Evaluation of Baobab Seed Cake based Diets for Growth Performance and Carcass Quality of Pig in Central zone, Tanzania

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Abstract

This study was carried out in Central Tanzania and aimed at evaluating the effect of Baobab seed cake (BSC) on growth performance and carcass quality of pigs. Twenty-four (24) weaners of both sexes were involved in the study which lasted for 84 days. Four diets were formulated with BSC replacing sunflower seed cake at four levels of 0, 7, 14 and 21% and allotted to four dietary treatments T1, T2, T3 and T4 respectively, in a completely randomized design. Results showed that the four levels of replacement had no significant effect on body weight gains although T2 outperformed the others in terms of weight gain with 23.19kg whereby T1 (20.54kg) and T3 (20.21kg) had almost similar weights and T4 had the lowest weight gain (15.52kg). The cost of production, carcass weights, and dressing percentages varied significantly (P≤ 0.05) whereby costs of production (in Tshs) were 151,643.28, 162,965.52, 150,820.03 and 117,646.74 for T1, T2, T3 and T4 respectively. Carcass weight and dressing percentages were 23kg, 20.5kg, 18.50kg, 9.50kgs and 55.4, 53.9, 51.4 and 48.7% for T1, T2, T3 and T4 respectively. Histopathology analyses of the carcasses indicated that there were no any detrimental changes resulting from an inclusion of BSC in pig diets thus the pork was fit for human consumption.

Keywords: Carcass weight, production cost, pork, weight gain, and diet.

Introduction

Pig production in Tanzania is mainly carried out by smallholder farmers, involving over 700,000 rural households, representing about 26.4% of agricultural households. According to the Ministry of Livestock and Fisheries (URT, 2019), there are approximately 2.4 millions pigs distributed throughout the country. Smallholder pig productions have managed to contribute considerably to growth rate of the pig sub-sector in the country compared with other common livestock. In the last two decades, annual growth rates of the pig sub-sector in Tanzania ranged between 3.5 and 7.4% compared with other classes of livestock such as beef cattle (1.4 and 4.7%), poultry (4.3 and 5.5%) and small ruminants (2.0 and 2.4%) sub-sectors (URT, 2015). The percentage shows a notable annul growth in pig sector than other sub-sectors.

The demand for animal protein for human nutrition in the country and developing world is rising due to rapid increase of human population, particularly for pork and poultry products (OECD and FAO, 2010). This provides an opportunity to pig small-scale farmers, especially in rural areas to generate their income from pig keeping due to their high growth rates and short generation intervals (Costales *et al.,* 2007, Kagira *et al.,* 2010 and Karimuribo *et al.,* 2011).

Despite the potential of the pig in the country, the industry faces challenges of high cost of feed especially protein which accounts 65 - 75% of the total costs in pig's production. (Obih and Ekenyem, 2010; Morel *et al.,* 2012). Many feed producers are being forced out of production or produce low quality feeds which do not meet the animal requirements. On account of farmers are producing below capacity or drop out of pigs

production (Nsa *et al.,* 2007). Previous studies by Mwale *et al.,* 2008 and Obih, 2009 suggested the use of an alternative protein with low-cost, locally available indigenous feed resources which does not compete with human, and which do not impair animal health.

Studies show that Baobab seed is rich in protein (20 - 36%CP) and contains substantial amount of energy (1 898 – 4 465k Cal/kg), also, it provides some necessary fiber, vitamin, minerals and amino acid particularly lysine and methionine which are limited in most of the cereals but essential for livestock growth and development (Mwale *et al.,* 2008).

Many studies on broiler, layers, guinea fowl, rabbit and juveniles of Clarias gariepinus have been conducted using Baobab Seed Cake (BSC) as protein source on different inclusion levels and indicate good performance in general (Mwale *et al.,* 2008; Chimvuramahwe *et al.,* 2011; Anene *et al.,* 2012; Oladunjoye *et al.,* 2014). A study conducted by Magonka *et al.* (2018) on growth performance of pigs fed baobab seed cake based diet, reported that BSC can replace Sunflower Seed Cake (SSC) up to 5% without detrimental effect on their performance. However, there is scanty information on the carcass quality of pig fed with BSC, regarding also rumours on BSC oil to consumer, no information on the safety of consumers who ate pork fed BSC. It was expected that result from this study would be very important in imparting knowledge on the use of BSC in pigs' rations; reducing production cost hence increased profitability in the pig industry. It is due to this need the study was designed to investigate the growth performance, production cost and carcass quality of pigs fed BSC as protein source on growing pigs.

