EFFECT OF GINGER ON THE PERFORMANCE, CARCASS, ORGANS AND GUTS CHARACTERISTICS OF JAPANESE QUAILS IN SEMI ARID ZONE OF NIGERIA

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Abstract: This experiment was carried out to determine the effect of ginger on the performance and carcass characteristics of Japanese quails. Five diets were formulated in which ginger was included at 0%, 0.5%, 1.0%, 1.5%, and 2.0% designated as treatment 1, 2, 3, 4 and 5, respectively. One hundred and five (105) four-week old Japanese quails were randomly allotted to the five dietary treatments with twenty one birds per treatment. There were three replicates of seven (7) birds each in a completely randomized design (CRD) arrangement. The experiment lasted for a period of four (4) weeks such that grower diet was fed to the birds in the 1st and 2nd week while breeder diet was fed in the 3rd and 4th week of the experiment. Feed intake was affected at the grower and starter phases; however, daily weight gain and feed conversion ratio were similar across the dietary treatments. The weights; carcass, neck, thighs/drumsticks (left and right), shank, rib cage, right and left wings and the dressing percentage were affected by dietary treatments. The weights of both small intestine and large intestine were also affected by the inclusion of ginger in the diets of Japanese Quails. All other parameters were the same between the quails fed diets without ginger and those fed ginger inclusive diets. In conclusion, Japanese quails can utilize ginger in diets up to 2% level of inclusion without adverse effect on performance however, 1.5% could be used for good response on carcass quality, organs and gut characteristics.

Keywords: Allotted, dietary, randomized, shank, utilize

Introduction

The production of ruminant animals such as sheep, goats, and cattle has not been able to bridge the gap of protein shortage, because of their long production cycle coupled with other factors (Ehebha *et al*., 2008). In order to bridge the gap, the production of poultry, rabbit and other microlivestock were encouraged because of their high production potential and short generation interval (Yisa *et al*., 2008). Owen *et al*. (2010) showed that Japanese quails should be the animal of choice in increasing animal protein supply in the developing countries. An additional advantage is that their capital investment is small (Oluyemi and Roberts, 2000). They are docile and can be raised in small confinement in large numbers. They appear to be more disease resistant and consume only 14 g of feed a day. Quails are photosensitive, have high metabolic rate and physiological aging is quicker because their lifespan is shorter than the chickens (Parkhurst and Mountney, 1988). It is noted for prolificacy especially in relation to its body weight, which is small, about 300 g at maturity (6 weeks) and is capable of producing up to 300-350 eggs in a year, averaging about 5 g per egg. Their incubation period is only 17 days. The hardy nature of the bird makes them suitable and adaptable to the tropical environment. Their meat is lean and the egg is low in cholesterol (Odunusi *et al.*, 2008).

A lot of growth-promoting antibiotics are used as feed additives; however, they are associated with residues in the meat and eggs. Because of these, many countries banned or limit it use in animal feeding. As a result, natural alternatives, such as herbs and medicinal plants have attracted attention due to their wide range of potential beneficial effects (Khan *et al*., 2012). Undoubtedly, there are many indigenous plant materials in tropical countries which could be used in poultry feeds if the information regarding their nutritional values and freedom from toxic substances are confirmed (Loosli *et al.*, 1974). Ginger (*Zingiber officinale* L.) may act as a pro-nutrient because of the vast active ingredients it contains (Zomrawi *et al*., 2011). It thus, present a potential alternative to Antimicrobial Growth Promoters (AGP). It is valued in medicine as a carminative and stimulant of the gastro-intestinal tract. It is a slender perennial herb, 30-100 cm tall, with robust branched rhizome borne horizontally the near surface of the soil; bearing shoots close together (Purseglove, 1972). It grows best in the tropics from sea level into an altitude of 1500 m both under rainfed and irrigated conditions (Kumar *et al*., 1997). The proximate composition of fresh ginger is; water 80.8%; protein 2.3%; fat 1.0%; carbohydrate 12.3%; fibre 2.4%; ash 1.2% and dried ginger contain about 10% moisture (Purseglove, 1972). Although there are indications that feeding ginger can promote growth performance and may be involved in enhancing gut functions and anti-oxidation in poultry, there is limited information concerning its effect on quails. It is against this background that this study was designed todetermine the growth performance, carcass yield and organs weight, and also to determine the weight and length of the various parts of the gastro-intestinal tract of Japanese quails fed diets containing ginger.

