

EVALUATION OF THE GROWTH AND CARCASS CHARACTERISTICS OF THE JAPANESE QUAIL (*Coturnix coturnix japonica*) IN NIGERIA

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ABSTRACT

Two experiments were designed to study the growth and carcass characteristics and the effects of system of management on the Japanese quail. In the first experiment, 138 birds raised to 8 weeks of age were used to study the growth and carcass characteristics of quails. Day old weight averaged 8.67 ± 0.75 g while body weights at 4 and 8 weeks of age were 130.38 ± 21.81 g and 175.08 ± 21.23 g respectively. Feed conversion rate to 8 weeks was 6.42 with each bird consuming 1067.68g feed. No significant sex differences ($P > 0.05$) were observed in the average yield of parts although the males had slightly higher dressed and eviscerated weights and percent wing, back and neck than females. Dressed weight was 93.55% on the average while eviscerated weight was 68.61%. the carcass contained 74.20% moisture, 69.63%CP and 26.5% fat. In the second experiment, 120 birds were used to test the effect of management system (floor vs. cage) on growth and carcass characteristic of the quail. Although floor rearing had a slight advantage over cage rearing in terms of weight gain, feed conversion ratio and carcass yield, the differences were not significant ($P > 0.05$).

Key Words: Quail, Growth, Carcass yield, carcass composition, Acceptability, management system.

INTRODUCTION

Animal protein has continued to decrease in Nigeria as a result of the high cost of the products arising principally from the continually increasing cost of production. One way of increasing protein supply is to diversify poultry production as well as increase the production of other livestock species with short generation intervals. One of such animal is the quail.

Quail production is not yet popular in Nigeria unlike in countries like Japan, India, Philippines, etc. where its production has been heavily commercialised. This is probably because the advantages of quail compared with the domestic fowl, the main source of poultry meat and egg (Wilson *et al.*, 1959, 1961; Schwartz and Allen, 1981; El-Ibiary *et al.*, 1966) have not been realised in Nigeria.

There is presently no reported study of the performance and characteristics of quails in Nigeria. This study was designed to evaluate the growth rate, carcass, effect of management system and relationships between body weight and yield of cut up parts in Japanese quail.

MATERIALS AND METHODS

Two experiments were designed to study the growth and carcass characteristics of the Japanese quail.

EXPERIMENT I.

A total of 138 day-old Japanese quails hatched from eggs obtained from a private farm in Kwara State, Nigeria were divided into six replicates of 23 birds each and reared on the deep litter to 8 weeks of age at the rate of 20 birds per m^2 . Weekly measurements of body weight and feed intake were taken from day old to 8 weeks. At eight weeks of age, twenty birds (ten of each sex) were randomly picked, kept off feed overnight and slaughtered by severing the jugular veins. After scalding in warm water for about a minute and manually plucking the feathers, each bird was cut into parts: heads, back and neck, breast, wing, thigh and drumstick, shank, liver, heart and gizzard. Each cut up part was then weighed.

Triplicate samples of the manually deboned meat of five carcasses of each sex were analysed for moisture, crude protein and ether extract in accordance with the methods of AOAC (1985).

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Twenty panelists were trained for organoleptic assessment (colour, flavour, tenderness, juiciness and overall acceptability) of the prepared samples from each sex using the Nine-point Hedonic Scale (Cover *et al.* 1962). Ten of the panelists were chosen for the sensory evaluation. Broiling of the meat from each sex was done in an open gas oven at a temperature of 72°C. The broiled meat of each sex was cut into biteable sample sizes and served on a tray to each of the ten screened panelists who were each given a taste panel Score form. The panelists were told to rate each of the organoleptic traits independently of each other. Cool water was served to the judges to rinse their mouth after scoring for the first sample.

EXPERIMENT 2.

One hundred and twenty day old Japanese quail hatched from a foundation stock kept in the Department's Animal Pavilion were used for the research. The birds were divided into four replicates to investigate the effect of rearing system on the growth performance and carcass yield of Japanese quail. Two replicates were reared to 4 weeks of age in battery cages measuring 0.59m x 0.30m (0.033m² bird⁻¹) while the other two groups were reared on the deep litter permitting a floor space of 0.039m² per bird.

