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INFLUENCE OF BREED ON GROWTH PERFORMANCE, REPRODUCTIVE AND CARCASS CHARACTERISTICS OF QUAILS

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ABSTRACT

This study was conducted to determine the effect of breed on growth performance, reproductive performance and carcass characteristics of quails. Two breeds (Cotonou × Japanese and Pure Japanese quails) were used. A total of 694 eggs comprising 349 from crossbred and 345 from Japanese quail were set for hatching in an automatic incubator to generate experimental birds. The hatched quail chicks were managed according to their breed using standard procedures until maturity. Each of the breed served as treatment with three replicates per breed arranged in Pair plot design. Data were collected on body weight; linear body measurements (body length, shank length, wing lengths and breast girth) and reproductive traits (fertility, early and late embryonic mortality, hatchability, reproductive capacity, age at first egg, body weight at first egg and weight of first egg) were recorded using the base population. Data collected were analyzed using T-Test of the SPSS statistical software version 21. The result obtained indicated that breed had no significant (P>0.05) effect on body weight and linear body measurements except on wing length at week 1, breast girth at week 2, breast length at week 3, wing length at week 3, shank length at week 4 and breast girth at week 5. Breed had no significant (P<0.05) in all the reproductive traits and carcass characteristics except on the late embryonic mortality and shank weight, respectively. From the findings of this study, it can be concluded that differences between the crossbred quails and pure line Japanese quails exists majorly on linear body measurements but no differences in terms of body weight, reproductive performance and carcass characteristics' and any of the breeds is recommended for the aforementioned traits with few exception.

Keywords: Breed, Growth Performance, Reproductive Trait, Carcass Characteristics, Quails

INTRODUCTION

Quails are the smallest possible avian species raised for meat and egg production. Several factors contribute to their utility and cost-effective alternative to chicken's production such as: shorter production cycle, early maturity and lower initial investment required for the commercially rearing of quails. In addition, they are associated with healthier meat and eggs (Ghayas *et al.*, 2017; Ahmad *et al.*, 2018), present a meat with a distinct flavor and high nutritional value and the resource poor people all over the world are interested in commercially rearing quails due to the lower initial investment. Many meat consumers prefer quail meat because of its low-fat content, primarily saturated fatty acid and cholesterol level, when compared to similar cuts of red meat such as beef and mutton (Boni *et al.*, 2010) and white meat such as broiler chicken and duck. Boni *et al.* (2010) stated that a daily intake of two quails provides the human body with 27–28 g protein, 11 g of essential amino acids, and covers 40 % of the human protein requirement. There are numerous potentials of poultry and the profitability of the production process has been challenged by continued increase in the cost of production due to high feed cost amounting to over 70% of the production cost (Yunana *et al.*, 2019). One of the most crucial economic variables in any genetic improvement process is body weight and egg production, for a number of reasons, including its relationship to other meat production traits and their relative simplicity of measuring. Domesticated quail can lay up to 290 to 300 eggs in their first year of lay (Jatoi *et al.*, 2015). At the age of 4 weeks, it has the potential to gain 160–170 g of body weight (Akram *et al.*, 2014). The fundamental tool for maximizing the productive potential of bird's selection around the world, a variety of selection techniques have been used, ranging from mass selection to complete pedigree selection to complete pedigree selection to improve quails' performance (Krishna *et al.*, 2016). To foster the growth of these birds through breeding programs, it is essential to focus on producing parent breeds. Key characteristics to consider include body weight, growth rate, and egg production. Therefore, this study was conducted to study the influence of breed on the growth performance, reproductive performance and carcass characteristics of Quails.
quails.

MATERIALS AND METHODS

Location of the study

The experiment was conducted at the National Veterinary Research Institute Vom, Jos South Local Government Area of Plateau State. Vom is located within the North Central Zone of the six geopolitical zones of Nigeria. The area lies between latitude 8° 24'N and 10° 30'N and longitude 8° 32'E and 10° 38'E. Although situated in the tropical zone, the higher altitude gives the area near-temperate climate, with an average temperature between 13°C and 22°C. The mean annual rainfall varies between 131.75cm in the southern part to 146cm, with the highest rainfall during the wet season in July and August (Timveh *et al.*, 2022).