Materials and Methods

The study area

The experiment was conducted in the Teaching and Research farm of the Department of Animal Science Bayero University, Kano located on longitude 11°59'N and latitude 8°36' E in the Semi-arid zone of Nigeria at an altitude of 460 meters above sea level. The climate is characterised by wet season spanning the period of May to September and dry season lasting from October to April (KNARDA, 2001). The annual temperature ranges is 16°C to 47°C with the annual rainfall range from 600 to 1000 mm (KNARDA, 2001).

Plan of the experiment and birds management

One hundred and five (105) four weeks old Japanese quails were obtained from the National Veterinary Research Institute, Vom in Plateau state Nigeria. The birds were randomly allotted to five (5) treatment groups each having three (3) replicates. Seven (7) birds were allocated to each replicate making a total of twenty one (21) quails per treatment. The experiment lasted for a period of four weeks. Five diets were formulated and compounded at the University Feedmill. The ground ginger was included at 0, 0.5, 1.0, 1.5, and 2.0% levels which were designated I, II, III, IV, and V, respectively. The experimental birds were placed on

commercial diets for one week adjustment period, after which they were introduced to the experimental diets for a period of four (4) weeks. Two rations were compounded; grower and breeder diets as presented on Table 1.

Table 1: Ingredients and chemical composition of quails diets containing ginger

Parameters	DIETS				
	I (0%)	II (0.5%)	III (1.0%)	IV (1.5%)	V (2.0%)
Grower Ration					
Maize	45.26	44.76	44.26	43.76	43.26
Groundnut cake (GNC)	34.74	34.74	34.74	34.74	34.74
Wheat Offal	6.00	6.00	6.00	6.00	6.00
Rice Bran	4.00	4.00	4.00	4.00	4.00
Palm Karnel Cake	2.10	2.10	2.10	2.10	2.10
Bone Meal	4.10	4.10	4.10	4.10	4.10
Blood Meal	3.00	3.00	3.00	3.00	3.00
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.30	0.30	0.30	0.30	0.30
Salt	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25
Ginger	0.00	0.50	1.00	1.50	2.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Chemical composition					
Ether Extract (EE)	4.72	4.66	4.92	4.80	5.05
Crude Protein (CP)	23.68	22.43	23.58	22.86	22.97
Ash	13.35	12.65	11.25	13.12	9.07
Crude Fibre (CF)	4.39	4.25	4.17	4.15	4.11
Breeder Ration					
Maize	40.00	39.50	39.00	38.50	38.00
GNC	35.00	35.00	35.00	35.00	35.00
Wheat Offal	16.20	16.20	16.20	16.20	16.20
Bone Meal	4.00	4.00	4.00	4.00	4.00
Limestone	4.00	4.00	4.00	4.00	4.00
Premix*	0.25	0.25	0.25	0.25	0.25
Common Salt	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.15	0.15	0.15	0.15	0.15
Ginger	0.00	0.50	1.00	1.50	2.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Chemical composition					
Ether Extract (EE)	4.64	4.70	5.04	4.38	4.72
Crude Protein (CP)	21.79	21.19	21.10	21.76	20.25
Ash	11.25	10.84	10.71	9.45	9.94
Crude Fibre (CF)	3.98	3.91	3.86	3.98	3.79

*Composition of the premix (Aero-mix layer) supplying the following per kg diet; vit A= 10,000IU, vit D_3= 20,000IU, vit E = 121IU, vit K=2 mg, vit B2=5 mg, vit C=2 mg, Niacin=15 mg, Panthothenic acid=5 mg, Vit B6=3 mg, rvit B12=0.015 mg, Folic acid=0.6 mg, Cu=2 mg, I=20 mg, FE=20 mg, Mn=75 mg, Zn=20 mg, Selenium=0.2 mg, Antioxidant=1.25 mg

Data collection

Data recorded for performance parameters included;

Feed intake (g) - Daily feed allowance was weighed before given to the birds. In the morning of the following day, the left over feed was collected and weighed before the day's feeding. The feed consumed by the birds is obtained from the difference between the amount fed to the birds and the left over. Daily feed consumption per bird was obtained by dividing the total feed consumed by the total number of birds in each replicate; **Body weight gain (g) -** Birds were weighed in group per replicate at the beginning of the experiment and subsequently weighed at weekly interval for four weeks. The average weight was obtained by dividing the total weight of the birds by the number of birds weighed per replicate. **Feed conversion ratio -** This was calculated by dividing feed intake by the weight gain as shown in the relationship; FC= Feed intake/weight gain.

