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RESPONSE OF JAPANESE QUAILS TO THREE COMMERCIAL BROILER FEEDS

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ABSTRACT

An experiment was conducted using 3 readily available commercial feeds. The work has the aim of proffering solution to the perennial problems of quail farmers due to lack of specifically formulated and compounded commercial quail feeds in developing countries and none determination of the most suitable nutrient combinations for such quails. Three commercial broiler starter feeds were used. They were designated T1, T2 and T3 respectively and were fed for 8 weeks. Data were collected on the chemical composition of the feeds, feed consumption, body weight gain, feed/gain ratio, nutrient digestibility, carcass and egg quality characteristics. The results showed that the feeds used had significantly ($P<0.05$) different protein levels ranging from 21.09 – 24.89 % and metabolisable energy (M.E.) between 2.89 to 3.10 Kcal / g feed. The mean micro- nutrient levels of the feeds indicated gross micro-nutrient deficiency in the three feeds compared to the National Research Council recommendations. The response of the quails to the feeds given showed that diet T3-fed quails had the best response, hence the most suitable nutrient combination for the quails good performance which were measured in terms of final body weight, weight gain, nutrient digestibility, liver, and heart proportions. It was concluded that farmers wishing to raise quail birds in Nigeria could give them feeds with nutrient combinations as in T3 and that broiler starter diets are adequate for optimum performance of quail birds.

(Key words: response, quail birds, three commercial feeds.)

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INTRODUCTION

Quail, a small bodied bird, is well adapted to many zones of the world. It belongs to the species *galliformes* and the family *phyasionidae.* Out of the several species of quails identified, Japanese quail (*Corturnix corturnix japonica*) is the bird of commerce (NVRI, 1996). Production of quail birds has many advantages which include fast growth and multiplication rate, low investment cost, early maturity and resistance to most of the diseases commonly affecting the domestic fowl. In addition, quail meat

and eggs are regarded as first class protein sources capable of reducing the problem of hypertension (Annon, 1991). Due to these obvious advantages quails were introduced to Nigeria with the aim of using them to bridge the protein gap in the diets of the populace and minimize the problems of kwashiorkor.

Quail introduction to the country has not satisfied these desired objectives due to certain factors which include lack of specially formulated commercial feeds for quail birds in our markets. Scanty information is currently available on the nutritional requirements of quails raised under African tropical climate. For instance several workers (Bruce and Latsaw, 1981; McNaughton and Reece, 1982) gave conflicting information on the dietary protein requirements of quails. While these earlier workers suggested a dietary protein level of 28 %, Whyte *et al.* (2000) suggested 18- 24 % for the intensively raised quails and for good performance of the birds. Little information is equally available on the other nutrients required by quails in this part of the world. So, lack of commercially prepared feeds as in the case of domestic fowl, to meet the nutrient needs of the quails is considered a major constraint against its large scale production. Consequently, available commercial domestic fowl feeds are being evaluated to determine the performance of quails that are raised on such feeds with a view to estimating the nutrient quantities and combinations that will support good performance of quails under African tropical condition.

MATERIALS AND METHODS

Two hundred and seventy day- old quail chicks were used for this study. They were randomly divided into 3 treatment groups of 90 quail chicks each. Each treatment group was subdivided into 3 replicates. The birds were raised on deep litter system and in an open sided tropical house as recommended by Oluyemi and Roberts (1979) for the domestic fowl. Brooding was done for 4 weeks using 60 Watts electric bulbs to supply the needed heat. Chicks' feeders and drinkers for the domestic fowl were also used. However, pebbles were placed in the drinkers to prevent the quail chicks from drowning. The birds were fed *ad – libitum* for 8 weeks on 3 commercial broiler starter diets designated T1, T2 and T3 for the different diets.

Data collection

Data were collected on the chemical composition of the feeds, average feed consumption, body weight gain, feed conversion ratio, nutrient digestibility, carcass and egg quality parameters.

Nutrient digestibility determination

At 7 weeks of age two birds from each of the 3 replicates were put in metabolism cages and allowed 7 days acclimatization period. Faecal samples were collected daily for another 7 days using total collection method (Longe, 1980). The collection for each group was wrapped in an aluminum foil after sprinkling with boric acid. Each sample was then dried in an electric oven at 80 ^{0}C until a constant weight was obtained. The dried samples were thereafter used for chemical analysis.

