GROWTH, PRODUCTION AND REPRODUCTIVE PERFORMANCE OF JAPANESE QUAILS (COTURNIX COTURNIX JAPONICA) IN HUMID ENVIRONMENT

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ABSRACT: This study was undertaken on Japanese quails to evaluate their growth, production and reproductive performance in a Humid environment of central Nigeria. One hundred and sixty nine (169) pedigrees hatched day-old Japanese quail chicks from 10 sires were used for this study. The traits studied include body weight, morphological traits, feed and reproductive traits. Results show that hatch weight and mature body weight of Japanese quails were 5.74±1.10g and 89.81±1.20g, respectively. At maturity, mean shank length, body length, wing length and breast girth were 3.93±0.15, 18.0±0.16, 15.00±0.17 and 6.51±0.07cm, respectively. Growth rate was highest (3.02±0.11g) at 4-5 weeks of age. Feed intake increased with age from 3.12±0.09g (week 0-1) to 15.16±0.08g at 5-6 weeks while feed conversion ratio was best (3.01±0.18g) at 1-2 weeks. Mortality decreased with age. Mean age at sexual maturity (AFE), was 54.49±0.20 days while body weight at first egg (BWFE) and weight of first egg were 138.91±0.64 and 7.83±0.08g, respectively. Hen-day and Hen-house egg production were 25.77 and 17.57%, respectively at the 3rd month of lay while part-period egg number was 62.43±0.23 eggs per hen. Percentage mean fertility was 80.72±1.03 while that of the hatchability of eggs was 70.48±1.74. It was concluded that given the productive and reproductive estimates, Japanese quail can serve as an alternate livestock species that can ameliorate shortage of protein intake in environment studied.

Key Words: Growth, production, japanese quails, humid environment.
INTRODUCTION

It has been observed by FAO (1991) that the daily protein intake in many developing countries is still far below the recommended level of 67g per Head per day of which 58% must be of animal origin. Nigerians consume only 5.5g of animal protein per person per day as against 38.86g per person per day recommended by FAO (1991). This has adverse consequences on health, productivity and development of the human being especially children, aged and pregnant women who are most susceptible to low protein intake.

Production of livestock species with short generation interval could be a viable option in ameliorating shortage of protein among the populace in developing countries (NVRI, 1994; Muthukumar and Dev Roy, 2005). Japanese quail is one of the poultry types with very short generation interval. Quail farming serves as a form of alternate poultry production in many nations and is gaining attention from the farmers, entrepreneurs, and researchers. It is used for food, game, pet and also for research purposes (Muthukumar and Dev Roy, 2005). Its consumption may be preferred by all, as it has no religious taboo. It has good nutritive value, amazing taste, gamy flavor, tender meat that are delicious with low caloric value and high dry matter. It is rich in protein, vitamins, essential amino acids, saturated fatty acids, unsaturated fatty acids and phospholipids (Muthukumar and Dev Roy, 2005). Although considerable work has been done on quail production, management, health and genetics, most of the works were carried out in temperate and sub-temperate climates. However in Nigeria, some studies have been conducted on quail production, nutrition, management and health NVRI (1996), Bawa (2006), Chindo and Olowaniyan (2006), Dafwang (2006) and Tuleun et al. (2008), there performance in the humid central Nigeria has not being adequately studied.

The objective of the study is to estimate growth, egg production and reproductive performance of Japanese quails reared in the Southern Guinea Savannah Zone of Nigeria.

MATERIALS AND METHODS

The experiment was carried out at Mundi’s Farm behind Livestock Teaching and Research Farm of the Faculty of Agriculture, Nasarawa State University Keffi, Lafia campus, Nasarawa State Nigeria. Nasarawa State falls within the Southern Guinea Savannah zone of Nigeria. The state lies between latitude 7º and 9º North and Longitude 7º and 10º East. It has a climate typical of the tropical zone because of its location. It has a temperature ranging from 25ºc in October to 36ºc in March while rainfall varies from 13.73 cm in some places to 14cm in others (Nasarawa State Ministry of Information, 2006).