Material and methods

Experimental site

The study was conducted on-station at TALIRI Vianze main farm about four kilometers from Mpwapwa town. The farm lies at an altitude of about 1,100m above sea level. The average rainfall of 660mm varies greatly in distribution and amount from year to year. The average minimum temperature is 15.5°C, the coolest months being August and warmest month being November (30.2°C).

Experimental Animals and Management

Pigs used in the experiment were born and raised in the farm. Pigs were housed in a house roofed with iron sheets. One side of each pen allowed pigs to access sunlight every day. Twenty-four (24) weaner pigs that are crossbreds of Large-white and Landrace aged twelve weeks were selected for the study. Pigs were randomly allotted to four (T1, T2, T3 T4) diets in a completely randomized design (CRD). Prior to commencement of the experiment, all pigs were treated against external and internal parasite. The first week was used to acclimatization the feed and monitoring of amount of feeds utilized/ fed per day. All the animals were fed twice and drinking water was provided ad-libitum.

Experimental Diets

As indicated in Table 1, four (4) experimental diets were formulated with BSC. The inclusion levels of BSC were 0, 7, 14 and

Table 1: Ingredient used in formulation of pig diet

Ingredient	T1	T2	T3	T4
Maize bran	70	70	70	70
Sunflower seed cake	21	14	7	0
Baobab seed cake	0	7	14	21
Fish meal	6	6	6	6
Bone meal	1	1	1	1
Limestone	1	1	1	1
Premix	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Total	**100**	**100**	**100**	**100**

21% in diet 1, 2, 3 and 4 respectively. Diet 1 (control) was sunflower based with no BSC while in the other diets; BSC was replacing part of the SSC. All rations were balanced to satisfy the nutrient requirements for growing pigs. BSC was collected from baobab oil extraction machine in Dodoma municipal.

Data Collection and Analysis

Data collected were feed intake, weight gain and mortality while feed conversion ratio was determined. Feed cost and feed cost per kilogram weight gain were calculated. Each pig was measured from the start of experiment and thereafter on weekly basis using weighing scale to the end. The experiment lasts for eighty-four (84) days. Feed intake was determined by subtracting the left over of the feed offered the previous day from quantity given. Feed Conversion Ratio (FCR) was calculated from records of feed intake and weight gain by dividing feed intake of pig by the weight gain.
Feed conversion ratio = feed intake/weight gain

Production cost

Feed cost per kg of the diet was calculated by considering the cost of each ingredient used in formulating the entire diet (diet 1, 2, 3 and 4). The costs per kg of the diet were calculated by multiplying the percentage composition of the feedstuffs with the price per kg of each feedstuff and summing all up. Total feed intake × cost per kg of feed gave total feed costs for each diet. Gross margin was calculated as total income minus total feed cost.

Carcass analysis

Four (4) male pigs from each replicate were used at the end of the experiment to evaluate the carcass quality and organ characteristic of the pigs fed different levels of BSC diets. Male pigs were chosen for carcass quality evaluation at the same time to reduce their number in the farm. Prior to slaughter, pigs were fasted for 16 hours while provided with sufficient drinking water. Then slaughtered and bled completely. The head, trotters, tail, intestinal contents and organs were removed. The remaining carcass were weighed and expressed as percentages of the live weight to obtain the warm dressing out percentage. The dressing percentage was calculated as Dressing Percentage (DP) = (Carcass Weight / Live Weight) x 100. The internal organs were also weighed and expressed as a percentage of the carcass weight.

