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***Research Paper***

# EFFECTS OF LOW PROTEIN DIETS SUPPLEMENTED WITH HIGH AMINO ACIDS (METHIONINE AND LYSINE) ON PERFORMANCE OF BROILERS.


**ABSTRACT**

**Aims:** These studies were to evaluate the effects of high level methionine and lysine supplementation on the performance and carcass characteristic of broilers fed low crude protein diets.

**Study design** The experiments employed a complete randomized design, all data generated were subjected to analysis of variance.

**Place and Duration of Study:** The experiment was carried out at the teaching and research farm of the University of Ibadan between April and July 2011.

**Methodology:** Two hundred day old unsexed broiler chicks were used in a six weeks feeding trials. For each study four experimental diets were formulated such that they contained methionine at four dietary levels of 0, .35,.45 and .55% while the other four set contained lysine at four dietary levels of 0, .60, .70 and.80% respectively

**Results:** Results indicated that broilers fed diet1 with normal protein level without methionine and lysine were higher (($P$=.05)) in body weight gain compared with others. Feed conversion also had the same statistical trend. It was indicated that level of crude protein lysine and methionine had significant effect on body weight gains. It was concluded that CP levels in the diets of the broilers could be reduced from 24.25 to 10.60 provided their methionine and lysine levels are higher than NRC recommended levels. This supplementation was found to increase monetary losses due to low feed intake reduced body weight gain and suboptimal feed conversions of the experimental broilers.

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**Conclusion:** The aim of the poultry farmer is to achieve optimum production with least inputs, from these studies it can be concluded that crude protein content of broiler diet reduced from 24.25 to 10.60% and augmented with either methionine between .35 and .45 and Lysine between .60 and .70%. This supplementation was found to increase monetary losses due to low feed intake reduced body weight gain and suboptimal feed conversions of the experimental broilers.

*Keywords: [* Lysine methionine low protein broiler *}*

## 1. INTRODUCTION

Poultry in one form or another are kept in most areas of the world. There are fewer religious or social taboos associated with them than there are with pigs, rabbit and cattle thus products from poultry provide an acceptable form of animal proteins for most people throughout the world with the exception of strict vegetarians and Vegas [1].

With the increasing human population the consumption of meat is increasing in the world and intensive animal production has many more challenges to solve including environmental pollution and animal welfare [2].

The prevailing scarcity and cost of conventional plant protein supplements such as full fat soybean meal and groundnut cake have resulted in the recent high cost of commercial feeds and poultry products in Nigeria [3].This major constraint necessitate intensified research on the possibilities of increasing the levels of amino acids and reducing the crude protein in the diets of the birds. Schutte and Pack [4] reported that in practical poultry diets methionine is the first limiting amino acid followed by lysine. Although the advantages of the digesitible amino acid system are recognized, diet formulation on the basis of total amino acid content is still widely practiced[5 ].Widespread commercial production of supplemental amino acids and further redefining of swine and poultry amino acid requirements have provided nutritionists with the option of reducing dietary CP without compromising performance levels. Therefore supplementation of methionine and lysine to practical poultry diets provide a means of increasing the efficiency of protein utilization and as a result nitrogen excretion will be reduced. In the past swine and poultry diets were formulated using a specified crude protein level that was proven to provide an acceptable level of production. However widespread commercial production of supplemental amino acids and further redefining of monogastrics amino acid requirements have provided nutritionist with the option of reducing

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dietary crude protein without comprising performance levels [6]. The crude protein and amino acid status of a diet influences the carcass composition of broilers with increased carcass protein and reduced carcass fat accompanying increases in dietary protein or essential amino acid content [7]. The positive benefits of using supplemental amino acids has been reported to include decreased nitrogen in manure decreased ammonia emission into the air, decreased water consumption by the experimental birds and decreased manure volume up to 55 [6]. When the CP is lowered the ability of the diet to supply essential amino acids in a ratio that the birds require is impaired. The use of supplemental amino acids allows nutritionists to use a wide range of alternative ingredients in the diet that otherwise may not be economically or nutritionally practical. The aim of this study was to investigate the effects of methionine and lysine in low crude protein diets on performance and carcass characteristics.

## 2. MATERIAL AND METHODS

The experiment was carried out at the teaching and research farm of the University of Ibadan. Maize and cassava flour were the main energy source while soybean was the major protein source. For each experiment four diets were formulated diet1served as the control it contained 24.25% crude protein while diets T2,T3 and T4 had 19.7, 15.15 and10.6% respectively. First set of diets 2,3and 4 had recommended level of lysine with varying levels of methionine while the other set contained recommended level of methionine with varying levels of lysine table 1.

One hundred and ninety two day old broilers of anak strain bought from a reputable farm at Ibadan were used for these feeding trials. The broilers were raised on deep litter with conventional feed during the first week to allow for acclimatization, they were weighed on the eight day and then randomly assigned to the experimental diets in such a way that each dietary treatment had 24 birds replicated thrice. The experimental feed and water were supplied ad libitum routine vaccination and necessary medications were administered as when necessary Records of feed intake were taken daily, body weight gain on weekly basis also mortality .

