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Performance of Broilers Fed Diets Containing Wet or Sun Dried Fermented Mixture of Grated Cassava Roots and Palm Kernel Cake as Replacement for Maize

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Abstract

The cost and effectiveness of drying processes have often limited the incorporation of solid state fermented agro by-products into poultry feeding programs. In this study, the efficacy of replacing maize with wet or sundried solid state fermented mixture of grated cassava root meal and palm kernel cake (FEMCARPP) was evaluated. 120 three weeks old broiler chickens were randomly allotted to four treatment diets replicated 3 times with 10 birds per replicate. The maize in control diet (T1) was replaced with either of wet, dry FEMCARPP or a 1:1 mixture of cassava meal and palm kernel cake (CSM-PKC) in treatments T2, T3 and T4 respectively. Performance data was collected on the live weight, weight gain and feed conversion efficiency. Though the chicks fed wet FEMCARPP had lower live weight gains and feed intake ($p < 0.05$), their feed conversion ratio was similar ($p > 0.05$) to the control and other treatment groups. Cost of feed per kg weight gained was best among chicks fed wet FEMCARPP suggesting that feeding broilers with solid state fermented mixture of grated cassava and palm kernel cake to broiler finishers without further processing such as sun drying would be effective in replacing maize in broilers diets.

Keywords: cassava meal, palm kernel cake, solid state fermentation, broiler chicken,

Introduction

The potential of solid state fermentation (SSF) as a bio-safe method for improving nutritive value of agricultural by-products has been reported (Yasar *et al.*, 2016; Missotten *et al.*, 2012; Aladi *et al.*, 2013; Lio & Wang, 2012 and Nibaet *et al.*, 2009). According to Aladi *et al.* (2013), though the SSF of a mixture of grated cassava roots and PKC increased its crude protein content from 9.75 to 13.33 % and reduced the crude fibre from 12.55 to 12.20, after 6 days of fermentation. The sundried product effectively replaced maize in diets of broilers (Chukwukaelo *et al.*, 2017) and is reported to have probiotic effect against intestinal *E. coli* and *Salmonella* in broilers (Aladi *et al.*, 2017). However, the effectiveness of the drying process has been identified as a major limiting factor especially for small holder farmers who would rely on weather conditions which fluctuate widely in the humid tropics (Aladi, 2016).

This study was therefore designed to evaluate the efficacy of dietary inclusion of the fermented mixture without further processing such as sun drying on the performance of broilers.

Materials and Methods

Four experimental diets (T1, T2, T3 and T4) were then formulated in which maize, wet FEMCARPP, sundried FEMCARPP or a 1:1 mixture of cassava meal/PKC was used as energy sources respectively. The ingredient composition is shown in Table 1. 30 Acres broiler chicks aged 3 weeks were randomly assigned to each of the four treatment diets with 3 replicates of 10 birds each in a completely randomized design (CRD). Feed and water were offered *ad libitum* throughout the experimental period.

Data was collected on live weight, feed intake weight gain and feed conversion ratio, feed cost and cost of feed per Kg weight gained on replicate basis each week, and then subjected to analysis of variance (ANOVA). Significantly different means were separated using the Least Significant Difference (LSD) as described by Little and Hills (1974).

Results and Discussion

The performance of the chicks fed the experimental rations is shown in Table 2. Birds fed dietary wet FEMCARPP had significantly ($p < 0.05$) lower live weight (2000.6 g), average daily weight gain (42.4 g/bird/day), lower feed intake but similar ($p > 0.05$) feed conversion ratio (2.36) compared to 2272.20g, 51.8g/bird/day, 121 g/bird/day and 2.35, respectively recorded by birds on the control diet. The live weight of the chicks on the control diet (2272.20g) was significantly ($p < 0.05$) superior to those fed sun-dried FEMCARPP (2177.8 g) and CSM-PKC mix (2146.3 g), which were in turn superior to their counterparts on wet FEMCARPP diet. The average daily bodyweight gain followed similar pattern observed for the live weight. No significant differences ($p > 0.05$) were observed for the feed intake among chicks on maize-based (control diet), dried FEMCARPP and CSM-PKC throughout the experiment.