Experimental Birds and Their Management:

The Japanese quails for this experiment were procured from Titus’s Farm along NTA road, Tudun Amba, Lafia, Nasarawa State. The total of 30 females and 10 males at three weeks of age were purchased and used as the base population. The base population is part of an original random bred population of Japanese quails purchased from the poultry unit of the National Veterinary Research Institute, Vom, Plateau State. This base population was housed in the same pen for two weeks for the purpose of acclimatization. At the 6th week of age, they were randomized into 10 breeding cages in the rearing house. A mating ratio of 1:3 (i.e. 1 cock to 3 hens) was used. Each breeding cage has a dimension of 47(length) x 40(width) x 36(height) cm. The hens in each breeding cage were allowed to freely mate the
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respective cock as from 6 weeks of age. However, fertile eggs for hatching were collected when the birds were at least 9 weeks of age. This is because higher rates of fertility and hatchability of Japanese quail eggs are achieved between 9 - 19 weeks of age. The birds were fed formulated diet containing 18% crude protein and 2700 Kcal/Kg metabolizable energy as recommended by Dafwang (2006). Feed and water were provided adlibitum.

Hatching eggs were collected twice a day and were given sire identifications. The eggs were accumulated for 6 days. The eggs were held in egg crates under room temperature with good ventilation. At the end of 6 days of egg collection, the eggs were set for pedigree hatching in an electric incubator. Incubated eggs were placed horizontally in egg boxes. The egg boxes were placed in the egg tray and set in the incubator. The eggs were turned manually during the day between 7am and 7pm at 4 hourly intervals, each day i.e. at 7am, 11am, 3pm and 7pm. Turning of eggs was stopped three days to the expected date of hatching to avoid dislocating the positioned beak ready for piping.

However, since the Japanese quail egg shells are coloured, tinted and botched, accurate assessment of the embryo by candling was not possible. Therefore, after taking out all the hatched chicks from the incubator, the unhatched eggs were broken open on the hatch day under bright sunlight to identify infertile eggs, early and late embryonic mortality. On hatching, chicks were weighed and given individual and sire identities using permanent marker of various colours. The chicks were then 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. The brooding was carried out for a period of 21 days (3 weeks) using stoves or electric bulbs as sources of heat and illumination. Wood shavings were used as litter materials. These were spread at a sufficient depth (5cm); and chicks guards were put in place to discourage chicks staying away from the heat sources. Feeders and drinkers were arranged to facilitate easy feeding both within and outside the brooder box. Stone pebbles were placed within the drinkers to discourage drowning and were removed after 2 weeks when the chicks have passed the stage when they can easily be drowned.

The quail chicks were brooded at a temperature of 35⁰C with adequate water and feeding 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°C on weekly basis as brooding progresses.

The chick’s phase of the study lasted for 3 weeks (21 days). During this phase, the birds were fed formulated chick mash which contained 24% crude protein (CP) and 2800 ME Kcal/kg metabolizable energy. After the chick phase is the grower’s phase which lasted for another three weeks and the birds were fed growers mash containing 21% CP and 3000 ME kcal/kg metabolizable energy.

Layers mash which contained 20%CP and 2,600 ME Kcal/kg metabolizable energy was given to the birds at point of lay (6 weeks of age). The birds were then allowed to lay and records of egg production were taken for the first three months (part-period egg production) to determine egg traits.

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 ensured throughout the experimental period.
Measurement of Traits:

Growth Traits:

Body Weight:

Live body weights were measured at hatch using sensitive electronic scale and then at weekly intervals afterwards until 6 weeks of age.

Body Weight Gain: Average daily gains (ADG) were estimated using the formula:
\[
\text{Body weight gain} = \frac{W_2 - W_1}{N}
\]
Where \(W_2\) is the final weight, \(W_1\) is the initial weight, and \(N\) is the number of days taken from initial weight to the present weight.

Growth Rate:

Absolute growth rate during the period of 0-1, 1-2, 2-3, 3-4, 4-5 and 5-6 weeks of age were determined from the weekly body weight changes using the formula:
\[
\text{Growth Rate} = \frac{(W_2 - W_1)}{0.5(W_2 - W_1)}
\]
Where \(W_1\) = weight at the beginning of the period and \(W_2\) = weight at the end of the period.

Feed Intake:

Feed intake was recorded for the first 6 weeks. This was estimated on daily basis.

Feed Conversion Ratio:

The gain per feed intake was estimated for the first 6 weeks on weekly basis. This was estimated using the formula:
\[
\text{Feed conversion ratio} = \frac{\text{Feed intake}}{\text{Weight gain}}
\]

Mortality Rate:

The percentage mortality was estimated for the first 6 weeks on weekly basis. This was estimated using the formula:
\[
\text{Mortality rate} = \frac{\text{No. of dead quail over the week}}{\text{No. of quail at the beginning of the week}} \times 100
\]

Linear Body Measurement:

The linear body measurements such as body length, shank length, wing lengths and breast girth were measured at weekly interval for the first 6 weeks using measuring tape.

