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Effect of Dietary Treatment of Cassava (*Manihot esculenta* Crantz) Roots on Kuroiler Chicks' Performance

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Abstract

Cassava (*Manihot esculenta* Crantz) roots are an essential feedstuff used for public consumption, but little attention has been given to broiler' production in South Sudan using cassava as feedstuff. Hence, the effect of feeding treated cassava roots as an alternative feed source to maize on Kuroiler chicks' performance was evaluated. Ninety, one week old, Kuroiler chicks were allocated to three dietary treatments, three replicates each, with ten chicks per replicate in a completely randomized block design. Birds were fed *ad-libitum* on formulated dietary levels of cassava at 0.0% (control group), and 10.0% and 20.0% (experimental groups) for six weeks. The feed intake for respective three treatments (3.9, 3.2 and 3.1 g/kg DM) and the final body weight gains (1,042, 826 and 733g) were revealed. However, feed conversion ratio revealed values of 0.46, 0.50 and 0.96, respectively. Therefore, a cassava root could be used as an alternative feed ingredient to maize at low inclusion levels in poultry feeding regimens for sustainable development of the poultry industry in South Sudan.

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Introduction

Cassava roots are valuable feed ingredients for poultry diets. Evidence has shown that more than 800 million people utilize these roots as a major staple food worldwide [1]. The expansions of the cassava industries are owing to increasing food demands in Africa [2] and the industrial applications in East and Southeast Asia [3]. However, the poultry industry in the tropics is mainly affected by the high price of feed ingredients, including soya bean and maize meal [4]. Apparently, maize production has become low to meet the high demand [5-7]. Hence, the need for alternative food sources for animals is imperative worldwide. Nevertheless, cassava chip could be used in ruminant feed regimens depending on its local availability and affordability [8]. It seemed that the feed cost could be mitigated when replaced by a considerable percent of maize [9].

Nevertheless, evidence has shown that cassava roots are poorly utilized due to high linamarin content. Linamarin which is synthesized from valine [10] can release highly toxic cyanide [11]. Cyanide is most likely responsible for animals' poor performances, but it remains scanty [12]. In South Sudan, cassava is mostly grown in the Greater Equatoria State, but it spread into other parts of the country. Apparently, little progress has been made with the utilization of cassava as poultry feed for sustainable development of the poultry industry. Hence, this study evaluates the inclusion of cassava root meal on Kuroiler chicks' performances.

Materials and Methods

Experimental design

Ninety (90) one-day old Kuroiler chicks of 75 g average weights were allocated in a randomized complete block of three treatments; T_0, 0.0% cassava (100% maize), T_1, 10.0% cassava and T_2, 20.0% cassava. Each treatment contained three replicates with ten chicks each.

Experimental diets

Experimental diets were prepared by soaking cassava roots in barrels with clean water for three days to loosen the hard outer layers and reduce the cyanide content [13]. Then, roots were removed from the water to easily remove the outer layers. The remaining roots were peeled to chips and exposed to sun drying for a further five days. The sun-dried chips were ground using a hammer mill fixed with a 2 mm sieve screen. The processed powder was formulated as experimental diets.

Experimental house and management

An open system experimental house at the University of Juba farm was used. Pens were divided into nine (9) partitions, one square meter each. Each pen was provided with clean water and feed troughs. The chicks were reared in deep litter wooden shaved floor. The average temperature was maintained at 28.5°C (26°C-31°C) for six (6) weeks. Antibiotics, de-wormers and vaccination against Newcastle disease (ND), Gumboro, and Infectious Bronchitis (IB) were administered.

Measurement of performance parameters

The chicks were weighed every week using the spring balance machine. The feed was supplied *ad-libitum* and the chicks' performances were calculated as described by Ochi et al. [14].

Statistical analysis

The differences in means were determined using ANOVA and Duncan's multiple range test was used to compare different treatments. The statistical package for social sciences (SPSS), version 18.0.0 was used for analysis and a significant difference was taken at $P<0.05$.

Results and Discussion

Table 1 shows the results of weekly feed intake (g/kg dry matter) amongst the experimental chicks. Despite the significant decrease of feed intake, the quantity of cassava in the diet remained increased. Chicks fed on the control diet (T_0) showed significant differences ($P<0.05$) in feed consumption compared to T_1 and T_2 diets. Consequently, the feed conversion ratio varied significantly among the treatments. Chicks exclusively fed on control diet obtained better conversion efficiency of 0.96% compared to diets containing cassava (10.0% and 20.0%) with an average efficiency of 0.46 % and 0.50%, respectively (Table 2). Table 3 shows the body weight gain performance among the Kuroiler chicks fed on the three dietary treatments for six weeks, which was also highest in the control treatment.