The feed intake curve (Figure1) shows that among chicks on dietary wet FEMCARPP, feed intake increased progressively until the end of the experiment whereas in the other treatments (T1, T3 and T4), it levelled off after 6 weeks of age,

suggesting that physicochemical characteristics of wet FEMCARPP based diets might have impacted on dry matter intake. Since the feed conversion ratio did not vary significantly ($p > 0.05$) across treatment groups, it is therefore, very probable that, the

Table 1: Ingredient and calculated chemical composition of the experimental diets

Ingredients (%)	Maize	FEMCARPP		CSM-PKC MIX
		Wet	Dry	
Maize	60.00	-	-	-
Wet FEMCARPP	-	60.00	-	-
Dried FEMCARPP	-	-	60.00	-
Cassava meal	-	-	-	30.00
Palm Kernel Cake	-	-	-	30.00
Soybean meal	22.00	22.00	22.00	22.00
Wheat offal	5.00	5.00	5.00	5.00
Fish meal	3.00	3.00	3.00	3.00
Bone meal	4.00	4.00	4.00	4.00
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Vitamin / mineral premix*	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated nutrient composition				
Crude protein	18.49	19.19	19.19	19.19
ME(Kcal/kg)	2804.00	2604.00	2604.00	2604.00
Crude Fibre (max)	4.09	9.07	9.07	9.07
Ash	3.25	5.35	5.35	5.35
Calcium	1.60	1.74	1.74	1.74
Phosphorus	1.16	1.43	1.43	1.43
Methionine	0.23	0.49	0.49	0.49
Lysine	0.82	1.81	1.81	1.81

*Supplied per kg diet: Vit A, 900 I.U; Vit D3, 1440 I.U, Vit E, 21.6mg; Vit K, 2.7mg; Vit B1, 1.8mg; Vit B2, 3.6mg; Vit B6, 2.7mg; Niacin, 21.6mg; Pantothenic acid, 9.0mg; Biotin, 0.036mg; Vit B12, 0.018mg; Folic acid, 0.54mg; Cholin chloride, 270mg; Manganese, 108mg; Iron, 18mg; Zinc, 27mg; Copper, 1.44mg; Iodine, 0.72mg; Cobalt, 0.1mg; Selenium, 0.1mg; Growth promoter, 14.4mg; Anti- Oxidant, 720.

Table 2: Growth performance of finisher broilers fed wet and dried FEMCARPP as replacement for maize

Parameters	Maize	FEMCARPP		CSM-PKC	SEM
		Wet	Dried		
Initial live weight @ 3 weeks (g)	825.9	819.2	818.8	820.4	3.112
Final live weight @ 7 weeks (g)	2272.2 ^a	2005.6 ^c	2177.8 ^b	2146.3 ^b	31.518
Bodyweight gain (g)	1446.6	1186.4	1359.0	1325.9	7.213
Av. daily bodyweight gain (g/day)	51.8 ^c	42.4 ^a	48.5 ^b	47.4 ^b	1.097
Av. daily feed intake (g/day)	121.92 ^b	99.73 ^a	121.71 ^b	127.04 ^b	3.229
Feed conversion ratio	2.35	2.36	2.51	2.68	0.1856
Feed cost (₦/kg)	102.63	81.60	87.63	95.13	
Feed cost (₦ per kg weight gain)	311.43 ^b	244.66 ^d	277.19 ^c	328.26 ^a	5.85
Margin (₦/kg meat)	0.00	66.77	34.24	- 16.81	
Mortality (%)	3.33	0.00	0.00	13.33	

^{a,b,c,d} Means with different superscripts within a row are significantly different ($p < 0.05$)

CSM-PKC - sundried blend of Cassava root meal and Palm Kernel Cake

lower live weight of broilers on wet FEMCARPP was principally due to lower dry matter intake. The activity of multienzyme complexes and possible probiotic activity of FEMCARPP produced during fermentation are the likely biotechnological basis for this value addition to the fermented feed material. The release of multi-enzyme complexes during SSF has been reported to

improve nutritive value of fermented feeds and agro by-products (Niba *et al.*, 2009, Lawal *et al.*, 2010; Shim *et al.*, 2012, Mittosen *et al.*, 2012).