At the last week of the experiment an indigestible marker Titaniumdioxide ($TiO_2$) was included in the diets to monitor digestibility of the feed. Four birds per replicate were sacrificed and ilea digesta were collected in different bowls which were freeze dried and analyzed. The sacrificed birds were scalded in moderately hot water and defeathered. The eviscerated by carefully removing the gastro intestinal tracts. The weight of the cut up parts precisely the drumstick and breast muscle were taken.

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### 2.1 Chemical analysis

Proximate analysis of the experimental diets and ilea digesta were carried out using AOAC methods AOAC [8].

### 2.2 Statistical Analysis

The experiments employed a complete randomized design, all data generated were subjected to analysis of variance in case of significance the means were separated using Duncan multiple range test.

## 3. RESULTS AND DISCUSSION

The gross composition of the experimental diets are as shown in Table 1, the first four sets of diets are designated as methionine diet where the CP varied from 10.60 to 24.25% and methionine inclusion from .25 to.50.While the other four sets had lysine inclusion of .50 to .80.The feed intake of broilers on control diets were significantly higher ((*P*=.05)) compared with others for both trials. It implies low level of crude protein with either high methionine or lysine depressed feed intake of broilers. The feed intake of birds on diets T2 T3 and T4 were similar in methionine experiment while T2 and T3 were similar and higher than T4 in lysine experiment Table 2. The body weight gain also had a similar statistical trend as the feed intake those fed control had higher weight significantly (*P*=.05) different from others. However there were no significant differences (*P*=.05) among the dietary feed considering the feed conversion efficiency. From these trials it is apparent that in the methionine experiment feed intake in the treatments T2,T3 and T4 were similar being 2.43kg 2.38kg and 2.32kg. This is at variance with the reports of [9], [10],[4], [11] that methionine levels above NRC recommendations improves body weight [12], feed efficiency and breast meat yield.

**Table 1.** Gross composition of the Experimental diet

| Ingredients(%) | Methionine Diets | | | | Lysine Diets | | | |
|---|---|---|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | T1 | T2 | T3 | T4 |
| Maize | 54.50 | 54.4 | 54.3 | 54.2 | 54.50 | 54.4 | 54.3 | 54.2 |
| Soybean meal | 40 | 30 | 20 | 10 | 40 | 30 | 20 | 10 |
| Cassava flour | 0 | 10 | 20 | 30 | 0 | 10 | 20 | 30 |
| Methionine | 0.25 | 0.35 | 0.45 | 0.5 | 0.25 | 025 | 0.25 | 0.25 |
| Lysine | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.60 | 0.70 | 0.80 |
| $T1O_2$ | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Bone meal | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| Oyster shell | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| *Premix | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Crude protein % | 24.25 | 19.70 | 15.15 | 10.60 | 24.25 | 19.70 | 15.15 | 10.60 |
| ME kcal | 2821.8 | 2694.77 | 2970.42 | 3044.98 | 2821.8 | 2894.77 | 2970.42 | 3044.9 |
| Meth (%) | 0.60 | 0.64 | 0.67 | 0.71 | 0.60 | 0.54 | 0.47 | 0.41 |
| Lysine (%) | 1.84 | 1.54 | 1.24 | 0.93 | 1.84 | 1.64 | 1.44 | 1.23 |

*2.5 kg Premix used supplied vitamin A, 12,500000iv: vitamin D, 2500000iv; vitamin E,40,000mg; vitamin K3,2000mg;vitamin B1, 3000mg; vitamin B2 5500mg Niacin, 55000mg;calcium pantothenate, 11500mg vitamin B6, 5000mg; vitamin B12, 25mg; Folic acid,1000mg;biotin,80mg;choline chloride 500000mg;manganese, 120000mg; Iron100,000mg;zinc,80000mg;copper 8500mg;iodine 1500mg cobalt 3000mg;selenium 120mg and anti-oxidant 120,000mg.

