EFFECTS OF DIFFERENT LEVELS OF DIETARY METHIONINE ON THE CARCASS CHARACTERISTICS OF FINISHER COCKERELS

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ABSTRACT

The experiment was conducted to determine the effect of different levels of dietary methionine on carcass characteristics of finisher cockerels. 500 day old cockerels were reared together initially for 7 weeks and at 8 weeks of age, they were assigned to 8 dietary groups of different methionine levels. Weights of the birds were taken at the beginning and end of the experiment. In the 16th week, the birds were slaughtered to determine various carcass measurements. Results indicated that daily weight gain was significantly ($P < 0.05$) affected by dietary treatments. The daily weight gain increased with increasing level of dietary methionine until it was optimised at 0.37% level. The dressing percentage and most other cut up parts (Drumstick, Thigh, Neck, Back, Breast, Wing) were significantly ($P < 0.05$) different. Although significant differences were observed for most organs (except spleen), gut and comb measured, these were not however consistent with dietary treatments.

Key words: Cockerels, Methionine, Carcass characteristics

INTRODUCTION

Comparative slaughter data have been utilized and recommended by some investigators (Sibbald and Wolynetz, 1987; Gyles, 1987; Wolynetz and Sibbald 1987) as indices of measurements in poultry nutrition experiments. A fundamental assumption of the procedure is that birds of the same sex, genotype and body weight drawn from the same population have very similar body composition. Thus, having a good finished carcass for the consumer is the primary

objective of commercial table cockerel production. In addition, the condition of these birds at the time of marketing is of prime importance.

Nutritional manipulations with graded levels of amino acids (Nwokoro, 1991) can be used to vary the dressing percentages of birds. Also, Eggum (1976) established that weight of numerous muscles and organs are responsive to dietary protein (amino acids) supply. The desire to ascertain these variations in dressing percentage necessitated the need for a further study. Thus, this experiment was undertaken to determine the influence of graded levels of dietary methionine on carcass parameters.

MATERIALS AND METHODS

Birds and Management

Four hundred and eighty cockerels, which had been previously reared for seven weeks were used for the experiment. (See Table 1 for percentage composition of feed fed at this stage). They were then weighed and divided into 8 groups of 60 birds. These 8 lots were assigned to eight dietary treatments containing graded levels of methionine (Table 2) till they were 16 weeks of age. Formulation of diets were as recommended for cockerels by Nwokoro, (1991) and Okosun, (1987). Each dietary group was further subdivided into 4 groups so that each treatment was replicated four times.

The birds were housed in deep litter pens partitioned with wire netting and measuring 110cm x 280cm each. An electric brooder was provided in each pen for the first four weeks; the sides of the house were covered with polythene sheets to conserve heat.

A vitamin - mineral preparation was administered in drinking water for the first four days of life as antistress. The birds were vaccinated against New Castle disease at day old. Gumboro and New Castle Lasota

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**TABLE 1: PERCENTAGE
COMPOSITION OF RATION FED TO
COCKERELS BETWEEN DAY-OLD AND
49 DAYS OF AGE**

Ingredient	Composition (%)
Yellow Maize	44.41
Maize offals	22.33
Groundnut cake	29.13
Bone meal	2.00
Oyster shell	1.00
Premix*	0.25
Salt	0.25
DL-methionine	0.16
L-lysine	0.47
Calculated analysis:	
ME (kcal/kg diet)	2650.00
Protein (%)	21.00
Methionine (%)	0.41
Methionine + Cystine (%)	0.73
Lysine (%)	1.03

*Premix is composed of the following per kg of diet. Vitamin A, 10000 IU; Vitamin D₃, 2000 IU; Vitamin E, 5IU, Vitamin K, 2.24mg; riboflavin, 5.5mg; Vitamin B₁₂, 10mg; Niacin, 25mg; folic acid, 1mg; choline chloride, 250mg; calcium pantothenate, 8mg; manganese, 54mg; zinc, 48mg; copper, 10mg; iron, 20mg; cobalt, 1.25mg and BHT antioxidant.

vaccines were administered in drinking water at two and six weeks of age respectively. Deworming was carried out in the 8th week. Coccidiostat was administered between the 4th and 5th week. Feed and water were supplied *ad libitum*. Body weight of birds were measured at the beginning and end of the experiment.