Egg Production 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.

Egg Number:

The total numbers of eggs laid by each hen was recorded monthly for a period of 3 months (part period egg production). The following measures of egg production were determined.
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(a) Part-lay Hen Housed Production (% HHP): This was expressed as:
\[
% \text{ HHP} = \frac{\text{Total egg laid}}{\text{No. of birds housed} \times \text{No. of days since housed}} \times \frac{100}{1}
\]

(b) Part-lay Hen Day Production (% HDP)
\[
% \text{ HDP} = \frac{\text{Total egg laid}}{\text{No. of birds housed} \times \text{No. of days since hen laid}} \times \frac{100}{1}
\]

(c) Egg number per hen housed: The average number of egg per hen housed was determine as:
\[
\text{Egg number per hen} = \frac{\text{Total egg laid}}{\text{No. of hen housed}}
\]

Egg Weight:

The weights of the first 3 eggs of each hen were taken in grams at week 1, week 4, week 8 and week 12 of lay to determine average egg weight

Reproductive Traits

Fertility:

Fertility was determined based on total eggs set. Percentage fertility was expressed as:
\[
\text{Percentage fertility} = \frac{\text{Number of fertile eggs}}{\text{Total egg set}} \times \frac{100}{1}
\]

Hatchability:

This was expressed on the basis of fertile eggs and total eggs set.
Percent hatchability based on fertile egg = \[
\frac{\text{Number of hatched chicks}}{\text{Total fertile eggs}} \times \frac{100}{1}
\]
Percent hatchability base on total egg set (reproductive capacity) = \[
\frac{\text{Hatched chicks}}{\text{Total egg set}} \times \frac{100}{1}
\]

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 = \[
\frac{\text{Number of dead embryo}}{\text{Total no. of fertile eggs}} \times \frac{100}{1}
\]

Analysis of Data:

The design of the experiment was a nested or hierarchical design. In other word, random samples of dams were nested within random sample of sire.

Data Analysis:

The data collected from all the processes were analyzed using the restricted maximum likelihood (REML) procedure of SPSS Statistical software (2011). The linear model fitted to the body measurement data is as shown below:
\[
y_{ij} = \mu + S_i + e_{ij}
\]
Where \( y_{ij} \) = Single observation.
\( \mu \) = Overall mean (constant).
\( S_i \) = Fixed effects of sex
\( e_{ij} \) = Random residual error

RESULTS

Body Weight:

Table 1. shows the summary statistics of linear body parameters of Japanese quails. It was evident that shank length, breast girth, body length and wing length increased with age. Mean shank length at maturity was 3.93±0.15cm and a value of 1.39±0.14 at week 1. However, mean values for breast girth, body length and wing length at maturity were 6.51±0.07, 18.0±0.16 and 15.0±0.17cm with respective ranges of 2.30, 5.90 and 6.90cm. The coefficient of variation CV% in shank length presents an interesting trend. It was highest in week 2 (77.8%) but gradually reduces with age to a value of 43.6% at week 6. For wing lengths, breast girth and body length, highest CV(%) values of 54.4, 31.7 and 30.5, respectively occurred at week 1 and thereafter
respectively decreased to 12.8, 10.9 and 10.5 at week 6 (maturity).

The mean values and their standard errors of the mean for body weight at various ages are shown in Table 2. It was evident that regardless of sex, the mean body weight remarkably increased as the quail advanced in age. Body weight at hatch, 1, 2, 3, 4, 5 and 6 weeks of age averaged 5.74±1.10, 10.88±1.10, 23.70±1.18, 34.73±1.18, 54.54±1.19, 76.08±1.20 and 89.81±1.20g, respectively.

Table 3. Presents the least squares means of mortality rate, average daily weight gain, feed intake and feed conversion ratio. The mortality rates were 18.34%, 2.90% and 1.49% at between 0-1, 1-2 and 4-5 weeks, respectively. However, no mortality was recorded at between 2-3, 3-4 and 5-6 weeks age. Mortality rate decreased with age. The average daily gain was between 0.74±0.05g (week 0 - week 1) and 3.02±0.11g at 4-5 weeks of age. Average daily gain did not increased with chronological age, however feed intake increased with advancement in age and ranged from 3.12±0.09g in week 1 to 15.16±0.08g at the sixth week of age. Feed conversion ratio estimates were 3.01±0.18g at week 2 and 7.08±0.18g at week 6. Feed conversion ratio in quail increased gradually at the initial stage of life and later it increased largely as birds’ attained maturity.
Table (1): Summary statistics of linear body measurement (cm) of Japanese quails reared in southern guinea savannah zone of Nigeria