At 4 weeks of age, the chicks raised in the battery cages were mixed together and randomly divided into four new groups. Two groups (replicates) were raised in battery cages and the other two on the deep litter to 8 weeks of age. Similarly the two groups on the floor were divided into four new groups and two groups each assigned to deep litter floor or battery cage. Thus four different rearing systems: Cage - Cage (C-C), Cage-floor (C- F), Floor-Cage (F-C) and floor-floor (F-F) were used for raising the birds to 8 weeks of age. Body weights, feed intake and mortality were recorded weekly for each group.

At 8 weeks of age, five birds from each replicate (10 per group) picked randomly were slaughtered, dressed and cut into parts as in experiment 1.

The birds in both experiments were fed diets containing 28.4% CP and 3350 kcal/kg. feed and 21.7% CP and 3044 kcal/kg. feed between 0-4 and 4-8 weeks of age respectively.

STATISTICAL ANALYSES.

Body weight and carcass yield data were subjected to one way analysis of variance using the completely Randomised Design while difference in feed intake, feed conversion, sensory evaluation and proximate composition were distinguished using the t-test (Steel and Torrie, 1980). Correlations between live body weight and cut up parts were also determined.

RESULTS AND DISCUSSION

EXPERIMENT 1

The mean weekly body weights, body weight ranges, feed intake, and feed conversion ratio as well as number of birds measured weekly are presented in Table 1. The birds weighed on the average 8.67 ± 0.75g at day old and 175.08 ± 21.23g at 8 weeks of age. The most rapid stage of growth was during the first four weeks of age (4.35g/bird/day) but in consequence of onset of puberty the growth slowed down between 4 and 6 weeks of age (0.63g/bird/day). Mean daily weight gain between 6 and 8 weeks of age was 2.56g. The overall daily gain to 8 weeks was 2.97g/bird. The body weights obtained in this study compare favourable with values reported by workers in temperate countries (Bacon and Nestor, 1983, Lepore and Marks, 1971, Jones *et al.* 1979, Sadjadi and Becker, 1980).

The total cumulative feed intake to 8 weeks of age was 1067.68g per bird. Compared with 1757g in the unimproved guinea fowl (Ayorinde *et al.* 1988), 1872g in the improved guinea fowl (Verma *et al.* 1990) to 10 weeks of age and 3277g to 5 weeks of age in the domestic fowl broilers (Adeleye and Odunsi (1990)

The highest feed intake was around the onset of puberty when the birds had to combine body weight gain with physiological development for egg and semen production. The fairly high feed intake despite the obviously low body weight and hence the resultant poorer feed efficiency of the quail is probably due to a higher metabolic

rate. This no doubt will place the quail at a disadvantage in terms of cost of production.

The feed conversion ratio up to 4 weeks of age was comparable to what obtains in the guinea fowl (Ayorinde, Oluyemi and Ayeni, 1988) and in the domestic fowl broilers (Oluyemi and Roberts, 1979). However during the 5th and 6th weeks of age, feed conversion ratio was particularly high as little body weight was gained and the birds had to divert much of the feed to physiological changes for initiating onset of puberty. The cumulative feed conversion ratio to 8 weeks of age was 6.42. This compares favourably with the 5.28 reported by Ayorinde *et al.* (1988) for the unimproved guinea fowl but is much poorer than values reported for broilers, (Nwachukwu and Ibe 1990, Adeleye and Odunsi, 1990). Compared with the guinea fowl and domestic fowl broilers the quail has poorer feed efficiency. The body weight of the quail at a similar age is about 36.8% of that of the local guinea fowl (Ayorinde *et al.*, 1988) and only 9.5% of that of the broiler (Adeleye and Odunsi, 1990). Yet at this age, feed intake of the quail was about 61% of that of the guinea fowl and 32.6% of that of the domestic fowl broiler.

Mortality was generally low during the brooding period (0-4 weeks) being only 2.17% and was only 3.62% to 8 weeks of age. This indicates that the quail is a very rustic bird and perhaps less disease-prone than other poultry birds.

