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PERFORMANCE OF FINISHER BROILER CHICKENS AS AFFECTED BY DIFFERENT PROPORTIONS OF COOKED COWPEAS (*VIGNA UNGUICULATA*) IN THE GROWER-FINISHER DIET

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ABSTRACT

This study was carried out for 4 weeks at the Research Experimental Farm (FAR) of the University of Dschang-Cameroon, on the feeding of broilers with cowpea (*Vigna unguiculata*) as a source of protein, which replaced animal meal (CMAV 10%) in the finisher diet. The objective was to evaluate the effect of the incorporation level of cooked cowpea on the production performances of broilers in the grower-finisher diet, so cooking could be an easy solution to local farmers if proven efficient. A total of 160 male broiler chicks, 21days old and weighing 416.32g on average, were randomly distributed into 32 experimental units of 4 birds each. Each of the five experimental diets: F0, F1, F2, F3 and F4 containing 0% (control), 15%, 20%, 25%, and 30% of cooked cowpea was respectively allocated to 8 experimental units in a completely randomised design comprising 5 treatments with 4 replicates each. Cowpea grains bought from the local market were cooked for 3 minutes in a pressure cooker at the temperature of about 115^{o}C under a pressure of 155Pa. Cooked grains were sun-dried for one week (under a temperature of about 28-32^{o}C) to a humidity level of about 11%. Parameters measured were feed consumption, live weight and weight gain, feed conversion ratio, feeding cost for the production of one kg live weight, carcass yields, proportions of different parts analysed and the creatinine level in the chickens' serum. The results showed that there was no significant difference (P>0.05) between treatment groups for total feed consumption. Live weight (1941.93±77.74g and 1804.21±271.73g), weight gain (1207.61±71.50g and 1094.93±177.16g), and feed conversion ratio (2.79 ±0.15 and 3.02 ±0.46) recorded for the F3 group (25% cooked cowpea) and F4 (30% cooked cowpea) respectively were statistically significant (P<0.01) as compared with the other groups. The F3 and F4 rations induced the highest feeding cost for the production of one kg live weight (P>0.01) during the whole experimental period. F0, F1 and F2 broilers were comparable for these parameters. All the treatment groups were not statistically different (P>0.05) for carcass yield, proportions of organs and serum creatinine level. It was concluded that up to 20% of cooked cowpea could be used in the finisher diet without negatively affecting feed consumption, live weight, weight gain, feed conversion ratio, feeding cost for the production of one Kg live weight and carcass quality of broilers.

Key words: Cowpea, Diets, Production Performances, Broilers

INTRODUCTION

Soybean meal, with 44-48% crude protein is the major source of plant protein in poultry diets [1, 2]. According to Robinson and Singh, the price of soybean meal is forecasted to increase higher on the international market due to the high demands in China and the emergent countries of Asia [3]. As a consequence, there is the risk that this traditional source of protein for poultry would become too expensive and scarce in the years to come, particularly in low-income African countries south of the Sahara. It is, therefore, necessary to search for good substitutes using readily available local feedstuffs. Grain legumes could be good substitute for soybean meal, as they are known to have a similar amino acid profile [4]. However, recent studies agreed that the utilization of raw cowpeas (*Vigna unguiculata*) was limited by the presence of antinutritional factors (ANFs), which negatively affect broilers feed consumption and growth, thus confirming previous reports on the necessity to detoxify grain legumes before they can be included in monogastric animals' diets [5,6,7,8,9,10,11]. Different methods have been developed to de-activate the ANFs including heat treatment. Cooking could be an easy solution to local farmers if proven efficient.

The objective of this study was, therefore, to evaluate the effects different proportions of cooked cowpeas on the production performance of finisher male broilers.

