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Effect of Dietary Protein on the Performance of Local Guinea Keets in the Northern Region of Ghana

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Research Article

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ABSTRACT

An experiment was conducted on 524 guinea keets to test the effect of four dietary protein levels on general performance. The four levels evaluated were 0.22, 0.23, 0.24 and 0.25g dietary protein/g feed. Data were collected on feed intake, weight gains and mortality. Partial cost-benefit analysis was also done. The results showed significant feed intake differences between treatments ($P<0.05$). Keets on 0.22 protein feed recorded the highest feed consumption followed by 0.23, 0.25 and lastly 0.24. Mean daily weight gain was highest among keets on the 0.24 protein feed and lowest among keets on the 0.22 protein feed; however, these differences were not statistically significant. The 0.25 DP feed also appeared to perform better than 0.23 DP feed in terms of daily weight gain. Mean cost of feed per kilogram live weight gained seemed to be lowest for the 0.24 protein diet followed by keets on 0.25, 0.23 and then 0.22 protein feed. Mortality was highest in keets on 0.22 protein diet and least in keets on 0.24 protein diet. The 0.24 protein diet may therefore be the most economical diet to feed to growing indigenous keets between 0 and 8 weeks.

Keywords: Energy, feed, guinea fowl, performance, profitability, protein.

ABBREVIATIONS: DP = dietary protein, CP = crude protein

INTRODUCTION

Guinea fowl rearing is a pervasive culture in much of northern Ghana (Dei and Karbo, 2004). The bird is raised for eggs and meat under mostly smallholder arrangements. The manifold socio-economic benefits of the guinea fowl ranging from its role in marriage ceremonies and other social ceremonies to its critical role in poverty alleviation in rural areas have been well documented by Dei and Karbo (2004), Naazie et al. (2007), Teye et al. (2008) and Mwale et al. (2008). As the importance of the guinea fowl has been acknowledged and scientists are developing appropriate technologies to increase productivity, it is important to determine the most efficient feed package that will give the best performance at the cheapest cost. This trial was conducted to evaluate the effect of four levels of dietary protein on the performance of the guinea fowl and to determine the dietary protein level that gives the best growth rate at the cheapest cost.

MATERIALS AND METHODS

Location

The experiment was conducted between September and November at the Council for Scientific and Industrial Research – Animal Research Institute (CSIR-ARI) Station brooder house in Nyankpala, Tamale, Ghana.

Diet and Experimental Units

Four diets of different crude protein (CP) levels were fed to experimental keets over an 8 week period. The four diets contained 0.22, 0.23, 0.24 and 0.25 CP. Table 1 shows the ingredients and their percentage inclusion rates in the various diets tested. The four diets were fed to keets hatched from three different incubators. So the experimental keets were brooded in 12 cages in total.

Table 1: Ingredients and inclusion rates

Ingredients	**Inclusion of Ingredients (kg/100kg)**			
	Diet 1	**Diet 2**	**Diet 3**	**Diet 4**
Maize	58.4	56.0	54.0	51.8
Wheat bran	9.89	9.89	9.89	9.89
Broiler starter conc[a]. (0.51g CP/g concentrate)	30.0	32.5	34.8	37.2
Premix	0.25	0.25	0.25	0.25
$DiCaPO_4$	***0.34***	0.34	0.34	0.34
Oyster Shell	1.12	1.00	0.70	0.50
Chemical composition of diets				
Dietary Protein level	22.0	23.0	24.0	25.1
Oil	3.86.	3.86	3.86	3.86
Crude fibre	3.94	3.97	4.00	4.03
Ash	2.80	2.65	2.35	2.13
Ca	1.72	1.78	1.75	1.77
Av. P	0.69	0.74	0.77	0.81
Common salt	0.58	0.62	0.66	0.70
Lysine	1.34	1.42	1.51	1.59
Methionine	0.59	0.63	0.66	0.69
Metabolizable energy (MJ/kg feed)	11.5	11.4	11.2	11.1
Energy:protein (MJME/kg feed)/(kg protein/kg feed)	52.3	49.2	46.8	44.4
Price per kg (GH¢)[b]	0.79	0.82	0.85	0.88

