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Performance and economics of finisher broiler chickens fed diets containing *maiwa* millet (*pennisetum glaucum* l.) as replacement for maize

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Abstract

The increasing cost of conventional feed ingredients such as maize and soya bean has continued to be an issue of concern for poultry farmers. One of the ways of solving this problem is through the exploration of cheaper alternative feed resources. The objective of this study was to evaluate the performance indices and cost benefit of replacing maize with maiwa millet in broiler finisher diets. Three hundred broiler chickens weighing between 876.25 and 950.04g were allotted to five diets in replicates of four containing 15 birds each in a completely randomized design. In the diets, maiwa millet replaced maize at 0, 25, 50, 75 and 100% levels, designated as T1, T2, T3, T4 and T5 respectively. Feed and water were served ad libitum throughout the four-week feeding trial. Results showed no significant difference among groups in performance indices. Daily feed intake ranged between 93.81 and 98.06g, daily weight gain, from 46.62 to 51.68g, feed conversion ratio, from 1.80 to2.09 and total weight gain from 1305.43 to 1447.04g. Economic indices revealed that total feed intake was highest on T2 (2.75kg) and lowest on T4 (2.61kg). Feed cost per kg was lowest (N208.32) on T5 and highest on T1 (N235.00) while feed cost per kg gain was lowest on T4 (N386.33). The highest cost saving of 20.55% was made on T4. It was concluded that maiwa millet can completely replace maize in broiler finisher diets with no adverse effect on growth performance. Furthermore, replacing maize with maiwa millet at 75% level gave the highest cost saving.

Keywords: Performance, economics, finisher, broiler, *Maiwa*millet, maize

Performances et économie des poulets à griller en finition nourris avec des régimes contenant du mil maiwa (pennisetum glaucum l.) en remplacement du maïs

Résumé

L'augmentation du coût des ingrédients alimentaires conventionnels tels que le maïs et le soja continue d'être un sujet de préoccupation pour les aviculteurs. L'un des moyens de résoudre ce problème consiste à explorer des sources d'alimentation alternatives moins chères. L'objectif de cette étude était d'évaluer les indices de performance et le rapport coût-bénéfice du remplacement du maïs par du millet maiwa dans les régimes de finition des poulets de chair. Trois cents poulets à griller pesant entre 876,25 et 950,04 g ont été répartis en cinq régimes dans des répétitions de quatre contenant 15 oiseaux chacun dans une conception complètement aléatoire. Dans les régimes alimentaires, le mil maiwa a remplacé le maïs aux niveaux de 0, 25, 50, 75 et 100 %, désignés respectivement par T1, T2, T3, T4 et T5. La nourriture et l'eau ont été servies à volonté tout au long de l'essai d'alimentation de quatre semaines. Les résultats n'ont montré aucune différence significative entre les groupes dans les indices de performance. La consommation alimentaire quotidienne variait entre 93,81 et 98,06 g, le gain de poids quotidien, de 46,62 à 51,68 g, l'indice de conversion alimentaire, de 1,80 à 2,09 et le gain de poids total de 1305,43 à 1447,04 g. Les indices

économiques ont révélé que la consommation totale d'aliments était la plus élevée sur T2 (2,75 kg) et la plus faible sur T4 (2,61 kg). Le coût d'alimentation par kg était le plus bas (₦208,32) sur T5 et le plus élevé sur T1 (₦235,00) tandis que le coût d'alimentation par kg de gain était le plus bas sur T4 (₦386,33). La plus grande économie de coûts de 20,55 % a été réalisée sur le T4. Il a été conclu que le millet maiwa peut complètement remplacer le maïs dans les régimes alimentaires des poulets de chair sans effet néfaste sur les performances de croissance. De plus, le remplacement du maïs par du mil maiwa à 75 % a donné les économies de coûts les plus élevées.

