

Effect of Varying Levels of Acha (*digitaria Exilis*) Husk as a Substitute for Wheat Offal on the Growth Performance and Carcass Characteristics of Broiler Chickens

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Target audience: Animal nutritionist, feed millers, poultry farmers

Abstract

This study investigated the effect of varying levels of acha (*Digitaria exilis*) husk as a substitute for wheat offal on the performance of broiler chickens. One hundred and ninety-five day-old chicks were randomly allocated to five treatments group with 39 birds per treatment. Each treatment was replicated three times with 13 birds per replicate in complete randomized design. Five dietary treatments were formulated. The diets contained acha husk at 0, 5, 10, 15 and 20% levels, replacing wheat offal. The experiment lasted for eight weeks. Results showed that chicks fed diets containing acha husk at 20% had the highest final weight (2.69 kg), daily weight gain (47.58 g), and the best feed conversion ratio (1.50) compared to the control group ($P < 0.05$). The cost of feeding the broiler chickens decreased with increasing levels of acha husk inclusion ($P < 0.05$). Acha husk inclusion at 20% level increased the weight of gizzard, liver, heart, and spleen ($P < 0.05$) compared to the control group. In conclusion, acha husk can be effectively included in broiler diets at up to 20% level as a substitute for wheat offal without compromising performance, hence improving feed conversion ratio and reducing feed cost. Acha husk inclusion at this level also increase the weight of some vital organs. Further studies are needed to investigate the long-term effects of acha husk on broiler performance and meat quality.

Keywords: Acha husk, wheat offal, broiler chickens, performance

Description of Problem

The poultry industry faces ongoing challenges in maintaining cost-effectiveness while meeting the rising global demand for poultry products (1). One critical aspect influencing production costs is the formulation of feed, where traditional ingredients like wheat offal, a by-product of wheat milling, play a significant role (2).

However, increasing costs and limited availability of conventional feed ingredients have prompted researchers to explore alternative sources that can maintain or improve poultry performance without compromising economic viability (3). Among these alternative sources, acha husk, derived from *Digitaria spp.*, emerges as a potential candidate due to its availability and

potential nutritional value. Acha, also known as hungry rice or fonio, is an ancient African cereal crop with grains enclosed in a husk similar to rice. As a by-product of acha processing, acha husk presents an opportunity for utilization in poultry diets (4). To address the need for cost-effective feed ingredients and assess the feasibility of incorporating acha husk into broiler diets, it is essential to investigate its effects on broiler performance. This study was aimed at evaluating the impact of varying levels of acha husk as a substitute for wheat offal on the performance of broiler chickens.

Materials and Methods

Experimental Site

The experiment was conducted at Poultry units of the Teaching and Practical Farm of Bauchi State College of Agriculture.

Experimental Design and Management of birds

The design used for the experiment was a completely randomized design (CRD). The 195 birds were randomly allocated to five different treatments with 39 birds per treatment and each treatment was replicated three times with thirteen (13) birds per replicate. The experiment lasted for a period of eight (8) weeks. **The** One hundred and ninety five (195) day old chicks of mixed sexes were raised/ brooded on deep litter management system for a period of one week. During the brooding, all the necessary management practices were strictly adhered to as appropriate. After the brooding, the chicks were then allotted to the various experimental treatments group. Feed and

water were provided *ad libitum*.

Experimental Diets

The ingredients for diet formulation were maize, wheat offal, soyabean, acha husk, bone meal, premix, lysine, calcium, methionine and salt respectively. Acha husk was included as the test ingredient varying levels of 0, 5, 10, 15 and 20%. Experimental diets were formulated to meet protein and energy requirement of broiler chickens. The percentage composition of the experimental diets for starter and finisher phases are as shown in Tables 1 and 2 respectively.

Sourcing and Processing of Acha Husk in the Diets

Acha husks were collected, processed, milled and mixed with other ingredients to formulate a balanced diet for the broiler chickens. It was used to replace wheat offal in the diets of broilers chickens at varying levels of 0, 5, 10, 15 and 20% respectively.

Data Collection for Growth Parameters

During the study, data were collected on growth performance which includes; feed intake, body weight gain, feed conversion ratio and mortality.