[a] Conc. = concentrate; [b] US\$1.00=GH¢1.43

Incubation and Management of Experimental Keets

Nine hundred (900) eggs were incubated in 3 different incubators at 300 eggs per incubator. Five hundred and twenty-four (524) keets eventually hatched out after 28 days of incubation and used for the experiment. The three incubators hatched different numbers of keets. Consequently there were three different stocking rates in the 12 cages. Keets from the first incubator were stocked at 33 keets/m^2 (54 keets per cage), those hatched with the second incubator were stocked at 22 keets/m^2 (34 keets per cage) and those hatched with the third incubator were stocked at 26 keets/m^2 (43 keets per cage). The keets were randomly assigned to the twelve (12) cages and raised under the deep litter system. Six of the cages had windows. The windows were kept shut and covered with transparent poly sheets during the first two weeks. The windows were kept open on good days from the third week, but with the poly sheet covering and this admitted sunlight. After the fourth week, the poly sheets were rolled up. They were rolled down again during cold weather. Brooder house temperature was maintained at 35°C in the first week and reduced by 2°C every week until the fourth week of brooding when the temperature was maintained at 29°C. The heat was supplied by incandescent bulbs and “Awudu” heaters (an assembly of clay pots containing burning charcoal).

Data Collection and Analysis

Daily feed intake, weekly weight gains and mortality were observed over the entire period. The following parameters were also determined from the data collected:

Daily weight gain per keet (g/day) = {Final weekly weight (g) - Initial weekly weight (g)}/7
Feed conversion efficiency = Feed consumed (g)/Weight gain (g).

Keet performance = 1/ {(Cost of feed offered/Corresponding weight gained) + (Fractional weekly mortality)}
Cost of feed per unit weight gained (GH¢) = {Feed offered per bird (g) × Unit price of feed offered (GH¢)}/Live weight gain per bird on feed offered (g)
Where GH¢ = Ghana cedis (unit of currency)

US$1.00 = GH¢1.43

Data analysis

Data was analysed as a General Linear Model using Statistical Analytical System (SAS) version 8 (2001).

RESULTS

Feed Consumption

Feed intake was highest in keets on 0.22 protein feed (52 MJME/kg DP) followed by those on 0.23 DP (49 MJME/kg DP) and 0.25 DP (44 MJME/kg DP) and lastly on 0.24 DP (47MJME/kg DP) feed (P<0.05) (Table 2). It was apparent that keets in cages which had windows consumed more feed than those in cages without a window (P<0.05). Keets which were hatched with the second incubator consumed more feed than those obtained with the third incubator and lastly, the first incubator (P<0.05).

Table 2: Effect of feed type on various parameters

Parameter	Feed type				Significance
	0.22 Crude protein	**0.23 Crude protein**	**0.24 Crude protein**	**0.25 Crude protein**	
Mean feed consumed/keet/day (g/d)	28.1^{c}	27.8^{b}	24.5^{a}	26.2^{b}	P<0.001
Mean weight gain/keet/day (g/d)	5.91	6.00	7.04	6.64	NS
Mean live body weight at 8 weeks/keet (g)	357	363	421	398	NS
Mean FCE (g feed/g weight gain)	4.77	4.45	3.48	3.89	NS
Mean cost of feed per kg live weight gained (GH¢)	4.35	4.26	3.63	4.09	NS

Row means with the same superscripts are not significantly different at P<0.05, NS: Not significant

Effect of feed type and cage on weight gains

No statistically significant differences in weight gains were observed between treatments although the 0.24 protein feed showed the highest gains followed by the 0.25 protein feed, 0.23 and 0.22 protein feed, in that order (Table 2). No cage differences in weight gains were noticeable even though the cages housing the 0.22 and 0.23 CP treatments displayed lower gains as compared to those receiving the 0.24 and 0.25 CP feeds. The same may be said for the incubator differences as they were not significant. However the trend was that keets from the second incubator appeared to have displayed the biggest gains, followed by those hatched with the first incubator and lastly the third incubator.

Feed cost conversion efficiency

Feed cost differences were not clear between the treatments (Table 2). There were also no significant cage differences as far as the cost of feed per kilo weight gain was concerned. However, there were indications of better retention of the 0.25 DP feed compared to the 0.23 DP feed (Table 2). The same relationship was observed between the 0.24 DP and 0.22 DP feed. Generally, the keets appeared to have retained the 0.24 DP feed most efficiently followed by the 0.25 DP feed, then the 0.23 DP feed and finally the 0.22 DP feed.

Keet Mortality Rates

There were no observed significant treatment differences in the mortality rates of the keets. However, the 0.22 DP feed was associated with the highest mortality rate (8.4%) particularly in the day old to four weeks old keets (6.1%). The 0.24 DP feed was associated with the lowest mortality rates; 3.1% for the eight week period and 1% in the first four weeks.