<table>
<thead>
<tr>
<th>Age/Parameters</th>
<th>Mean</th>
<th>Min.</th>
<th>Max.</th>
<th>Range</th>
<th>Var.</th>
<th>SD</th>
<th>SEM</th>
<th>CV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WK1 SL</td>
<td>1.39</td>
<td>1.00</td>
<td>1.90</td>
<td>0.90</td>
<td>0.38</td>
<td>0.62</td>
<td>0.14</td>
<td>44.63</td>
</tr>
<tr>
<td>BG</td>
<td>2.15</td>
<td>1.40</td>
<td>3.40</td>
<td>2.00</td>
<td>0.46</td>
<td>0.68</td>
<td>0.06</td>
<td>31.72</td>
</tr>
<tr>
<td>BL</td>
<td>5.78</td>
<td>4.50</td>
<td>9.00</td>
<td>4.50</td>
<td>3.11</td>
<td>1.76</td>
<td>0.15</td>
<td>30.46</td>
</tr>
<tr>
<td>WL</td>
<td>3.28</td>
<td>2.20</td>
<td>4.80</td>
<td>2.60</td>
<td>3.19</td>
<td>1.79</td>
<td>0.15</td>
<td>54.38</td>
</tr>
<tr>
<td>WK2 SL</td>
<td>2.19</td>
<td>1.80</td>
<td>2.60</td>
<td>0.80</td>
<td>2.90</td>
<td>1.70</td>
<td>0.15</td>
<td>77.75</td>
</tr>
<tr>
<td>BG</td>
<td>3.10</td>
<td>2.30</td>
<td>4.30</td>
<td>2.00</td>
<td>0.53</td>
<td>0.73</td>
<td>0.06</td>
<td>23.51</td>
</tr>
<tr>
<td>BL</td>
<td>9.24</td>
<td>6.80</td>
<td>12.30</td>
<td>5.50</td>
<td>3.52</td>
<td>1.88</td>
<td>0.16</td>
<td>20.30</td>
</tr>
<tr>
<td>WL</td>
<td>7.41</td>
<td>3.60</td>
<td>9.90</td>
<td>6.30</td>
<td>3.60</td>
<td>1.90</td>
<td>0.16</td>
<td>25.61</td>
</tr>
<tr>
<td>WK3 SL</td>
<td>2.50</td>
<td>2.00</td>
<td>3.10</td>
<td>1.10</td>
<td>2.86</td>
<td>1.69</td>
<td>0.15</td>
<td>67.49</td>
</tr>
<tr>
<td>BG</td>
<td>4.34</td>
<td>3.00</td>
<td>5.40</td>
<td>2.40</td>
<td>0.53</td>
<td>0.73</td>
<td>0.06</td>
<td>16.79</td>
</tr>
<tr>
<td>BL</td>
<td>11.49</td>
<td>7.60</td>
<td>14.50</td>
<td>6.90</td>
<td>3.47</td>
<td>1.86</td>
<td>0.16</td>
<td>16.22</td>
</tr>
<tr>
<td>WL</td>
<td>9.90</td>
<td>4.20</td>
<td>12.70</td>
<td>8.50</td>
<td>3.60</td>
<td>1.90</td>
<td>0.16</td>
<td>19.16</td>
</tr>
<tr>
<td>WK4 SL</td>
<td>2.91</td>
<td>2.20</td>
<td>3.50</td>
<td>1.30</td>
<td>2.90</td>
<td>1.70</td>
<td>0.15</td>
<td>58.43</td>
</tr>
<tr>
<td>BG</td>
<td>5.38</td>
<td>3.80</td>
<td>7.00</td>
<td>3.20</td>
<td>0.55</td>
<td>0.74</td>
<td>0.06</td>
<td>13.78</td>
</tr>
<tr>
<td>BL</td>
<td>14.50</td>
<td>10.00</td>
<td>18.00</td>
<td>8.00</td>
<td>3.52</td>
<td>1.88</td>
<td>0.16</td>
<td>12.93</td>
</tr>
<tr>
<td>WL</td>
<td>12.37</td>
<td>7.00</td>
<td>15.30</td>
<td>8.30</td>
<td>3.65</td>
<td>1.91</td>
<td>0.17</td>
<td>15.44</td>
</tr>
<tr>
<td>WK5 SL</td>
<td>3.21</td>
<td>2.70</td>
<td>3.70</td>
<td>1.00</td>
<td>2.93</td>
<td>1.71</td>
<td>0.15</td>
<td>53.32</td>
</tr>
<tr>
<td>BG</td>
<td>5.81</td>
<td>4.20</td>
<td>7.00</td>
<td>2.80</td>
<td>0.51</td>
<td>0.71</td>
<td>0.07</td>
<td>12.25</td>
</tr>
<tr>
<td>BL</td>
<td>16.84</td>
<td>12.80</td>
<td>19.00</td>
<td>6.20</td>
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<td>1.88</td>
<td>0.16</td>
<td>11.19</td>
</tr>
<tr>
<td>WL</td>
<td>13.80</td>
<td>10.00</td>
<td>17.50</td>
<td>7.50</td>
<td>3.68</td>
<td>1.92</td>
<td>0.17</td>
<td>13.90</td>
</tr>
<tr>
<td>WK6 SL</td>
<td>3.93</td>
<td>2.90</td>
<td>3.70</td>
<td>0.80</td>
<td>2.93</td>
<td>1.71</td>
<td>0.15</td>
<td>43.57</td>
</tr>
<tr>
<td>BG</td>
<td>6.51</td>
<td>5.30</td>
<td>7.60</td>
<td>2.30</td>
<td>0.51</td>
<td>0.71</td>
<td>0.07</td>
<td>10.94</td>
</tr>
<tr>
<td>BL</td>
<td>17.99</td>
<td>14.60</td>
<td>20.50</td>
<td>5.90</td>
<td>3.55</td>
<td>1.88</td>
<td>0.16</td>
<td>10.47</td>
</tr>
<tr>
<td>WL</td>
<td>15.00</td>
<td>11.00</td>
<td>17.90</td>
<td>6.90</td>
<td>3.68</td>
<td>1.92</td>
<td>0.17</td>
<td>12.79</td>
</tr>
</tbody>
</table>