MATERIALS AND METHODS

Animals and Diets

A total of 160 male *Hubbard* broiler chicks, 21days old with an average live weight of 416.32g were used. The chicks were started in deep-littered open side type house, with a conventional diet to contain crude protein (CP) (21.89%), metabolizable energy (ME) (2990.79Kcal/kg), calcium (0.96%) and phosphorous (0.1%). They were immunised against Newcastle disease and infectious bronchitis at 7 and 23 days of age and infectious bursal disease (Gumboro) at 10 days of age. Anti-stress (Aliseryl W.S®: 1g/5l of water) was given during the first three days, before and after each vaccination, during the transfer of birds from the brooding to the finishing housing, and during transition of starter to finisher diet. Coccidistatics (Vetacox®), and an anti-infection drug (Furaltadone®) were administrated in drinking water for 3 consecutives days from 10th day of age and every week there after until 6 weeks of age. An antibiotic, Oxytetracycline®, was used to treat a respiratory disease at 3 weeks of age. Feed and water were provided *ad libitum.*

Cowpea grains bought from the local market were cooked for 3 minutes in a pressure cooker at the temperature of about 115^{o}C under a pressure of 155Pa. Cooked grains were sun-dried for one week (under a temperature of about 28-32^{o}C) to a humidity level of about 11%. Five experimental diets containing 15% (F1), 20% (F2), 25% (F3) or 30% (F4) cowpea and one control (F0) were formulated as shown in Table 1. Samples of cowpea and feeds were analysed according to AOAC [12].

Experimental Design and analysis

The 160 chicks were caged in pairs. Each of the five experimental diets (treatments) F0, F1, F2, F3 and F4 was allocated to 8 experimental units in a completely randomised design and replicated 4 times. Parameters measured were feed consumption, live weight and weight gain, feed conversion ratio, feeding cost for the production of one kg live weight, carcass yields, proportions of different analysed parts and the creatinine level in the chickens' serum.

Initial live weights of the chickens were determined by weighing them in group at the beginning of the experiment and individually every week of age. The total weight of birds in each replicate was divided with the total number of birds to arrive at the average live weight of birds. Weight gain was determined by subtracting initial live weight from final live weight of 2 consecutive weeks. Daily feed intake was determined by subtracting the quantity left over from the quantity given each day. The weighing of birds and food was done using a top loading (20 kg capacity. Goat Brand^{R}) weighing scale. Weighing took place in the morning (6.00-7.00 am) each week. Feed conversion ratio (FCR) was determined as feed intake divided by weight gain of each week. The cost per Kg weight gain was calculated as FCR x cost/kg feed. At the end of the trial, 8 birds per treatment were slaughtered for carcass evaluation [13]. Blood samples (10ml) collected from the jugular vein of sacrificed birds were also collected and analysed for creatinine according to Jaffe's reaction, using a commercial kit by Boehringer Mannheim GmbH Firm (Mannheim, Germany) to evaluate the toxicity of the antinutritional factor of the cowpea [14].

All the data collected were subjected to analysis of variance. The Duncan's Multiple Range test was used to determine the extent of dispersion between the means [15].

RESULTS

The chemical composition of raw and cooked cowpeas is presented in Table 2. Cooking affected the nutritive value of cowpeas. Cooked cowpeas had higher ME and organic and dried matter contents than raw cowpeas. However, CP, ash, fat and CF contents decreased after cooking.

In general, the feeding of cooked cowpea diets significantly ($P<0.05$) affected all the performance parameters of broilers, except feed consumption and percent mortality (Table 3). Weight gain was significantly ($P<0.05$) lowest for birds fed on the diet containing 30% cooked cowpeas and highest for those on F2 with 20% cowpeas. However, there was no significant difference between the F2, F1 and the control birds for weight gain. The F3 (25%) and F4 (30%) diets induced the highest ($P<0.05$) feed conversion ratio and cost per kg of weight gain. There were no significant differences between the birds fed control, F1 (15% cooked cowpea) and F2 (20% cooked cowpea) diets for these parameters.

Data on carcass characteristics and creatinine level in the fowl's serum are summarized in Table 3. There was no significant difference between all the treatment groups for carcass yield, the percentage body weight of gizzard, liver and abdominal fat. The birds under the diet with 30% cooked cowpeas recorded the highest leg and heart percent as compared to the control. There was no significant difference between all the groups fed cooked cowpea, between the control and the groups fed less to 30% cooked cowpea for leg and heart percent. The serum creatinine level was not significantly different (P>0.05) among treatment groups.

No treatment effect was recorded on mortality rate throughout the experiment (Table 3).

DISCUSSION

The ME and CP levels obtained in the raw cowpeas were higher than values reported [16]. The difference among varieties of grains used could probably be the cause. The decrease in the CP level of the cooked beans could be related to the denaturation of protein by heat treatment, thus reducing the level of this nutrient together with the protease inhibitors in the grains during the cooking process [17].