Significant cage differences were also not observed for mortality. However, in the first four weeks, lowest mortalities appeared to have occurred in cages without windows. No significant incubator differences with regard to keet mortality rates were seen; however, keets hatched with the first incubator appeared to record lower mortality than those hatched with the second incubator. This effect was more apparent in the first four weeks.

Performance of Keets on the Different Treatments

Performance differences were not obvious with regard to the treatments. Cage differences were also not obvious; however, there was an indication that keets kept in cages without windows probably displayed the best performance at day old to four weeks of age. Keets hatched with the first incubator showed superior performance in the first four weeks ($P<0.05$) than their counterparts hatched with the other incubators.

DISCUSSION

Feed Consumption

The observation that feed intake was highest in keets on 0.22 protein feed, followed by the 0.23 protein feed, 0.25 protein feed and lastly the 0.24 DP (47MJME/kgDP) ($P<0.05$) somehow contrasts with the observations of Nahashon et al. (2006) and Elhag et al. (2012) that guinea keet feed intake bore a positive correlation with the protein content of the feed offered to them. Gous (2010) mentioned that poultry tended to consume more feed to meet their requirement of a limiting resource in the feed and that if the feed was limiting in energy, birds would consume more of the feed. Probably the 0.25 protein feed was limiting in energy and also because of its higher protein content than the 0.24 protein feed, the keets consumed more of it than the 0.24 protein feed. According to Teeter et al. (1996), there should be a commensurate increase in the energy content to match the 0.25 protein content of the feed to improve growth performance. Conversely, Donaldson et al. (1956) and Summers et al. (1964) were of the view that birds would indulge in the overconsumption of energy in an attempt to satisfy their protein requirement. Keets consuming the 0.22 CP feed consumed more probably to meet their protein requirement.

Summers et al. (1964) observed interaction between energy and protein contents of feed fed to chickens but Nahashon et al. (2007) observed no interaction between dietary protein and metabolizable energy contents of feed offered to laying pearl grey guinea hens. The present study keets' pattern of feed consumption appeared to be a response to the energy: protein content of the diet rather than just the DP level (Summers et al., 1964). Even though Nahashon et al. (2006) and Elhag et al. (2012) reported a positive linear relationship between feed intake and protein content of the feed, Mbajiorgu et al. (2011) using Venda chickens have reported a quadratic fit to feed intake and energy: protein ratio suggesting an optimal ratio beyond which one nutrient will be in excess while the other one will be limiting. Gous (2010) reported that there was a critical energy: protein ratio at which monogastric growth performance was optimum. In broilers it was around 54MJME/kg dietary CP (Gous, 2010).

The works of Nahashon et al. (2006) and Elhag et al. (2012) suggested that guinea keets between age 0 and 8 weeks old needed high protein low energy diets and this study shares the same opinion. The keets in cages with windows consumed more feed probably because the windows admitted cold air into these cages and keets would need to increase feed intake to increase heat production and keep warm (Gous, 2010). Also, the windows were kept open on good days from the third week and this admitted sunlight which among other things probably increased the visibility of the feed to the keets leading to increased feed consumption. Increased visibility also probably allowed more activity among the birds resulting in energy expenditure and the need to replace lost energy through increased feed intake.

It appeared that the higher the stocking rate of keets the lower the feed consumption per bird. Therefore, incubator differences in feed intake may be as a result of the different stocking rates. The level of crowding might have interfered with keets' access to feed. Avornyo et al. (2007), however, were of the view that the preferred stocking rate for the local guinea keet might be around 35 keets/m^2.

Effect of feed type and cage on weight gains

When the keets were young, there was usually not much variation in their sizes. However, between the fourth and eighth week the variation in their sizes was more pronounced and therefore a bigger variation in the growth rate of keets was observed in keets receiving the same treatment and even in the same cage. This observation corroborates the observation of Saina et al. (2005) that there is great variation in the performance of local guinea fowls reared by smallholder farmers. These differences in growth rate of keets receiving the same treatment might be attributable to their genetic differences (Gous, 2010). If this assertion is true then there is the need for the selection of the local guinea fowl for more uniform growth for any treatment effect to be noticed. Supply of inadequate number of feeders has also been associated with non-uniform growth rate of intensively reared poultry. Of concern also was the observation that male keets appeared to grow faster than the female keets, however, the technique to separate the sexes at day old was lacking. This constraint further obscures the detection of treatment differences.