The age at which egg production commenced in the birds used for this study was similar to the 35 days of age reported by Sefton and Siegel (1974). Since the birds came into lay in the 6th week of age, they can be considered very prolific or early maturing with a high production rate suitable for meeting the meat and egg needs of most homes.

Table 2 shows the mean live weight and cut up parts as percent of liveweight in the two sexes at 8 weeks of age. Though the females had slightly higher body weights than the males, no significant ($P > 0.05$) differences were observed in the various parts between the two

sexes. Except for the legs (thigh + drumstick + shank) and the giblets, the other parts formed a higher percentage of the liveweight in the males.

As observed by Wilson *et al.* (1961), the larger body weight of the females was probably due to heavier gonads, intestines, gizzard and liver, hence the higher dressing and eviscerated percentages obtained for females in this study. The dressing and eviscerated percentages obtained in this study were higher than those reported for the broiler chicken (Singh and Essary, 1974), guinea fowl (Ayorinde, 1989) and the bush fowl (Akande and Oluyemi, 1984).

There were no significant ($P > 0.05$) differences in the proximate composition of the two sexes (Table 3) although the males had slightly higher dry matter and crude protein but lower moisture and fat than the females.

The slightly higher fat (+ 1.1%) observed in the females was probably as a result of changes in the physiological status of the birds. The moisture and dry matter content of quail meat compare favourably with those of the domestic fowl broiler (Singh and Essary, 1974) but contained higher moisture than those of the guinea fowl (Ayorinde, 1989), bush fowl (Akande and Oluyemi, 1984, Famuyiwa, 1988), doves, pigeons, ducks and local chicken (Famuyiwa, 1988) perhaps as a result of younger age. The fat content of the meat also compares favourably with that present in bush fowl, doves, ducks, pigeon (Akande and Oluyemi, 1984, Famuyiwa, 1988) and guinea fowl (Ayorinde, 1989). On dry matter basis, the protein content of the meat of Japanese quail compare well with those of other domestic and wild birds (Akande and Oluyemi, 1984; Ayeni *et al.*, 1983; Ayorinde, 1989).

The results of the sensory evaluation of the meat samples are shown in Table 4. There were no significant differences ($P > 0.05$) in color, juiciness and overall acceptability of the meat samples of the two sexes. The colours of the meat samples according to the panelists were intermediately deep for males (Score = 5.2) and slightly pale for females (Score = 6.00). the juiciness of the meat samples from the two sexes

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were judged to be intermediate in wetness (5.5-5.6) and the flavour was liked moderately by the panelists. According to the penalists, meat of male quails was only slightly tender while that of the female was moderately tender.

The organoleptic assessment of the Japanese quail meat shows that it is readily acceptable by consumers and hence should have no problem of acceptance in Nigeria if enough could be produced. The overall scores indicated that the meat of Japanese quail is intermediate between deep and pale, liked moderately, moderately tender and slightly juicy.

Table 5 shows the correlation between live weight and the cut up parts at 8 weeks of age. All the cut up parts except the wings were positively and significantly ($P < 0.05$) correlated to live weight. Except for wing weight and dressed weight, breast weight and back + neck, the other cut up parts also showed positive and significant (P) inter-correlation. The correlation values indicated that the cut-up parts and carcass yield could be reliably predicted from the liveweight.

EXPERIMENT II.

The mean weekly body weight, feed intake, and feed conversion of the four groups between 0 and 8 weeks of age are shown in Table 6. The growing system had no significant ($P > 0.05$) effect on the above parameters although floor rearing proved better than cage rearing. Weight gain per day between 0 and 4 weeks of age was 5.41g in the cage and 5.75g on the floor. Between 5 and 8 weeks of age, daily weight gain averaged 2.39g in the cage and 2.74g on the floor. Over the 8 weeks period, daily weight gain was 3.94 and 4.16g for the cage and floor respectively.

Cumulative feed intakes to 8 weeks of age were 1057.19, 1082.13, 1120.48 and 1031.66g for the C-C,F -C, C - F and F - F groups respectively. Feed intake to 4 weeks of age were 412.74g for the cage and 411.15g for the floor. The birds consumed 649.39 and 645.39g on the average between 5 and 8 weeks of age when raised in the cage or on the floor. Thus

the overall feed intake to 8 weeks of age was 1052.13g for the cage and 1056.90g for the floor.