In general, feed consumption was comparable in all groups of birds and the total feed consumed was in the 3000-3500g range generally considered as normal [18]. The results of the present study agreed with those reported that the incorporation level of legumes grains detoxified (autoclaved Bambara groundnuts) in finishing broiler diets did not affect their feed consumption [19]. However, the total feed consumption in all groups was lower as compared to that of 4787g suggested by Hubbard [20]. The lower performances observed respectively with 5% cooked and 6% of toasted cowpeas were probably due to the poor control of the temperature during the detoxification of grains [7,8].

In general, weight gain was lower and feed conversion ratio higher in all groups of birds including the controls as compared to the suggestions of Hubbard [20]. These poorer performances could be related to the bacterial infection that occurred in all treatment groups at 6 weeks of age. The inclusion of up to 20% cowpeas in the diet resulted in higher weight gain but not significantly different from the control group. However, as the inclusion level of cowpeas increased above 20%, there was a rapid linear drop in weight gain. This suggests, in agreement with earlier reports, the presence of residual quantities of antinutritional factors in the cooked cowpea [7, 8, 9, 19, 20, 21, 22, 23, 24]. A longer cooking time could probably have been more efficient. The growth performances recorded in the present study with rations containing more than 25% cooked cowpeas were higher than those who used only 5% boiled and 6% toasted cowpeas respectively [7,8]. Under pressure-cooking, there is a better control of the temperature and this could have improved the nutritional value of the grains [25,26]. The results of this study are in agreement with those of Nji Fru et *al.* who found a proportional decrease in total growth when above 19% autoclaved

Bambara groundnuts were used in broiler finishing diets [21]. The lowest body weight gains recorded in the birds fed on the diets containing 25 and 30% cooked cowpeas were associated with the poorest feed conversion ratio and the highest cost of production. Therefore, it would not be technically justified to include the tested feedstuff above the 20% level.

No significant difference was detected among treatment groups for carcass yield, proportion of liver, gizzard, head and abdominal fat, percent mortality and serum creatinine. This indicated that the incorporation of up to 30% cooked cowpeas in the finisher diet not affect the carcass characteristics of the broilers. Although the carcass yields recorded for the all groups of birds was in the range suggested, the percentage of liver, gizzard, head and heart were highest [13,27]. Some researchers recorded an increase in the liver and gizzard percents in birds fed raw, cooked and toasted cowpeas respectively [6,7,8].

The creatinine levels recorded in all the groups of chickens were higher than the normal range (0.5-1.5 mg/dl) suggested [28]. The increase in the level of serum creatinine could be associated with the use of Oxytetracycline® to treat all the birds against respiratory affections. Indeed it was reported an azotemia or high concentration of serum creatinine associated with the consumption of drugs such as Gentamicine®, Oxytetracycline®, Amphotericine B®, Furosemide® and Trimethoprim-sulfadiazine® [29]. These drugs are known to reduce the excretion capacity of kidneys thus, causing the accumulation of ammonia in the blood and the consequent increase of creatinine level in the serum.

CONCLUSION

This study was conducted to evaluate the effect of the incorporation level (15%, 20%, 25%, and 30%) of cooked cowpea (*Vigna unguiculata*) on the production performances of broilers in the grower-finisher diet.

It was concluded that, up to 20% of cooked cowpeas could be used in the finisher diet without negatively affecting the production performance (Feed consumption, live weight, weight gain, feed conversion ratio, feeding cost for the production of one Kg live weight and carcass quality) of broiler chickens.