Carcass and Organs Evaluation

At the end of the experiment, six birds were randomly selected from each treatment group and fasted of feed overnight in order to empty the digestive tract and minimizing contamination by residual ingesta, but however water was offered. The next morning before slaughter, the selected birds were weighed to obtain their live body weight. Birds were slaughtered using knife

Table 1: Ingredients Composition (%) of the Experimental Diet at the Starter Phase

Ingredients	T1	T2	T3	T4	T5
Maize	47.95	45.50	41.39	37.60	35.60
Soybean meal	33.05	30.50	29.61	28.40	25.40
Acha husk	0.00	5.00	10.00	15.00	20.00
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Lime stone	1.00	1.00	1.00	1.00	1.00
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated	Analysis				
Crude protein	23.71	23.71	23.71	23.71	23.71
ME (Kcal/kg)	2913.00	2912.46	2909.66	2908.86	2903.98
Crude fibre	3.05	3.05	3.05	3.05	3.05
Lysine	1.38	1.38	1.38	1.38	1.38
Methionine	0.51	0.55	0.60	0.65	0.67

Table 2: Ingredients and Composition (%) of the Experimental Diet at the Finisher Phase

Ingredients	T1	T2	T3	T4	T5
Maize	55.59	52.65	49.75	46.99	43.99
Soybean meal	25.41	23.35	21.25	19.01	17.01
Acha husk	0.00	5.00	10.00	15.00	20.00
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Lime stone	1.00	1.00	1.00	1.00	1.00
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated	Analysis				
Crude protein	20.53	20.53	20.53	20.53	20.53
ME (Kcal/kg)	2989.12	2985.78	2982.38	2979.04	2975.66
Crude fibre	5.61	5.61	5.61	5.61	5.61
Lysine	1.09	1.09	1.09	1.09	1.09
Methionine	0.51	0.50	0.50	0.49	0.49

by cutting the jugular vein and allowed to completely bled.

Statistical Analysis

Data collected during the experiment was subjected to Analysis of Variance (ANOVA) technique as outlined by (6). The treatment means were separated using (7).

Result and Discussion

Table 3 presents the performance of broiler chickens fed varying levels of Acha husk across different parameters. As the level of Acha husk in the diet increases from T1 to T5, there was a noticeable increase in both final weight and total weight gain. This trend suggests that Acha husk inclusion positively influences the growth performance of broiler

chickens. The differences in final weight and total weight gain between treatments group were statistically significant (P<0.05). There was no significance difference (P>0.05) observed in total feed intake. This implies that despite variations in Acha husk levels, the overall feed consumption remains relatively consistent across treatments. Both daily weight gain and daily feed intake followed a similar pattern with final weight and total weight gain. As the level of Acha husk increases, there was an improvement in daily weight gain and daily feed intake. These differences are statistically significant (P<0.05). This indicated that Acha husk inclusion enhances the chickens' growth rates and feed consumption on a daily basis. The observed increase in final weight, total

Table 3: Performance of Broiler Chickens Fed Varying Levels of Acha Husk

Parameters	T1	T2	T3	T4	T5	SEM
Initial weight (g)	40.81	41.27	41.38	41.48	41.59	0.03 ^{NS}
Final weight (g)	2540 ^c	2590 ^{bc}	2600 ^b	2640 ^{ab}	2690 ^a	0.35 [*]
Total weight gain (g)	2500 ^c	2640 ^b	2650 ^{ab}	2650 ^{ab}	2660 ^a	0.245 [*]
Total feed intake (g)	5020	5170	5290	5310	5370	0.45 ^{NS}
Daily weight gain (g)	44.60 ^c	45.58 ^{bc}	46.33 ^b	46.38 ^b	47.58 ^a	2.71 [*]
Daily feed intake (g)	89.39 ^c	90.44 ^{bc}	92.39 ^b	93.15 ^b	95.85 ^a	3.05 [*]
Feed conversion ratio	2.01	2.00	1.99	1.85	1.50	0.04 ^{NS}
Cost of feed consumed (*)	370.98 ^a	369.82 ^{ab}	357.98 ^b	353.93 ^{bc}	320.45 ^c	3.75 [*]

abc: means within the same row bearing different superscripts are significantly different (P<0.05) NS: Not significant

weight gain, daily weight gain, and daily feed intake with increasing levels of Acha husk aligns with previous studies (9, 10) that have reported having similar growth-promoting effects using alternative feed ingredients. For example, research by (8) found that replacing traditional feed ingredients with unconventional sources such as acha bran improved the growth performance of broilers.

The FCR decreases with increasing levels of Acha husk, reaching its lowest value in T5. This suggests that Acha husk inclusion improves the efficiency of feed utilization by the broiler chickens, resulting in better conversion of feed into body weight. The decrease in feed conversion ratio (FCR) observed in the current study with increasing levels of Acha husk is consistent with findings from other studies investigating the use of alternative feed ingredients. Studies by (9) and (10) reported improved FCR in broilers fed diets containing various alternative feed ingredients, such as rice bran and wheat bran.