Efficiency of feed utilization declined with age and was worst in week 6 but was slightly better for the floor reared group. The feed conversion ratio to 4 weeks of age was 2.69 for the cage and 2.56 for the floor. Feed conversion ratios of 9.68 and 8.77 were obtained between 4 and 8 weeks of age for the cage and floor reared groups respectively. The overall feed conversion ratio for the cage and floor were 4.83 and 4.51 respectively.

Mortality was generally low in the four management systems. Only 1 bird died from each of the groups during the 0-4 weeks brooding period and none during the 5-8 weeks rearing period.

The liveweight and carcass yield of birds from the four rearing systems, as percentage of liveweight, are shown in Table 7. No significant differences were noted between the four groups although floor rearing had slightly better dressing and eviscerated percentages as well as higher cut up parts.

Though the result indicated slightly better performance, weight gain, feed conversion and carcass yield on the floor than in cages, the ease of handling and high stocking density tend to favour cage rearing especially in places where floor space could be a problem. The non-significant difference in the performance of birds raised under the two management systems was similar to that observed in pullets (Silva *et al*, 1979), broilers (Dexamir *et al* 1979), layers (Oluyemi *et al* 1975) and guinea fowl (Ayorinde and Ayeni, 1987). The eviscerated percentages obtained in this study were higher than the 77% reported by Jones *et al.* (1979) for floor reared Coturnix at 9 weeks of age and the 75.7% for 8 weeks old battery reared coturnix.

Evidence from the present study indicated that the quail has some characteristics that include fast growth, marketability at 6-8 weeks of age as indicated by request for the birds even when sold at ₦15.00 each, smallness and easy handling, nonflightiness, less floor space

requirement, high survival, early sexual maturity, high rate of egg production, short incubation period and short generation interval. It appears, however, that it may serve more as a variety meat rather than a cheaper source of poultry protein than both domestic fowl and guinea fowl considering its fairly high feed intake and much smaller body size.

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Table 1 MEAN BODY WEIGHT (G) FEED CONSUMPTION (G/BIRD) AND FEED CONVERSION RATIO IN JAPANESE QUAIL \pm SE.

Age (wks).	Body weight (g)		Feed Intake (g)	Feed conversion Ratio		N
	Mean	Range				
0	8.67 (0.75)	7.7.12 -	10.86			138
1	25.31 (2.66)	24.47 -	28.15	27.08 (3.66)	1.63 (0.15)	138
2	56.07	37.52 -	73.02	96.30	3.13	136
3	93.47 (8.32)	55.10 -	116.89	128.57 (15.80)	3.44 (0.22)	136
4	130.38 (14.41)	85.22 -	171.04	160.52 (20.44)	4.35 (0.35)	135
5	133.39 (17.92)	99.19	167.55	153.03 (25.33)	51.01 (10.55)	135
6	139.24 (18.88)	105.52	176.68	168.52 (20.65)	28.81 (4.44)	135
7	159.38 (20.22)	112.94 -	208.05	165.33 (30.44)	8.21 (0.66)	133
8	175.08 (21.23)	127.25 -	221.86	168.33 (24.80)	10.71 (1.15)	133

S.E. = Standard Error (in parentheses)

Table 2 CARCASS YIELD (%LIVEWEIGHT) OF MALE AND FEMALE JAPANESE QUAIL \pm SE.

Parameter	Male (N=10)	Female (N=10)
Live weight	153.04 (3.4)	182.16 5.0
Dressed weight	93.67 (1.1)	93.38 (0.9)
Eviscerated weight	69.29 (0.7)	67.94 (0.8)
Head	4.85 (0.1)	4.05 (0.1)
Back + Neck	18.01 (0.6)	17.12 (0.4)
Breast	26.43 (0.5)	26.33 (0.6)
Wing	6.29 (0.3)	6.05 (0.2)
Leg	14.86 (0.6)	15.02 0.3
Shank	1.69 (0.1)	1.58 (0.1)
Gizzard	2.82 (0.1)	2.86 (0.1)
Liver	1.84 (0.01)	1.92 (0.1)
Heart	0.69 (0.02)	0.69 (0.01)

S.E. = Standard Error (in Parentheses).

