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Effect of replacing concentrates with plantain peels and maize stalk on performance and serum biochemistry of weaned pigs

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Abstract

A total of 36 pigs were randomly allotted into three dietary treatments to evaluate the effects of feeding concentrates, plantain peels and maize stalk on the weight gain, feed intake, feed conversion ratio, high density lipoprotein, Aspartate amino transferase, Alanine amino transferase, glucose, total protein, triglycerides and cost of production of weaned pigs. Treatment 1 (T1) contained 100% concentrate; Treatment 2 (T2) contained Plantain peels supplemented concentrate diet, while Treatment 3 (T3) had Maize stalk supplemented concentrate diet. The diets were fed in a ratio of 40:60 (concentrates: supplement). Each treatment had 12 weaned pigs with three replicates of four pigs per replicate in a completely randomized design. The experiment lasted for six weeks. Results showed significant variations in the feed intake of all the experimental animals. Pigs fed concentrate (T1) consumed 5.04kg/pig/week compared to 5.57kg/pig/week and 5.11kg/pig/week that were consumed by pigs in T2 and T3 respectively. However, pigs fed on 100% concentrate (T1) had better feed conversion ratio (3.09) compared to their counterparts fed plantain peels (T2) supplemented concentrate diet (5.69) and maize stalk supplemented concentrate diet (4.91). Although, it cost more to feed pigs T1 diet (#100/week) compared to T2 (#59.00) and T3 (#65.00), the cost/ gain ratio was however better with pigs in TI having value of #309.00 compared to #355.70 and #319.15 recorded for pigs in T2 and T3, respectively. No significant (P>0.05) difference was observed in glucose, cholesterol and triglycerides of the weaners across the treatments. However, pigs fed T2 had AST value of 57.77mg/dl which was significantly higher than 49.05 mg/dl and 26.00 mg/dl observed for pigs fed T3 and T2 respectively. The results further revealed 47.64 mg/dl as the ALT value recorded for pigs that were fed T1 which was significantly lower compared with 59.81md/dl recorded for pigs fed T2. Based on the results of this experiment, it can be concluded that feeding plantain peel and maize stalk as supplement to weaned pigs might be cheaper. The cost/weight gain was not encouraging. Furthermore, the plantain peels and maize stalk supplementation did not confer any additional benefit in the serum profile of the weaners. They should therefore be discouraged in weaners diet.

Keywords: Performance, Serum biochemistry, Concentrate, Plantain peels and Maize stalk

Introduction

Growth and healthy living of the human race will be virtually impossible without adequate and regular supply of protein. However, Food and Agricultural Organization (FAO, 2010) estimated that the average Nigerian consumed 51g of protein per day which is less than the recommended 86g per day. It therefore becomes imperative to increase animal production in order to meet the recommended daily protein intake. Swine industry is a fast growing industry in Nigeria especially in meeting the protein consumption of the populace. However, feed constitute 60 - 80% of the total cost of intensive livestock production especially for poultry and pigs (Tewe, 1997). The high

cost of conventional feedstuffs as well as fluctuations in their supply may result in imbalanced nutrition and poor animal performance. As such, exploitation of other non-traditional feed resources is an obvious way to resolve the issue (FAO, 2002). It has been suggested that, producers may have to rely on locally available, cheap but nutritionally adequate feed ingredients such as Agricultural By-Products (AIB's) to bring down the cost of animal products (Longe and Adetola, 1983). Some of these products end up in a compost pile, but many others are delivered to the local landfill, creating an additional environmental burden. Therefore, the use of the locally available feedstuffs in pig nutrition would be of great importance for successful operations. Two important factors need to be considered before the use of these AIB's; one has to do with the establishment of their nutrient composition, and the other has to do with the optimum inclusion levels. Plantain peels are available in populated areas or in the vicinity of plantain processing plants while maize stalk is an agricultural crop residue that remains after maize harvest. The current importance of banana and plantain product used in livestock feeding varies considerably from country to country. Every part of the banana and plantain plant (except the roots and suckers) can be and has been used to feed livestock in various parts of the world (Michael et al, 2016). Most of the research on this subject has been carried out in Latin America and certain Asian countries, including India and the Philippines (Michael et al, 2016). The outcome of a recent study in Thailand sustaining feeder pigs on fermented banana stalks (MEAS Case Study 2013) has generated interest amongst Hawaii;s swine producers, as Hawaii also produces a significant amount of banana stalks and enjoys a similar tropical environment. This study is focused on the utilisation of plantain and maize stalk supplement in weaner pigs.