Carcass Measurements

At the 16th week, 3 birds were removed per replicate. These birds were slaughtered, wet plucked and eviscerated. The head and the feet were removed. Weights of the feathers were also taken, and the eviscerated carcasses were weighed for computation of the dressing percentage. The liver (with gall bladder removed), heart, lungs, spleen, kidneys, testes and empty gizzard were separated and weighed. The intestines (small and large) and caeca were removed cleaned of gut contents and, their weights and lengths determined. In measuring the intestines and caeca length, over-stretching was minimized as much as possible. Measurements were also made of cut-up parts (Oluyemi and Roberts, 1979) and

body parameters (Nwokolô, 1985). The comb size was determined by tracing one side of the comb on acetylated graph sheet from where the size was computed. The left lobes of the liver were removed, oven dried at 55°C for 3 days and at 105°C for 24 hours. They were then analysed for nitrogen and fat using the method of A.O.A.C. 1980. At the end, the carcasses were frozen for one week, thawed and manually deboned, and ratio of flesh to bone determined.

The data collected were subjected to analysis of variance and significance of the difference of means were determined (Steel and Torrie, 1980).

RESULTS

The values for the daily weight gain, feather weights and carcass characteristics of the experimental birds are presented in Table 3. The results indicated that daily weight gain were significantly ($P < 0.05$) influenced by dietary methionine until the parameter was optimised at 0.37%. Thereafter, there was no consistency.

Although, the dressing percentages were significantly affected by dietary treatments, it appeared that birds on diets between 0.29 and 0.69% methionine were not significantly affected. The treatment had no effect on mortality. The feather weights expressed as percentage of live weight showed significant difference ($P < 0.05$), but there were no consistent pattern that could be ascribed to treatment. Although the result of the cut up parts showed significant difference, the values were however, not consistent with dietary treatments. The highest values for drumstick, thigh and breast were obtained in the 0.45% dietary methionine group. The flesh-to-bone ratio was not significantly ($P > 0.05$) affected by treatments. The comb weight and size (cm^2) as presented in Table 4 were significantly ($P < 0.05$) affected by dietary treatments. The highest values were obtained in the 0.45 and 0.69% methionine diets, while the least was recorded in the 0.53% diet.

Results of the organ weights (Table 4) show that with the exception of the spleen, all other

DIETARY METHIONINE AND CARCASS CHARACTERISTICS IN COCKERELS

TABLE 2: PERCENTAGE COMPOSITION OF EXPERIMENTAL DIETS FED TO COCKERELS BETWEEN 9 AND 15 WEEKS OF AGE

INGREDIENTS	DIETS							
	1	2	3	4	5	6	7	8
Maize	27.91	29.17	29.17	29.17	29.17	29.17	29.17	29.17
Maize Offals	55.81	52.74	52.66	52.58	52.50	52.42	52.34	52.26
Groundnut Cake	10.28	14.18	14.18	14.18	14.18	14.18	14.18	14.18
Fish Meal	2.50	-	-	-	-	-	-	-
Common ingredients*	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
DL-methionine	-	-	0.18	0.16	0.24	0.32	0.40	0.40
L-lysine	-	0.41	0.41	0.41	0.41	0.41	0.41	0.41
Calculated Composition:								
Protein (%)	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
ME (Kcal/kg diet)	2250	2250	2250	2250	2250	2250	2250	2250
Methionine (%)	0.23	0.21	0.29	0.37	0.45	0.53	0.61	0.69
Methionine + cystine (%)	0.49	0.34	0.55	0.63	0.71	0.79	0.87	0.95
Lysine (%)	0.56	0.90	0.90	0.90	0.90	0.90	0.90	0.90

*Common ingredients is composed of the following: Bone meal, 2.0%; Oyster shell, 1.0%; Premix 0.25%; Salt 0.25%.

Premix is composed of the following per kg of diet: vitamin A, 5000 I.U.; vitamin D₃ 1000 I.U.; Vitamin E, 8mg; vitamin K₃, 0.4mg; vitamin B₂, 1.2mg; Vitamin B₃, 1mg; vitamin B₁₂, 0.004mg; niacin, 3mg; vitamin C, 4mg; choline, 112mg; Manganese, 24mg; iron, 8mg; copper, 16mg; zinc, 1.8mg; iodine, 0.5mg; selenium, 0.0048mg and BHT antioxidant.

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TABLE 3: EFFECTS OF METHIONINE LEVEL ON DAILY WEIGHT GAIN, DRESSING PERCENTAGES, FEATHER WEIGHT AND RELATIVE WEIGHTS OF CERTAIN BODY PARTS OF TABLE COCKEREELS (16 WEEKS OF AGE).