WK= week, SL= shank length, BG= breast girth, BL= body length, WL= wing length, Var. =variance, SD=standard error of the mean, SD= standard deviation, CV=coefficient of variation.

Table (2): Least squares means±sem of body weight of Japanese quails at various ages

<table>
<thead>
<tr>
<th>Age (week)</th>
<th>No. of Observation</th>
<th>Body Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day-old</td>
<td>169</td>
<td>5.74±1.10</td>
</tr>
<tr>
<td>1</td>
<td>138</td>
<td>10.88±1.10</td>
</tr>
<tr>
<td>2</td>
<td>134</td>
<td>23.70±1.18</td>
</tr>
<tr>
<td>3</td>
<td>134</td>
<td>34.73±1.18</td>
</tr>
<tr>
<td>4</td>
<td>134</td>
<td>54.54±1.19</td>
</tr>
<tr>
<td>5</td>
<td>132</td>
<td>76.08±1.20</td>
</tr>
<tr>
<td>6</td>
<td>132</td>
<td>89.81±1.20</td>
</tr>
</tbody>
</table>
TABLE (3): Least squares means±sem of average daily gain (g), feed intake (g), feed conversion ratio and mortality rate (%) of Japanese quails raised in southern guinea savannah zone of Nigeria

<table>
<thead>
<tr>
<th>PERIODS (WEEK)</th>
<th>NO. OF OBSER.</th>
<th>MORTALITY RATE (%)</th>
<th>ADG (g)</th>
<th>FI (g)</th>
<th>FCR (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>138</td>
<td>18.34</td>
<td>0.74±0.05</td>
<td>3.12±0.09</td>
<td>4.22±0.20</td>
</tr>
<tr>
<td>1-2</td>
<td>134</td>
<td>2.90</td>
<td>1.83±0.05</td>
<td>5.50±0.08</td>
<td>3.01±0.18</td>
</tr>
<tr>
<td>2-3</td>
<td>134</td>
<td>0.00</td>
<td>1.58±0.09</td>
<td>7.65±0.07</td>
<td>4.84±0.19</td>
</tr>
<tr>
<td>3-4</td>
<td>134</td>
<td>0.00</td>
<td>2.87±0.13</td>
<td>11.63±0.08</td>
<td>4.05±0.16</td>
</tr>
<tr>
<td>4-5</td>
<td>132</td>
<td>1.49</td>
<td>3.02±0.11</td>
<td>14.03±0.09</td>
<td>4.65±0.17</td>
</tr>
<tr>
<td>5-6</td>
<td>132</td>
<td>0.00</td>
<td>2.14±0.18</td>
<td>15.16±0.08</td>
<td>7.08±0.18</td>
</tr>
</tbody>
</table>

