SHORT COMMUNICATION

Effect of feed particle size on the performance of guinea fowl (*Numida meleagris*) keets

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Abstract

A total of one hundred and fifty, a day-old keets were used in an experiment arranged in a Completely Randomized design (CRD) with the aim of determining the effect of feed particle size on the performance of the keets. The keets were randomly divided into three treatment groups viz; 1, 2 and 3mm particle sizes having 45 keets each. These were further subdivided into three replications of 15 keets per replicate. The keets were reared for 56 days post 21days of brooding. They were fed and watered ad libitum. Data collected were subjected to One-Way Analysis of Variance. The proximate composition of the feed particle sizes were statistically similar (P>0.05) in contents. The results obtained revealed significant (P<0.05) differences in all the parameters considered with the exception of the initial weight. The keets on 2mm feed particle size had the highest final weight of 1529.73 ± 8.74g/bird; the highest weight gain of 26.85 ± 0.16g/bird/day; the highest feed intake of 44.50 ± 0.54g/bird/day; the best feed: gain of 1.66 ± 0.03 and the best protein efficiency ratio of 3.10 ± 0.05. The highest mortality of 33.33 ± 0.00% (n = 15) was recorded in keets fed 3mm feed particle size. The results showed that birds fed 2mm feed particle size depicted potential for efficient utilization of feed which is related to the fine texture of the feed. Hence, it could be concluded that keets up to 11 weeks of age can be managed effectively on feed particle size 2mm.

Keywords: Feed, particle size, performance, guinea fowl, keets

Introduction

A survey of poultry production reported by Dahouda *et al.* (2007) revealed that guinea fowl productivity was low because of high keet mortality. Average keet mortality was estimated at 48% which constituted a major constraint to guinea fowl rearing. Other reported constraints included keet weakness, poor quality of eggs, egg losses (hidden in undergrowth), keet predation, poor housing and infestations (Chrysostome, 1997, Hien *et al.,* 2000). In a trial to measure the impact of management systems on local guinea fowl body weight, Dahouda (2003) reported no differences in body weight at six months Of age between confined birds receiving a complete feed and scavenging birds. It was established that scavenging keets performed better in the rainy season, when insects and vegetation are available than those raised in confinement during the same period (Ayorinde and Ayeni, 1986; Sonaiya, 2009). Hence, the application of knowledge about the use of nests, artificial hatching, prompt marketing of surplus eggs and the use of locally available feed resources results in increased productivity and profitability (Mwalusanya *et al.,* 2002; Saina, 2005).

In poultry production, whole grain feeding has been associated with

increased gut development leading to a more muscular gizzard and less recurrence of proventricular dilation (Jones and Taylor, 2001). However, reducing grain particle size has been shown to increase hammer mill energy and production rate. A review of literature (Reece *et al.,* 1986 and Lott *et al.,* 1992) revealed inconsistencies in recommended grain particle size for optimal poultry performance. The authors reported improved broiler performance when corn particle size decreased from 1,289 to 987µm and from 1,173 to 710µm, respectively. Kilburn and Edwards (2001) had also shown that young bird may not be able to efficiently utilize large corn particle size due to underdeveloped gastrointestinal tracts. Further decrease from 900 to 300µm has also been found to improve feed efficiency and growth performance (Healy, 1992). On the other hand, Nir (1994) reported that feeding large particle corn may produce beneficial effects similar to whole grain feeding. It is noteworthy that the digestion and utilization of different feed particle sizes by birds would vary due to the texture of the feed which would in-turn affect the birds' performance. However, there is dearth of information on the optimum particle size required for optimum growth and development of guinea fowl keets, hence the study.

Materials and methods

Experimental site

The experiment was carried out between August and November, 2008 at Bajoo Farms, Camp, Abeokuta, Ogun State, Nigeria. The farm is situated in the South-western part of Nigeria which is a derived savanna zone with an annual mean temperature of 43.70°C and a relative humidity of 82%. It is in the region 70m above sea level of latitude 7°5'-7°8'N and longitude 3°11.2'E.