PARAMETERS	DIET (METHIONINE LEVELS % OF DIET)								SEX
	1(0.23)	2(0.21)	3(0.29)	4(0.37)	5(0.45)	6(0.53)	7(0.61)	8(0.69)	
Daily weight gain (g/bird)	18.11 ^a	14.28 ^b	17.66 ^a	19.72 ^c	18.61 ^{ac}	16.57 ^a	17.99 ^a	18.01 ^a	5.739
Dressing percentage (%)	66.98 ^a	66.22 ^a	68.22 ^b	71.97 ^b	69.59 ^b	70.32 ^b	71.11 ^b	68.08 ^b	1.990
Feather (% liveweight)	12.72 ^a	16.07 ^b	12.66 ^{ac}	15.22 ^b	14.21 ^a	11.60 ^c	11.77 ^c	13.48 ^{ac}	1.601
Mortality (%)	3.34	3.37	-	-	-	-	3.34	-	-
CUT PARTS CHARACTERISTICS:									
Drumstick (% of Eviscerated weight (PEW))	12.61 ^a	12.66 ^a	9.46 ^b	12.93 ^a	13.71 ^a	12.66 ^a	10.29 ^b	13.03 ^a	1.476
Thigh (PEW)	13.59 ^a	14.62 ^a	11.36 ^b	13.69 ^a	14.45 ^a	13.75 ^a	11.03 ^b	13.39 ^a	1.331
Neck (PEW)	7.51 ^a	7.99 ^a	5.53 ^b	7.31 ^a	7.60 ^a	6.45 ^b	6.42 ^b	7.52 ^a	0.824
Back (PEW)	16.46 ^a	15.69 ^a	11.90 ^b	16.01 ^a	15.70 ^a	15.09 ^a	11.71 ^b	15.07 ^a	1.846
Breast (PEW)	16.85 ^a	17.26 ^a	13.85 ^b	16.93 ^a	18.93 ^c	17.45 ^a	14.21 ^b	18.46 ^c	1.826
Wing (PEW)	11.13 ^a	11.31 ^a	8.43 ^b	11.19 ^a	9.90 ^c	10.11 ^{ac}	7.28 ^b	10.59 ^{ac}	1.446
Flesh/Bone Ratio	3.06	3.10	3.08	3.07	3.13	3.11	3.08	3.00	0.039

abcd Means on the same row with different superscripts are significantly different ($P < 0.05$).

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TABLE 4: COMB AND ORGAN CHARACTERISTICS OF COCKERELS FED DIFFERENT LEVELS OF DIETARY METHIONINE BETWEEN 8 AND 16 WEEKS OF AGE.

PARAMETERS	DIET (METHIONINE - % OF DIET)								SEX
	1(0.23)	2(0.21)	3(0.29)	4(0.37)	5(0.45)	6(0.53)	7(0.61)	8(0.69)	
Comb (% of live weight)	0.18 ^{ab}	0.20 ^a	0.21 ^a	0.17 ^{ab}	0.32 ^c	0.13 ^b	0.20 ^a	0.43 ^c	0.097
Comb size (cm ²)	10.00 ^a	11.00 ^a	14.00 ^a	10.67 ^a	24.00 ^b	8.00 ^c	15.00 ^a	25.00 ^b	6.437
Testis (g/kg body weight)	0.45	0.36	0.83	0.41	3.79	0.17	0.39	3.33	1.463
Empty gizzard (g/kg body weight)	27.54 ^{ab}	21.93 ^b	27.17 ^{ab}	26.62 ^{ab}	17.52 ^c	27.33 ^{ab}	30.39 ^a	23.75 ^b	4.046
Liver (g/kg body weight)	10.22 ^a	16.50 ^b	10.50 ^a	13.04 ^{ab}	11.52 ^a	12.00 ^a	15.85 ^b	9.92 ^a	2.523
Heart (g/kg body weight)	3.96 ^a	3.57 ^a	5.08 ^b	4.14 ^a	5.24 ^b	4.25 ^{ab}	4.54 ^{ab}	4.58 ^{ab}	0.559
Lungs (g/kg body weight)	4.93 ^a	5.43 ^{ab}	6.33 ^{bc}	6.35 ^{bc}	5.66 ^{ab}	7.75 ^c	6.08 ^b	6.83 ^{bc}	0.874
Spleen (g/kg body weight)	6.94	6.79	7.17	7.17	6.83	4.25	6.31	6.83	0.962
Kidney (g/kg body weight)	2.02 ^a	1.50 ^b	2.17 ^a	1.72 ^b	2.07 ^a	1.83 ^{ab}	1.92 ^{ab}	1.50 ^b	0.253

abc Means on the same row with the different superscripts are significant different. (P < 0.05).