ADG = Average daily gain, FI = feed intake and FCR = feed conversion ratio

Reproductive and Egg Production Performance:

The mean performance of reproductive traits of Japanese quails in the population studied is presented in Table 4. The average percentage fertility, early embryo mortality (%), late embryo mortality (%), hatchability (%) and reproductive capacity (%) were 80.72±1.03, 17.10±1.66, 12.42±1.24, 70.48±1.74 and 56.90±1.81, respectively. Age at first egg ranged from 46-63 days with a mean of 54.49±.20 days. Similarly, weight of first egg ranged from 6-10 g with a mean of 7.83±0.08 while body weight at first egg with a mean of 138.91±0.64 g ranged from 114-167g.

The hen-housed and hen-day egg productions are shown in Table 5. The hen-housed and hen-day egg production increased as month of lay increased. Hen-housed egg productions were 13.11, 16.61 and 17.57 percent for months 1, 2 and 3, respectively. The corresponding values for hen-day egg production were 19.23, 24.37 and 25.77 percent, respectively.

Table 5. presents short-term (three months) egg number, egg weight and egg mass of Japanese quails. Average monthly egg numbers per bird were 17.31±0.05, 21.93±0.08 and 23.19±0.11 for the 1st, 2nd and 3rd month of lay, respectively with a mean short-term egg number per bird of 62.43±0.23 eggs, egg weight of 8.43±0.06g and egg mass, 526.28±2.66. Egg numbers and egg mass increased with months of egg production.
Growth, production, japanese quails, humid environment.

Table (4): Reproductive performance of Japanese quails raised in the southern guinea savannah zone of Nigeria

<table>
<thead>
<tr>
<th>Parameters</th>
<th>No. of Observation</th>
<th>Mean±SEM.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertility (%)</td>
<td>297</td>
<td>80.72±1.03</td>
</tr>
<tr>
<td>Hatchability (%)</td>
<td>240</td>
<td>70.48±1.74</td>
</tr>
<tr>
<td>Reproductive capacity (%)</td>
<td>297</td>
<td>56.90±1.81</td>
</tr>
<tr>
<td>Early embryo mortality (%)</td>
<td>240</td>
<td>17.10±1.66</td>
</tr>
<tr>
<td>Late embryo mortality</td>
<td>240</td>
<td>12.42±1.24</td>
</tr>
<tr>
<td>Age at first egg (days)</td>
<td>43</td>
<td>54.49±0.20</td>
</tr>
<tr>
<td>Body weight at first egg (g)</td>
<td>43</td>
<td>138.91±0.64</td>
</tr>
<tr>
<td>Weight of first egg (g)</td>
<td>43</td>
<td>7.83±0.08</td>
</tr>
</tbody>
</table>

Table (5): Short-term hen-day and hen housed egg production of Japanese quails raised in the southern guinea savannah zone of Nigeria

<table>
<thead>
<tr>
<th>Month of Lay</th>
<th>No. of Observation</th>
<th>Hen-housed (%)</th>
<th>Hen-day (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42</td>
<td>13.11</td>
<td>19.23</td>
</tr>
<tr>
<td>2</td>
<td>42</td>
<td>16.61</td>
<td>24.37</td>
</tr>
<tr>
<td>3</td>
<td>42</td>
<td>17.57</td>
<td>25.77</td>
</tr>
</tbody>
</table>

Table (6): Some egg parameters of Japanese quails in the first three months of lay

<table>
<thead>
<tr>
<th>Month of Lay</th>
<th>No. Of Birds</th>
<th>Egg no. Per Bird</th>
<th>Egg Weight (g)</th>
<th>Egg Mass (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42</td>
<td>17.31±0.05</td>
<td>8.41±0.12</td>
<td>145.578±2.33</td>
</tr>
<tr>
<td>2</td>
<td>42</td>
<td>21.93±0.08</td>
<td>8.28±0.09</td>
<td>181.58±2.08</td>
</tr>
<tr>
<td>3</td>
<td>42</td>
<td>23.19±0.11</td>
<td>8.60±0.04</td>
<td>199.43±3.02</td>
</tr>
<tr>
<td>Mean value</td>
<td>42</td>
<td>62.43±0.23</td>
<td>8.43±0.06</td>
<td>526.28±2.66</td>
</tr>
</tbody>
</table>
DISCUSSION

Growth Traits:

As expected, body weight in Japanese quails increased as the birds advanced in age. Body weight at hatch obtained in this study is in agreement with the findings of Aboul-Seoud (2008) and Ojo et al. (2011) who reported values that ranged between 4.78 and 6.60g for both sexes in random bred populations. Body weight at 1, 2, 3, 4, 5 and 6 weeks of age were lower than those reported by (El-Full et al., 2001; Abdel-Fattah, 2006; Abdel-Tawab, 2006 and Daikwo, 2011). The observed differences when compared with these earlier studies could be due to differences in the climate and managerial conditions under which different flocks were reared. Also, due to selection for increased body weight and possible differences in genetic make-up of the different flocks, body weight at different ages could differ for different population.