Egg analysis

Eggs laid by the birds were collected from the 3 replicates of the 3 experimental groups of birds. Egg collection was on weekly basis. Egg analysis was done to determine the effect of the feeds on the eggs. The analysis was done immediately the eggs were collected from the pens. The external egg traits measured included egg weight, circumference, length and shell thickness.

Egg circumference and length were determined using vernier sliding calipers.

Each egg was broken on a clean flat surface. The egg shells were collected and air-dried for one hour after which the shell thickness was measured with micrometer screw gauge. The measurements were taken from 3 parts, top (pointed part), bottom (round part) and the middle of the eggs. The internal egg quality characteristics were also measured. Egg albumen and yolk height were measured with tripod micrometer. The yolk diameter was taken as the maximum cross sectional diameter of the yolk using a pair of divider, which was read in millimeter with a ruler. Mean yolk weight was obtained by carefully separating the yolk from the albumen with a very sharp knife. The yolk was then rolled on a damp paper to remove any adhering albumen prior to weighing. Yolk index was calculated as the proportion of yolk height to yolk diameter in millimeters.

Chemical analysis

Chemical analysis was done by A.O.A.C. (2000) methods. The absorbance of copper, iron, manganese, zinc, cobalt and selenium was measured by atomic absorption spectrophotometer (AAS) as explained by Ayanwale and Gado (2001). The metabolisable energy (ME) of the feeds was estimatedby Pauzenga (1985) equation.

Carcass analysis

At the end of the experiment, two birds from each replicate group were weighed and slaughtered by severing the jugular vein, bled and defeathered after scalding. The different parts were expressed as the percentage of live-weight. The cutting and dressing of the birds were done manually.

Experimental design and data analysis

The experimental design was completely randomized design (CRD). The data were analysed using analysis of variance (ANOVA) with statgraphics statistical package. Duncan Multiple Range test (Duncan,1955) was used to separate the means where there were significant ($P< 0.05$) differences.

RESULTS AND DISCUSSION

The results of the chemical analysis of the diets are shown in Table 1. Diet T3 had the highest protein (24.89 %) which was significantly ($P<0.05$) higher than the protein in diet T1 (21.09 %). The metabolisable energy (ME) of diet T1 (3.10 kcal/g) was however significantly ($P< 0.05$) higher than those of diets T2 and T3. There were no significant ($P> 0.05$) differences in ether extract (EE), ash, calcium and phosphorus contents of the diets. The values of crude protein (21.09- 24.89 %) obtained in this work is within the range (18- 24 %) reported by Whyte *et al.* (2000). However, the values are lower than those reported by McNaughton and Reece (1982) and Donald (1988) who fed quails with turkey diets containing 27-28 % CP. The metabolisable energy (ME) levels are also within the recommended range(2.8 – 2.9 Kcal/ g) except in diet T1 where the ME level was slightly higher (3.10 Kcal/ g).

Table 2 shows the micronutrient levels of the feeds used for this work. The results indicate that the inclusion levels of the micronutrients were below the NRC (1990) recommended levels. In a similar work Ayanwale and Gado (2001) reported that only one of the four layers' diets tested met the iodine require-

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Table 1: Energy and proximate composition of the experimental diets.

Parameters	Dietary Types			
	T1	T2	T3	SEM
Dry matter(%)	89.13	89.35	89.39	4.74
Crude protein(%)	21.09[b]	22.74[ab]	24.89[a]	1.23
Crude fibre(%)	5.83	8.32	8.80	3.21
Ether extract(%)	10.00	10.18	9.86	2.40
Ash (%)	10.64	9.08	9.82	2.33
Calcium (Ca)(%)	1.20	1.02	1.14	0.98
Phosphorus (P)(%)	0.55	0.50	0.53	0.04
Ca: P ratio	2.18	2.04	2.15	0.10
Metabolisable energy(Kcal/g)	3.10[a]	2.93[b]	2.89[b]	1.08

a,b Means denoted by different superscripts in the same row are significantly ($P< 0.05$) different.