The performance of the Kuroiler chicks fed on cassava meals was evaluated as low. However, an inclusion of cassava not exceeding 20-30%, particularly in young animals was reported due to low protein content in cassava [15]. Moreover, numerous studies have shown that the practical use of the cassava roots in non-ruminant feeds is generally low. This level of utilization is due to low protein and dry matter and the potentially toxic

Table 1 Feed intake (g/kg dry weight) among the experimental Kuroiler chicks for six weeks at the experimental house, University of Juba Farm**.**

Dietary treatments	Timeline						Cumulative feed intake
	W_1	W_2	W_3	W_4	W_5	W_6	
T_1	7.70	10.02b	11.27a	11.75a	19.54b	27.48b	87.76b
T_2	6.84	8.61c	8.17b	8.67b	17.33c	25.67c	75.29c
T_0	8.61	13.37a	11.87a	14.67a	23.56a	32.60a	104.68a
±SEM	0.08	0.39	0.58	0.38	0.34	0.60	2.37
GM	7.71	10.67	10.43	11.69	20.15	28.58	89.23

±SEM = standard error of mean; GM = grand mean
T_0 = control diet 100% maize, T_1 = diet with 10% cassava, T_2 = diet with 20% cassava

Table 2 Final performances of the Kuroiler chicks in control and experimental groups.

Performance parameters	T_0	T_1	T_2
Final live weight (g)	1,041.67a	825.00b	733.33c
Feed intake (kg)	3.90a	3.10c	3.20b
Feed conversion ratio	0.46b	0.50b	0.96a

T_1 = diet with 10.0 % cassava; T_2 = diet with 20.0% cassava; T_0 = control diet 100% maize

Table 3 Performance evaluation of Kuroiler chicks fed on experimental diets for six weeks (W).

Dietary treatments	Timeline						Cumulative feed intake
	W_1	W_2	W_3	W_4	W_5	W_6	
T_1	124.33^{a}	227.50^{b}	323.67^{b}	475.33^{ab}	666.67^{ab}	825.0^{b}	2642.5^{b}
T_2	129.33^{a}	234.67^{b}	284.67^{b}	404.33^{b}	583.33^{b}	733.3^{b}	2369.63^{b}
T_0	148.33^{a}	276.33^{a}	413.33^{a}	558.33^{a}	771.00^{a}	1041.7^{a}	3209.02^{a}
±SEM	07.92	10.26	17.07	30.82	43.10	54.43	163.6
GM	134.00	246.17	340.56	479.33	673.67	866.67	2740.0

±SEM = standard error of mean; GM = grand mean
T_0 = control diet 100% maize, T_1 = diet with 10% cassava, T_2 = diet with 20% cassava

cyanogenic glycosides in fresh cassava [16]. The reduction in final body weight noted on the inclusion level of sun-dried cassava flour seemed to have an effect on feed intake and feed conversion ratio. Numerous researchers observed that the inclusion of cassava in poultry diets had reduced performance [17, 18]. On the contrary, other studies demonstrated that cassava root meal could be fed to broilers up to 50% for maize without any negative impact on bird growth performance [19-21]. The cassava root meal could replace up to 75% of dietary maize, resulting in a cost-benefit ratio of 1.41:1 against maize. A similar study also showed the use of 75% of maize in Mubi and its environs in Guinea [22]. This might be linked to an increased awareness of how to balance the nutrients and the negative impacts of cyanide [23].

This study showed that a 10.0% level of cassava meal could be used in broiler diets as recommended by Osei and Duodu [24]. However, Gomez et al. [25] recommended 30%, but it seemed that 40%-60% level of cassava was appropriate [26-27]. Cassava could potentially be an alternative for maize in poultry diets without adverse effects on bird performance if well-processed for the reduction of cyanide content to non-toxic levels. Sun-drying has been reported as one of the effective methods of reducing hydrocyanic acid in cassava products [13]. The variations on the performance of chicks fed on cassava meals may highly be attributed to cassava varieties, growing conditions, processing methods and formulation of cassava-based diets.

Conclusions

Cassava roots could be used as an alternative feed ingredient for maize at low inclusion levels in poultry feeding regimens. Prospective studies are needed to identify and characterize a variety of cassava with low cyanide levels for sustainable development of the poultry industry in South Sudan.

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Conflict of interest

The authors declare that they have no conflict of interest.

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