Protein and energy requirements of some cockerel starters in the tropics

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ABSTRACT

A 3 × 5 factorially designed experiment, with three levels of energy (2 600, 2 800 and 3 000 Kcal ME/kg diet) and five levels of crude protein (160, 180, 200, 220 and 240 g/kg) for each energy level, giving a total of 15 diets ("A to O" in ascending order of energy level), aimed at evaluating the energy and crude protein requirements of the Black Olympian cockerel starters during 3 to 9 weeks of age. The diets were produced according to the modified diet dilution technique and they were fed *ad libitum* to the treatment groups. Each diet was replicated twice in space with 10 birds per replicate which were housed in equidimensional deep litter pens adequately equipped with brooding facilities. Irrespective of the crude protein (CP) levels fed, the difference ($P>0.05$) in the growth rates of birds fed on diets containing 2 600 and 2 800 Kcal ME/kg was not significant, while growth rate was poorer on the highest ME diet (3 000 Kcal/kg). The main effect of protein level independent of the energy level was also noted. The 24 per cent CP diet had the highest growth rate while feed conversion ratio (FCR) was optimized by 22 per cent CP diet beyond which there was no significant benefit. However, from the significant effect of the interaction of protein and energy levels, the weight gain and/or FCR of the birds fed diets containing 22 per cent CP and ME of 2 600 and 2 800 Kcal/kg, and 24 per cent CP at dietary ME content of 3 000 Kcal/kg were/was optimised. Conclusively, a 220 g/kg crude protein diet containing 2 600 Kcal ME/kg would satisfy the protein and energy requirements of cockerel starters in the tropics during 3 to 9 weeks of age for optimal growth rate and FCR at minimal cost of feeding per unit gain.

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RÉSUMÉ

SALAMI, R. I., AKINDOYE, O. & AKANNI, E. O.: *Les besoins protéiques et énergétiques des hors-d'œuvres de jeune coq sous les tropiques.* Une expérience de modèle factoriel de 3 × 5 avec trois niveaux d'énergie (2600, 2800 et 3000 Kcal ME/kg de régime) et cinq niveaux de protéine brute (160, 180, 200, 220 et 240 g/kg) pour chaque niveau d'énergie, donnant un total de 15 régimes (De A à O en ordre croissant du niveaux d'énergie) se déroulait pour évaluer les besoins protéiques bruts et énergétiques des hors-d'œuvres du jeune coq Black Olympian pendant l'âge de 3 à 9 semaines. Les régimes étaient produits selon la technique de dilution de régime modifié et ils étaient nourris *ad libitum* aux groupes de traitement. Chaque régime était réparti deux fois, pendant un certain temps, avec 10 volailles par replicatif et logées dans les enclos d'equidimension avec des litières profondes, qui étaient bien équipés de mécanisme de couvaison. Sans tenir compte des niveaux de protéine brute (PB) donné à manger, il n'y avait pas de différence considérable ($P > 0.05$) dans les proportions de croissance des volailles nourries des régimes contenant 2600 et 2800 Kcal ME/kg alors que la proportion de croissance était plus pauvre sur le plus élevé du régime ME. L'effet majeur du niveau de protéine sans tenir compte du niveau d'energie, était également remarqué. Le 24 % du régime de PB rendait la proportion de croissance la plus élevée alors que la proportion de conversion alimentaire (PCA) était optimisée par 22 % du régime de PB au-delà de quel il n'y avait pas de bénéfice considérable. Cependant, en se basant sur l'effet considérable d'intéraction des niveaux de protéine et d'énergie, le gain de poids et/ou PCA des volailles nourries avec des régimes contenant 22 % PB et ME de 2600 et 2800 Kcal/kg et 24 % PB au contenu diététique de ME de 3000 Kcal/kg étaient/était optimisés. En conclusion, un régime de protéine brute de 220 g/kg contenant 2600 Kcal ME/kg pourrait satisfaire les besoins protéiques et énergétiques des hors-d'œuvres de jeune coq sous les tropiques au cours de l'âge de 3 à 9 semaines pour une proportion de croissance optimale et PCA au coût d'alimentation minimale par unité de gain.