**Table 2** Performance and carcass characteristics of broiler fed experimental diets

| Parameters Kg/bird | METHIONINE | | | | | LYSINE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | T1 | T2 | T3 | T4 | SEM | T1 | T2 | T3 | T4 | SEM |
| Feed intake | 2.75$^{a}$ | 2.43$^{b}$ | 2.38$^{b}$ | 2.32$^{b}$ | 0.03 | 2.67$^{a}$ | 2.41$^{a}$ | 2.32$^{b}$ | 2.01$^{c}$ | 0.02 |
| Weight gain | 1.18$^{a}$ | 1.03$^{ab}$ | 0.88$^{b}$ | 0.85$^{b}$ | 0.01 | 1.06$^{a}$ | 0.93$^{b}$ | 0.87$^{b}$ | 0.55$^{c}$ | 0.00 |
| Feed conversion ratio | 2.33 | 2.36 | 2.70 | 2.73 | | 2.52 | 2.60 | 2.67 | 3.65 | |
| Drumstick | 0.24$^{a}$ | 0.18$^{b}$ | 0.20$^{ab}$ | 0.19$^{ab}$ | 0.003 | 0.28$^{a}$ | 0.20$^{ab}$ | 0.21$^{ab}$ | 0.15$^{b}$ | 0.00 |
| Breast | 0.19$^{a}$ | 0.14$^{a}$ | 0.18$^{a}$ | 0.16$^{a}$ | 0.0009 | 0.19$^{a}$ | 0.15$^{ab}$ | 0.17$^{ab}$ | 0.13$^{b}$ | 0.00 |

abc-means along the same row with different superscripts differs significantly ($P< 0.05$)

Feed intake values across the methionine and lysine diets decreased as the amino acid inclusion level increased, this was contrary to the findings of [13] who reported increased feed consumption in low CP diet supplemented with lysine in broiler. This agrees with [14] that broiler chickens given a very high dietary concentration of a single amino acid reduce their voluntary feed intake, consequently reducing growth rate and feed conversion efficiency. The decreased feed intake of the broilers fed low crude protein supplemented with high levels of methionine and lysine could probably be due to reason adduced by [15] that high methionine and lysine diets could result in amino acid imbalance. It was further reported that amino acid imbalance precipitates ill effects by reducing feed intake. The

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reduced feed intake coupled with the imbalance in the ratio of methionine and lysine may have contributed to the significantly (*P*=.05) lowered body weight gain recorded by broilers across the diets. Possibly the imbalance had a toxic effect on the broilers. This confirmed the assertion that feed intake is influenced by dietary crude protein and amino acid levels.[16,17] This is in agreement with the report of [18] who reported that broiler chicks receiving a low protein starter diet had inferior body weights and feed conversion ratio at four weeks of age compared with those receiving the required amount. This is contrary to [19] who reported no adverse effect on feed intake of growing broilers fed low crude protein with supplemental methionine. The digestibility result of this study had been reported elsewhere. The non significance trend of feed conversion efficiency across the diets is an indication that low crude protein diet supplemented with methionine and lysine can be fed to broilers. This could possibly be due to reason adduced by [20] who opined that greater growth efficiency is expected when protein deposition is maximized and the ratio of protein synthesis to protein deposition is minimized. In the view of Reeds [21] it could imply that increases in nutrient intake above those required for nitrogen equilibrium are moderated by increases in both synthesis and degradation. Therefore inclusion levels of lysine and methionine in these trials above those required for optimal growth increases protein synthesis.

These results indicated that reduction up to10.6% in the CP level of the broiler diets had no effect on the feed conversion ratio during the experimental period of eight weeks provided the diets were supplemented with high methionine and lysine which was similar to the reports of [22] but contrary to [23] who observed an improvement in the feed conversion ratio of birds fed diets with low CP supplemented with essential amino acids in hot summer months. This agrees with [24] and [25] they reported that lower protein content supplemented with amino acid will improve efficiency of protein utilization because equal gain is achieved from a lower protein intake and this amount to reduced cost of production. According to [26] it is reasonable to expect that maximum protein deposition and growth rate is associated with an optimum requirement crude protein and amino acid, where amino acid levels above those needed for growth does not improve deposition likely due to increased rate of protein catabolism.

The breast weight in the methionine possibly implying muscle accretion reached a plateau in response to methionine at each level of CP. This was contrary to the report of [14] that increased methionine but not lysine significantly improved breast weight and feed conversion ratio at six weeks of age not at three weeks. This result also contrary to [9] who opined that lysine above NRC levels did not improve breast meat yield unless methionine was also greater than the recommended level. This result further revealed that there is significant interactions between methionine and lysine in broiler diets for carcass parameter with

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respect to drum stick and breast hence it is at variance with the conclusion of [14] that there were no significant interactions between methionine and lysine levels in broiler diets for any parameter studied whether fed amount recommended or in excess

**4. Conclusion**

The aim of the poultry farmer is to achieve optimum production with least inputs, from these studies it can be concluded that this supplementation was found to increase monetary losses due to low feed intake reduced body weight gain and suboptimal feed conversions of the experimental broilers.

## COMPETING INTERESTS

The Authors declare no conflict of interest and the studies were not funded by any agency.

## AUTHORS' CONTRIBUTIONS

Author A' designed the study and contributed to literature search, Authors C and D managed the analyses of the studies performed the statistical analysis, while Author B wrote the protocol, and the first draft of the manuscript. All authors read and approved the final manuscript."

## ETHICAL APPROVAL

All authors hereby declare that "Principles of laboratory animal care" (NIH publication No. 85-23, revised 1985) were followed, as well as specific national laws where applicable. All experiments have been examined and approved by the appropriate ethics committee"

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