The microbes implicated in the production of FEMCARPP are such as *Aspergillus oryzae*, *Aspergillus niger* and *Rhizopus spp* are widely used for production of enzymes such as mannanases, cellulases, etc., capable of degrading the complex cell wall polysaccharides of PKC (Iluyemi *et al.*, 2006). These fungi (*Aspergillus oryzae*, *Aspergillus niger*, *Rhizopus spp*) as well as lactic acid bacteria like *Lactobacillus plantarum* and *Bifidobacterium spp* implicated in the fermentation process (Aladi, 2016) have also been reported to possess probiotic activities (Aladi *et al.*, 2017).

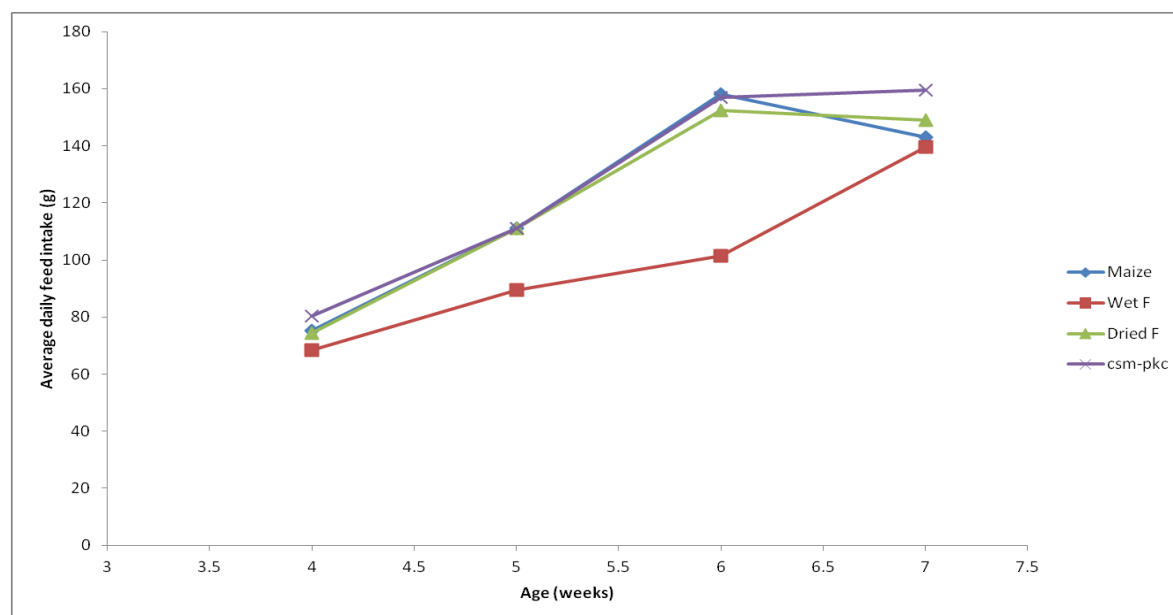


Fig. 1: Average daily feed intakes of finisher broilers fed the experimental diets plotted against age

The cost of feed per kg bodyweight gained (₦) at the prevailing market price was ₦ 66.77 less among the chicks fed wet dietary FEMCARPP than the control whereas those fed dietary dry FEMCARPP were ₦34.24 lower than the control. Replacement of maize with CSM-PKC mix increased cost per kg body weight gained by ₦ 16.81 relative to the control. Therefore, SSF of the mixture of grated cassava tuber and PKC translated to a value addition worth ₦ 83.60 per Kg bodyweight gained by broilers relative to dietary inclusion of CSM and PKC mix as a replacement for dietary maize.

Conclusion and Recommendation

It is therefore, concluded that though feeding of FEMCARPP 'as is' without further processing such as drying may reduce weight gain of broilers, this reduction is compensated for by the reduced feed intake and comparable feed conversion ratio. Further research is therefore needed to develop appropriate feeding techniques that would maximize its use in poultry feeding.

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