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High-Quality Cassava Peel[®]Mash Supplemented with Direct Fed Microbial as an Alternate Source of Energy Supplement: Effect on Performance and Economic Analysis of Weaned Pig

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Abstract

The main objective of this study was to investigate the effect of Direct fed microbial (DFM) on High-quality cassava peel[®] (HQCP) utilization when HQCP is used to replace maize up to 15kg(37.5%) out of total 40kg maize in the diet of by weaned pigs. A total number of ninety crossbred (Large White × Landrace) weaned pigs with an average initial weight of 11.10 ± 0.4 kg ($\pm$ SE) were used for the study. The experimental animals were assigned to five dietary treatments (T) in a $2 \times 2 + 1$ factorial design of eighteen weaned pigs per treatment. Pigs on T1 were given 40% maize-based diet without HQCP, while T2 had 7.5kg (18.75%) of the total maize replaced with HQCP and T3 had 15kg (37.5%) of total maize replaced with HQCP. The pigs on T4 were given the same diet as in T2 with the addition of multi-strain DFM and pigs on T5 were given the same diet with those on T3 with addition of multi-strain DFM. The least final weight was recorded in treatment 3 while the highest final weight was recorded in treatment 2. Treatment 4 recorded the lowest body weight gain while the highest body weight gain was recorded in treatment 2. There was no effect of DFM on the performance of the pigs, as the treatments with DFM inclusion did not give improved performance over the treatment without the DFM. The feed conversion ratios of 2.60 to 3.10 were obtained in this study. Treatment 2 recorded the least feed conversion ratio (2.60) while treatment 4 feed conversion ratio (3.10) was the highest. There was neither significant effect of HQCP level nor DFM inclusion on all the performance parameters. The interaction between HQCP levels and DFM was likewise not significant. The cost of feeding per unit weight gain (N/kg) was comparable among the groups mainly due to the savings on account of the lower cost of HQCP. It was therefore concluded that weaned pig can utilized HQCP up to 15kg (representing 37.5% of the maize content) without any deleterious effect on their performance while the addition of DFM may not be necessary in order to reduce the cost of production.

Keywords: Multi-strain direct fed microbial, processed cassava peel, non-conventional feedstuff, pig feeding

Introduction

A good alternative source of energy for animal feeding that can replace maize is cassava peel. More than 95 percent of cassava processing requires peeling which generates up to 14 million Mt of waste annually, and the generated peel can be further processed and used as energy source for the monogastric animal (Okike *et al.*, 2015). The recent advance in feed technology has led to the development of new feedstuff from cassava peels which has brought about an improvement in the quality of the peel known as high-quality cassava peel[®] (HQCP).

High-quality cassava peel has been reported to replace up to 75% of maize in the diet of growing pig (30% of the total diet) but can only replace maize up to 15% in the total diet of weaner pigs (Adesehinwa *et al.*, 2016). The inability of the weaner pigs to effectively utilize HQCP may be due to their age, since utilization of fiber by pigs has been reported to increase with advancement in age (Noblet *et al.*, 1994). It is probable that the use of feed additives that aid digestion may further enhance the utilisation of HQCP by weaned pigs.

Direct-fed microbials (DFM) are live microorganisms, which when administered in adequate amounts confer a health benefit on the host. Usually, DFM contains desirable gastrointestinal microbial cultures and/ or ingredients that may enhance the growth of desirable gastrointestinal microbes. Proliferation of this microorganism in the gastrointestinal stimulates metabolic activities and improves digestion of fibre from various sources (Kerr *et al.*, 2013, Fatufe *et al.*, 2016).

This study was therefore designed to investigate the effect of DFM on HQCP utilization by weaned pigs.

Materials and Methods

A total number of ninety crossbred (Large White × Landrace) weaner pigs with an average initial weight of 11.10 ± 0.4 kg ($\pm$ SE) were used for the study. The study took place at AK Research farm, Eleyele, Ibadan and lasted for eight weeks. The experimental animals were assigned to five dietary treatments (T) in a $2 \times 2 + 1$ factorial design of eighteen weaners per treatment. The factors were two (2) levels of HQCP (i.e. 7.5 and 15kg), two (2) levels of multi-strain direct fed microbials (DFM) inclusions and one (1) control with neither HQCP nor DFM inclusion. Each treatment had three replicates with six pigs per replicate. A basal diet was formulated based on maize, groundnut cake and palm kernel cake. High-Quality Cassava peel replaced maize in the basal diet in treatment 2 to treatment 5.