Mots-clés : Performance, économie, finisseur, poulet de chair, mil Maiwa, maïs

Introduction

The Agricultural sector has long been recognized as having great potentials for employment generation, food security and poverty reduction. In the third quarter of 2021, the sector's contribution to nation's GDP stood at 29.94% (Statista, 2021). Among the various sub-sectors of agriculture, the poultry industry has been reported to be the most commercialized, having a net worth of N1.6 trillion (CBN, 2019) and representing about 25% of the agricultural GDP. Nigeria is currently the 2nd largest poultry producer in Africa with a population of 180 million birds placed annually. However, per capita consumption of eggs and meat was reported at 3.5g and 2.5kg respectively. This is lower than the world's averages of 9.4kg for eggs and 15.2 kg for meat (Kansenkaart, 2020). This scenario was occasioned by the high poverty level in the country and increasing cost of feed ingredients used in poultry diets. Feed alone, constitutes approximately 75% of the variable cost in intensive poultry production (Asaniyan and Ogundele, 2020). The conventional feed ingredients, especially maize and soya bean, which are competitive and expensive, need to be substituted with cheaper and more readily available alternatives in order to reduce feed cost. Earlierstudies have shown that millet has the potentials to replace maize in poultry diets. Its amino-acid profile was reported to be better than maize (NRC 1994). Similarly, it has a crude protein valueof 10 - 12.96% (Aduku, 1993; Purushothaman and Thirumalai, 1995). However, its metabolizable energy (2675kcal/kg) is lower than that of maize (NRC, 1994). Previous research findings on the utilization of millet as substitute of maize in broiler chicken diets showed no adverse effect on performance (Davis *et al*., 2003).Rama Rao *et al*. (2004) evaluated the performance of broiler chickens (1 - 42 days of age) fed diets containing pearl millet, foxtail millet or finger millet and reported that body weight gain and feed utilization were significantly decreased ($P<0.01$) at 21 days of age. However, at 42 days, the workers observed that body weight gain in foxtail millet fed group was similar ($P<0.01$) to those fed the maize reference diet, indicating that maize can be totally replaced with foxtail millet on a weight basis in broiler diets without affecting growth. In another study, Tornekar *et al*. (2009)replaced maize with *Bajra* (pearl millet) at 0, 25 and 50% levels in broiler chicken diets and reported that during the 0-42 days of age, birds fed diet containing 50% replacement level grew faster ($P<0.01$) (5.3% higher) than those on the other two groups. Using the Canadian pearl millet to replace maize in broiler diets, Baurhoo *et al*. (2011) reported higher body weights in birds fed millet-based diets. Replacing maize with pearl and finger millets, Bulus *et al*. (2014) found higher daily weight gain in birds fed millet-based diets. In another study, Yunusa *et al*. (2015) used *dauro* and *gero* millets to replace maize and reported no significant

difference in daily feed intake. However, daily weight gain was higher (P<0.001) on birds fed millet-based diets. A recent work by Bot *et al.* (2021) in which maize was replaced with red finger millet at 25, 50, 75 and 100% levels, revealed no significant influence on growth performance of broiler chickens. *Dauro, gero and maiwa* are local (Hausa) names for the pearl millet types grown in Northern Nigeria. Unlike *gero,* both *dauro* and *maiwa* are photoperiod-sensitive and late maturing (Aken'Ova, 1976 and Unguwanrimi *et al.,* 2019). Although extensive trials have been conducted on the feeding value of different varieties of millets, there is paucity of information on the utilization of *maiwa* by broiler chickens. Therefore, the objective of this study, is to determine the growth performance and economics of finisher broiler chickens fed *maiwa* millet as dietary replacement for maize.

Materials and methods

Experimental site

The research was carried out at the Agricultural Farm, Federal College of Education, Pankshin, Plateau State. The GPS location of Pankshin is latitude 9°N and longitude 9.92°E. The area has minimum and maximum temperatures of 10°C and 27ºC respectively (Dafur. *et al.,* 2008).

Source of Maiwa millet

Maiwa millet used in the study was purchased from Pankshin market in Pankshin Local Government Area of Plateau State.

Experimental birds and their management

A total of 300 broiler chickens weighing between 876.25 and 950.04g were allotted to five diets in replicates of four containing 15 birds each in a completely randomized design. Feed and clean drinking water were provided *ad libitum* throughout the experimental period which lasted for 4 weeks.

Experimental diets

Five experimental finisher diets (20% CP) were formulated in which *Maiwa* millet replaced maize at 0, 25, 50, 75 and 100% levels coded as diets T1, T2, T3, T4 and T5 respectively. Other ingredients contained in the diets were full fat soya bean, fish meal, wheat offal, bone meal, limestone, premix, salt, methionine and lysine (Table 1). A calculated analysis of the diets revealed contained a metabolizable energy content of between 3018. 34 and 3084.51 kcal/kg which has met minimum requirement of 3000 kcal/kg for finisher broiler chickens in the tropics (Aduku, 1993).

Table 1: Ingredients and percent replacement of *maiwa* millet for maize in finisher broiler diets

	Diets				
Parameter	**T1**	**T2**	**T3**	**T4**	**T5**
Maize	50.93	38.20	25.47	12.73	0.00
Maiwa Millet	0.00	12.73	25.47	38.20	50.93
Full fat soya bean	26.07	26.07	26.07	26.07	26.07
Wheat offal	15.00	15.00	15.00	15.00	15.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20	0.20
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis					
Metabolizable Energy (kcal/kg)	3084.51	3070.02	3051.53	3036.99	3018.34
Crude Protein (%)	20.00	20.08	20.13	20.17	20.22
Crude Fibre (%)	3.23	3.64	3.81	4.01	4.40