Table 2: Mean micro – nutrient composition of three commercial diets (ppm)

Micro – nutrients	Dietary Types			
	T1	T2	T3	NRC*
Copper (Cu)	0.01	0.11	0.03	3.50
Iron (Fe)	0.10	0.19	0.15	80.00
Manganese(Mn)	0.09	0.98	0.09	25-10
Magnesium(Mg)	60.33	61.80	75.45	300.00
Zinc (Zn)	0.26	0.30	0.38	50.00
Iodine (Io)	13.50	13.45	13.50	40.00
Selenium(Se)	0.00	0.00	0.00	0.00
Cobalt (Co)	0.00	0.00	0.00	0.00

*NRC – National Research Council requirement.
Source: Payne (1990).

ment of the laying birds. The low inclusion of micronutrients in the commercial feeds could be a way of reducing the cost per kilogramme of feed by the feed millers, moreso, that most of the micronutrients are imported to the country and are expensive. This is attested to by the results of the micro nutrient analysis levels (Table 2) which show higher values in diet T3 than in T1 and relative low cost of diet T1 compare to the other two diets. There is therefore an obvious need for the fortification of the commercial poultry feeds with adequate micronutrients to meet the needs of the birds.

The response of the quail birds to the different commercial diets indicated that quails fed diet T3 had the heaviest ($P<0.05$) final body weight (198.76 ± 6.80g) followed by those fed diet T2 (178.22± 9.55g) while those fed diet T1 had the lowest body weight (115.93±6.43). The body weights of quails fed diets T2 and T3 are in agreement with Lombin *et al.* (1997) who reported the final quail body weight to be between 150-180 g at

six weeks of age. However, the values obtained in this work reflects more of the levels of feed consumption in the 3 different groups. The pattern of feed consumption indicates that the quails consumed feed in the order of diet T3, T2 and T1. This order of consumption reflects the levels of ingested energy which were about 2245, 2104 and 1717 kcal/Kg for diets T3, T2 and T1 respectively. This consumption pattern may have been as a result of the level of molasses inclusion which may have impacted on the palatability of the diets. The observed response of the quails is in agreement with the findings of Pym and Farrell (1977) who reported that the growth rate of broiler chickens was positively correlated to feed intake. The values of feed consumption in this work compared favourably with the values reported by Lombin *et al.* (1997).

Table 3: Response of quail birds to three different commercial diets

Parameters	Dietary Types		
	T1	T2	T3
Initial body weight (g)	6.12±0.90	6.35±1.80	6.15±2.10
Final body weight (g)	115.93±6.43^{c}	178.22±9.55^{b}	198.76±6.80^{a}
Feed consumption (g)	554.83±48.45^{a}	718.14±52a^{b}	777.45±57.59^{a}
Body weight gain (g)	109.81±6.43^{b}	171.87±9.55^{b}	192.61±6.80^{a}
Feed / gain ratio	5.05±2.35	4.18±1.90	4.04±1.58

abc Means denoted by different superscripts in the same row are significantly ($P< 0.05$) different

The response of the quails to the different diets also reflects the degree of the digestibility of the diets (Table 4). Diet T3 with a higher digestibility also produced quails with a better growth performance than any other group. Diet T3 had better DM and CP digestibility, and ash availability than either of the other two diets. Diet T2 was better than diet T1 in nutrient digestibility. T2 can The observed results could partly be explained by the magnesium (Mg) level of the diets. Lloyd *et al.* (1978) stated that Mg activate those enzymes (kinases, mutases, choliestrase ,alkaline phosphatases, enolases, and arginase) concerned with carbohydrate metabolism. This means that Mg deficiency or hypomagnesium diets as in diets T1 and

Table 4: Nutrient digestibility of quail birds fed different commercial diets

Nutrients (%)	Dietary Types		
	T1	T2	T3
Dry matter	66.47±2.81^{c}	77.10±1.19^{b}	81.42±1.45^{a}
Crude protein	50.0±4.12^{c}	71.71±1.33^{b}	80.96±1.37^{a}
Crude fibre	45.59±1.40^{c}	68.04±1.47^{b}	55.89±3.43^{a}
Ether extract	84.18±1.35^{c}	92.49±0.31^{b}	90.25±2.67^{a}
Ash	43.44±4.76^{c}	52.67±2.25^{b}	65.81±1.04^{a}
Nitrogen free extract	78.33±1.39^{b}	86.88±0.61^{a}	86.69±1.04a

a,b,c Means denoted by the same superscripts in the same row are not significantly ($P > 0.05$) different.