Pigs on T1 were given 40% maize-based diet without HQCP and multi-strain DFM, T2 had 18.75% of the total maize replaced by HQCP and T3 had 37.5% of the total maize replaced by HQCP. The pigs on T4 were given same diet as in T2 with the addition of multi-strain DFM and pigs on T5 were given the same diet with those on T3 except with the addition of multi-strain DFM (table 1). The multi-strain DFM used in the study contained 99.9% water, 1×10^8 CFU/g *Lactobacillus* sp, 4×10^{12} CFU/g *Bacillus* sp and 11×10^5 CFU/g *Saccharomyces cerevisiae*, and was supplemented at 1.5 ml/kg diet. The animals were allowed *ad libitum* access to feed and water in the concrete-floored pens where they were kept throughout the 56-day duration of the trial.

Pigs were weighed on day one prior to the onset of the trial and thereafter, weekly. Feed intake record was taken on a daily basis and feed conversion ratio was calculated. Proximate composition and gross energy value of the test ingredients and experimental diets were carried out as described by Association of Official Analytical Chemists (AOAC, 1990). Energy was determined with a bomb calorimeter. Data obtained were subjected to analysis of variance (ANOVA) appropriate for factorial design, using the general linear model procedures of SAS. Statistical significance was assessed at $p < 0.05$ (95% confidence).

Table 1. Ingredient composition of diets having graded level of high-quality cassava peel mash

Ingredients (%)	T1	T2	T3	T4	T5
Maize	40	32.5	25	32.5	25
HQCP	0	7.5	15	7.5	15
Wheat bran	10.5	9.5	8.5	9.5	8.5
Palm oil	1.5	2.5	3.5	2.5	3.5
Others	48	48	48	48	48
Total	100	100	100	100	100
Calculated analysis					
Crude fibre (%)	5.06	5.48	5.90	5.48	5.90
Crude protein (%)	20.55	20.20	19.86	20.20	19.86
Metabolizable energy (kcal/kg)	2754.85	2782.47	2810.10	2782.47	2810.10
Calcium	1.67	1.68	1.69	1.68	1.69
Phosphorus	0.80	0.79	0.79	0.79	0.79
Lysine	1.09	1.07	1.04	1.07	1.04
Methionine	0.38	0.36	0.35	0.36	0.35

Others (%): Groundnut cake meal 20, Fish meal 3, Palm kernel cake 20, Limestone 1.3, Bone meal 2.5, Salt 0.5, DL-Methionine 0.05, L-Lysine 0.40 and Vitamin-mineral premix 0.25. HQCP: High-quality cassava peel.

Results and Discussion

Table 2 shows the proximate composition of the test ingredients and experimental diets, with the analysed values of the test ingredients and the diets found to be similar to the calculated values (Table 1).

Table 2: Proximate composition of experimental diets (%)

Parameters	T1	T2	T3	T4	T5	Maize	HQCP
Dry matter	9.325	9.235	9.135	9.19	9.095	90.65	90.94
Crude Protein	17.53	17.735	18.635	17.825	18.835	11.21	6.63
Crude Fibre	5.835	6.135	6.29	6.08	6.235	1.27	8.7
Crude fat	3.6	3.64	3.7	3.68	3.74	4.12	2.47
Ash	6.315	6.41	6.505	6.45	6.595	3.76	3.28
NFE	57.395	56.845	55.735	56.775	55.5	70.3	70
Gross energy (kcal/kg)	4009.5	4041.5	4024.5	4037	4033	3784	2985

NFE - Nitrogen free extract, HQCP – High quality cassava peel

The performance response of weaned pig to the dietary maize replacement with HQCP is presented in Tables 3. The lowest final weight (24.42kg) was recorded in treatment 3 while the highest final weight (26.97kg) was recorded in treatment 2, however, there were no significant ($p>0.05$) differences in the final weights across the treatments. Treatment 4 recorded the lowest body weight gain (13.25kg) numerically, while the highest body weight gain (16.01kg) was recorded with pigs fed treatment 2 diet, though the differences were not statistically significant.

