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Research Article

Replacement Value of Sundried Cassava Peels Meal for Maize on Growth Performance and Haematology of Grower Pigs

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Abstract: Twenty four (24) cross breed grower gilts (Largewhite X Duroc) of 60-65 days old with an average weight of 20.73+0.173 kg were randomly assigned to four treatments of T1 (40% maize diet and 0% cassava peels (CP)), T2 (20% maize and 20% CP), T3 (10% maize and 30% CP) and T4 (0% maize and 40% CP) in a completely randomized design. Each treatment was replicated thrice with two gilts each. They were fed the above rations for 84 days. All data obtained were subjected to analysis of variance while significant means were separated using Duncan's New Multiple Range Test. The results showed no significant difference (P>0.05) in the weekly body weight gain among all the treatments whereas the weekly feed intake showed a significant difference (P<0.05) when T1 was compared with other treatments. However, there was no significant difference (P>0.05) in weekly feed intake among T2, T3, and T4 pigs. In the haematology, T1 demonstrated a significant difference (P<0.05) when the Hgb concentration and WBC count were compared with the T2, T3 and T4 counterparts. Meanwhile, T2, T3 and T4 were not significantly different (P>0.05) after comparison. In the same vein, T1 and T2 were significantly different (P<0.05) when the PCV and RBC counts were compared with those of T3 and T4 but not the same (P>0.05) when compared together (T3 and T4). There was a significant difference (P<0.05) when the MCH and MCHC of T1 and T3 were compared with that of T2 and T4 but no statistical difference (P>0.05) between T1 and T3 or between T2 and T4. In the same vein, there was no significant difference (P>0.05) in MCV among all the treatments. All the haematological parameters fell within the normal physiological values. The above results showed that replacement of maize with up to 40% of cassava peels has no significant detrimental effect on pigs.
Keywords: Cassava peels, feed intake, haematology, gilts, growth performance

INTRODUCTION

Protein-energy malnutrition remains a major public health problem in many developing countries and there is the need to increase daily intake of protein, especially animal protein, using cheap and non conventional sources such as agricultural wastes and by-products of food processing [1]. Cassava (*ManihotesculentaCrantz*) is a staple food in tropical Africa and central and South America. Nigeria with an annual production of 34-40 million tonnes is the world largest producer of the crop [2]. Chief among the wastes obtained from cassava processing is the cassava peels which accounts for 5-20% of the root and it is estimated that about 4 million tonnes of cassava peels are generated from cassava processing in Nigeria annually [3-5]. They may contain high amounts of cyanogenic glycosides and higher protein content (< 6%) than other tuber parts [6]. Fresh cassava peels have 3 main deficiencies; they spoil very quickly, they contain phytates (up to 1% DM) resulting in low phosphorus availability in non- ruminants [7] and contain high amount of cyanogenic glycosides. Processing such as fermentation reduces cyanogenic potential andphytate content (0.7%) [8-11]. Well processed cassava peels have generally acceptable levels of HCN below 50mg/kg [4, 12].

The developed countries of the world produce a greater proportion of the grains, while the cereal production in the developing countries can not keep pace with the demand for human consumption, therefore hardly is any available for livestock feeding [13], hence the need for alternative feedstuff with less competition by other secondary industrial users and producers which are readily available in commercial quantity and affordable price [13]. Cassava peels, leaves and tender stems are under-utilized in Nigeria because they are often left to rot away or burnt off to create space for the accumulation of new generation of waste heaps [14] and emitting carbon iv oxide and producing a strong offensive smell [5, 15]. Cassava peels and pomace may cause surface water pollution especially if they are stored under heavy rain or simply disposed of in surface waters [16-18].

The addition of fibre to swine diets decreases the digestible energy (DE) and metabolizable energy (ME) concentrations of the diet [19, 20] and often results in bulk feeds. The fibrous portion of feed, being fairly indigestible to pigs, influences the digestibility of the other constituents by exerting a protective action, encasing these constituents in a digestion-proof shield, thereby obstructing the access of digestive enzymes [21,22]. Hence for efficient use of cassava peels in pig feeding, some form of physical treatment is essential to the breaking down of the fibre encapsulating the more soluble constituents so that digestive secretions can penetrate more completely [23].