Growth rate of the birds was very slow initially (during 0-1 week of age) but became faster as the birds advanced in age. The highest growth rate (3.02±0.11g/day) was shown during the period from 4-5 weeks of age. This pattern of growth is similar to the findings of (Aboul-Hassan, 1997 and 2001 and Aboul-Seoud, 2008). The growth rate achieved during 1-2 weeks period in this study agreed with Aboul-Hassan (1997) who reported a range of 1.66-2.64g/day for average daily gain from 0-2 weeks. Average daily gain for 2-3, 3-4, 4-5 and 5-6 weeks periods also agreed with a range of 1.36-3.30g/day for 2-6 weeks periods as reported by (Aboul-Hassan, 1997). However, the values of average daily gain obtained in this study differed from what El-Full et al. (2001), Abdel-Fattah et al. (2006), Vali (2009) and Daikwo (2011) earlier reported. The observed differences could have been caused by genetic differences, management and other non-genetic factors.

Feed intake increased with advancement in age and body weight. Mark (1993) reported a similar pattern of increment in feed intake with increasing age and body weight. Values obtained for feed intake in this study fairly agreed with the findings of Vali (2009) who reported 2.63, 6.55, 9.80, 11.60, 15.25, 18.19 and 19.14g as individual feed intake at 1, 2, 3, 4, 5, 6 and 7 weeks of age respectively in Japanese quails.

The values of feed conversion ratio obtained in this study for 0-1, 1-2, 2-3, 3-4, and 5-6 weeks periods, respectively were higher than 1.96, 2.02, 2.72, 2.70 and 4.67g reported by Vali (2009) for the same periods. However, the value of FCR (4.65±0.17) observed at week 4-5 is similar to 4.07 reported by Vali (2009) for Japanese quails. The high feed to gain ratio observed during the first week in this study when compared to the 1-2 weeks period, could be due to wastage of feed as the chicks were learning to feed. Between 2-5 weeks, the rates of feed conversion were fairly uniform and efficient. The value of 7.08 obtained during 5-6 weeks showed that the quails became less efficient in converting feed at maturity. Possible reasons for the differences in the feed conversion ratio (FCR) might be due to climate, feed type and strains of the birds used for the experiment.

Mortality rate of 18.34% observed in this study between hatch and 1 week of age is fairly higher than 16.67% reported by Roshdy et al. (2010). Value of 2.90% for week 1-2 falls within 2.20 and 10.00 % as the mortality rate of quails housed in pens and cages, respectively while 1.49 % obtained for 4-5 week is less than 2.20 % reported by Roshdy et al. (2010). Generally, mortality rate decreased with increasing age as similarly reported by Seker et al. (2009). These authors equally reported higher but non-significant (p>0.05) mortality in larger group (8.33%) of quails than smaller group (6.67%).
Variation in mortality rate could be due to differences in incubator used, management, environment, stocking density, system of housing and diseases.

Reported values for linear body measurements for quails are very scanty in literature as compared to other poultry types such as the chicken. This might be due to some practical problems associated with measurement of the traits such as the small size of the bird and the need for careful handling of birds to measure these traits. Among the linear body measurements, shank length demonstrated the greatest variability at all ages except week 1. This high variability inherent in shank length could be used for breed characterization as well as selection tool for genetic improvement. The shank length values obtained at different ages in the present study fairly agreed with Adeogun and Adeoye (2004) who reported 1.47, 1.76, 2.18, 2.67, 3.05, 3.35 and 3.36cm as average shank length at hatch, 1, 2, 3, 4, 5, 6 and 7 weeks of age, respectively.

Reproductive and Egg Production Performance:

The percentage fertility (80.72±1.03) recorded in this study falls within the range of 66.7-85.8% and 72-92% reported by Sachdev et al. (1985) and Wilson et al. (1961), respectively. However, it is lower than 85.41% reported by Daikwo (2011) but higher than the values documented by (Mark, 1980; Aboul-Hassan et al., 1999 and Kurshid et al., 2004). Fertility of 80.72% would suggest that Japanese quails are highly fertile and could, therefore, be utilized efficiently in meat and egg production enterprise.