Abdominal fat was measured at the abdominal underlay and back fat thickness at the 1st and 4th ribs with vernier calipers. The carcass length was measured from the anterior edge of the first rib to anterior edge of the aitchbones

Laboratory analyses

Samples of experimental diet and baobab seed cake were analyzed for proximate composition using the methods of AOAC (1990). Different parts of male pig were taken to laboratory to analyze the histopathology trend of four treatments.

Statistical Analyses

Data analysis was carried out by one-way analysis of variance using SAS (2006) software package where significance were observed and Duncan's multiple range tests were used to separate the means.

Result and Discussions

The chemical compositions of the diets used in this study are shown in Table 2. Crude protein content was slightly higher in diets with SSC than in those contain BSC. The content of crude fibre was lower in diets contain BSC alone than those composed with SSC. This implies that fibre content in SSC is higher than in BSC. The energy content increased as level of BSC increased in the diets. Though there were slight differences in the crude protein and energy contents among the SSC and BSC based diets, all diets were almost isoproteneous and isocaloric.

Figure 1 shows the growth performance trend of four diets. Diet 2 had higher gain than other three diets, followed by diet 3 and the lowest gain was found on diet 4 with BSC alone as source of protein. No significant effect of diets was observed in the body weight gain. Pigs received 7% and 14 % BSC were almost similar with respect to their final and gain weight indicates that they can tolerate up to 14% BSC without adverse effect on growth. However,

Table 2: Chemical composition of the experimental diets

Component	Diets			
	1	2	3	4
Dry matter (%)	92.50	92.57	91.85	92.20
Crude protein	17.50	17.30	17.20	16.90
Crude fibre	8.20	6.25	6.00	5.85
Ether extract	10.75	10.72	10.22	10.10
Tryptophan	0.27	0.26	0.25	0.23
Lysine	1.08	1.07	0.98	0.89
Methionine and Cystine	0.74	0.73	0.66	0.56
Energy content (Kcal/kgDM)	1,880.13	2,024.81	2,065.33	2,085.21

the weight depression that was observed in at full BSC (21%) may indicate their inability to tolerate BSC alone. These findings are supported by Mwale *et al.* (2008) who reported poor performance in guinea fowl fed 15% BSC. Also, Chimvuramahwe *et al.* (2011) who reported poor performance in broilers, fed high level of BSC. Oladunjoye *et al.* (2014) who reported growth depression in rabbit, fed 15% inclusion level of BSC.

Performance and economy of feeding BSC in growing pigs

Table 3 shows weight, feed cost, intake and income of using BSC in pig diets. Feed cost decreased progressively with increased level of BSC in the diet. Pigs that received diets with high level of BSC had lower feed cost than the control group. The reduction that was observed in feed cost can be attributed to low cost and readily availability of BSC. The lower production cost makes the BSC attractive in pig production, however, pigs in that group had lower weight this might be attributed to the poor growth which can be caused by poor feed utilization. This is supported by Uchegbu *et al.* (2004) who reported poor utilization of feed in higher level of seed meal in finisher broiler.