Amino acid derived glycosides of α-hydroxynitriles, termed cyanogenic glycosides, are produced by a variety of plants as defense biomolecules [24, 25]. The cassava plant produces two toxic cyanogenic glycosides:–linamarin (2-β-D-glucopyranosyloxyl isobutyronitrile) and lotaustralin (methylbutyronitrile), a large proportion of which is present in the peels [26]. Chronic ingestion of fresh or processed cassava peel-based diets containing sub-lethal dietary cyanide has reportedly caused impaired thyroid function and growth, neonatal deaths and lower birth rates in animals [27, 28]. Various methods of processing, some more effective than others, have been described [29, 30]. The methods include grating and sundrying[31, 32], ensiling [33], fermentation [34, 35]. Sun-drying; the commonest method used in the treatment of cassava peels for livestock feeding by subsistence farmers in Nigeria, is only partially effective in reducing cyanogenic glycoside content [32].

Generally, the long-term and broad-based impact of cassava processing on the environment can be corrected by proper waste treatment [36] and the use of cassava by-products as feedstuffs or as an alternative substrate for biotechnological processes is a good way to alleviate environmental issues [18]. Since cassava peels are highly digestible products with reported values of 78% DM [37] and also highly degradable with reported values higher than 70% [38], they are a good feed for pigs, but must be supplemented with sources of protein and lipids in order to improve their palatability and digestibility [39] as well as processed in order to bring down to a tolerable levels, the cyanogenic glycoside content.

MATERIALS AND METHODS

Experimental Site and Materials

The experiment was carried out at the piggery unit of the Teaching and Research Farm of the Department of Animal Science, Ebonyi State University, Abakaliki, Nigeria. A total of 24 mixed breed (Largewhite x Duroc) gilts of 60-65 days old with an average initial body weight of 20.73$\pm$0.173 kg were used. Fresh cassava peels got from garri processing layout in Ezzamgbo, Ohaukwu L.G.A. of Ebonyi State were sundried for 3-5 days. Thereafter, the peels were crushed into particles of 5mm using a hammer mill. Other ingredients for the compounding of the diet were bought from Abakaliki Main Market.

Experimental Diets, Design and Management of Animals

The experimental diets are as below:

T1 = 40% maize and 0% cassava peels (CP) (control)
T2 = 20% maize and 20% CP
T3 = 10% maize and 30% CP
T4 = 0% maize and 40% CP

Each treatment was replicated thrice with two gilts each. The pigs were randomly assigned to each treatment in a completely randomized design. The pig house was cleaned and disinfected using detergent solution and later cresol and diazinon solutions. It was however, left for one week before stocking. The pigs were fed twice daily (at 5% body weight) in the morning (7am) and evening (5.30pm). Clean drinking water sourced from borehole was given *ad-libitum*. Routine deworming and deticking using Ivermectin injectable at 1ml per 33kg as prescribed by the Veterinary Doctor was administered subcutaneously before the commencement of the experiment. Other routine medications, vaccinations, sanitation and good management practices were observed during the course of the experiment.

Data Collection and Analysis

The feed intake on daily basis and weekly weight gain were obtained using weigh back mechanism from the beginning till the end of the experiment. In the same vein, at the end of the experiment, sterile 10ml syringes and 21 gauge needles were used to collect aseptically 10ml of fresh blood via the external jugular vein. The blood samples were put in a sterile EDTA sample bottles for haematological analysis. The haematological indices included the red blood cells (RBC) and white blood cells (WBC) counts, haemoglobin (Hgb) concentration and packed cell volume (PCV) as described by [40, 41,57]. All the results were subjected to analysis of variance and statistical different means separated using Duncan's New Multiple Range Test [42]. Similarly, the feed conversion ratio (FCR) was obtained using:

FCR=average total feed intake/average total weight gain.