Data collection

Data for growth performance which include; daily feed intake (DFI), daily weight gain (DWG), feed conversion ratio (FCR), final weight and mortality were collected. Daily feed intake was obtained by difference between quantity of feed offered and the left-over retrieved the following morning. Weight gain was determined by the difference between two consecutive weighing carried out on weekly basis. This value was divided by 7 to obtain the DWG while FCR was computed by dividing DFI with DWG. Mortality was recorded as it occurred. Feed cost per kg was calculated using the prices of feed ingredients at the time of purchase. Feed cost per kg gain was obtained by dividing the total cost of feed consumed per bird by total weight gain. Percent cost saving was computed by dividing the difference between feed cost per kg gain of each diet and the control (T1) by feed cost per kg gain (T1) and multiplying by 100.

Data analysis

All Data were subjected to ANOVA using the SPSS vr. 25 statistical software. Where means differed among diets, Duncan Multiple Range Test (DMRT) was used to separate them.

Results and discussion

Performance of finisher broiler chickens fed diets containing *maiwa* millet as replacement for maize is presented in Table 2. There was no significant influence of diet on all the parameters studied. Initial weight of birds ranged from 876.25 to 950.04g andfinal weight was between 2181.67 and 2376.05g on T1 and T4 respectively. Total weight gain spanned from 1305.43g on T1 to 1447.04 on T4, daily feed intake was within the ranged of 93.15g (T4) and 98.06 (T2) while daily weight gain and feed conversion ratio, which were also not significantly affected, were 46.62 – 51.68g and 1.80 – 2.09 respectively. This contradicts the findings of Baurhoo *et al.* (2011) where birds fed millet-based diets had higher DWG. The values for FCR in this study are however better than 2.48 – 2.98 reported by Bashar *et al.* (2012) in a similar study. The results also agreed with Akintola *et al.* (2015) who reported no significant effect on DFI and FCR of broiler chickens fed dietary substitution of whole millet at 40 and 60% levels for maize. Their findings also showed that birds fed millet-based diets had better ($P<0.05$) FCR than those fed maize-based diet. Mortality was recorded only on T1, T4 and T5 which was one bird for each. Economic analysis of finisher broilers fed dietary *maiwa* millet is presented in Table 3. Total feed intake was highest on T2 (2.75kg) followed by T1 (2.68kg), T3 (2.68kg), T5 (2.63kg) and T4 (2.61kg) in that order. Feed cost per kg was highest on T1 (N235.00) followed by T2 (N228.11) while T5 (N208.32) was the lowest. Feed cost per kg gain was highest on T1 (N486.27) and lowest on T4 (N386.33) thus making it the diet on which the highest percent cost saving of 20.55% was realized. This contradicts the report of Bot *et al.* (2021) where diets containing red finger millet had higher feed cost per kg gain values than the control (maize-based). However, it concurs with Rama Rao *et al.* (2002) and Ibe *et al.* (2014) who reported that feed cost per kg gain was lower in birds fed millet-based diets than those fed maize.

Table 2: Performance of finisher broiler chickens fed dietary levels of *maiwa* millet as replacement for maize

		Diets				
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
Initial weight (g)	876.25	942.59	936.09	929.01	950.04	24.34^{NS}
Final weight (g)	2181.67	2369.61	2338.19	2376.05	2354.80	65.03^{NS}
Total weight gain (g)	1305.43	1427.02	1402.10	1447.04	1404.76	73.23^{NS}
Daily feed intake (g)	96.91	98.06	95.66	93.15	93.81	1.78^{NS}
Daily weight gain (g)	46.62	50.96	50.08	51.68	50.17	2.62^{NS}
Feed conversion ratio	2.09	1.95	1.92	1.80	1.88	0.11^{NS}
Mortality	1	0	0	1	1	-

NS = Not significant, SEM = Standard Error of the Mean.

Table 3: Cost benefit of finisher broiler chickens fed dietary levels of *maiwa millet* as replacement for maize

		Diets			
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**
Total feed intake (kg)	2.69	2.75	2.68	2.61	2.63
Feed cost per kg (₦)	235.00	228.11	221.08	214.63	208.32
Feed cost per bird (₦)	632.15	627.30	592.49	560.18	547.88
Total weight gain (g)	1.30	1.43	1.40	1.45	1.40
Feed cost per kg gain (₦)	486.27	438.67	423.21	386.33	391.34
Cost saving (%)	-	9.79	12.96	20.55	19.52

Conclusion

The study showed that *maiwa* millet can completely replace maize in finisher broiler diets without any reduction in performance. Similarly, replacement of maize with *maiwa* millet resulted in reduction in feed cost. Seventy-five (75%) replacement level revealed the highest cost saving and was therefore recommended for broiler chicken producers and feed millers in order to reduce feed cost and increase farm profit.

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