Carcass measurements - At the end of the experiment, fifteen birds (one from each of the three replicate in each treatment) were randomly selected and starved overnight, weighed early in the morning to obtain the final live weight and were eventually slaughtered by severing the jugular veins. They were scalded plucked, eviscerated and weighed. The dressing percentage was determined by dividing the carcass weight by live weight (slaughtered weight) and multiplied by 100. All measurements were made using sensitive weighing balance.

Organ and gut measurements -The heart, gizzard, small intestine, large intestine, liver, lungs, crop and gonads were measured in grams using Sensitive Electric scale and the length of the gastro-intestinal tract was measured in centimeter. Individual organs were placed on an electric sensitive balance and the weight obtained was recorded. The weights were expressed as a percentage of live weight

Statistical analysis

All data collected were subjected to analysis of variance (ANOVA) using completely randomized design as described by Steel and Torrie (1984). Where there was a significant difference, the means were separated using Least Significant Difference (LSD)

Results and Discussions

Chemical composition of experimental diets

The chemical composition of the grower and breeder diets is shown on Table 1, dry matter increases with increase in level of inclusion of ginger but the level of crude protein decreases. However, the chemical composition of the breeder diet showed that dry matter decreases with increasing level of ginger in the diet from treatment 1 to 5. Generally, the chemical composition of the experimental diets indicated that the diets met the crude protein requirement of Japanese quails as suggested by Banerjee (1992).

Growth Performance of Japanese quails

This is presented on Table 2. In the grower phase, daily feed intake across the dietary treatments obtained showed a very highly significant ($P<0.001$) difference. Daily feed intake of birds fed diet containing 1.5 ginger (Diet 4) was similar to those fed the control (Diet 1). Daily feed intake in the breeder phase, was also very highly significantly ($P<0.001$) affected by dietary treatments. However, birds fed diets containing ginger included at 0.5, 1.0 and 1.5% were similar to the birds fed the control diet with 0% ginger. This result do not agree with Zhang *et al.* (2009) who reported no significant difference in daily feed intake when ginger was processed into different particle sizes (300, 149, 74, 37 and 8.4 µm) although numerically feed intake was not different from the control broilers. Nasiroleslami and Torki (2010) also showed that ginger oil did not affect feed intake or feed conversion in laying hens. The differences in feed intake observed may be due to variety of ginger, processing method, dose and the duration of feeding. In both phases daily weight gain and feed conversion ratio across the treatments were not significantly affected. The non-significance ($P>0.05$) in daily weight gain obtained in this study agrees with Zhang *et al.* (2009); Dieumou *et al.* (2009); Zhao *et al.* (2011). However, Herawati (2010) reported that the use of 2% red ginger in the ration of broiler chickens resulted in higher body weights. The range of values for the feed conversion ratio (FCR) during the grower phase agrees with the report by Bonos *et al.* (2010) who obtained a similar value ranging from 3.11 – 3.23, when he tested oligosaccharides and calcium propionate on the

performance and carcass characteristics of Japanese quails as affected by sex. However, the value for FCR during the breeder is slightly high; this may be due to the fact that Japanese quail matures at 6 weeks of age as reported by Maurice (2008). The non-significant difference obtained in this study on FCR in both phases agrees with reports of Zhang *et al*. (2009) and Zhao *et al*. (2001). Conversely, Incharoen and Yamauchi (2009) fed dried fermented ginger at I and 5% to White Leghorm laying hens found that FCR tended to increase in ginger fed group. The effect of ginger on growth performance and body weight gain observed in this study which differed with reports (Tekeli *et al*. 2011; Onu 2010; Kausar *et al*., 1999; Javed *et al*., 2009; Farinu *et al.*, 2004) could be attributed to differences in species since most of the study were on broiler birds and may also be ascribed to the different doses used in the experiments. Similar with this report, Al-Homidan (2005) observed reduced growth rate in starter broilers when ginger was fed at the rate of 60 g/kg body weight at the 6th week of age. Also, Zhang *et al*. (2009) did not find any significant difference for average daily gain in broilers by feeding ginger at the rate of 5 g/kg.