Table 1: Composition of the experimental diets for grower pigs

Ingredients	T1	T2	T3	T4
Maize	40	20	10	-
Cassava peels	-	20	30	40
PKC	23.50	23.50	23.50	23.50
BDG	23	23	23	23
Soybean	4	4	4	4
Blood meal	5	5	5	5
Bone meal	2	2	2	2
Oyster shell	1	1	1	1
Methionine	0.35	0.35	0.35	0.35
Lysine	0.35	0.35	0.35	0.35
Premix	0.50	0.50	0.50	0.50
Salt	0.30	0.30	0.30	0.30
Total	100	100	100	100
Crude protein (%)	17.61	16.79	16.38	15.97
ME (Kcal/kg)	2577.33	2410.93	2327.73	2244.53

Key:-PKC = Palm kernel cake; BDG = Brewer's dried grain; ME = Metabolisable energy

RESULTS AND DISCUSSIONS

Growth Performance Parameters

Table 2 shows the performance of grower pigs fed diets with graded cassava peels meals (CPM). There was no significant effect ($P>0.05$) of inclusion CPM at 20%, 30% and 40% on all the parameters of performance considered excepting the average weekly feed intake ($P<0.05$). When the average weekly feed intake in T_1 (1.84kg) was compared with T_2 (2.14kg), T3 (2.20kg) and T_4 (2.21kg), there was a significant difference ($P<0.05$) but not when T_2, T_3 and T_4 were compared ($P<0.05$). The pigs on T_1 (2.13) treatment showed a significant difference ($P<0.05$) in feed conversion ratio (FCR) when compared to T_2 (2.65), T_3 (2.67) and T_4 (3.06) while T_2 and T_3 showed similar difference ($P<0.05$) when compared with T_4. The increase in weekly feed intake as the CPM increased could be due to the fact that the energy content of the feed progressively declined and the pigs had to eat more to meet their energy requirements. This conforms to the earlier confirmation through researches that animals eat in order to satisfy their energy needs and thus in a situation of progressively lowered dietary energy, feed intake will be higher [43; 44; 45; 46; 47]. The average weekly body weight gain of the pigs progressively decreased with increase in CPM when T_1 (0.86kg) was compared with T_2 (0.81kg), T_3 (0.82kg) and T_3 (0.72kg). This is in tandem with the findings of [48; 49] who found that increase in dietary energy increases the weight gain of pigs and vice versa. This is also in consonance with the work of [40] who stated that nutrition, especially dietary protein intake, affects the live weight and haematological parameters of animals since in this experiment there was gradual decrease in crude protein content of the diet as the CPM increased.