Experimental guinea fowl hatching eggs and management

A total of 250 guinea fowl hatching eggs were collected from peasant farmers and taken to UNAAB-LFN Agro Allied hatchery, Kotopo, Abeokuta for hatching. The eggs were properly sorted out, leaving 240 hatching eggs which were fumigated using $KMnO_4$ and formaldehyde in the ratio of 1 to 2 before setting them in the incubator which had been fumigated earlier. The eggs were incubated for 28days. However, during the candling carried out at the 25th day of incubation, a total of 198 eggs were said to be fertile (82.5% fertility) and these were transferred to the hatcher. Consequently, at the 28th day of incubation, a total of 155 eggs hatched into keets (78.3% hatchability).

Table 1: Percent Composition of the experimental diet

Ingredient	Composition (%)
Yellow maize	45.00
Soyabean	15.00
Wheat offal	31.50
Palm kernel cake	2.50
Fish meal	1.00
Bone meal	2.50
Oyster shell	1.50
*Vitamin and mineral premix	0.25
Salt	0.25
Lysine	0.25
Methionine	0.25
Total	**100.00**
Determined analysis	
Dry matter (%)	93.40
Crude protein (%)	20.13
Crude fibre (%)	3.79
Ether extract (%)	3.74
Ash (%)	38.39
Nitrogen -free extract (%)	33.95
Gross energy (Kcal/g)	3.16

*Vitamin and mineral premix contained: Vit. A, 1 500iu; Vit. D_3, 1 600iu; Riboflavin, 9.0mg; Biotin, 0.25mg; Pantothenic acid, 11.0mg; Vit. K, 3.0mg; Vit. B_2, 2.50mg; Vit. B_6, 0.30mg; Vit. B_{12}, 8.00mg; Nicotinic acid, 8.00mg; Fe, 5.00mg; Zn, 4.50mg; Mn, 10.00mg; Co, 0.02mg; Se, 0.01mg

Experimental guinea fowls and management

A total of 135 keets were used in the experiment. The 135 keets were fed and brooded for 3 weeks using commercial feed and lantern as source of heat, respectively. Thereafter, they were divided into three treatment groups of 1, 2 and 3mm feed particle size consisting of 45 keets each which were further divided into 3 replications of 15 keets each and maintained for 56 days. The keets were fed the dietary mix shown in Table 1 with feed particle sizes 1, 2 and 3mm *ad libitum*. Water was also given *ad libitum*.

Experimental diets mix

The macro feed ingredients (maize, soyabean, wheat offal and palm kernel cake) were milled, and the micro feed ingredients (ground bone meal, fish meal, ground oyster shell, vitamin and mineral premix, salt, lysine and methionine) were properly and proportionately mixed together and bagged separately. The macro feed ingredients mix was sieved using 1mm mesh and the particles that passed through the mesh were considered feed particle size = 1mm, the feed that remained on the mesh were then sieved through 2mm mesh to get = 2mm particle size feed and the feed that remained were sieved through 3mm mesh to obtain = 3mm particle size feed. The micro feed ingredients were then divided equally into the three treatment groups and then mixed thoroughly with the already sieved macro feed ingredients of 1, 2 and 3mm feed particle size, respectively.

Chemical Analysis

The proximate analysis of the three diets of 1, 2 and 3mm particle sizes were determined according to the methods of AOAC (1995). The moisture content was determined by oven-drying 2grams of each diet for 26 hours at 60^0C. The gross energy of the feeds was determined using Adiabatic Bomb® calorimetry method.

Data collection

The following data were taken weekly on the performance of the keets: feed intake and weight gain. The other data on feed: gain, protein intake, protein efficiency ratio and mortality were generated by evaluation.

Statistical analysis

The data collected were subjected to one-way Analysis of Variance (ANOVA). Significantly ($P<0.05$) different means were separated using Duncan's Multiple Range Test as contained in the Statistical Analysts Software (SAS®, Littell *et al.,* 2002).

The model used is as follows:

$Y_{ij} = \mu + T_i + \varepsilon_{ij}$

where: Y_{ij} = Observed value

μ = Overall mean value.