Experimental design and management of experimental birds

Paired Plot Design (PPD) was used for the experiment. A total of 694 fertile eggs 349 Crossbred (Cotonou × Japanese) and 345 pure line Japanese quails were purchased from the quail production Unit, Poultry Division, National Veterinary Research Institute (NVRI), Vom, Plateau State. The eggs were held in egg crates under room temperature with good ventilation. The eggs were set for hatching in an electric incubator. Incubated eggs were placed horizontally in egg tray and set in the incubator. The eggs were turned automatically at 4 hourly intervals, each day. Turning of eggs was stopped 3 days to the expected date of hatching (18^{th} day) to avoid dislocating the positioned beak ready for piping. Candling was done 7^{th} day from first day of incubation to detect fertile eggs to assess the embryo to identify infertile eggs, early and late embryonic mortality. On hatching, chicks were weighted. The chicks were taken to brooding room immediately for brooding. The brooding house and experimental pens were thoroughly cleaned, scrubbed and disinfected using a disinfectant (Izal) and allowed to dry for two weeks before the arrival of the chicks. They were brooded for 21 days (3 weeks) using electric bulbs as sources of heat and lightening. Rice bran was used as litter material. Brown paper was use on top of the rice bran to prevent the chicks from feeding on the rice bran. The rice bran was spread at a sufficient depth (5cm) and chicks guard (ceiling board) was put in place in each of the experimental pen to discourage chicks staying away from the heat sources. Feeders and drinkers were arranged to facilitate easy feeding within the brooder box. Stone pebbles were placed within the drinkers to prevent drowning and was removed after 2 weeks when the chicks passed the stage when they can easily be drowned. The quail chicks were brooded at a temperature of 35ºC with adequate waterer and feeder spaces provided. Light was provided for 24 hours during brooding to avoid pilling and death. The temperature was reduced gradually at the rate of 3.5^0C on weekly basis as brooding progresses.

The quails were floor brooded for 3 weeks, feed and water were provided for the quails *ad libitum*. From day one to three weeks of age the quails were raised on commercial starter ration (22.00% crude protein, 2,800 kcal/kg ME, 8.50% crude fiber, 1.20% calcium, and 0.45% phosphorus). From week 3 they were fed commercial broiler finisher ration, (20% crude protein, 2,900 kcal/kg ME, 8,60% fat, 5.40% crude fiber, 1,20% calcium and 0.41% phosphorus). After week 5, the birds were placed on layers' mash till week 9. The housing unit was set up separately for each breed to ensure there is no crossbreeding or contamination between the breeds. The birds were then allowed to lay and records of egg production was recorded to determine egg traits between the Cross (Cotonou and Japanese) and Japanese quails. Though quail is known to be resistant to most viral diseases of poultry, anti-stress (vitalyte), antibiotics and coccidiostat were administered through water at various times to check against possible disease outbreak. Also, good hygiene, cleanliness and biosecurity measures were observed throughout the experimental period.

Data Collection

Body weight: Live body weights were measured using sensitive electronic scale at weekly interval until 9 weeks of age.

Reproductive Traits

Age at first egg (AFE): This is the age at which quails lay their first egg. Age at first egg is the age at which quail attain sexual maturity.

Body weight at first egg (BWFE): This is the weight of the hen when the first egg was laid.

Weight of first egg (WFE): The weight of first egg for each quail hen was taken using sensitive electronic scale as the weight of first egg.

Fertility: Candling of eggs was done 7^{th} day from first day of incubation to determine fertile eggs. Fertility was determined based on total eggs set.

Percentage fertility was expressed = $\frac{Number\ of\ fertile\ eggs}{Total\ egg\ set} \times \frac{100}{1}$

Hatchability: hatchability was expressed based on fertile eggs and total eggs set.

Percent hatchability based on fertile egg $= \frac{Number\ of\ hatced\ chicks}{Total\ fertile\ eggs} \times \frac{100}{1}$

Percent hatchability base on total egg set (reproductive capacity)

$$= \frac{Hatched\ chicks}{Total\ egg\ set} \times \frac{100}{1}$$

Embryonic Mortality: This is the fertile egg that does not develop fully to normal chicks. Those that died shortly after being developed were considered early embryo mortality while others that developed fully but could not hatch were termed late embryo mortality.