Because keets receiving the same treatment displayed varying growth rates, no statistically significant differences in weight gains were observed between treatments (Table 2). Keets on 0.25 protein diet might have performed worse than those on the 0.24 protein diet because some of the protein in the feed might have been converted into energy as the energy content of the feed might be lower than required to utilize the protein in the feed (Summers et al., 1964). There might have been differences between treatments on weight gains at the latter stages of the brooding period; however, it was during this period that the runts had become conspicuous. Kari et al. (1978) recommended a diet of 0.24 crude protein and 12.5 MJ ME/kg feed for keets between ages 0 and 8 weeks.

Feed cost conversion efficiency

Feed cost differences were not clear between the treatments probably due to the apparent variability in the growth rates of the local guinea fowls. This notwithstanding, it appeared that one might make a savings of between GH¢650 and GH¢800 on feed to produce one tonne live weight of guinea keets (about 2,500 eight-week old keets) if the 0.24 DP feed rather than 0.22 DP feed was used. Moosavi et al. (2011) realised using broiler chickens that it turned out cheaper feeding feed formulations richer in energy and protein than feeding those poorer in these nutrients because the poorer feeds though cheaper were poorly converted into meat. If a farmer’s strategy was to use one feed from the first day to the eighth week, then the farmer might be better-off offering the 0.24 CP feed. If however the farmer’s strategy was to offer two separate feeds, one during the first four weeks and the other during the last four weeks, then the farmer might feed the 0.24 CP during the first four weeks. The farmer might then feed 0.24 CP in the last four weeks, or consider using the 0.25 CP feed in the last four weeks. Blum et al. (1975) reported that just one diet was recommended for keets aged 0-8 weeks. It was difficult at this stage to assign a reason to why it might be cheaper to feed higher protein diet to four to eight weeks old keets than to day-old to four weeks old keets. The Edinburgh model on guinea fowl feed requirement tested by Sales and Du Preez (1997) agreed with the observation that 4 to 8 weeks old keets appeared to require a higher protein feed than one to four weeks old keets. Nahashon et al. (2006) also arrived at the conclusion that guinea fowls at 5 to 10 weeks of age required the highest protein content of feed for guinea fowls.

There were no significant cage differences as far as the cost of feed per kilo weight gain was concerned; however, one thing was apparent; it appeared to be cheaper feeding in cages without windows particularly in the first four weeks. Savings of about GH¢1,000 might be made in producing one tonne of guinea keets live weight in cages without windows than in cages with windows.

Keet Mortality Rates

The results appeared to suggest that the 0.22 DP feed was the least suitable for day old to four weeks old keets as it was associated with the highest mortality rate. Apparent unsuitability of the 0.22 DP feed observed in day old to four weeks old keets was not observed in four to eight weeks old keets. This seems to suggest that young keets might succumb to poor feed more than older keets.

The results showed no significant cage differences with respect to keet mortality, however in the first four weeks, lowest mortalities appeared to have occurred in cages without windows. There was probably lesser draught in these cages so the birds were warm. Temperature is a key factor which affects the survival of day old to four weeks old keets.

Performance of Keets on the Different Treatments

Performance was measured in terms of the treatment which recorded the fewest deaths and attained the best weights at the cheapest costs. Even though performance differences were not obvious with regard to the treatments, had the experimental keets a fairly uniform growth potential, keets on 0.24 DP feed were most likely to have exhibited the best performance throughout the brooding period.

Cage and incubator differences were also not obvious; however. the apparently better performing keets happened to be in cages without windows implying less wind reaching them. Also, their stocking rate was similar to what was recommended by Avornyo et al. (2007).

CONCLUSION AND RECOMMENDATIONS

The 0.24 P (47 MJME/kg DP) feed appeared to be the feed of choice for brooding zero to eight weeks old keets while the 0.22 DP feed might not be recommended, in particular for day old to four weeks old keets. Keets of four to eight weeks of age appeared to require a higher protein (lower energy: protein ratio) diet than when they were day old to four weeks of age. Keets appeared to respond to the energy: protein content of feed rather than just the protein content alone. The energy: protein content should therefore be the focus for identifying the best feeds for the local keet. Keets might be brooded in the first four weeks in houses without windows for good performance. Growth potential of the local guinea fowl was so varied that application of a treatment might not yield the desired results. This calls for selection of the local guinea fowls for uniform and faster growth. There was the need for sexing of keets at day old to help remove the variation due to sex from the error variation.

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