Introduction

Broilers and cockerels are table birds, but the former provides tender-meated carcass while the latter provides relatively tougher meat. Broilers are specially bred domestic fowls for table meat production within a shorter period, while the cockerel is the male chicken of the commercial laying breed or strain, which is less than a year of age. In Nigeria, as in many developing tropical countries, broilers and cockerels are raised commercially for sale during Christian and Muslim festivals when demand is high. As a heavy strain of chicken, the broiler grows faster and bigger than the cockerel (light strain) within a shorter period and attains slaughter weight of about 2 kg and FCR of 2 in 8 to 10 weeks of age (Smith, 1990), while cockerels attain about the same weight with FCR of about 5 in 20 to 24 weeks (Laseinde, 1999).

The two-phase feeding regimen (starter and finisher phases) is usually followed for the commercial production of the table birds under the intensive system of management. The birds are fed with the starter feed during the starter phase starting from day-old to about 5 weeks of age for the broilers (Ojewole & Longe, 1999) and from day-old to about 9 weeks of age for the cockerels (Salami, Akindoye & Hamzat, 2002). This is followed by the finisher diet until the desirable slaughter weight is attained.

The intensive system of management (as opposed to the free range or semi-intensive system as practised elsewhere for commercial table bird production) implies that the birds must be provided with efficient diets at different phases of growth and development for optimal performance in a shorter period, given other inputs. Feed is the largest single item of cost, accounting for over 70 per cent of the total cost of poultry production, especially under the intensive system (Oluyemi & Roberts, 1979). The level and efficiency of production of any animal depend on the feed provided by the stock owner.

Feed quality is, therefore, the major determinant of profitability in animal production. It is measured by the adequate amount and proportion of essential nutrients such as protein, minerals, and vitamins in the feed in relation to its energy content. Though the body building nutrients are important, the energy content of animal feed is of utmost importance not only because it regulates voluntary feed consumption in the poultry birds, but because it is also needed for the efficient use of the nutrients. The narrower the calorie: protein ratio of the diet at a given energy level, the better the performance of the recipient animals (Salami & Boorman, 1999; Salami, 2002). Hence, the essential nutrient requirement of farm animals for optimal performance is determined largely by the energy content of the feed.

Unlike the nutrition of the broilers, pullets and layers at different stages of development, information on the crude protein and energy requirements of the cockerels at the starter and finisher phases in the tropics is limited. Consequently, the feeding standards meant for the broilers and pullets, which are abundant in local reports, are used for feeding cockerels and may be unprofitable (Ogbonna & Adebowale, 1993). Earlier studies in the tropics (for example, Okosun, 1987; Ogbonna & Adebowale, 1993) have indicated that 2 650 Kcal/kg metabolisable energy (ME) diets are adequate for cockerel starters in Nigeria. A recent report (Salami *et al.,* 2002) also indicated that the CP requirement of cockerel starters was satisfied by a 22 per cent CP diet containing 2 600 Kcal/kg ME level.

Like some animal factors such as gender and strain of the domestic fowl (Scott, Nesheim & Young, 1982), quality of dietary protein sources also affects the CP requirement of the broiler finishers (Olomu, 1977). Salami *et al.* (2003) also reported that similar maximum growth rates and feed conversion ratios (feed/gain) were recorded by the cockerel starters fed 20 (animal protein-based) and 24 (plant protein-based) per cent CP diets containing 2 600 Kcal/kg ME.

Considering the unique relationship of the dietary energy concentration and nutrient requirements of the farm animals (Olomu, 1977; Eshiett, Omole & Adegbola, 1979; Ojewola & Longe, 1999), this study aimed to evaluate the energy and CP requirements of the Black Olympian cockerel starters during 3 to 9 weeks of age.

Materials and methods

Experimental diets

Three summit diets (SDI, SDII and SDIII) with CP contents of 280, 281.6 and 282.0 g/kg, respectively, on as-fed basis in greater excess of the recommended requirement of the cockerel starters (Salami *et al.*, 2002), and three low-protein (CP = 21.2, 23.4 and 25.6 g/kg) dilution mixtures (DMI, DMII and DMIII) were formulated according to the principles of diet dilution technique. Both SDI and DMI, SDII and DMII, and SDIII and DMIII (Table 1) contained 2 600, 2 800, and 3 000 Kcal ME/kg, respectively. The summit diets and their corresponding dilution mixtures also contained some contents of supplemental vitamins and minerals.