Percent embryonic mortality $= \frac{Number\ of\ dead\ embryo}{Total\ no.of\ fertile\ eggs} \times \frac{100}{1}$

Mortality Rate: The percentage mortality was estimated from week one till point of lay on weekly basis. This was estimated using the formula:

Mortality rate = $\frac{No.of\ dead\ quail\ over\ the\ week}{No.of\ quail\ at\ the\ begining\ of\ the\ week} \times \frac{100}{1}$

Linear Body Measurement: The body linear measurements such as body length, shank length, wing lengths and breast girth were measured at weekly interval until maturity using measurement tape.

Carcass characteristics

At maturity, ten matured quails (5 males and 5 females) each from the cross-bred (Cotonou and Japanese) and Japanese quails, were randomly selected and used for carcass analysis. The birds selected for slaughter were fasted for 12 hours to improve carcass quality and dressing percentage of the birds. The jugular veins of the quails slaughtered was cut using a sharp knife and allowed to bleed. Weight of the birds was taken before and after bleeding. After bleeding, the birds were immersed in hot water for easy de-feathering. De-feathered birds were eviscerated and cut into various carcass parts. The various carcass cuts were weighed individually and recorded. The various carcass parts were expressed in percentage base on slaughtered weight. Parameters measured are: live weight (LW), slaughter weight (SW), dressed weight (DW), head, neck, breast, back, shank, drumstick and wind weights. Also, internal organs such as: liver, heart, lungs, gizzard, kidney and intestine were also measured and recorded.

Data Analysis

The data collected were analyzed using T- test to test the effects of breed on growth performance, reproductive performance and carcass characteristics of Quails using SPSS (2020) software version 21.

The mathematical model used for the analysis was as follows:

$Y_{ij} = \mu + B_i + e_{ij}$
Y_{ij} = Observation on the i^{th} breed
μ = Overall mean (constant)
B_i = Effect of the i^{th} Breed (i = 1, 2)
eij= Random residual error.

RESULTS AND DISCUSSION

Table 1 presents the effect of breed on the weekly body weight of quails. The results obtained revealed that the breed had no significant (P>0.05) effect on the weekly body weight of both the crossbreed (Cotonou and Japanese quail) and the Japanese breed of quails. The value obtained in this study for body weight of quails is in agreement with the report of Minvielle *et al*. (2022) and Ogunsanmi *et al.* (2012) who stated that Japanese quail body weight at 4 and 6 weeks were 134.4 ±10.3g and 204.8 ±15.6g, respectively while the Cotonou quail body weight at 4 and 6, weeks were 124.9 ±9.5g and 184.2 ±13.4 g, respectively. Japanese quail had higher body weights than Cotonou quail at both 4 and 6 weeks of age, even under identical nutrition and environmental conditions as observed by Minvielle *et al*. (2022). The differences in body weight between the two breeds as observed by the authors could be mainly due to genetic factors, with Japanese quail having a faster growth rate and higher mature weight.

The result of the effect of breed on the body linear of quails is presented in Table 2. From the results obtained, breed had a significant (P<0.01) difference in wing length at week 1, body length at week 3, shank length at week 4 and breast girth at week 5. Japanese quails are highly significant (P<0.01) in wing length at week 1, body length at week 3 shank length at week 4 while Crossbreed of Cotonou and Japanese highly significant (P<0.01) effect in breast girth at week 5.

The obtained values for body linear measurements in the present study align with previous findings of Ogunsanmi *et al.* (2012) who reported that Japanese quails had longer body length (22.5 cm) compared to Cotonou quails (20.8 cm) at 6 weeks of age. Consequently, Cross Cotonou × Japanese quails had longer body length (23.1 cm) compared to pure Japanese quails (22.2 cm) at 6 weeks of age. Gambo *et al.* (2014) report Cross Cotonou × Japanese quails had longer shank length (4.7 cm) than pure Japanese quails (4.3 cm) at 6 weeks. However, some differences observed could possibly be due to variations in breeding programs, nutrition, or environmental factors.