reduce the efficiency of energy and protein utilization and cause a waste of feed consumed. This might be responsible for the better performance of quails on diet T3 with higher proportion (75 ppm.) of Mg. The uptake of $Mg2+$ and SO_4^{2-} ions in the heart is known to be facilitated by Zn^{2+} ions (Lloyd *et al.*1978) which were also higher in diet T3

Feeding of the different commercial broiler starter diets had no significant ($P > 0.05$) effect on the egg quality parameters of the quails (Table 5). However, the feeds had significant ($P<0.05$) effects on the proportions of the liver, heart, and gizzard) (Table 6). The results also followed the growth pattern in which diet T3 produced the best results followed by diet T2 , which could be attributed to the micronutrient composition of the diets used. This in agreement with Kekeocha (1985) who reported Mg as one of the principal minerals required by quail birds.

Table 5: Egg quality characteristics of quail birds fed on different commercial diets

Parameters	Dietary Types			
	T1	T2	T3	
Egg weight (g)	9.05	9.40	9.83	0.21 NS
Egg circumference (cm)	6.78	7.67	7.78	0.21 NS
Egg length (cm)	2.49	2.54	2.53	0.07 NS
Egg yolk weight (g)	3.14	3.04	3.14	0.08 NS
Albumen weight (g)	4.18	4.06	4.06	0.21 NS
Yolk height (mm)	8.57	8.66	8.43	0.24 NS
Shell weight (g)	0.75	0.76	0.78	0.23 NS
Shell thickness (mm)	0.17	0.18	0.18	0.05 NS

a, b, c : means the same superscripts in the same row are not significantly ($P<0.05$) different.

NS: not significantly different ($P> 0.05$).
SEM: Standard error of mean

Table 6: Effect of different commercial diets on the internal organ proportions of quails

Internal organ proportion (%)	Dietary Types		
	T1	T2	T3
Liver	2.31 ± 1.03^{b}	2.43 ± 1.24^{b}	2.80 ± 1.07^{a}*
Heart	1.02 ± 0.83^{c}	1.35 ± 0.21^{b}	1.56 ± 0.90^{a} *
Kidneys	0.35±0.01	0.35±0.05	0.35±0.06 NS
Gizzard	3.83 ± 1.24^{b}	5.40 ± 2.24^{a}	5.63 ± 1.22^{a}*
Intestinal weight (%)	4.54±1.66	4.55±1.42	4.25±2.81 NS

abc Means denoted by the same superscripts in the row are not significantly ($P > 0.05$) different.

* Significantly different ($P < 0.05$)
NS: Not significant ($P > 0.05$)

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The results of the cost / benefit analysis in Table 7 indicate that diet T1 has the lowest cost of production per quail (₦60.09) followed by diet T2 (₦71.30) while diet T3 has the highest value (₦75.37). However, diet T3 was more profitable since it gave ₦27.98 profit per quail bird sold. This was followed by the profit for diet T2 (₦21.37) and the lowest profit was in diet T3 (₦0.19) per bird sold. This results further point to the superiority of diet T3 over other diets. The cost – benefit analysis equally show that diet T2 is superior to diet T1.

CONCLUSION

Feeding of commercial broiler starter feeds to quail birds can support optimum performance provided such feeds have up to 24 % protein, 2.89 Kcal/g ME and fortified with 75 ppm Mg with Ca: P ratio of 2:1.

Table 7: Cost – benefit analysis of quails fed three different commercial diets.

A. Cost of production:

Parameters	T1	T2	T3
(a) Cost per day old bird (₦)	10.00	10.00	10.00
(b) Cost /Kg feed (₦)	51.50	55.40	56.40
(c) Cost of medication /bird(₦)	3.00	3.00	3.00
(d) Cost of feed consumed/bird(₦)	28.57	39.78	43.85
(e) Cost of labour/bird (₦)	18.52	18.52	18.52
Total cost of production/bird(₦)(a+c+d+e)	**60.09**	**71.30**	**75.37**
B. Benefit			
(a) Weight per bird (g)	115.93	178.22	198.76
(b) Cost per Kg of bird (₦)	520.00	520.00	520.00
(c) Income from sale of a bird (₦)	60.28	92.67	103.35
Profit (Income – Cost of Production)(₦)	**0.19**	**21.37**	**27.98**

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