Table 3: Performance of weaned pigs fed experimental diets

Parameters	T1	T2	T3	T4	T5	P (ANOVA)	SEM
Initial weight (kg)	10.97	10.96	10.88	11.46	11.53	0.99	0.50
Final weight (kg)	25.95	26.97	24.42	24.71	26.42	0.87	0.85
DWG (g)	267.49	285.87	241.78	236.57	265.87	0.33	8.22
ADFI (g)	716.51	769.50	691.80	672.24	753.29	0.77	26.35
FCR	2.80	2.60	2.91	3.10	2.98	0.65	0.10

DWG - Daily weight gain, ADFI - Average daily feed intake, FCR – feed conversion ratio, SEM - Standard error of mean

The addition of DFM did not confer improved performance on the pigs fed diets T4 and T5 over the pigs on treatments T2 and T3, without the DFM addition. This shows that the DFM may not have any effect on the levels of HQCP used in the study, taking into consideration the crude fibre contents and fibre fractions of the test diets. However, the study of Fatufe *et al.* (2016) on the effect of DFM on two different fibre sources (palm kernel cake and rice bran) showed that DFM improved utilization of palm kernel cake but had no positive effect on rice bran as a fibre source in pig diet. It is well known in the literature that the utilization of crude fibre by non-ruminants vary considerably depending on fibre source, the degree of lignification, level of inclusion and extent of processing. The least daily feed intake (672 g) was recorded with T4 diet, while T2 recorded the highest feed intake (770 g). Although there was no significant difference in feed intake and body weight gain, the treatment with the highest feed intake (T2) likewise recorded the highest weight gain vis-à-vis the one with lowest feed intake also recorded the lowest weight gain. The feed conversion ratios of 2.60 to 3.10 were obtained in this study. The levels of HQCP, DFM inclusion and their interaction had no effect on all the performance parameters of the pigs (Table 4). There was no mortality recorded during the feeding trial.

Table 4: Interaction between HQCP level and direct fed microbial on performance of weaner pigs fed experimental diets

Parameters	T2	T3	T4	T5	SEM	P(ANOVA)		
						DFM	HQCP	DFM×HQCP
Initial weight (kg)	10.96	10.88	11.46	11.53	0.60	0.64	1.00	0.96
Final weight (kg)	26.97	24.42	24.71	26.42	1.03	0.95	0.84	0.31
DWG (g)	285.87	241.78	236.57	265.87	9.76	0.52	0.70	0.06
ADFI (g)	769.50	691.80	672.24	753.29	32.14	0.78	0.98	0.27
FCR	2.60	2.91	3.10	2.98	0.12	0.25	0.69	0.3806

DWG - Daily weight gain, ADFI - Average daily feed intake, FCR – feed conversion ratio, SEM - Standard error of mean., DFM - Effect of direct fed microbial, HQCP LEVEL - Effect of high quality cassava peel, DFM × HQCP - effect of interaction between level of high quality cassava peel and direct-fed microbial.

Table 5 shows the economics of production of the pigs in this study. Cost of feed per kilogram (N), total cost of feeding (N), average cost of feed per day (N) and cost of feed per kilogram weight gain (N/kg) were calculated by using the market cost of the ingredients at the time of the study. The highest cost of feed was recorded in treatment 4 due to the additional cost of DFM. The cost of feeding per unit weight gain was comparable across the groups, mainly due to the savings on account of the lower cost of HQCP compared to maize grains. Summarily, there were no significant differences in the total cost of feeding (N), average cost of feed per day (N) and cost of feed per kilogram weight gain (N/kg).

Conclusion

The addition of DFM to weaned pigs diet containing up to 15kg HQCP as a replacement for 37.5% of the maize fraction showed no positive effect on the weaned pig performance. It can therefore, be concluded that weaned pigs can utilize up to 15kg HQCP without any deleterious effect on their performance, hence the addition of DFM may not be necessary, as it will result in additional production cost without any positive effect on the performance of the weaned pigs.

Table 5: Economic analysis of weaned pigs fed HQCP diets supplemented multi-strain direct fed microbial

Parameters	T1	T2	T3	T4	T5	±SEM
Cost of feed (N/Kg)	137.37	134.56	131.75	137.76	134.95	0.23
Total feed intake (Kg)	40.13	43.09	38.74	37.65	42.18	1.48
Average daily feed intake (Kg)	0.72	0.77	0.69	0.67	0.75	.026
Total cost of feeding (N)	5511.90	5798.30	5104.00	5186.00	5692.70	199.35
Average cost of feed per day (N)	98.43	103.54	91.14	92.61	101.65	3.60
Feed Gain Ratio	2.80	2.60	2.91	3.10	2.98	.105
Feed Cost/kg Weight Gain (N/Kg)	385.20	349.79	383.98	427.25	402.40	14.26

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