Haematological Parameters

Table 3 shows that there was a gradual decrease in the haemoglobin (Hgb) concentration, packed cell volume (PCV) and red blood cell (RBC) as the CPM increased in the diets while the white blood cell (WBC) showed no definite pattern. The Hgb concentration of the pigs showed T_1 (11.61g/dl), T_2 (9.81g/dl), T_3 (9.81g/dl) and T_4 (9.24g/dl) and for PCV as T_1 (34.60%), T_2 (32.19%), T_3 (30.05%) and T_4 (29.46%) whereas the RBC count showed T_1 (6.12 X 10^6/µl), T_2 (5.63 x 10^6/ µl), T_3 (5.22 x 10^6/ µl) and T_4 (5.10 x 10^6/ul) and the WBC counts were demonstrated as T_1 (15.10 x 10^3/ul), T_2 (14.63 x 10^3/ µl), T_3 (14.82 x 10^3/ µl) and T_4 (14.52 x 10^3/ µl). There was a significant difference ($P<0.05$) when the Hgb concentration for T_1 was compared with those of T_2, T_3 and T_4 but no significant difference ($P>0.05$) when those of T_2, T_3 and T_4 were compared. The same trend of significance ($P>0.05$) was also observed when PCV and RBC count of T_1 and T_2 were compared and similarly ($P>0.05$) when T_1 and T_2 were compared with T_3 and T_4. Although the above parameters fall within the normal physiological values for pigs as established by [50; 51; 52].The Hgb concentration, WBC and RBC counts fell with in the lower limits of the range as the CPM increased in quantity in the feed. This trend could have been orchestrated by the antinutritional factor(s) in the CPM which binds erythropoietic metals to itself, thereby progressively rendering them unavailable for absorption as the CPM increased. This conforms to the postulation of [53] that hydrogen cyanide has high affinity for metals such as copper and iron. This also attests to the observation of [50] that there is decreasing haematological parameters associated with low protein quality and increased hydrogen cyanide in diets. The above trend could be due to effect of hydrogen cyanide on protein since [54; 55] reported that protein deficiency reduces most haematological and serum parameters through reduced or impaired synthesis of blood cells which are largely proteinous. In the same vein, other calculated haematological parameters including mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular haemoglobin (MCH) demonstrated in-orderly gradation of values as the CPM inclusion progressively increased. It showed that pigs on T_1, T_2, T_3 and T_4 had MCHC values of 33.55g.dl, 30.48g/dl, 32.65g/dl and 31.36g/dl respectively. When the MCHC for T_1 and T_3 were compared with T_2 and T_4, there was significant difference (P<0.05) while no significant difference (P>0.05) existed when T_1 and T_3 were compared or when T_2 and T_4 were compared (P>0.05). Similarly when the MCH values for the pigs were equally compared, the T_1 (18.97pg) and T_3 (18.79pg) were not significant (P>0.05) similar to T_2 (17.42pg) and T_4 (18.12pg) (P>0.05) but when T_1 and T_3 were compared with T_2 and T_4, there was a significant difference (P<0.05). Unlike the MCHC and MCH, the mean corpuscular volume (MCV) increased in value with T_1, T_2, T_3 and T_4 demonstrating 56.54fl, 57.18fl, 57.57fl and 57.76fl respectively as the CPM inclusion progressively increased. In spite of this progressive increase in values, there was no significant difference (P>0.05) among the treatment pigs. Meanwhile, in all the haematological parameters considered above, they all fell within the normal physiological values as established by [51; 56]. It is also evident by these figures that the MCHC, MCH and MCV values for the pigs in T_1 demonstrated the best haematological parameters since the MCHC and MCH indicate the concentration of Hgb in RBC while the MCV indicates the RBC size and the higher the size, the higher the immature RBCs which is indicative of macrocytic regenerative anaemia [52]. The relatively poorer MCHC, MCH and MCV associated with CPM inclusions could be as a result of bound erythropoietic metals like iron, copper etc as the HCN content of the diet increased with increasing CPM. This trend could be linked to [53] who postulated high affinity of HCN for haemopoietic metals such as copper and iron as well as [50] who observed declining haematological parameters as HCN increased in feed. It also corroborates and absolves the work of [40; 54] who observed that dietary protein intake affects the live weight, serum and haematological parameters of animals.

Table 2: Performance characteristics of grower pigs fed cassava peels diets

Parameter	T1	T2	T3	T4	SEM
Av initial bwt (kg)	20.83	20.67	20.91	20.52	0.03
Av total bwt (kg)	31.15	30.33	30.78	29.16	0.56
Av total bwt gain (kg)	10.32	9.66	9.87	8.64	0.58
Av wklybwt gain (kg)	0.86	0.81	0.82	0.72	0.01
Av total feed intake (kg)	22.03^a	25.62^b	26.39^b	26.48^b	4.42
Av wkly feed intake (kg)	1.84^a	2.14^b	2.20^b	2.21^b	0.03
Feed conversion ratio	2.13^a	2.65^b	2.67^b	3.06^c	2.88

abc = rows with different superscripts are statistically different (P<0.05)

Table 3: Haematological parameters of grower pigs fed cassava peels diets

Parameter	T1	T2	T3	T4	SEM
Haemoglobin (Hgb) (g/dl)	11.61^a	9.81^b	9.81^b	9.24^b	0.48
PCV (%)	34.60^a	32.19^a	30.05^b	29.46^b	1.64
WBC (X 10^3 /UL)	15.10^a	14.63^b	14.82^b	14.52^c	1.19
RBC (X 10^6/UL)	6.12^a	5.63^a	5.22^b	5.10^b	0.34
MCHC (g/dl)	33.55^a	30.48^b	32.65^a	31.36^b	0.78
MCH (pg)	18.97^a	17.42^b	18.79^a	18.12^b	0.41
MCV (fl)	56.54	57.18	57.57	57.76	0.31

abc= rows with the different superscripts are statistically different (P<0.05)

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