GROWTH PERFORMANCE AND FAT DEPOSITION IN EARLY WEANED PIGS FED DIETS CONTAINING HIGH QUALITY CASSAVA PEEL

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Abstract

Early weaning is a nutritionally demanding phase in pig production that requires use of quality feed resources. In many developing countries, the rising cost of conventional feed ingredients has prompted interest in alternative feedstuff. This study investigated the effect of replacing maize with High Quality Cassava Peel (HQCP) on the growth performance of early weaned piglets. Eighteen (18) early weaned piglets with average initial weight of 7.33 ± 0.42 kg were assigned to three dietary treatments in a completely randomized design: T1 (control), T2 (15% HQCP) and T3 (30% HQCP) with three (3) replicates of two (2) piglets each. The trial lasted 42 days during which feed intake and weight gain were monitored. There were no significant ($p<0.05$) differences in all performance parameters measured across all experimental treatments. Piglets fed the control diet (T1) had a final weight of 36.83 kg while those on T2 and T3 had final weights of 37.41 kg and 36.91 kg respectively. Total weight gain ranged from 29.58 kg (T3) to 29.91 kg (T2). Average daily feed intake values were 1.14, 1.13 and 1.15 kg for the pigs on T1, T2 and T3 respectively. Feed conversion ratio varied from 2.65 (T1) to 2.78 (T3). The back fat thickness was significantly ($P<0.05$) lower in pigs on T1 (10.40 mm) compared to 9.44 mm in control (T1). The study revealed that early weaned pigs tolerated HQCP-based diets without adverse effects on performance with back fat deposition within commercially acceptable limits.

Keywords: Alternative feedstuff, Back fat, By-product, HQCP, Maize

Description of Problem

Early post-weaning period is one of the most critical stages in swine production, marked by abrupt dietary, environmental and physiological changes that can severely impair growth, feed efficiency and immune competence of animals [1]. During this stage, pigs are particularly sensitive to dietary imbalances, making the choice of feed ingredients crucial for successful transition from sow milk to solid feed. Traditionally, energy-dense grains like maize have been the primary components of post-weaning pig diets. However, the escalating cost and competition for this feed resource with human and industrial sectors in sub-Saharan Africa have increased the economic burden on pig producers [2]. These constraints make it imperative to identify alternative, low-cost and nutritionally viable feed resources that can help reduce feed-related production limitations.

In an attempt to address these challenges, interest has grown in the use of agro-industrial by-products as alternative energy sources. High Quality Cassava Peel (HQCP) produced by fermenting and drying cassava processing waste has been identified as a promising substitute for maize. It is locally available, non-competitive with human food and has a substantially lower cost per unit of energy [3]. Previous studies have shown its suitability in grower and finisher pigs, with minimal negative impacts on feed intake or digestibility when properly incorporated [2, 3, 4]. However, there is need to investigate the effect of HQCP inclusion in the diet of pigs during the early weaning phase. This is a period during which pigs may be more sensitive to dietary fibre, feed texture and energy availability. This study evaluated the effects of partially replacing maize with HQCP on the growth performance and back fat deposition of early weaned pigs.

Materials and Methods

Study Site and Animal Management

The experiment was conducted at AK Research Farm, Oyo State, Nigeria. Eighteen (18) healthy early weaned crosses of Landrace and Large White piglets (average initial weight: 7.33 ± 0.42 kg) were used for the experiment. The piglets were housed in well ventilated open-sided concrete pens and provided with unrestricted access to clean drinking water throughout the experimental period. Prior to the commencement of the trial, the animals were dewormed and allowed a 7-day adaptation period during which they were fed the control diet. The piglets were randomly allotted to three (3) dietary treatments (T1, T2 and T3) with each treatment replicated three (3) times and two (2) piglets per replicate in a completely randomized design (CRD).

Experimental Diets

Three diets were formulated to meet the nutrient requirements of early weaned pigs according to NRC [5] guidelines. Diet 1 contained maize as the primary energy source, Diet 2 had 15 % of the maize component replaced with High Quality Cassava Peel (HQCP) and Diet 3 had 30 % of the maize replaced with HQCP. The gross composition of the experimental diet is as presented in Table. 1. The piglets were fed *ad libitum* throughout the 42-day feeding trial.