Percentage hatchability (70.48±1.74) reported in this study agreed with the findings of Chahil et al. (1975) who obtained a wider range of 65.0 to 88.9% for 10 weeks old Japanese quails and El-Fiky et al. (1996) who reported a range of 68.2-78.5% during 3 consecutive generations. This hatchability value is also similar to 71.52% reported by Daikwo (2011). Lower values of hatchability (50.8 and 67.6%) were reported by Mark (1979) and Kurshid et al. (2004), respectively. The percent reproductive capacity (hatchability based on total egg set) of 56.90±1.81% observed in this study is above the value reported by Kurshid et al. (2004) who reported 55.14% as the percent hatchability base on total egg set but lower than 58% and 61.31±1.93 reported by Farooq et al. (2001) and Daikwo (2011), respectively. Reproductive capacity is of more practical important to the farmer than hatchability. Higher hatchability in the present study could be due to better fertility than that reported by (Kurshid et al., 2004).

The present value of 17.10±1.66 for early embryonic mortality is higher than 5.0-9.5% reported by (El-Fiky et al., 1996). However, late embryonic mortality (12.42±1.24%) is lower than the finding of El-Fiky et al. (1996) who reported between 16.50 and 22.20% for late embryonic mortality. Daikwo (2011) reported higher (18.59±1.85%) early and lower (9.89±1.31) late embryonic mortality. The variations observed could be due to the differences in pre-incubation storage, holding period, mating ratio and incubators used.

The body weight at first egg of 138.91±0.64g obtained in this study is higher than the value of 132.1g reported by Wilson et al. (1961) but lower than 145.2g and 145.68±0.74g as reported by (El-Ibiary et al., 1996 and Daikwo, 2011). Cerit (1997) and El-Deen et al. (2008) reported very high values of 202.3g and 183.55g, respectively for this trait. The variation between the observed value in this study and those values reported by these authors for this trait could be due to the fact that the birds used for this study has not been subjected to selection for body weight at first egg as some of those under reference.

The 7.83±0.08g reported for weight of first egg in this study is similar to 7.12±0.06g obtained by Daikwo (2011) but lower than the values of 8.99-9.72 and 9.33
Age at first egg (54.49±0.20) obtained in this study falls within the range of 45.3-58.9 days reported by Mark (1979) and 50.94-61.22 days reported by El-Deen et al. (2008) and El-Full (2001) respectively. Sezer et al. (2006) documented that, Japanese quails lay her first egg at an early age of 45.82±0.22 days. However, Thomas and Ahuja (1988) and Daikwo (2011) reported that the age at sexual maturity was 48.9-49.6 and 47.01±0.22 days, respectively in Japanese quail. Age at first egg can be very variable because it is affected by feeding and management practices. Early age at first egg can be very advantageous because selection for it could lead to reduced generation interval but for commercial egg production it might lead to many small eggs which may not find a ready market. However, if early age at first egg is accompanied by a corresponding increase in body weight then the egg size could also increase.

The part-period (3 months) egg production of 62.43±0.23 eggs per quail hen observed in this study is lower than the value of 72.19±0.22 eggs reported by Daikwo (2011). Nestor et al. (1983) reported that egg production during the first 60 days of laying in Japanese quails ranged from 54.5 to 56.5 eggs in random bred population. El-Fiky and Aboul-Hassan (1995) reported an estimate of 54.8 eggs for 60 days. Abdel-Tawab (2006) recorded an average egg number per female Japanese quail among a base population during the first 10 weeks of lay as 56.12 eggs. Egg production in Japanese quail is variable. This could be due to strains differences, feeding, climate and management. Percentage hen-day and hen-house egg production are fairly high and could ensure adequate supply of eggs to consumers. High hen-day shows the effectiveness of production while hen-house indicated good management.

The part period egg weight and egg mass of 8.43±0.06g and 526.28±2.66g obtained in the present study were similar to 8.19±0.04 and 590.88±0.24g reported by Daikwo (2011). Variation in part period egg weight could be due to genetic and non-genetic factors while observed differences in egg mass are due to varying egg number and egg weight since egg mass is a product of egg number and weight.

Conclusion

The findings on growth and reproductive performance of Japanese quails in this study suggest that the environment is favorable for their multiplication and growth and therefore can serve as an alternative source of protein to the populace, thus adequate publicity is required to propagate the production of this bird to increase animal protein intake in this environment.
REFERENCES