Table 2: Performance of Japanese quails fed graded levels of ginger based diets at the grower and breeder phases

Parameters	DIETS					LSD
	I (0%)	II (0.5%)	III (1.0%)	IV (1.5%)	V (2.0%)	
Grower phase						
DFI (g)	11.53^{a}	9.03^{bc}	8.73^{bc}	11.97^{a}	8.70^{c}	1.42***
DWG (g)	2.87	2.58	2.29	2.85	2.72	0.87^{NS}
FCR	4.02	3.50	3.80	4.20	3.20	0.89^{NS}
Breeder phase						
DFI (g)	13.17^{a}	11.17^{ab}	11.17^{ab}	12.97^{ab}	10.97^{b}	2.06***
DWG (g)	2.33	2.00	2.03	2.18	2.08	0.18^{NS}
FCR	5.65	5.59	5.03	5.95	5.27	1.18^{NS}
Mortality	-	-	-		-	1

^{a,b,c} = means within the same row with a different superscripts, NS = Not significant, *** = Significant at (P<0.001), and LSD = Least Significant Difference

Table 3: Carcass characteristics showing cut-up parts of Japanese quails fed graded levels of ginger based diets

Parameters	DIETS					LSD
	I (0.00)	II (0.50)	III (1.00)	IV (1.50)	V (2.00)	
Final Live Weight (g)	123.77	123.80	127.33	130.27	132.90	7.27^{NS}
Slaughtered Weight (g)	118.03	116.80	119.33	122.10	122.67	7.70^{NS}
Plucked weight (g)	107.20	106.20	109.90	108.72	111.27	8.88^{NS}
Carcass Weight (g)	92.43^{a}	89.97^{ab}	94.43^{a}	90.27^{ab}	84.60^{b}	6.20*
Dressing (%)	74.69^{a}	72.71^{a}	74.15^{a}	69.29^{ab}	63.72^{b}	8.08***
Head	2.51	2.21	2.20	2.49	2.64	0.42^{NS}
Neck	3.88^{c}	3.91^{bc}	4.68^{a}4	.22^{abc}	4.74^{a}	0.66*
Breast	20.18	20.00	21.10	23.48	21.27	1.10^{NS}
Rib Cage	9.07^{a}	7.54^{ab}	6.57^{b}	7.64^{ab}	8.44^{a}	1.70**
Wings (left)	3.40^{abc}	2.74^{c}	2.88^{bc}	3.30^{abc}	4.12^{a}	0.89***
Wings (right)	3.51^{abc}	2.99^{c}	3.06^{bc}	3.56^{abc}	3.96^{a}	0.62**
Thigh Drumstick (left)	9.65^{c}	9.86^{bc}	10.37^{abc}	11.17^{a}	11.74^{a}	1.38*
Thigh drumstick (right)	10.42^{cd}	10.12^{d}	10.48^{bcd}	11.66^{abc}	11.99^{a}	1.26*
Shanks	1.86^{abc}	1.67^{bc}	1.99^{a}	1.67b^{c}	1.66^{c}	0.24*

^{a,b,c} = means within the same row with a different superscripts differ significantly, NS = Not significant, Significant differences at * = (P<0.05); ** = (P<0.01) and *** = (P<0.001), and LSD = Least Significant Difference

Carcass characteristics

The result of the carcass quality parameters is presented on Table 3. There were no significant differences on final live weight, slaughtered weight, plucked weight, breast weight and the weight of the head. This agrees with Omage *et al*. (2007) who observed no significant difference in the final live weight in rabbits fed ginger waste meal as energy substitute for maize. The value for the live weight of Japanese quails in this study agrees with Maurice (2008) who reported a range of 100 – 140 g as the live weight for adult male Japanese quails. However, there was significant (P<0.05) difference on carcass weight, neck weight, thigh/drumstick (left), thigh/drumstick (right) and the weight of the shanks; a highly significant (P<0.01) difference in weight of rib cage and right wing and also a very highly significant (P<0.001) difference in dressing percentage and left wing. Zhang *et al*. (2009) observed that broilers fed ginger produced higher carcass weights compared to untreated birds. Dressing percentage, breast weight and leg weights increased significantly in response to an aqueous extract of a plant mixture containing ginger. Conversely, El-Deek *et al*. (2002) found that the dressing percentage of broilers did not differ between control and ginger treated broilers up to sixth week of age.