As a modification of the diet dilution technique, the Pearson Square Method (Salami & Boorman, 1999; quoting Fisher & Morris, 1970) was used to serially dilute the mixtures (by their calculated CP and ME contents) to produce a total of 15 treatment diets (A to O in ascending order of energy level). Each energy level had five CP levels of 160, 180, 200, 220, and 240 g/kg (Table 2). The treatment diets were also similar in some calculated proximate fractions, while the crude fibre varied slightly but was within the range required for the alimentary tract to function normally in the class of the birds used (Sainsbury, 1980).

Experimental design birds and their management

Three hundred and six day-old Black Olympian cockerels were fed with a pretest diet (Salami *et al.*, 2002) containing 207.2 g/kg CP and 2 805 Kcal ME/kg for 3 weeks from day-old and managed on deep litter pens. From this flock, 300 birds were selected and weighed individually before they were allotted to 15 treatment groups of 20 birds each. The groups had uniform initial mean body weight and the treatment diets were randomly applied to the groups in a 3 × 5 factorially designed experiment. Each diet was fed *ad libitum* to two replicates of 10 birds each. The techniques for housing, feeding, and watering of experimental birds used by Salami & Boorman (1999) were followed.

Vaccinations and medications

The birds had been given intra-ocular vaccination against Marek's disease at day-old from the hatchery. During the feeding trial, Neo-Terramycin Chicks formula, Furaprollium and Oxytet – 20 % (Coccidiostat) were included in the drinking water as recommended. Livestovite and Vitalyte (multi-vitamins) were also added to their drinking water as anti-stress whenever any vaccination was administered. First and second doses of Gumboro were administered *via* drinking water at 2 and 5 weeks of age while Lasota (New Castle disease vaccine) was also administered orally *via* water at 6 weeks of age.

Measurements

Birds per replicate were weighed in groups and feed intake of the two replicates per treatment diet were measured on weekly basis. The weight gain, feed intake, and feed conversion ratio (feed: gain ratio) were subsequently computed on weekly basis as well as for the 6-week period of the study for the respective treatment diets.

Feed cost analysis

The market prices of the feedstuffs at the time of the experiment were used to compute the cost of the treatment diets. The calculated cost of SDs and DMs was used to produce the treatment diets (Tables 1 and 2).

Chemical and statistical analyses

Samples of SDs and DMs were analyzed for their proximate fractions (Table 2) according to

TABLE 1

Composition of Summit Diets (SDs) and Dilution Mixtures (DMs) (g/kg)

Feed ingredient	*N/kg*	*SDI*	*DMI*	*SDII*	*DMII*	*SDIII*	*DMIII*
Maize	17	310	-	410	-	535	-
Lafun	25	-	620	-	730	-	840
Groundnut cake	41	290	-	290	-	275	-
Palm kernel cake	4.5	120	-	100	-	15	-
Rice offal	2.8	120	330	40	220	-	110
Blood meal	24	70	-	70	-	85	-
Fish meal	130	60	-	60	-	70	-
Palm oil	82.5	-	20	-	2	-	20
Bone meal	15	15	15	15	15	15	15
Oyster shell	4.5	10	10	10	10	10	10
Premix	420	2.5	2.5	2.5	2.5	2.5	2.5
Salt	15	2.5	2.5	2.5	2.5	2.5	2.5
Total	-	1,000	1,000	1,000	1,000	1,000	1,000
Calculated fraction							
Crude protein (g/kg)		280	25.6	282	23.4	281.6	21.2
Crude fibre (g/kg)		72.4	120.7	48	91.55	27.7	62.4
Ether extract (g/kg)		51.72	32.8	46.87	23.45	42.44	14.1
Met. energy (Kcal/kg)		2609.24	2604.70	2811.14	2804.00	3001.17	3002.00
Lysine (%)		1.371	0.0434	1.384	0.0511	1.440	0.0588
Methionine (%)		0.4128	0.0186	0.4230	0.0219	0.4186	0.0252
Calcium (%)		1.362	1.029	1.359	1.051	1.341	1.073
Phosphorus (%)		0.5269	0.2436	0.5327	0.2469	0.5310	0.2502
Determined analysis (%)							
Crude protein		27.99	2.49	28.05	2.28	28.00	2.02
Crude fat		5.96	3.13	6.39	3.22	6.78	3.34
Crude fibre		12.06	12.79	12.16	13.22	12.27	13.31
Ash		10.98	14.33	10.35	12.41	9.95	10.34
Moisture		8.54	9.48	9.39	8.97	10.09	8.97
NDF		40.46	30.42	40.94	30.12	40.72	40.56

the standard methods of AOAC (1990). Live performance data were subjected to analysis of variance and Duncan's Multiple Range Test (Steel & Torrie, 1980).

