might be due to small sample size (n=6). Further Serem *et al. (*2017) opined that reduction in haematology profile when MOLM was fed at higher levels (12% inclusion) can be attributed to the toxic effect that impaired oxygen carrying capacity of RBC. Serum metabolite profile indicates that there was no significant (P>0.05) effect of replacing 30% of the concentrates with moringa leaves and all the studied parameters were within the

Table 2. Effect of partial replacement of concentrates with fresh moringa leaves on growth performance of pigs

Parameter	Control (n=6)	Treatment (n=6)	P value
Initial body weight (kg)	27.88±3.21	27.91±3.74	0.71
Final body weight (kg)	56.58±5.12	57.08±6.09	0.37
Weekly body weight gain (kg)	2.04±0.15	2.08±0.24	0.16
Average daily gain (ADG, g)	291.50±21.19	297.62±35.97	0.16

Level of significance (P<0.05)

Table 3. Effect of partial replacement of concentrates with fresh moringa leaves on haematology and serum biochemistry of grower pigs

Attribute	Control (n=6)	Treatment (n=6)	P value
RBC count, 10^6/µl	6.69±0.40	7.25±0.23	0.41
WBC count, 10^3/µl	12.16±0.39	13.32±0.87	0.27
PLT count, 10^3/µl	482.4±67.52	423.2±88.88	0.89
Hb level, g/100 ml	9.86±0.31	11.76±0.39	0.84
MCV (fL)	63.72±1.76	63.40±0.70	0.05
HCT (l/l)	39.00±1.16	45.18±1.53	0.98
Biochemical attributes			
Glucose, g/dl	88.86±7.22	105.71±12.60	0.17
Total protein, g/d	7.11±0.61	7.62±0.76	0.49
Albumin, g/d	2.54±0.13	2.57±0.52	0.31
Globulin, g/d	4.56±0.57	5.06±0.79	0.65
BUN, mg/dl	20.37±1.42	22.09±1.06	0.45
Cholesterol, mg/dl	51.84±3.53	49.87±6.70	0.37
Calcium, mg/dl	8.57±0.61	9.10±0.62	0.84

normal range. Treatment group has recorded numerically higher serum glucose, total protein, globulin, calcium and reduced cholesterol concentration. Earlier studies have attributed increased globulin and calcium concentrations to immunomodulatory (due to presence of flavonoids, polyphenols and terpinoid) effect (Babeker and Bdalbagi *(*2015) and higher calcium (3.11%) concentration of moringa leaves. However, Divya *et al.* (2014) reported reduction in total serum protein concentration of broiler chicken fed with MOLM upto 1.5% level. Hypocholesteraemic effect of moringa leaves had been been reported by, Divya *et al.* (2014), Babeker and Bdalbagi (2015) and Serem *et al.* (2017) in growing pigs, Nubian goats and broiler chicken, respectively. Divya *et al. (*2014) opined that hypocholestermic effect can be attributed to flavonoids, alkaloids and phenolic compounds present in moringa leaves. However, we fail to observe any significant improvement in the serum metabolite profile of pigs. Nevertheless data indicate that replacement of 305 of connotates with Moringa leaves showed no adverse impact on serum metabolites.

From the calculated data it was observed that cost per kg live weight gain was reduced from ₹ 84.78 (T_1) to ₹ 64.80 (T_2) by replacing 30% of concentrates with feeding moringa leaves (Table 4). Compared to T_1 there was a reduction of cost per kg live weight gain by 23.61% (₹ 20/- per kg gain) in T_2. Similar to present finding,

Table 4. Effect of feeding moringa leaves on cost economics of grower pigs

Parameter	Control	Treatment
Concentrate feed offered (kgs)	561 kg	372 kg
Moringa leaves offered	-	1110 kg
Total feed cost (concentrates ₹ 27 per kg; moringa leaves ₹ 1.50/- per kg	₹ 14,586/-	₹ 1,337/-
Body weight gains (Kgs)	172 gs	175 kgs
Cost/kg live wt. gain	₹ 84.80/-	₹ 64.78/-

***Reduction of feed cost by 23.61%

Oduro-Owusu *et al. (*2015) reported best feed to gain ratio by feeding of 5% MOLM in diets of weaner pigs without compromising the growth performance. Shankhpal *et al.* (2019) reported a net increase of ₹ 46.21/- per head/day in lactating crossbred cows fed moringa leaves @15 kg/day/cow.

CONCLUSIONS

It was concluded that 30% of the concentrates can be replaced with fresh Moringa leaves without any adverse impact on clinical chemistry profile and growth performance of grower pigs. Additional benefits of feeding Moringa leaves was reduction in feed cost by 23.6%.

ACKNOWLEDGEMENT

Authors are grateful to Sri Venkateswara Veterinary University, Tirupati for providing necessary facilities to conduct the research.

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Received on 29-09-2020 and accepted on 10-10-2020