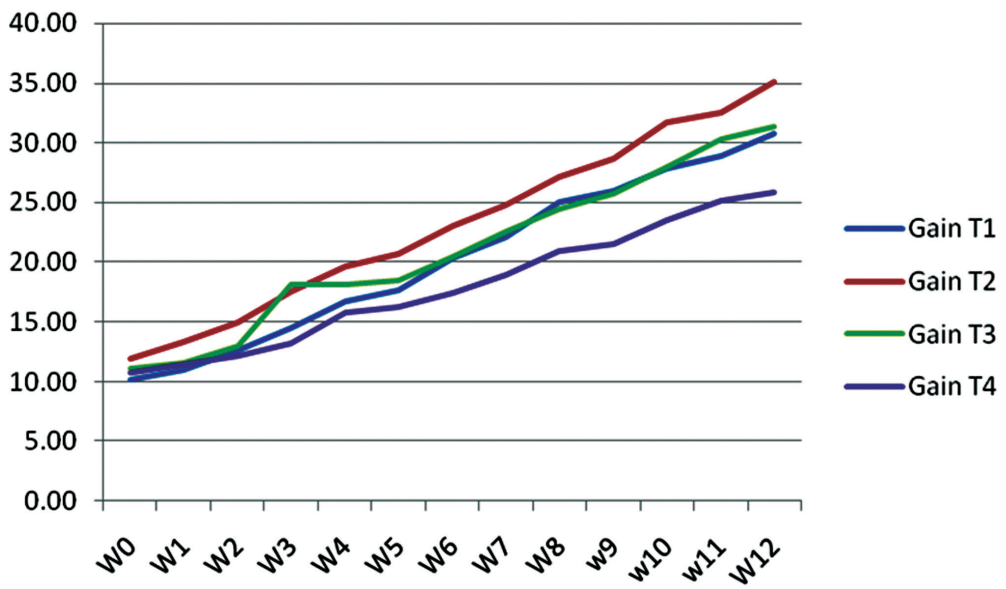

Figure 1: Trend showing performance of pigs in four diets

Table 3: Performance and economy of feeding BSC in pig

	Diet 1	Diet 2	Diet 3	Diet 4
Number of pig	6	6	6	6
Final weight	30.75[a]	35.08[b]	31.33[a]	25.90[c]
Initial weight	10.20[a]	11.89[a]	11.12[a]	10.72[a]
Total weight gain (kg)	20.5[a]	23.19[a]	20.21[a]	15.53[b]
Feed cost / kg	386.50	404.00	386.50	386.50
Total feed intake (kg)	392.35	403.38	390.22	304.00
Total feed cost (Tshs)	151 643.28	162 965.52	150 820.03	117 646.74

Carcass characteristics and internal organ weight of pigs fed different levels of BSC

Table 4 shows the carcass characteristics and internal organs of the pig fed BSC. The pre-slaughter weight and carcass weight were similar but the diet 4 with full BSC (21%) was lower than others. No significant effect of the diets was observed in internal organs however the diet 4 was lower in weights than others.

Histopathology results of tested tissues

The results of the histological examination of the colon, skeletal muscles, duodenum, lymph nodes and kidney did not show any significant changes. This implied that colon, duodenum and kidney of the pigs were able to cope with the test ingredient without signs of toxicity at the highest level of inclusion in this study, thus explaining why there were no signs of disease in the experimental pig. On the other hand, ileum shows some mild changes to the crypts and villi that appeared to be dose-dependent. They include villous shortening and destruction and an increase in goblet cells. The results of the jejunum show mild shortening and distortion of villi and hemorrhage in villous and cryptal areas. The liver examination points out hemorrhage from central veins extending to mid-zonal areas of the hepatic lobule. The severity of this change was in a dose-dependent manner. Spleen results reveal a splenic reaction manifested by increase in blood to the organ and loss of lymphoid follicle organization. These changes appear to be in a dose-dependent manner.

Lung examination shows thickening of alveolar wall (interalveolar septa), some hemorrhage and infiltration of inflammatory cells (lymphocytes and plasma cells). The changes were in a dose-dependent fashion. All the changes observed in some of internal organs investigated were not bad for consumption.

Table 4: Carcass characteristics and internal organ weight of pigs fed different levels of BSC

Parameter	Diet 1	Diet 2	Diet 3	Diet 4
Live weight (kg)	41.5	38	36	19.5
Carcass wt (kg)	23	20.5	18.5	9.5
Dressing percentage (%)	55.4	53.9	51.4	48.7
Carcass length (cm)	71	58	52.5	40.5
Spleen (kg)	0.13	0.11	0.09	0.07
Kidney (kg)	0.34	0.27	0.26	0.28
Lungs (kg)	0.96	0.80	0.83	1.12
Liver (kg)	2.62	1.97	2.02	2.66
Heart (kg)	0.41	0.36	0.37	0.38

Conclusion

BSC can be included in pig's diets up to 7 % without detrimental effect on growth performance. Production cost progressively reduced when level of BSC increased in the diets.

No significant effect of the diets was observed in internal organs. They may or may not develop into lesion when exposure time is extended. Probably an experiment with long time exposure could provide an answer.

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