Table 1: Gross composition of the experimental diets

Ingredient (Kg)	T1	T2	T3
Maize	45.00	30.00	15.00
HQCP	0	15.00	30.00
Corn bran	12.00	12.00	12.00
SBM	25.00	25.00	25.00
Wheat bran	10.00	10.00	10.00
Fish meal	3.00	3.00	3.00
Bone meal	2.50	2.50	2.50
Limestone	1.50	1.50	1.50
Methionine	0.15	0.15	0.15
Premix	0.25	0.25	0.25
Lysine	0.25	0.25	0.25
Salt	0.30	0.30	0.30
Toxin binder	0.05	0.05	0.05
Total	100.00	100.00	100.00
Calculated Analysis			
Crude Protein (%)	19.55	18.65	17.75
Metabolisable Energy (kcal/kg)	2817.10	2752.00	2686.90
Crude fibre (%)	4.91	6.41	7.91

Data Collection and Performance Evaluation

Piglet weights were recorded at the start of the experiment and then weekly using a calibrated platform digital scale. Feed offered and feed refusal were monitored daily and recorded to determine total feed intake. Growth performance indices such as total weight gain, average daily feed intake and Feed Conversion Ratio (FCR) were also calculated.

Back fat deposition

Back fat thickness was measured at the end of the feeding trial using an ultrasound device. Measurements were taken at the P2 position located 5 - 6.5 cm off the dorsal mid-line between the third and fourth last ribs, following the standard procedure described by NPPC [6].

Statistical Analysis

Data were subjected to one-way analysis of variance (ANOVA) using SPSS version 26.0

(IBM Corp., Armonk, NY, USA). Treatment means were compared using Duncan's Multiple Range Test at a significance level of $P < 0.05$.

Results and Discussion

Results of the growth performance of early weaned piglets fed diets in which maize was partially replaced with High Quality Cassava Peel (HQCP) are as shown in Table 2. All performance data did not differ ($p<0.05$) significantly across all the treatments. At the end of the feeding trial, piglets fed 15% HQCP (T2) recorded a final body weight of 37.41 kg while those on the control diet recorded 36.83 kg. Total weight gain and average daily gain followed a similar trend with piglets on the HQCP diets achieving growth rates similar to those on the conventional maize-based diet. Pigs in T1 and T3 gained 0.42 kg/day while those in T2 gained 0.43 kg/day. This observation can be attributed to high capacity for starch digestion typical of the gut of early weaned pigs and their adaptation to utilise the non-starch polysaccharides (NSPs) in HQCP when introduced gradually [1]. The absence of growth depression at higher inclusion rates could also be linked to the moderate crude fibre level of fine HQCP which may have promoted optimal gut motility and microbial fermentation without exceeding the piglets' digestive tolerance threshold [7]. This corroborates previous findings by Adesehinwa *et al*. [3] who reported no significant ($p<0.05$) differences in growth rate when cassava peels were processed into HQCP and used in pig diets up to 30%. The results further reinforce the claim by Amole [2] that HQCP, when detoxified and properly included in the diet, can provide sufficient energy to support growth in monogastric animals.

Table 2: Growth indices and back fat thickness of early weaned piglets fed HQCP as partial replacement for maize in the diet

	T1	T2	T3	SEM	P-value
Initial Weight (kg)	7.16	7.50	7.33	0.34	0.94
Final Weight (kg)	36.83	37.41	36.91	1.36	0.99
Feed intake (kg)	79.96	79.34	80.75	1.28	0.92
Weight Gain (kg)	29.66	29.91	29.58	1.04	0.99
ADFI (kg)	1.14	1.13	1.15	0.01	0.92
ADWG (kg)	0.42	0.43	0.42	0.01	0.99
FCR	2.70	2.65	2.78	0.06	0.79
Back fat (mm)	9.44[b]	10.40[a]	10.13[a]	0.17	0.03

[abcd] Means with different superscript in each row are different significantly ($P<0.05$).
Where T1 = Control diet; T2 = 15% HQCP without soybean meal; T3 = 30% HQCP without soybean meal. ADWG = Average daily weight gain (kg/day); ADFI = Average daily feed intake (kg/day); FCR = Feed conversion ratio; SEM = Standard error of the mean. Means within a row with different superscripts differ significantly at $P < 0.05$.