Materials and methods

A total of thirty-six weaned pigs with average initial body weight ranging from 4.61±1.03kg to 5.39±1.23kg were used for the study. The experiment was carried out at the Piggery unit of the Teaching and Research Farm, University of Ibadan, located at latitude 07º2'N and longitude 03º5'E, 300m above sea level. The plantain peels were obtained from roast plantain vendors at Agbowo, Ibadan and maize stalks were obtained fresh from maize farmers inside University of Ibadan. The pigs were randomly allotted to three treatments and three replicates with four animals per replicate using completely randomized design. The treatments include; T_1 100% concentrate as the control diet, T_2 (Plantain peels supplemented diet) and T_3 (Maize stalk supplemented diet). The supplemented diets were fed in a ratio of 40:60 (concentrate: supplement). The same levels of inclusion were maintained throughout the course of the experiment. The pigs were all treated for both endo-parasite and ecto-parasite by injecting 1ml of Ivomectin per pig intramuscularly.

The pigs were fed twice daily with provision of clean and cool water ad libitum. The blood samples were obtained from six pigs per treatment for serum collection. Serum samples were stored in ice boxes and transferred to the laboratory for further analysis. The parameters determined were cholesterol level, high density lipoprotein (HDL), triglycerides (TG), total protein (TP), Aspartate amino transaminase (AST), alanine amino transaminase (ALT).

Statistical Analysis

All data obtained were subjected to one way analysis of variance ANOVA of SAS (2010), while significant means were separated using Duncan Multiple Range Test (DMRT) of the same software.

Table 1: Gross composition of experimental concentrate diet fed to weaned pigs

Ingredient	Percentage
Maize	46.75
Wheat offal	30.00
Groundnut cake	10.00
Full fat soya	10.00
Bone mean	1.50
Oyster shell	1.00
Premix	0.25
Salt	0.5
Total	100
Calculated composition	
Metabolisable energy (Kcal/kg)	2720.50
Crude Protein (%)	18.28
Calcium (%)	0.99
Phosphorus (%)	0.68
Lysine (%)	0.74
Methionine (%)	0.27
Fibre (%)	4.53

Adapted from Adelowo and Adebiyi (2016)

Results and discussion

Table 1 shows the nutrient composition of the concentrate diet used in this research. The feed was formulated to meet the nutrient requirement of the pig at the weaner stage. Table 2 shows the performance characteristics of the experimental animals. Significant differences existed in the feed intake of weaner pigs on all the treatments. Pigs fed Treatment 1 (5.04kg/week/pig) had the least feed intake compared to their counterparts on Treatment 2 (5.57kg/week/pig) and Treatment 3 (5.11kg/week/pig). The increase observed in the feed intake of the pigs fed T2 and T3 could be due to nutrient dilution by these AIB's thus forcing the animals to consume more in order to satisfy their requirement. This result agrees with the conclusion drawn by Akinmutimi *et al*. (2008) reported that weaner rabbits fed 50% plantain and yam peels in their diet, had increased feed intake. However, pigs that were fed pure concentrate (T1) had their nutrient requirement met by the small amount of feed that was consumed which translated to the better feed conversion ratio that was observed. The FCR of pigs fed T1 was 3.04 as regard 5.69 and 4.91 observed for pigs fed T2 and T3, respectively. The poor feed utilization by pigs in T2 and T3 could also be due to the underdevelopment of the digestive systems of the weaner. Mature pigs might have better ability to utilize the supplement better if the supplementation is not above the fibre requirement of the animal. The reduced feed intake of maize stalk supplemented diet can be attributed to bulkiness of maize straw in digesta as reported by Ndou *et al*. (2013). Also, cereal crop residues are low in nutritive value because of their relatively low digestibility, low crude protein content and low content of available minerals and vitamins and high fibre levels (Owen, 1994) or due to production of chaffs as leftover feed when maize straw is being chewed. Weaners fed on concentrate (T1) had significantly ($P<0.05$) higher weight gain (1.63 kg/pig/week) and final weight (15.69kg/pig) than pigs on plantain peels (T2) (0.98 kg/pig/week and 10.65kg/pig) and maize stalk (T3) (1.04kg/pig/week and