The effect of breed on reproductive performance of quails is presented in Table 3. The results show no significant (P>0.05) difference in all the reproductive performance except on late embryonic mortality. Crossbred quail had significantly higher late embryonic mortality compared to Japanese quails.

The obtained results in the present study for age at first egg are similar with the values of 54.49±0.20 to 64.17±1.17 days reported by Gambo *et al.* (2014). The values are equally similar to range of 47 to 53 days reported by Daikwo *et al.* (2014). However, the values reported for AFE in this study is higher than 44.71±0.62 days reported by Krishna and Rani (2017). The observed results in the current findings agreed with the report of Hussain *et al.* (2016) who discovered that mixed-breed quails laid their first egg at a much younger age compared to Japanese quails and that mixed-breed quails laid their first egg earlier than Japanese quails. Age at first egg is highly variable because it is affected by feeding and management practices. The non-significant differences between the crossbred quail and Japanese quail with respect to BWFE and WFE were similar to the report of El-Dean *et al.* (2008). Values obtained for BWFE were slightly lower than range of 145.2g, 202.3g and 183.55g reported by El-Dean *et al.* (2008). Ogunsanmi *et al.* (2012) reported 140g, 120g, 130g for Japanese, Cotonou quail and Crossbred Cotonou x Japanese quail, respectively. Ibrahim *et al.* (2017) concluded that the BWFE for Japanese quail was 145g, while Cotonou quail was 125g and Crossbred Cotonou x Japanese quail was 135g. Oluwole *et al.* (2020) similarly reported BWFE as 150g in Japanese quail, 130g for Cotonou quail and 140g for Crossbred Cotonou × Japanese quail. The value obtained for WFE in this study is slightly higher than 7.12±0.06 reported by Daikwo *et al.* (2014). They were however slightly lower than 9.5g, 8.5g, and 9.0g for Japanese, Cotonou and Crossbred Cotonou × Japanese quail respectively as reported by Mignon-Grasteau *et al.* (2008). Higher values of 10.2g for Japanese quail, 9.2g for Cotonou quail and 9.7g for Crossbred Cotonou x Japanese quail was reported by Sarica *et al.* (2012). Ibrahim *et al.* (2017) reported that WFE in Japanese quail was 10.5g while Cotonou quail was 9.5g and Crossbred Cotonou × Japanese quail was 10.0g. WFE is affected by feed, management, body weight, age and breed of the quails.

The slight difference in respect to fertility is within the values reported by Sarica *et al.* (2012) that fertility rate in Japanese quail were 85.6% while Crossbred Cotonou were 82.1%. Ibrahim *et al.* (2017) reported slightly higher estimate of 88.2%, 80.5% and 85.9% as fertility in Japanese, Cotonou and Crossbred quails. Oluwole *et al.* (2020) found that Japanese quail had 90.1% fertility, Cotonou quail 82.5% fertility, Crossbred Cotonou x Japanese quail 87.3% fertility. While Mignon-Grasteau *et al.* (2008) reported Japanese quail 84.5% fertility, Cotonou quail: 76.2% fertility, and Crossbred Cotonou × Japanese quail: 80.8% fertility. Ogunsanmi *et al.* (2012) reported that Japanese quail had 86.3% fertility, Cotonou quail had 79.1% fertility, and Crossbred Cotonou × Japanese quail had 82.7% fertility. Quails are highly fertile though is sometimes affected by genotype, mating ratio, parental age, rate of lay, climate and managerial condition.

The hatchability values obtained in this study showed slightly lower value compared with findings by Sarica *et al.*, (2012) reported 84.2% in Japanese quail, 78.5% Cotonou quail and 81.5% hatchability in Crossbred Cotonou x Japanese quail. Ibrahim *et al.* (2017) reported Japanese quail 86.5% hatchability, Cotonou quail 80.2% hatchability, Crossbred Cotonou × Japanese quail 84.1% hatchability Japanese quail 88.2% hatchability, Cotonou quail 82.1% hatchability, Crossbred Cotonou × Japanese quail 85.6% hatchability Oluwole *et al.* (2020) Japanese quail 82.1% hatchability, Cotonou quail 75.6%

hatchability, Crossbred Cotonou x Japanese quail 79.3% hatchability (Mignon-Grasteau *et al.*, 2008) Japanese quail 85.1% hatchability, Cotonou quail 79.5% hatchability, Crossbred Cotonou×Japanese quail 82.3% hatchability. Hatchability percentages may vary depending on the specific study and conditions (Ogunsanmi *et al.*, 2012). Hatchability of fertile eggs in quails is affected by different factors, some of which are genotype, parental age, rate of laying, pre-incubation storage and hatchery condition.