TABLE 5: GUT CHARACTERISTICS, LIVER NITROGEN AND LIVER FAT OF COCKERELS FED DIFFERENT LEVELS OF DIETARY METHIONINE BETWEEN 8 AND 16 WEEKS OF AGE.

PARAMETERS	DIET (METHIONINE LEVEL - % OF DIET)								SEX
	1(0.23)	2(0.21)	3(0.29)	4(0.37)	5(0.45)	6(0.53)	7(0.61)	8(0.69)	
Small Intestine (g/kg body weight)	31.19 ^a	26.71 ^b	32.33 ^a	37.10 ^c	31.72 ^a	31.50 ^a	24.30 ^d	26.58 ^b	4.074
Small Intestine length (cm)	110.00 ^a	138.00 ^b	140.00 ^b	154.00 ^c	120.00 ^d	140.00 ^b	108.00 ^a	128.00 ^d	16.448
Large Intestine (g/kg body weight)	2.54 ^{ab}	2.43 ^a	3.08 ^{ab}	2.83 ^{ab}	1.38 ^c	1.75 ^c	4.15 ^d	1.50 ^c	0.924
Large Intestine length (cm)	13.00 ^a	10.50 ^{bd}	6.00 ^c	11.00 ^{abd}	5.50 ^c	9.00 ^d	11.50 ^{ab}	6.00 ^c	2.896
Caeca (g/kg body weight)	5.45 ^a	6.79 ^b	5.75 ^{ab}	6.14 ^{ab}	6.35 ^{ab}	5.00 ^c	6.85 ^b	5.17 ^c	0.708
Caeca length (cm)	6.00 ^a	17.50 ^b	9.50 ^a	18.00 ^b	17.25 ^b	24.50 ^c	18.50 ^b	14.00 ^a	5.381
Liver nitrogen (%)	9.55	10.26	10.04	10.96	9.40	9.64	10.50	9.91	0.525
Liver fat (%)	4.00 ^a	6.25 ^{bc}	4.67 ^a	7.67 ^c	2.83 ^a	6.00 ^{bc}	5.92 ^{bc}	5.67 ^{bc}	1.496

abcd Means on the same row with different superscripts are significantly different (P < 0.05).

organs examined namely testes, liver, heart, lungs and kidney were significantly affected by treatment. The results for the testes indicated that cockerels on the 0.45% and 0.69% dietary methionine recorded the highest testes weight. One interesting observation was that the comb size and weight have relationship with testicular weight. The diets that recorded higher daily gains reflected the pattern on the comb parameters. Empty gizzard weight (g/kg body weight) increased with increasing dietary methionine except for the abberantly low value (17.52) obtained at 0.45% diet.

Table 5 shows the results of the gut characteristics, liver nitrogen and liver fat. The results showed that although significant differences ($P < 0.05$) occurred in the parameters measured, only the caeca length showed similar relationship with diets as observed for daily weight gain.

DISCUSSION

Information emanating from the study indicated that daily weight gain increased significantly ($P < 0.05$) with increasing dietary methionine levels up to optimal diet (0.37%). Growth was depressed in birds fed the basal diet (diet 2), that is diet not supplemented with methionine. This observation is in line with those reported earlier (Cole *et al.*, Pfatt and Austic, 1976; Okumura and Muramatsu, 1978). Hewitt and Lewis (1969) observed that amino acid deficiency and the nature of the diet are the two factors which limit growth in methionine deficiency.

Appraisal of carcass characteristics and gut measurements show that the effect of dietary treatment was less evident with the latter. The differences in the dressing percentages may indicate that dietary treatments contributed to the differences in carcass yield. It is worthy of note that dressing percentages obtained in the various dietary methionine groups were within the range reported by Oluyemi and Roberts (1979) as optimum for meat chickens. The dietary methionine level (0.37%) that optimized growth rate gave the highest small intestine weight and length. Diets 3, 4, 5 and 6 containing 0.29, 0.37, 0.45 and 0.53 per cent

methionine respectively, improved intestinal weight and length.

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