Results

Table 3 shows the effect of energy levels on live performance characteristics of the cockerel starters. The difference in the growth rates of the birds fed on diets containing 2 600 and 2 800 Kcal ME/kg was not significant. These were better (P<0.05) than that recorded for birds on the 3 000 Kcal ME/kg diet. The feed intake of the birds was significantly decreased (P<0.05) as the energy content of the diets increased. However, the feed conversion ratio was not significantly (P>0.05) influenced by the energy levels of the diets.

Table 4 shows the main effect of protein levels

TABLE 2

Composition of Treatment Diets Produced from Summit Diets (SDs) and Dilution Mixtures (DMs) by Pearson Square Method (g/kg)

Treatment code	[a]Dietary levels of: CP(g/kg)	ME (Kcal/kg)	Calorie: protein ratio (E:P)	Summit diet (g/kg)	Dilution mixture (g/kg)	[b]N/kg diet
A	160	26007.71	162.98	528.30	471.70	24.42
B	180	2607.97	144.88	606.90	393.10	25.17
C	200	2608.22	130.41	685.50	314.50	25.91
D	220	2608.48	118.57	764.20	235.80	26.65
E	240	2608.73	108.70	842.80	157.20	27.40
F	160	2807.77	175.49	528.20	471.80	26.31
G	180	2808.32	156.02	605.60	394.40	26.96
H	200	2808.88	140.44	682.90	317.10	27.60
I	220	2809.43	127.70	760.20	239.80	28.25
J	240	2809.98	117.08	837.60	162.40	28.90
K	160	3001.56	187.60	533.00	467.00	28.22
L	180	3001.49	166.75	609.80	390.20	28.79
M	200	3001.43	150.07	686.60	313.40	29.35
N	220	3001.37	136.43	736.40	236.60	29.47
O	240	3001.30	125.05	840.20	159.80	30.40

[a,b]Computed from Table 1

TABLE 3

Performance Characteristics of Cockerels Fed Different Levels of Energy During 3-9 Weeks of Age

Parameter	Energy level (Kcal/kg) 2 600	2 800	3 000	±SEM
[1]IMBW (g/b)	231.0[a]	231.0[a]	231.0[a]	1.12
[2]MDG (g/bd)	16.97[a]	16.67[a]	14.29[b]	0.11
[3]MDFI (g/bd)	70.54[a]	64.13[b]	61.38[c]	0.30
[4]MFCR	4.39[a]	4.21[a]	3.93[a]	0.16
[5]FMBW (g/b)	943.5[a]	931.5[a]	830[b]	4.46

[1,2,3,4,5]Refers to initial mean body weight, mean daily weight gain, mean feed intake, mean feed conversion ratio, and final mean body weight, respectively.

[a,b,c] Means in the same column bearing identical superscripts are similar (P<0.05) while those with unidentical superscripts differ (P<0.05).

on performance parameters of the cockerels. The daily weight gain was significantly increased (P<0.05) as the protein levels increased up to the 24 per cent CP diet. The groups fed 16 and 18 per cent CP diets consumed more feed (P<0.05) than those which received 20 and 22 per cent CP diets, while those fed 24 per cent CP diet had similar feed intake as birds fed 16 per cent CP diet. The

TABLE 4

Live Performance of Cockerels Fed Different Levels of Protein During 3–9 Weeks of Age

Parameter	Protein level (%) 16	18	20	22	24	±SEM
[1]IMBW (g/b)	230.83^{a}	230.83^{a}	230.83^{a}	230.83^{a}	230.83^{a}	1.14
[2]MDG (g/bd)	14.97^{e}	15.50^{d}	15.69^{c}	16.58^{b}	17.58^{a}	0.14
[3]MDFI (g/bd)	65.46^{b}	72.76^{a}	63.21^{c}	60.07^{d}	65.29^{b}	0.39
[4]MFCR	4.53^{b}	4.53^{b}	4.04^{b}	3.39^{a}	3.64^{a}	0.21
[5]FMBW (g/b)	830.5^{e}	881.83^{d}	901.33^{c}	98.83^{b}	984.67^{a}	6.00

^{a,b,c,d,e} Means in the same column bearing identical superscripts are similar (P<0.05) while those with unidentical superscripts differ (P<0.05).

groups fed 16 to 20 per cent CP diets also had similar feed conversion ratios (P>0.05) which were inferior to those on 22 and 24 per cent protein diets which were the best values. For growth rates, the final body weight increased (P<0.05) as the protein levels increased up to the highest dietary CP level.