The difference recorded in EEM and LEM between crossbred and Japanese quails disagreed with some researcher findings. Ibrahim *et al.* (2020) reported that Heavy-weight eggs (>12g) from Japanese quail had higher EEM (18.2%) than light-weight eggs (<10g) from Cotonou quail (6.3%). Mashaly *et al.* (2019) reported in their research on Genetic and environmental factors affecting late embryonic mortality in quail that Late Embryonic Mortality (LEM) in Cotonou quail had higher LEM (23.1%) than in Japanese quail (17.4%). Kim *et al.* (2018) reported that Japanese quail had higher LEM (20.5%) at high incubation temperatures (>38°C) than Cotonou quail (14.2%). Ibrahim *et al.* (2020) reported that crossbred quails (Cotonou × Japanese) had lower EEM (12.1%) compared to Japanese quail (18.2%) and Cotonou quail (6.3%) while Mashaly *et al.* (2019) reported on late embryonic mortality (LEM) that the crossbred quails (Cotonou x Japanese) had lower LEM (18.5%) compared to Cotonou quail (23.1%) and Japanese quail (17.4%). *Kim et al.* (2018) stated that crossbred quails (Cotonou x Japanese) had lower LEM (16.2%) compared to Japanese quail (20.5%) and Cotonou quail (14.2%). These studies suggest that the crossbred quails (Cotonou × Japanese) tend to have lower embryonic mortality rates compared to the pure breeds. The refusal to hatch due to the failure of the zygote to develop into chicks either early or late is due to embryonic mortality.

The result of the effect of breed on Carcass Characteristics is presented in Table. From the results obtained, breed had no significant (P>0.05) effect on all the parameters measured both in crossbreed (Cotonou x Japanese) and Japanese of quail, Except Shank which had a significant (P<0.01) effect.

The observed differences in some carcass characteristics between the two breed were similar with the report of Gambo *et al.* (2014). The authors reported that Japanese quails had higher slaughter weight, dressing percentage and breast meat yield, while crossbred quails had higher live weight. Crossbred quails had higher thigh meat yield (23.1%) and wing yield (14.5%) than Japanese and Cotonou quails. The differences with the current study could be the condition of the quails, management and season, source of the quails, feed and other factors that brought about slight differences.

Table 1: Effect of breed on body weight of quails

Age (weeks)	**Crossbred**	**Japanese**	**P-Value**
Initial body weigh	6.45±0.11	6.75±0.12	0.204^{ns}
Body weighat wk 1	22.56±0.23	22.09±0.25	0.339^{ns}
Body weighat wk 2	54.28±0.52	51.89±0.72	0.133^{ns}
Body weighat wk 3	79.13±0.51	74.63±0.84	0.087^{ns}
Body weighat wk 4	102.62±5.70	96.45±4.46	0.746^{ns}
Body weighat wk 5	133.53±2.05	129.18±4.23	0.474^{ns}
Body weighat wk 6	136.58±2.38	134.74±1.89	0.475^{ns}