The carcass characteristics expressed as percentage of the live weight showed that the values of dressing percentage for diets I, II, III and IV were the same. This result agreed with Chatiratikul *et al.* (2010) who reported a range of 74.49 – 79.17% as dressing percentage in Japanese quails fed diets containing wolffia meal as a protein replacement for soya bean meal. This implies that inclusion of up to 1.5% ginger in Japanese quail diet will not affect dressing percentage of the birds. However, results do not agree with Omage *et al*. (2007) who observed no significant difference in dressing percentage of rabbits fed ginger waste meal. The weight of thigh/drumstick (right) indicated that diets II, III and IV were the same with control but only diets II and III were similar to the control on the weight of the thigh/drumstick (left). The weight of the rib cage had a different trend, birds fed diet V compared well to those fed the control diet. The weights of the shank, right and left wings were all the same throughout the dietary treatments. These dietary effects may be attributed to an assertion by Zhang *et al*. (2009) which suggested that improved carcass quality may be associated with the antioxidant effect of ginger which enhances protein and gut metabolism. The carcass characteristics observed in this study was affected by dietary treatments; this is entirely different from that of Onu (2010) who reported that the addition of ginger (0.25%) in basal diets of broiler chicks did not result in significant differences in carcass characteristics.

Organ weights and gut characteristics

These parameters are presented on Table 4. Inclusion of ginger in the diets of quails do not show any significant difference on the weights of the liver, lungs, empty crop, gizzard, heart, gonad and the length of gastrointestinal tract (GIT). The similarity obtained on all the parameters that were not significantly affected by dietary treatments could be attributed by the non-toxic properties of the test ingredient. There was highly significant (P<0.01) difference in the weight of small intestine and a very highly significant (P<0.001) difference in the large intestine weight across the treatments. Diets containing 0.5 and 1.0% ginger had the same small intestine weight with the control diet. On the large intestine weight, diets II, III and IV were the same with diet I (control Diet). The results generally indicated that ginger was not injurious to quails.

Table 4: Organ weights and guts characteristic of Japanese quails fed graded levels of ginger based diets

Parameters	DIETS					LSD
	I (0%)	II (0.5%)	III (1.0%)	IV (1.5%)	V (2.0%)	
Liver Weight	1.41	1.46	1.65	1.38	1.98	0.70^{NS}
Lungs Weight	0.56	0.70	0.81	0.85	0.86	0.82^{NS}
Empty crop	0.53	0.51	0.65	0.64	0.86	0.24^{NS}
Gizzard	2.80	2.83	2.39	2.99	2.83	0.97^{NS}
Heart	0.67	0.69	0.62	0.64	0.68	0.08^{NS}
Gonads	2.14	2.20	2.04	1.98	1.98	0.51^{NS}
Small Intestine	1.74^{c}	2.10^{bc}	2.62^{abc}	2.76^{ab}	3.24^{a}	0.97**
Large Intestine	0.81^{c}	1.16^{abc}	1.10^{abc}	0.87^{bc}	1.48^{a}	0.51***
Length of GIT (cm)	62.90	63.30	67.80	75.23	74.90	16.07^{NS}

^{a,b,c} = means within the same row with a different superscripts differs, NS = Not significant, **= Significant at (P<0.01), *** = Significant at (P<0.001), and LSD = Least Significant Difference

Conclusion

Whilst reports regarding the efficacy of ginger in poultry diets varied, there are indications that feeding (2%) of the plant material can promote growth performance in Japanese quails. The feeding of ginger up to 1.5% levels may also be involved in enhancing gut function and quality carcass. However, the doses, application and processing of ginger need to be standardized in order to give a firm recommendation to farmers.

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