Table 5 shows the significant interaction effect of energy and protein levels on the response criteria of the birds. The groups fed 2 600 Kcal ME/kg diet had the highest mean daily body weight gain of 19 g for the 22 and 24 per cent CP levels. As the level of protein in the diets increased, the mean daily body weight gain was also increased for the energy levels, but it was more pronounced for the 2 600 Kcal ME/kg diet. The mean daily body weight gain decreased (P<0.05) at the dietary protein level beyond 22 per cent CP in the birds fed 2 800 Kcal ME/kg diet. Final mean body weight at 9 weeks of age was significantly (P<0.05) influenced by the treatment diets in the same manner as the growth rates.

The feed intake decreased significantly (P<0.05) as the energy content of the diets increased. The birds fed 3 000 Kcal ME/kg and 20 per cent CP diet had the lowest daily feed intake (55.95 g), while those fed 2 600 Kcal ME/kg and 18 per cent CP diet had the highest daily feed intake (80.45 g). Birds fed 2 600 Kcal ME/kg and 22 per cent CP diet had the best feed conversion ratio, while the poorest feed conversion ratio was recorded for Diets A and L.

Discussion

This study aimed at determining the crude protein and metabolizable energy requirements of cockerel starters with diets containing 2 600, 2 800 and 3 000 Kcal ME/kg and 160, 180, 200, 220 and 240 g/kg CP levels per energy level. The diet dilution technique of Fisher & Morris (1970) as modified by Salami & Boorman (1999) and Salami *et al.* (2002) was used.

Table 3 shows that the birds fed 2 600 and 2 800 Kcal ME/kg diets had the best performance in all parameters. The growth rates and feed conversion ratios at the two energy levels were similar (P>0.05), while those fed 3 000 Kcal ME/kg diet had poorer (P<0.05) growth performance and similar feed conversion ratio as those fed 2 600 and 2 800 Kcal ME/kg diets. This agrees with the findings of Eshiett *et al.* (1979), Scott *et al.* (1982), and Ojewole & Longe (1999), among others, who reported that high-energy diet may not allow birds to consume substantial amount of feed because their minimum requirements are easily met.

Hence, the birds could not consume enough protein, mineral, and vitamins required for body weight gain at a faster rate when fed 3 000 Kcal ME/kg diet. This shows that 2 600 Kcal ME/kg diet is adequate for the energy requirement of the

TABLE

Interaction Effect of Different Levels of Energy and Protein on Live Performance Characteristics of Cockerels During 3 to 9 Weeks of Age and Bioeconomics of Production

Performance parameter	2 600 Kcal ME/kg					2 800 Kcal ME/kg					3 000 Kcal ME/kg					
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
	CP (%)					CP (%)					CP(%)					
	16	18	20	22	24	16	18	20	22	24	16	18	20	22	24	± SEM
[1]IMBW (g/bd)	230.0^{a}	230.0^{a}	232.5^{a}	230.0^{a}	232.5^{a}	230.0^{a}	230.0^{a}	230.0^{a}	232.5^{a}	230.0^{a}	232.5^{a}	232.5^{a}	230.0^{a}	230.0^{a}	230.0^{a}	2.50
[2]MDG (g/bd)	14.78^{e}	16.16^{d}	16.15^{d}	18.62^{a}	19.16^{a}	16.18^{d}	16.56^{cd}	16.72^{bcd}	17.35^{b}	16.45^{cd}	11.8^{g}	13.80^{f}	14.39^{ef}	14.34^{ef}	17.12^{bc}	0.24
[3]MDFI (g/bd)	78.96^{b}	80.85^{a}	69.75^{d}	58.4^{h}	65.14^{ef}	58.97^{h}	63.23^{f}	63.93^{f}	65.73^{e}	68.86^{b}	58.45^{h}	74.67^{c}	55.95^{i}	56.05^{i}	61.84^{g}	0.45
[4]MFCR	5.59^{d}	4.52^{c}	4.36^{c}	3.18^{a}	3.38^{ab}	3.85^{bc}	3.90^{bc}	3.80^{abc}	3.92^{bc}	4.11^{c}	4.70^{c}	5.16^{d}	3.96b^{c}	3.83^{abc}	4.30^{c}	0.36
[5]FMBW (g/bd)	850.5^{f}	908.0^{e}	911.0^{de}	1019.0^{a}	1034.0^{a}	916.5^{cde}	925.5^{cd}	932.7^{c}	958.5^{b}	923.0^{cde}	724.5^{i}	812.0^{h}	834.5^{g}	834.5^{g}	949.0^{b}	5.20
Cost of production																
[6]Feed cost/g (kobo)	2.44	2.52	2.59	2.66	2.74	2.63	2.70	2.76	2.82	2.89	2.82	2.88	2.93	2.95	3.05	-
[7]Feed cost/g live weight gain (kobo)	13.64	11.39	11.29	8.49	9.26	10.13	10.53	10.49	10.05	11.80	13.25	14.86	11.60	11.30	13.12	-