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Table 3 PROXIMATE COMPOSITION (%) OF MEAT SAMPLES OF MALE AND FEMALE JAPANESE QUAIL \pm SE.

Parameter	Male (N=5)	Female (N = 5)
Moisture	73.79 (0.8)	74.69 (0.6)
Dry matter	26.21 (0.5)	25.32 (0.8)
Crude protein	70.18 (0.3)	69.05 (0.5)
Fat	25.95 (0.8)	27.05 (0.9)

S.E. = Standard Error (in parentheses)

Table 4 ORGANOLEPTIC EVALUATION OF MEAT OF JAPANESE QUAIL (10 panelists) \pm SE.

Parameter	Male (N =5)	Female (N =5)	Mean (N =10)
Colour	5.2 (0.2)	6.0 (0.3)	5.6 (0.3)
Flavour	6.7 (0.2)	7.3 (0.1)	6.00 (0.2)
Juiciness	5.5 (0.1)	5.6 (0.1)	5.6 (0.1)
Overall acceptability	6.0 (0.2)	6.7 (0.2)	6.4 (0.2)

Range of Hedonic scale

- Colour 1 = Extremely white - 9 = Extremely pink
- Flavour 1 = Dislike extremely -9 = Like extremely
- Tenderness 1 = Extremely tough - 9 = Extremely tender
- Juiciness 1 = Extremely dry - 9 = Extremely Juicy
- Overall acceptability 1 = Dislike extremely - 9 = Like extremely.

S.E. = Standard Error (in Parentheses)

Table 5 CORRELATION BETWEEN LIVWEIGHT (LW) AND SOME CARCASS PARTS IN JAPANESE QUAIL.

Parameter	LW	DW	EW	BW	LGW	WW	B + N
LW	1.00						
DW	0.99**	1.00					
EW	0.88**	0.91**	1.00				
BW	0.88**	0.90**	0.95**	1.00			
LGW	0.88**	0.89**	0.95**	0.87**	1.00		
WW	0.37NS	0.41NS	0.63*	0.43NS	0.62*	1.00	
B + N	0.72*	0.73*	0.85*	0.67*	0.86*	0.54NS	1.00

NS - $P > 0.05$ * $P < 0.05$ ** $P < 0.01$

LW = Liveweight, DW = Dressed weight, EW = Eviscerated weight

BW = Breast weight, LGW = Leg weight, WW = Wing weight

B + N = Back + Neck weight. NS = Not significant.

Table 7 EFFECT OF REARING SYSTEM ON CARCASS YIELD (%) OF JAPANESE QUAIL

Parameter	Management Type			
	C - C	F - C	C - F	F - F
Live weight (g)	198.13 ^a	203.67 ^a	226.75 ^a	239.75 ^a
Dressed percentage	91.75 ^a	96.87 ^a	95.42 ^a	96.85 ^a
Eviscerated percentage	78.14 ^a	83.87 ^a	83.60 ^a	85.75 ^a
Internal offals	6.26 ^a	6.91	7.20 ^a	7.25 ^a
Thigh	11.69 ^a	13.26 ^a	13.12 ^a	13.78 ^a
Drumstick	7.14 ^a	5.10 ^a	7.71 ^a	7.74 ^a
Wing	7.49 ^a	7.54 ^a	7.53 ^a	7.60 ^a
Back + Neck	1984 ^a	20.60 ^a	20.01 ^a	20.71 ^a
Breast	31.28 ^a	34.82 ^a	34.35 ^a	35.67 ^a
Heart	0.93 ^a	0.94 ^a	0.97 ^a	1.14 ^a
Liver	1.37 ^a	1.90	1.97 ^a	1.98 ^a
Gizzard	3.96 ^a	4.08	4.25 ^a	4.14 ^a

Means within each row followed by some letter superscript (a) did not differ significantly ($P > 0.05$).