

Effects of partial replacement of maize with 2:1:1 combination of plantain peels, yam peels and palm kernel cake in broiler starter diet

Efectos de la sustitución parcial de maíz con la combinación 2:1:1 de cáscaras de plátano, cáscaras de ñame y torta de almendras de palma en la dieta de inicio de pollos de engorde

Edeheudim Bassey ETUK , Anthonia Chinelo UDEGBUNAM, Nnanyere Okwunna ALADI, Oliver Onwueyiagba EMENALOM and Babington Onyemechi ESONU

Department of Animal Science and Technology. Federal University of Technology, Owerri. Nigeria
E-mail: edeheetuk@yahoo.com  Corresponding author

Received: 03/29/2012 First reviewing ending: 06/22/2012 First review received: 07/28/2012 Accepted: 07/30/2012

ABSTRACT

Ninety nine, one-day-old Marshall Broiler chicks were used in a 28 day feeding trial to evaluate effects of partial replacement of maize with 2:1:1 combination of plantain (*Musa paradisiaca*) peels (PP), yam (*Dioscorea alata*) peels (YP) and palm (*Elaeis guineensis*) kernel cake (PKC) respectively in broiler starter diets. Three experimental diets were formulated, diet T1 (control) contained 0% PP, YP, PKC. In diets T2 and T3 25 and 50%, respectively, of maize was replaced with 2:1:1 combination of PP, YP and PKC. These diets were assigned randomly to three groups of 33 chicks; each replicated three times to give 9 replicates 11 chicks in each in a completely randomized design experiment. Feed and water were offered *ad libitum*. Results indicated that body weight gain and feed cost (₦/kg) were significantly lower ($p < 0.05$) in T3 with 50% level of maize replacement than others. However, no significant difference ($p < 0.05$) in feed intake was observed among the different dietary levels of the test material. It appears that PP, YP and PKC when combined in the ratio of 2:1:1 could optimally replace up to 25% level of maize in broiler starter diets.

Key words: Chickens, Marshall broilers, *Zea mayz* replacement, body weight gain, feed intake

RESUMEN

Se utilizaron pollos de engorde Marshall de noventa y nueve días de edad en un ensayo de alimentación de 28 días para evaluar los efectos de la sustitución parcial de maíz con la combinación 2:1:1 de cáscaras de plátano (*Musa paradisiaca*) (CP), cáscaras de ñame (*Dioscorea alata*) (CÑ) y torta de almendras de palma (*Elaeis guineensis*) (TAP) en dietas de iniciación de pollos de engorde. Se formularon tres dietas experimentales, la dieta T1 (control) contenía 0% de CP, CÑ y TAP. Las dietas T2 y T3 contenían el maíz reemplazado con 25 y 50% el nivel de CP, CÑ y TAP, respectivamente, combinado en la relación 2:1:1. Estas dietas se asignaron aleatoriamente a tres grupos de 33 pollos cada uno repetidos tres veces para dar 11 pollos por repetición en un experimento con un diseño completamente aleatorizado. El alimento y agua se ofrecieron *ad libitum*. Los resultados indicaron que una ganancia de peso corporal y costo de alimentación (₦/kg) fueron significativamente menores ($p < 0,05$) en T3 con un nivel del 50% de reemplazo de maíz que los otros. Sin embargo, no se observó diferencias significativas ($p > 0,05$) en el consumo de alimento entre los diferentes niveles dietarios del material evaluado. Parece que CP, CÑ y TAP combinados en la proporción 2:1:1 pudiera reemplazar hasta el 25% del maíz en las dietas de iniciación de pollos de engorde de manera óptima.

Palabras clave: Pollos de engorde Marshall, reemplazo de *Zea mayz*, ganancia de peso corporal, consumo de alimento

INTRODUCTION

Rapid increase in the price of maize, a major energy source in poultry diets in Nigeria, is not new (Abubakar *et al.*, 2006). The need to cheap and available energy source substitutes not consumed by human rose when the price of maize reached that of soybean especially in South-eastern Nigeria.

Several low cost agro by products have been identified, these include yam peels (Etuk *et al.*, 2010a), plantain peels (Nworgu and Ogbosuka, 2003), palm kernel cake (Ezieshi *et al.*, 2004), soybean hulls (Esonu *et al.*, 1997 and Etuk *et al.*, 2010b) and bambara groundnut offal (Anyanwu *et al.*, 2003). The utilization of these agro by products gave some good results.

This study sought to examine the effect of partial replacement of maize with 2:1:1 combination of plantain peels (PP), yam peels (YP) and palm kernel cake (PKC) in broiler starter diets.

MATERIALS AND METHODS

Fresh yam peels (YP) and plantain peels (PP) were sun-dried until they became crispy. Then they were hammer-milled separately through a 2mm screen to obtain a fine meal. Hydraulic pressed palm kernel cake (PKC) and other feed ingredients were obtained from a reputable feed supplier in Owerri, Nigeria. PP, YP and PKC, were subsequently combined in the ratio 2:1:1 before incorporation into the diet.