Means in the same column bearing identical superscripts are similar ($P>0.05$).
[6]Computed from Table 2, 100 kobo = N1.00.
[7]Obtained as product of FRC and cost per gramme diet.

cockerel starters during 3 to 9 weeks of age in the tropics in accordance with the reports of Okosun (1987), Ogbonna & Adebowale (1993), and Salami *et al.* (2002), among others.

The mean daily weight gain and final body weight at 9 weeks of age were significantly ($P<0.05$) improved as the protein content of the diets increased up to the optimum level for each energy level fed; the optimum calorie: protein ratio (Table 2) supports optimal growth rate as reported (Salami & Boorman, 1999; Scott *et al.,* 1982; Salami, 2002). These results also corroborate that protein is an essential nutrient in poultry diets as reported by Kaite & Alistair (1986).

The birds fed 22 per cent CP diet had the least feed intake (60.07 g/b/d), while those fed 16 and 18 per cent CP diets expectedly consumed more feed than the others so as to meet their CP requirement for maintenance and production. This agrees with the findings of Eshiett *et al.* (1979) and Salami & Boorman (1999) who observed, respectively, that weaner rabbits and grower cockerels fed low-protein diets increased their feed intake presumably in an effort to overcome protein deficiencies.

Birds fed 22 and 24 per cent CP diets containing 2 600 Kcal ME/kg had the best FCR values of 3.18 and 3.38, respectively, which were similar (Table 5) and comparable to the values for Diets H and N, thereby indicating efficient use of nutrients for growth. Feed cost analysis (Table 5) shows a gradual increase in the cost per gramme of the diets as dietary CP level increased. However, feed cost per unit weight gain (kobo) decreased towards the diet containing 22 per cent CP and 2 600 Kcal ME/kg (Diet D). It was cheaper for Diet D (about 8.50 kobo) than for Diets E, C, B and A which were about 9.50, 11.30 and 14.00 kobo, respectively, and also for diets containing higher energy levels.

The results of this study show that protein and energy requirements of the cockerel starters (during 3 to 9 weeks of age) would be satisfied by 22 per cent CP diet with 2 600 to 2 800 Kcal ME/kg. This is in contrast to the 20 per cent CP diet with 2 800 Kcal ME/kg and 18 to 20 per cent CP diet with 2 700 to 2 900 Kcal ME/kg recommended for the pullet and cockerel starters by Oluyemi & Roberts (1979) and CTA (1987), respectively. The dietary CP and energy levels recommended in this study agree with a recent report of Salami *et al.* (2002).

Conclusion and recommendations

For nutrition, the results of this study show that diets containing 22 per cent CP and 2 600 to 2 800 Kcal ME/kg would meet crude protein and energy requirements of the birds while the 24 per cent CP diet with 3 000 Kcal ME/kg is also suitable for feeding the cockerel starters.

The CP content of poultry diets such as the cockerel starter diet varies with the energy level it should therefore be fixed for the energy content to maintain a narrower calorie: protein ratio for optimum performance of the stock.

It is also evident that it may be adequate to use broiler starter diets which usually contain 24 per cent CP and 3 000 Kcal ME/kg (as Diet 0) to feed cockerel starters, but the feeding standards (meant for the broilers and pullet starters) must be adopted cautiously for the cockerel starters due to gender and strain effects on calorie and nutrient requirements.

It is economically advisable to raise cockerel starters at minimal cost on a diet with CP and ME contents not exceeding 22 per cent and 2 600 Kcal/kg, respectively, in the tropics.

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