Table 1: Ingredients and nutrient composition (%) and cost (FCFA) of experimental diets

Feedstuffs	Experimental diets				
	F0 (Control)	**F_1**	**F_2**	**F_3**	**F_4**
Maize	62	53	50	47.5	44.5
Wheat middling	8	10	10.5	9	9
Soya bean meal	8	11	10	10	7.75
Cottonseed meal	5.5	3.5	3	2.5	2.25
CMAV 10% [1]	10	0	0	0	0
Cooked cowpea	0	15	20	25	30
Fish meal	4	5	4	3.5	4
Bone meal	1.25	1.25	**1.25**	1.25	1.25
NaCl	**0.5**	0.5	0.5	0.5	0.5
Synthetic D-L Methionine	0.25	0.25	0.25	0.25	0.25
Synthetic Lysine	0.5	0.5	0.5	0.5	0.5
Total %	100	100	100	100	100
Calculated nutrient composition (%)					
M.E., Kcal/Kg	3072	3037	3067	3087	3125
Crude protein	18.75	18.55	18.71	18.89	19.09
Crude Fiber	3.9	3.8	3.5	3.2	2.9
Lysine	1.3	1.3	1.2	1.2	1.1
Methionine	0.53	0.52	0.58	0.50	0.50
Total phosphorous,	0.7	0.53	0.52	0.48	0.49
Calcium	0.93	0.9	0.9	0.9	0.9
Cost of production of kg of ration (FCFA/kg)²	264.10	255.35	267.35	268.22	279.6

[1](CMAV 10%) composition (g kg^{-1}): protein (20), fat (40), fibre (20), Ca (90), P (37.5), lysine (28), methionine (23), Methionine +Cystine (28), M.E. (2300 Kcal Kg^{-1}), vitamin (100kg): A ($15x10^6$ IU), D_3 ($3x10^6$ IU), E ($53X10^4$ mg), vitamin (mg kg^{-1}): K_3 (26), B_1 (25), B_2 (60), B_6 (25), B_{12} (0,3), folic acid (20), trace minerals (g kg^{-}1): Fe (1650mg kg^{-1}), Cu (200mg kg^{-1}), Zn (1300mg kg^{-1}), Mg (850mg kg^{-1}), Se (3mg kg^{-1}))

² 1 Euro = 655.95 FCFA

* Metabolizable Energy calculated according to Sibbald quoted by Wiseman [34]

Table 2:Chemical composition (%DM) of raw and cooked cowpea

Nutriments	Raw cowpea	Cooked cowpea
M.E. (Kcal kg^{-1}DM) *	4460.89 etc.	4506.58 etc.
Crude protein	26,51	25,47
Organic matter	94,89	95,52
Dry matter	88,22	89,31
Ash	5,11	4,98
Ether extract (Crude fat)	2,20	2,13
Crude Fiber	5,28	5,27

* See Table 1

DM: Dry Matter

Table 3: Growth performances, carcass characteristics (% body weight) and serum creatinine (mg/dl) of finisher male broilers fed graded levels of cooked cowpea diets from 3 to 7 weeks of age

Parameters	**Diets (% Inclusion of cooked cowpea)**					
	Control (0%)	**F_1 (15%)**	**F_2 (20%)**	**F_3 (25%)**	**F_4 (30%)**	**SEM**
Feed consumption (g)	3286.12a	3348.43a	3313.75a	3366.40a	3236.26a	38.60
Weight gain (g)	1337.74a	1362.49a	1357.43a	1207,61b	1094.93c	33.30
Feed conversion ratio (g feedg^{-1}gain)	2.48c	2.48c	2.46c	2.79b	3.02a	0.07
Feed cost/kg weight gain (FCFA)*	509.45c	508.90c	518.85c	603,88b	747,92a	21.15
Mortality, %	0.31a	0.43a	0.43a	0.50a	0.56a	0.02
Carcass yield (% BW)	69.01a	73.17a	71.53a	71.17a	68.16a	1.75
Organs weight (% BW)						
Liver	3.16a	3.75a	3.26a	3.54a	3.38a	**0.32**
Gizzard	2.58a	3.63a	3.07a	3.31a	3.56a	**0.33**
Head	3.16a	3.50a	3.51a	3.72a	4.20a	**0.28**
Heart	0.62c	1.62ab	1.17abc	0.97bc	1.73ab	**0.22**
Legs	3.16b	3.50ab	3.51ab	3.73ab	4.20a	**0.33**
Abdominal fat	1.94a	2.41a	2.71a	2.47a	1.69a	**0.38**
Creatinine level (mg/dl)	4.8a	4.8a	4.8a	5.2a	5.2a	**0.46**

a, b, c : Means in the same raw carrying the same letter are not significantly different (P>0,05).
SEM: Standard Error of means.
* See Table 1
BW: Body Weight

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