The combination of yam peels, plantain peels and palm kernel cake (2:1:1) were analyzed for proximate composition (AOAC, 1995). Three experimental broiler starter diets were formulated diet T1 (control) contained 0% PP, YP and PKC. Diets T2 and T3 contained 2:1:1 combination of PP, YP and PKC replacing 25 and 50% of maize, respectively (Table 1).

Ninety nine, one-day-old Marshall broiler chicks were divided into three groups of 33 chicks

in each on equal weight basis. Each group was replicated thrice to obtain 11 chicks per replicate. Then the three groups were randomly assigned to the three experimental starter diets in a completely randomized design. Each replicate was housed in a deep litter compartment measuring 3.3m x 1.7m. Stoves and lanterns were used to provide heat for brooding. Routine vaccinations and medications were administered in the course of the trial.

Feed and water were offered *ad libitum*. Data on feed intake and body weight were recorded and used to calculate feed conversion ratio (FCR) and feed cost per kg body weight gain. Data collected were subjected to analysis of variance (ANOVA) (Little and Hills, 1978) and means were separated using the least significant difference (LSD) (Obi, 1990). The level of significance was 0.05.

RESULTS AND DISCUSSION

The proximate analysis of the 2:1:1 combination of PP, YP and PKC are presented in Table 2. The crude protein content was slightly lower than the 8.9% reported for maize by Aduku (1993), while the 74.77% nitrogen free extract (NFE) was slightly lower than the 77.13% reported

Table 1. Composition and calculated analysis of experimental broiler starter diets.

Ingredients	Levels of maize replacement with combination of PP, YP and PKC (%)		
	T1	T2	T3
Maize	55.00	41.25	27.50
Plantain peels (PP)	0.00	6.87	13.76
Yam peels (YP)	0.00	3.44	6.87
Palm kernel cake (PKC)	0.00	3.44	6.87
Others*	45.00	45.00	45.00
Calculated analysis of nutrients			
ME (Kcal/kg)	2965.90	2843.90	2720.00
Crude protein (%)	22.52	22.40	22.37
Crude fibre (%)	3.66	3.80	3.93
Ether extract (%)	3.73	3.70	3.60
Calcium (%)	1.17	1.18	1.18
Phosphorus (%)	0.70	0.71	0.71
Lysine (%)	1.50	1.52	1.54
Methionine (%)	0.59	0.60	0.61

* Balance of ingredients made up of: Soybean meal, 28.00%, Wheat bran, 8.00%, Fish meal, 6.00%, Bone meal, 2.00%, Vitamin/Mineral premix**, 0.25%, salt, 0.25, Lysine, 0.25, Methionine, 0.25%.

** Provides the following per kg: Vit. A, 10,000,000 IU, Vit. D3, 2,000,000 IU, Vit. E, 20,000 IU, Vit. K, 2,250mg, Thiamine, 2,750mg, Riboflavin, 5,000mg, Pyridoxine, 2,750mg, Niacin, 27,500mg, Vit. B12, 15mg, Pantothenic acid, 7,500mg, Folic acid, 7,500mg, Biotin, 50mg, Antioxidant, 125g, Manganese, 80g, Zinc, 50g, Iron, 20g, Copper, 5g, Iodine, 1.2g, Selenium, 200mg, cobalt, 200mg.

by Anyanwu *et al.*, (2008) for cassava root meal.

Body weight gain was significant lower ($p < 0.05$) in chicks fed 50% inclusion level of 2:1:1 combination of PP, YP and PKC (i.e. T3) than other groups as shown in Table 3. This might have resulted from decreased metabolisable energy (ME) and slightly higher fibre content of the diet T3 (Uchegbu, 2005).

The fact that no significant differences ($p > 0.05$) in feed intake was observed in this study, has been previously reported by Etuk and Ukaejiofo (2007). This might have resulted from the decrease in ME with dietary level of the combination of PP, YP and PKC. Similarly, chicks on diet T3 recorded significantly ($p < 0.05$) poorer FCR than those on other treatment diets (Table 3). This might have resulted from the slightly higher feed intake and lower body weight gain of chicks on this diet which is similar to the observations of Uchegbu, 2005. Anyanwu *et al* (2008) also reported poorer FCR among birds fed on diets with lower ME content.

Feed cost (₦/kg) decreased with increasing dietary level of the combination of PP, YP and

Table 2. Proximate analysis of 2:1:1 combination of PP, YP and PKC (% Dry matter).

Parameters	%
Crude protein	7.08
Fat	1.82
Crude fibre	3.58
Ash	4.06
Moisture	9.42
Nitrogen free extract (NFE)	74.04

Table 3. Performance of starter broilers fed on diets containing 2:1:1 combination of PP, YP and PKC.