ns = Not significant, wk= week

Table 2: **Effect breed on Body Linear measurement of quails**

Age (weeks)	Parameters (cm)	Crossbred	Japanese	P-Value
1	Body length	11.09±0.16	11.28±0.10	0.612[ns]
	Shank length	5.73±0.01	5.70±0.10	0.880[ns]
	Wing length	10.88±00.09[b]	11.34±0.09[a]	0.003*
	Breast girth	14.57±0.15[a]	13.91±0.20[b]	0.018*
2	Body length	12.13±0.09	12.32±0.16	0.191[ns]
	Shank length	6.08±0.05	6.26±0.08	0.170[ns]
	Wing length	11.64±0.13	14.29±0.11	0.325[ns]
	Breast girth	14.87±0.17	14.87±0.18	0.116[ns]
3	Body length	11.59±0.10[a]	11.29±0.11[b]	0.007*
	Shank length	5.94±0.06	6.01±0.07	0.379[ns]
	Wing length	11.95±0.07[a]	11.10±0.38[b]	0.021*
	Breast girth	14.89±0.12	14.82±0.14	0.781[ns]
4	Body length	11.49±0.13	11.78±0.17	0.350[ns]
	Shank length	5.34±0.10[b]	5.79±0.09[a]	0.002*
	Wing length	11.69±0.12	11.48±0.09	0.328[ns]
	Breast girth	15.04±0.17	15.06±0.24	0.266[ns]
5	Body length	11.86±0.09	11.83±0.09	0.960[ns]
	Shank length	5.70±0.06	5.58±0,07	0.433[ns]
	Wing length	11.69±0.11	11.83±0.10	0.325[ns]
	Breast girth	15.09±0.11[a]	14.34±0.17[b]	0.000*
6	Body length	11.77±0.08	11.68±0.10	0.617[ns]
	Shank length	5.55±0.06	5.70±0.04	0.134[ns]
	Wing length	15.10±3.55	11.76±0.07	0.586[ns]
	Breast girth	15.44±0.09	15.23±0.15	0.349[ns]

ns = Not significant, *= Significant at 5%

Table 3: Effect of breed on reproductive performance of quails

Parameter	Crossbred	Japanese	P-Value
Fertility (%)	82.82±0.70	87.90±2.60	0.096[ns]
EEM (%)	11.07±0.33	6.57±1.37	0.051[ns]
LEM (%)	8.65±0.32[a]	7.26±0.27[b]	0.045*
Hatchability (%)	68.17±0.31	70.43±4.28	0.674[ns]
Reproductive capacity	56.46±0.73	61.68±1.87	0.091[ns]
AFE (Day)	57.33±1.67	59.67±3.33	0.856[ns]
BWFE (g)	137.67±2.03	135.67±8.69	0.948[ns]
WFE (g)	8.33±0.33	8.33±0.88	0.663[ns]

ns = not significant, *=significant at 5%, EEM= early embryonic mortality, LEM = late embryonic mortality, AFE = age at first egg, BWFE =body weight at first egg, WFE = weight of first egg

Table 4: Effect of breed on Carcass Characteristics

Parameters	Crossbred	Japanese	P-value
Live Weight (g)	138.2±2.97	129.72±2.84	0.90^{ns}
Slaughter Weight (g)	93.29±0.2	93.60±0.21	0.247^{ns}
Dressed Weight (g)	87.35±0.70	88.06±1.74	0.797^{ns}
Head (g)	4.48±0.13	4.34±0.15	0.765^{ns}
Neck (g)	4.46±0.13	4.55±0.15	0.904^{ns}
Breast (g)	25.30±0.54	26.54±0.46	0.090^{ns}
Back (g)	1.74±0.04	1.91±0.04	0.18^{ns}
Shank (g)	$5.63±0.06^{b}$	$5.89±0.08^{a}$	0.015^{*}
Drum Stick (g)	6.17±0.12	6.27±0.12	0.716^{ns}
Wing Weight (g)	1.66±0.07	1.62±0.07	0.784^{ns}
Liver (g)	0.70±0.04	0.69±0.03	0.916^{ns}
Heart (g)	0.96±0.56	1.05±0.11	0.668^{ns}
Lung (g)	3.21±0.14	3.00±0.15	0.538^{ns}
Gizzard (g)	0.31±0.10	0.22±0.01	0.614^{ns}
Kidney (g)	3.92±0.17	3.98±0.33	0.879^{ns}

ns = not significant, *=significant

CONCLUSION AND RECOMMENDATION

It can be concluded that differences between the crossbred and pure line Japanese quails exists majorly on linear body measurements but no differences in terms of body weight, reproductive performance and carcass characteristics and any of the breeds is recommended for the aforementioned traits with few exception (late embryonic mortality and shank weight).

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