The results also revealed that feed intake was unaffected by HQCP inclusion. Piglets on the 30 % HQCP diet (T3) consumed 80.75 kg while those on 15 % HQCP consumed 79.34 kg, indicating that the fibrous nature of HQCP did not negatively impact palatability or voluntary intake when compared to the control diet. The particle size reduction and detoxification of cyanogenic glycosides during HQCP processing may have enhanced diet acceptability and reduced anti-nutritional stress, enabling voluntary intake similar to maize-based diets [8, 9]. The moderate crude fibre content of HQCP, particularly in finely ground form, could also have improved gut health by stimulating peristalsis without imposing excessive bulk thus maintaining steady feed consumption [1]. This observation aligns with that of Adesehinwa *et al*. [10] who reported that properly fermented HQCP maintains acceptable palatability for pigs and offers a viable alternative energy source. Feed conversion ratio (FCR) of piglets on the control (2.70), those on T2 (2.65) and those on T3 (2.78) did not differ ($p<0.05$) significantly.

Back fat Deposition

The back fat thickness was significantly ($P<0.05$) lower in piglets on T1 (9.44 mm) than the back fat thickness of piglets on T2 (10.40 mm) and T3 (10.13). The slight increase in fat depth in HQCP-

fed pigs may be linked to the higher fermentable carbohydrate content of HQCP which enhances acetate production in the hindgut necessary for lipogenesis [1]. Variations in protein-to-energy ratios between HQCP and maize diets may also influence nutrient partitioning, favouring modest fat deposition [11]. These findings agree with that of Sogunle *et al*. [7] who reported that cassava peel inclusion in pig diets can alter carcass fat composition.

Conclusion and Application

This study demonstrates that High Quality Cassava Peel (HQCP) can effectively replace maize (partially) in the diets of early weaned piglets at inclusion levels up to 30% without compromising growth performance, feed intake or feed conversion efficiency. HQCP offers swine producers in cassava-growing regions a sustainable, locally available and cost-effective alternative to maize. Its adoption can reduce feed costs while maintaining production efficiency, making it particularly relevant for small-to-medium scale pig enterprises operating under cost constraints.

References

1. Pluske, J. R., Turpin, D. L., and Kim, J. C. (2018). Gastrointestinal tract (gut) health in the young pig. *Animal Nutrition*, 4(2), 187–196. https://doi.org/10.1016/j.aninu.2017.12.004
2. Amole, T. A. (2021). Transforming cassava peel waste into high quality livestock feed. *Innovation Brief: International Livestock Research Institute*, Pp 1 – 6.
3. Adesehinwa, A. O. K., Samireddypalle, A., Fatufe, A. A., Ajayi, E., Boladuro, B. and Okike, I. (2016). High quality cassava peel fine mash as energy source for growing pigs: effect on growth performance, cost of production and blood parameters. *Livestock Research for Rural Development*, *28* (11), 207.
4. Unigwe, C. R., Mhomga, L. I., Igwe, I. R. and Egwu, L. U. (2023). Cassava peels as feed resource for animal production - A review. *World Scientific News*, *183*, 104-120.
5. National Research Council, Division on Earth and Committee on Nutrient Requirements of Swine (2012). Nutrient requirements of swine.
6. National Pork Producers Council (NPPC) (2000). *Procedures to evaluate market hogs* (3rd ed). Des Moines, IA: National Pork Producers Council.
7. Sogunle, O. M., Adekunle, O. A. and Fanimo, A. O. (2018). Performance and nutrient digestibility of pigs fed dietary inclusion levels of cassava peel meal. *Livestock Research for Rural Development, 30* (9).
8. Tewe, O. O. and Egbunike, G. N. (1992). Utilization of cassava in non-ruminant livestock feeds.
9. Amole, T. A., Adekeye, A. B., Adebayo, A. B., Okike, I., Duncan, A. J. and Jones, C. S. (2022). High-Quality Cassava Peel® (HQCP®) mash as a feed ingredient for livestock – a review of feeding trials.
10. Adesehinwa, A. O. K., Amole, T. A., Ajayi, E., Makanjuola, B. A., and Okike, I. (2019). High quality cassava peel® production and its utilization in pig production: A review. *Nigerian Journal of Animal Production*, *46*(3), 205 - 218.
11. Lopez-Ordaz, R. (2002). Investigation of nutritional and metabolic regulators of puberty in dairy and beef heifers. *New Mexico State University.*