T_i = Random effect of the i^{th} housing types

ε_{ij} = Random residual error

Table 2: Proximate composition (± SE) on oven - dry basis of different particle size feeds

Component	Feed particle size 1mm	2mm	3mm
Dry matter (%)	91.08 ± 0.38	91.97 ± 0.80	91.21 ± 0.67
Crude protein (%)	19.41 ± 0.07	19.43 ± 0.06	19.60 ± 0.08
Crude fibre (%)	3.56 ± 0.03	3.58 ± 0.61	3.66 ± 0.02
Ether extract (%)	3.56 ± 0.04	3.45 ± 0.06	3.60 ± 0.06
Ash (%)	37.27 ± 0.09	37.31 ± 0.07	37.59 ± 0.02
Nitrogen - free extract (%)	36.20 ± 0.13	36.23 ± 0.09	35.55 ± 0.11
Gross energy (Kcal/g)	3.10 ± 0.02	3.17 ± 0.04	3.17 ± 0.04

SE = Standard error

Results and discussion

The values obtained on the proximate composition of different particle size feeds (Table 2) showed that the composition of the feeds did not differ significantly (P>0.05) as to confer variability at the start of the experiment.

In Table 3, the feed particle sizes significantly (P<0.05) influenced the final weight, weight gain, feed intake, feed: gain, protein intake, protein efficiency ratio and mortality. The highest value of 1529.73 ± 8.74g/bird/day final weight was obtained in birds fed feed particle size 2mm.

The low final live weight of keets at the 11th week in this study confirmed the reports of Ayorinde *et al.* (1988) that low live weight is characteristic of guinea fowls. The values obtained for the feed intake (44.50 ± 0.54g/bird/day), weight gain (26.85 ± 0.16g/bird/day), protein intake (8.65 ± 0.07g/bird/day) and protein efficiency ratio (3.10 ± 0.05) were highest in keets reared on 2mm feed particle size. In addition, the best feed: gain (1.66 ± 0.03) was obtained in keets fed feed particle size 2mm and this value is comparable only to 1.74 ± 0.07 recorded in feed particle size 1mm.

These results agreed with the findings of Reece *et al.* (1986) and Lott *et al.* (1992) who reported improved broiler performance when corn particle size decreased from 1 289 to 987µm and from 1 173 to 710µm, respectively.

Table 3: Performance of keets (± SE) on different particle size feed (45 keets per treatment)

	Feed particle size		
Parameter	1mm	2mm	3mm
Initial weight (g/bird)	26.27 ± 0.13	26.39 ± 0.12	26.16 ± 0.27
Final weight (g/bird)	1324.16 ± 2.39 [b]	1529.73 ± 8.74 [a]	1272.01 ± 1.29 [c]
Weight gain (g/bird/day)	23.18 ± 0.04 [b]	26.85 ± 0.16 [a]	22.25 ± 0.02 [c]
Feed intake (g/bird/day)	40.48 ± 0.19 [c]	44.50 ± 0.54 [a]	42.77 ± 0.42 [b]
Feed : gain	1.74 ± 0.007 [b]	1.66 ± 0.03 [b]	1.92 ± 0.02 [a]
Protein intake (g/bird/day)	7.55 ± 0.06 [c]	8.65 ± 0.07 [a]	8.38 ± 0.09 [b]
Protein efficiency ratio	3.07 ± 0.02 [a]	3.10 ± 0.05 [a]	2.66 ± 0.03 [b]
Mortality (%)	13.33 ± 0.00 [b] (n = 6)	20.00 ± 0.00 [b] (n = 9)	33.33 ± 0.00 [a] (n = 15)

[a,b,c] : Means in the same row with different superscripts differ significantly (P<0.05)
SE = Standard error
n = number of keets

The reduced weight gain by keets reared on feed particle size 3mm agreed with the findings of Kilburn *et al.* (2001) which stated that young birds may not efficiently utilize large corn particles due to underdeveloped gastrointestinal tracts. The highest feed intake of 44.50 ± 0.54g/bird/day recorded in this study in keets fed feed particle size 2mm corroborated the findings of Hetland *et al.* (2002) that higher inclusion of smaller grinded cereal particles increased feed intake. The poorest feed: gain recorded in keets on feed particle size 3mm was also in line with the findings of Hetland *et al.* (2002) who reported lower feed efficiency in broiler chickens fed coarse corn compared to birds fed diets containing fine, small or medium sized corn.

Conclusion

The results depicted potential for varied utilization of feed particle sizes up to

3mm.

Guinea fowl keet up to 11 weeks would perform at its best in diet composed of feed particle size 2mm.

Further research should be carried out on the effect of feed particle size on the performance of older keets.

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