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National Animal Production Research Institute
Ahmadu Bello University
P.M.B 1096, Shika-Zaria,
Kaduna State, Nigeria.
Email:japr@napri.gov.ng Url:journals.napri.gov.ng

EFFECT OF AGE AND MATING RATIO ON HATCHABILITY OF JAPANESE QUAILS (*Coturnix coturnix japonica*)

[1]Jimoh, A. E., [2]Orunmuyi, M. and [1]Mallam, I.
[1]Department of Animal Science, Ahmadu Bello University, Zaria.
[2]Department of Animal Science, Faculty of Agriculture, Federal University, Oye, Ekiti.
**Corresponding Author: emmanueljimoh1414@gmail.com; +2348052828686*

ABSTRACT

The study was carried out to determine the effect of breeder age and mating ratio on the fertility and hatchability characteristics in Japanese quail (*Coturnix coturnix japonica*) eggs. A total of 56 healthy quails were randomly selected from a breeding population. They were selected based on two different age groups as young (8week old) and old (24week old). Each of the age groups had 28 quails each comprising of 8 males and 20 females separated into four different mating ratios of 1:1, 1:2, 1:3 and 1:4 replicated twice. Eggs were collected, stored and set in the incubator. A total of 118 eggs were collected and set for the younger aged quails (8week old) while 121 eggs were collected and set for the older aged quails (24 weeks old) and for male to female mating ratios; 1:1, 1:2, 1:3, and 1:4 had the following egg numbers 24, 45, 71 and 99 eggs were collected and set in the incubator for hatching. Data collected were subjected to Analysis of Variance (ANOVA) using the General Linear Model (GLM) procedures of SAS (2004) means were compared using Duncan Multiple Range Test. Differences in age had significant ($P<0.01$) effect on fertility, embryonic mortality and hatchability. Mating ratio had significant effect on fertility as 1:1 male to female had 100% fertility and 1:4 with the lowest fertility of ($P<0.01$). Mating ratio had significant ($P<0.01$) effect on embryo mortality; 1:1 mating ratio had the lowest while 1:3 had the highest percentage dead in germ. Significant effect ($P<0.01$) on hatched eggs due to mating ratio was observed with 1:2 having the highest hatched eggs with 79.00% and lower in 1:3 and 1:4 with 68.64 and 69.15%, respectively. There was significant ($P<0.01$) effect on hatching characteristics by the interactions between breeder age and mating ratios with younger aged quail at 1:2 male to female ratios having the highest percentage value of 83.33%. The 1:2 males to female ratios of 8 weeks old as breeder stock are recommended for better fertility and hatchability.

Keywords: Japanese quails, breeder age, mating ratio, fertility, hatchability.

INTRODUCTION

The Japanese quails (*Coturnix coturnix japonica*) are hardy birds that thrive in small cages and are inexpensive to keep. They are fairly disease resistant. Japanese quail mature in about 6 weeks and are usually in full egg production by 50 days of age. With proper care, hens should lay 200 eggs in their first year of lay. Life expectancy is only 2 to 2½ years (Darden and Marks, 1988). If the birds have not been subjected to genetic selection for body weight, the adult male quail will weigh about 100–140 g, while the females are slightly heavier, weighing from 120–160g (Darden and Marks, 1988).

The females are characterized by light tan feathers with black speckling on the throat and upper breast. The males have rusty brown throat and breast feathers. Males also have a cloacal gland, a bulbous structure on the upper edge of the vent that secretes a white, foamy

material. This unique gland can be used to assess the reproductive fitness of the males.

Quails are naturally endowed with rapid growth, early sexual maturity, high reproductive ability and of much lower feed and space requirement than the chicken (Adeogun and Adeoye, 2004).

Fertility and hatchability are affected by a number of factors. Changes due to many biological features as a result of ageing of individual bird or flock should be expected as its true for all living organisms (Koçak and Özkan, 2000). One of the notable differences observed in the egg due to ageing is the increase in egg weight (Dafwang, 2006). One of the factors affecting fertility is male to female ratio. It is generally acknowledged that fertility decreases with increasing female to male ratio (Dafwang, 2006).

The results of this study will provide necessary framework on the improved mode of quail production in order to increase output, help scientists, breeders and extension delivery agencies in providing useful information of adequate ages and mating ratio at which quails should be bred. The study was aimed at determining the effect of breeder age on the hatching characteristics, mating ratio on hatching characteristics and the interaction between ages and mating ratio on hatching characteristics of Japanese quail (*Coturnix coturnix japonica*)

MATERIALS AND METHODS

Experimental site

The study was conducted at the Department of Animal Science Research Farm, Faculty of Agriculture, Ahmadu Bello University, Zaria located within the Northern guinea savannah zone of Nigeria at latitude 11^0 09' 06'' N and longitude 7^0 38 55'' E, at an altitude of 706m above sea level (IAR Meteorological Unit, 2012).