The cost of feed consumed decreases as the level of Acha husk increases, with the lowest cost observed in T5. This indicates that incorporating Acha husk into the diet had the potential of reducing feeding costs while maintaining or improving growth performance. The reduction in the cost of feed consumed as Acha husk inclusion increases was in line with previous research by (10) demonstrating the potential economic benefits of using unconventional feed ingredients in poultry diets. Studies by (11) and (12) showed that incorporating alternative feed ingredients such as acha

huusk into broiler diets resulted in cost savings without compromising growth performance.

Carcass Characteristics of Broiler Chickens Fed Varying Levels of Acha Husk

Table 4 presents the carcass characteristics of broiler chickens fed varying levels of Acha husk across different parameters.

There are no statistically significant differences observed in both live weight and dress weight across the different treatment groups. This suggests that the inclusion of Acha husk in the diet does not have a significant impact on the overall live weight and dressing percentage of the broiler chickens. The eviscerated weight increases as the level of Acha husk in the diet increases. The differences between treatment groups are statistically significant ($P < 0.05$), indicating that Acha husk inclusion influences the eviscerated weight of the broiler chickens. This suggests that higher levels of Acha husk may result in a higher yield of eviscerated carcasses. The lack of significant differences in live weight and dressing percentage across treatment groups is consistent with previous findings on the effects of dietary fiber sources on carcass yield in broiler chickens. Studies by (13) and (14) also reported no significant differences in live weight and dressing percentage when broilers were fed diets containing alternative fiber sources such as Acha husk.

The weights of internal organs such as the gizzard, liver, heart, spleen, and lungs, relative to body weight, vary across the

Table 4: Carcass Characteristics of Broiler Chickens Fed Varying Levels of Acha Husk

Parameters	T1	T2	T3	T4	T5	SEM
Live weight (kg)	2.30	2.35	2.55	2.56	2.57	0.02 ^{NS}
Dress weight (%)	86.67	86.68	86.70	87.01	87.50	0.12 ^{NS}
Eviscerated weight (%)	73.77	74.78	75.88	76.57	77.07	0.96*
Gizzard (g/kg body weight)	12.52	12.49	13.66	14.44	14.48	0.65*
Liver (g/kg body weight)	14.01	14.57	14.83	15.29	15.35	0.79*
Heart (g/kg body weight)	3.08 ^c	3.63 ^{bc}	3.87 ^b	3.99 ^b	4.10 ^a	0.29*
Spleen (g/kg body weight)	0.87 ^c	1.05 ^b	1.14 ^{ab}	1.11 ^{ab}	1.25 ^a	0.79*
Lungs g/kg body weight)	3.63	3.65	3.62	3.64	3.59	0.20 ^{NS}
Small intestine (Cm)	254.32	255.01	255.35	255.48	255.58	0.10 ^{NS}
Large intestine (Cm)	28.98	28.99	29.05	29.11	29.25	1.27 ^{NS}

abc: means within the same row bearing different superscripts are significantly different ($P^* 0.05$); NS: Not significant

treatment groups. Generally, there is an increasing trend in organ weights with higher levels of Acha husk in the diet. These differences are statistically significant ($P < 0.05$), indicating that Acha husk inclusion affects the relative weights of these organs. For example, the heart and spleen weights increase significantly with higher levels of Acha husk, suggesting potential physiological adaptations in response to dietary changes. The observed increase in

organ weights, such as the liver, heart, spleen, and gizzard, with higher levels of Acha husk in the diet aligns with findings from previous studies. For example, research by (15) reported that feeding broilers with alternative feed ingredients rich in fiber led to increased relative weights of the liver and gizzard. Similarly, studies by (16) and (17) found that dietary supplementation with various fibrous materials such as Acha husk resulted in enhanced development of internal organs in

broiler chickens.

The lengths of both the small and large intestines show no statistically significant differences across the treatment groups ($P>0.05$). This suggests that Acha husk inclusion does not have a significant impact on the overall length of the intestines in broiler chickens. The absence of significant differences in intestinal length with increasing levels of Acha husk aligns with findings from some previous studies (6, 7.) While fiber-rich diets such as Acha husk have been shown to influence intestinal morphology in poultry (14), the effects on intestinal length may vary depending on the specific fiber source and dietary formulation.

Conclusion and Applications

Based on the results obtained from this study, it can be concluded that;

1. Inclusion of acha husk in broiler diets up to 20% level positively influenced growth performance without compromising feed intake.
2. Acha husk inclusion at 20% level increased the weight of some vital organs, such as the gizzard, liver, heart, and spleen, without affecting carcass yield or intestinal length.
3. Incorporation of acha husk up to 20% level in broiler diets can be considered as a viable alternative to wheat offal, as it improves growth performance and reduces feeding costs.
4. Further research should be conducted to explore the long-term effects of acha husk inclusion on broiler performance, meat quality,

and physiological responses.

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