10.84 kg/pig) supplements. This might be due to the high crude fibre content and low crude protein level of the feed, suggesting that the metabolizable energy and crude protein level decreased as the level of inclusion of unconventional feedstuffs in the diet increased. This is in agreement with the findings of Owen (1994) and Abel et al. (2015). Although, the cost of feed for pigs fed T2 (#59.00) and T3 (#65.00) might be reduced compared with the pigs fed T1 (#100.00), the cost/ gain ratio of pigs fed T1 (#309.00) was however better than T2 (#335.71) and T3 (#319.15). This implies that when weaners are fed highly nutritious feeds (concentrate) that meet their nutrient requirement, quantity is of no significance. Such concentrate feeds are better utilized, resulting in faster growth rate and bigger animals as observed in this study.

Table 2: Performance characteristics of weaned pigs fed experimental diet and its cost implication

Parameters	Concentrate (T1)	Plantain peels (T2)	Maize stalk (T3)	SEM
Initial Weight (kg/pig)	5.39	4.75	4.61	0.53
Final Weight (kg/pig)	15.17^{a}	10.65^{b}	10.84^{b}	0.34
Weight Gain (kg/week/pig)	1.63^{a}	0.98^{b}	1.04^{b}	0.27
Feed Intake (kg/week/pig)	5.04^{c}	5.57^{a}	5.11^{b}	0.30
Feed Conversion Ratio (FCR)	3.09^{c}	5.69^{a}	4.91^{b}	0.52
Cost/kg of Concentrate	100	40.00	40.00	-
Cost/kg of ABPs	0.00	19.00	25.00	-
Cost/kg of Conc + ABPs (total cost of feed/ week/pig)	100	59.00	65.00	-
Cost of feed/week x FCR (#: k)	309.00	335.71	319.15	-

^{abc}: Means along the row with the same subscript are not s ignificantly different (P>0.05), Cost in Naira (₦); ABPs- Agricultural by-products

Table 3: Serum Biochemistry characteristics of Weaned pigs fed Concentrates, Plantain peels and Maize stalk

Parameters	**Concentrates (T1)**	**Plantain peels (T2)**	**Maize stalk (T3)**	**SEM**
Glucose (mg/l)	66.60	61.40	61.00	1.22
Cholesterol (mg/l)	62.14	66.43	58.57	2.41
Total Protein (g/dl)	6.72	6.95	7.05	0.16
Triglycerides (mg/dl)	41.29	51.61	54.45	5.48
*AST (mg/dl)	26.00^{c}	57.77^{a}	49.05^{b}	0.84
**ALT (mg/dl)	47.64^{b}	59.81^{a}	50.53^{b}	0.82
***HDL(mg/dl)	86.78^{ab}	75.25^{b}	98.15^{a}	2.36

^{abc}: Mean along the row with the same subscript are not significantly different (P>0.05) *AST - Aspartate amino transferase **ALT- Alanine amino transferase ;***HDL- High density Lipoprotein

The results in Table 3 shows that there were no significant (P>0.05) differences in glucose, cholesterol and triglycerides of the weaners placed on different dietary treatments and all values obtained in this study fell within the normal serum physiological values (Mistruka and Rawnsley, 1977) and Adesehinwa (1997) for normal growing pigs. However, significant (P<0.05) differences within the AST and ALT for the three treatments were within the normal range (Mistruka and Rawnsley, 1977) which indicated that there was no sign of organ toxicity due to the presence of anti-nutritional factors at the inclusion of plantain peels or maize stalks. Serum metabolites (glucose, triglyceride and cholesterol) used to indicate the efficiency of utilisation of metabolisable energy in a given diet (Fanimo, 1991 and Anderson, 1983) were similar in all the treatments.

Conclusion

The results of this study showed that both plantain peels and maize stalk might be good feed resources in swine production through reduction in cost of production, however, weaner pigs are not good converters of these resources based on their stage of growth and should therefore be excluded from their diet. It was established that plantain peels and maize stalk had no negative effect on the serum metabolites of the weaners thus are safe to use but for older pigs.

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