Parameters	Replacement level of maize in broiler starter diet (%)			SEM
	T1	T2	T3	
Initial body weight (g)	45.30	45.45	45.30	0.12
Final body weight (g)	814.00 ^a	751.00 ^a	669.20 ^b	23.12
Body weight gain (g)	768.60 ^a	706.00 ^a	624.10 ^b	23.26
Total feed intake (g)	1267.69	1271.60	1278.38	37.23
Feed conversion ratio (FCR)	1.64 ^a	1.80 ^a	2.06 ^b	0.10
Feed cost (₦/kg)	81.98 ^a	73.76 ^a	65.48 ^b	3.89
Feed cost /kg body weight gain (₦)	134.99	132.77	134.89	16.73

^{ab} Means within a row with different superscripts are significantly different ($p < 0.05$)

PP = plantain peels, YP = yam peels, PKC = Palm kernel cake

SEM = Standard error mean

PKC, diet T3 produced a significantly ($p < 0.05$) lower feed cost (₦/kg) when compared to the other two diets (Table 3). Lower feed cost had earlier been reported for broilers fed on agro-by-products (Ijaiya and Awonusi, 2002; Anyanwu *et al.*, 2008). Feed cost per kg body weight gain did not differ significantly ($p > 0.05$) among all treated groups (Table 3).

CONCLUSIONS AND RECOMMENDATIONS

The results of this study indicated that a 2:1:1 combination of plantain peel, yam peels and palm kernel cake can replace up to 25% of maize in broiler starter diet. Therefore, it is recommended that 2:1:1 combination of plantain peels, yam peels and palm kernel cake at a 25% level replacement of maize is ideal in starter broiler chick diet.

LITERATURE CITED

- Abubakar, A.; Y. A. Bashir and B. O. C. Eguke. 2006. Pearl millet as substitute for maize in diets of broiler chickens in Sokoto, Nigeria. *Trop. J. Anim. Sci.* 9 (2): 53-61.
- Aduku, A. O. 1993. Tropical feedstuff analysis table. Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Samaru, Zaria, Nigeria.
- Anyanwu, G. A.; B. O. Esonu, E. Iwuala, K. Okorie and E. B. Etuk. 2003. Bambara groundnut (*Voandzea suberranea* (L) thours) offal as partial substitute for maize in broiler diets. *Trop. Anim. Prod. Res. Invest.* 6: 55-61.

- Anyanwu, G. A.; E. B. Etuk, I. C. Okoli and A. B. I. Udedibie. 2008. Performance and egg quality characteristics of layers fed different combinations of cassava root meal and bambara groundnut offal. *Asian J. Poultry Sci.* 2(1): 36-41.
- AOAC. (1995). Official methods of analysis. 7th edn. Association of Official Analytical Chemists. Washington D. C. United States of America.
- Esonu, B. O.; O. C. Ezeigbo and E. B. Etuk. 1997. Determination of the optimal dietary level of soybean hulls for broilers *J. Tech. Edu. Nig.* 2 (1/2): 76-82.
- Etuk, E. B.; C. Umeobi, L. N. Azodo, I. U. Obasi and O. O. Emenalom. 2010a. Utilization of low cost agro-by products in turkey diets. *In: Commercialisation of livestock agriculture in Africa: Challenges and opportunities. Book of Abstracts 5th All Afr. Conf. Anim. Agric. and 18th Ann. Meeting of Ethiopian. Soc. Anim. Prod. (ESAP).* October 25-28. Addis Ababa. p. 125.
- Etuk, E. B.; A. G. Orih, J. N. Ohaji and V. U. Odoemelam. 2010b. Evaluation of soybean hulls in grower turkey diets. *Int. J. Agric. Rur. Dev.* 13 (2): 220-223.
- Etuk, E. B. and U. R. Ukaejiofo. 2007. Tannin content and dietary effect of brown coat coloured sorghum on the performance of young local turkey. *Anim. Prod. Res. Adv.* 3 (2): 86-90.
- Ezieshi, E. V.; I. F. Okhuevbie, C. Ezennabike and J. M. Olomu. 2004. Comparative performance of broiler chicks fed graded levels of palm kernel cake and maize offal. *Proc. 29th Ann. Conf. Nig. Soc. Anim. Prod.* March 21st - 25th, Usman Danfodiyo University, Sokoto. p. 253-256.
- Ijaiya, A. T. and E. A. Awonusi. 2002. Effect of replacing maize with yam peel meal on growth performance of weaner rabbits. *Proc. 7th Ann. Conf. Anim. Sci. Assoc. Nig. (ASAN), Univesiy of Agriculture, Abeokuta, Nigeria.* p. 161-163.
- Little, T. M. and F. J. Hills. 1978. *Agricultural Experimentation Design and Analysis.* John Wiley and Sons, New York. United States of America.
- Nworgu, F. C. and G. E. Ogbosuka. 2003. Ripe plantain (*Musa paradisiaca*) peels meal as an alternative energy source for weaned rabbits *Proc. 30th Ann. Conf. Nig. Soc. Anim. Prod. IAR&T, Ibadan* p. 348-351.
- Obi, I. U. 1990. *Statistical methods of detecting differences between treatment means.* Snaap Press, Enugu, Nigeria.
- Uchegbu, M. C. 2005. Combinations of brewers' grains, jack bean and cassava root meals as major energy sources of poultry. PhD. Thesis, Federal University of Technology, Owerri. Nigeria. p. 27-140.