Experimental Animals and Design

A total of 56 healthy Japanese quails were randomly selected from a randomly bred population of quails at the quail unit of the Departmental of Animal Science, Ahmadu Bello University, Zaria. They were selected from two different age groups: the first age group (young) was 8 weeks old and the second was 24 weeks old. Each of these ages had 28 quails each made up of 8 males and 20 females and allotted to 4 different mating ratios: 1:1, 1:2, 1:3 and 1:4 with two replicates each. Birds were fed *ad libitum* on diets made up of 26% CP and 2741 Kcal/kgME from day old to four weeks after which selected individuals were fed breeder diet containing 23% CP and 2990Kcal/kgME as suggested by (Elibol *et al*., 2002) from the 4^{th} week throughout the period of the study for both age groups. Clean drinking water was given *ad libitum* and the animals were mated at 6 weeks old.

Egg collection, Incubation and Hatching

The eggs were collected every morning at 7:00am and stored inside a carton partitioned according to age and mating ratio and kept at room temperature within the six days of collections after which the eggs were taken to a private hatchery where it was fumigated and set in the incubator at temperature of about 37.8^oC and the relative humidity of 65-75%. The eggs in the incubator were turned at every 6 hour interval until the 14^{th} day of setting when they were transferred to the hatcher and 90% humidity was maintained. The eggs hatched 17 days after setting and the chicks were collected and counted. The unhatched eggs were also collected and analysed for fertility, infertility (clear), dead in germ and dead in shell. An egg was either clear (not fertile) or Not clear (Which may either be fertile having a living or dead chick.

Hatching parameters were calculated as follows:

Hatchability % =

$$\frac{\text{Number of chicks hatched}}{\text{Number of fertile eggs}} \times 100$$

Fertility % = Number of fertile eggs X 100
Total number of eggs set

Hatch % = Number of chicks hatched X 100
Total number of eggs set

Data analysis

All data collected were subjected to Analysis of Variance (ANOVA) and means were compared for significance using Duncan's Multiple Range Test (Duncan, 1955) of SAS (2004).

RESULTS AND DISCUSSION

Effect of age on hatchability

The effect of age on hatchability parameters of Japanese quails are shown in Table 1. Age had significant (P<0.01) effect on hatchability parameters. The highest was obtained at week 8. The young parents had higher (18.40%) infertile eggs than old parents (15.60%). Young parents recorded lower (8.71%) dead in germ than old parent with 12.00%. Percentage of dead in shell eggs was lower (14.18%) in young compared to the old stock (17.16%), which occurred at an intermittent, occurrence. Fertility was lower (81.61%) in young flock compared to older flock (84.42%), which is high.

The result of the hatchability is in agreement with work of (Gabriel *et al*., 2001) who reported that age having a significant effect on fertility. The hatched eggs were higher in young stocks and lower in old stocks with 76.95 and 70.86% respectively. This is also in agreement with the work of (Ipek, *et al*., 2004) who reported that there is a significant effect on fertility and hatchability by increasing breeder age. Similarly, hatchability of fertile eggs in the Japanese quails is higher in young quails than old quails.

Table 1: Effect of age on hatchability parameters of Japanese quails

Parameters (%)	Age1 (8wk old)	Age2 (24wk old)	SEM	LOS
Pclr	18.40[a]	15.60[b]	0.06	**
Pdig	8.71[b]	12.00[a]	0.07	**
Pdis	14.18[b]	17.16[a]	0.09	**
Pfert	81.61[b]	84.42[a]	0.06	**
Phatch	76.95[a]	70.86[b]	0.09	**
Tpfert				
Tphatch				

Means within the same column with different superscript are significantly different, Pclr = percentage clear, Pdig = Percentage dead in germ, Pdis = percentage dead in shell, Pfert = Percentage fertile, Phatch = Percntage hatched, LOS = level of significance, SEM = standard error of mean. Significant difference at 1% level of probability ****** **(**P<0.01).

Effect of mating ration on hatchability

The single effect of mating ratio on hatchability parameters of Japanese quails are presented in Table 2. There was significant (P<0.01) effect of mating ratio on hatchability of eggs which increased with increasing mating ratios of 1:1, 1:2, 1:3 and 1:4 with 0.00, 20.54, 21.04 and 26.40%, respectively. There were significant (P<0.01) effect on dead in germ between the various mating ratios of 1:1, 1:2, 1:3 and 1:4 with 3.60, 5.28, 8.65 and 14.21%, respectively. The highest dead in shell was obtained in 1:3. There was significant (P<0.01) effect on dead in shell chicks between the various mating ratios of 1:1, 1:2, 1:3 and 1:4 with 17.60, 15.75, 12.75, and 16.65%, respectively. This is in agreement with (Gabriel *et al.*, 2001) who reported a significant effect on embryonic mortality by varying mating ratios. The author recorded highest dead in shell in 1:1. The

differences obtained in fertility could be due to differences in mating ratios (1:1, 1:2, 1:3 and 1:4). This is in agreement with Gabriel *et al.* (2001) who reported a significant effect on flock fertility by mating ratios as 1:1 as the best. This contradicts the report of Uluocak and Okan (1993) who obtained lowest fertility in 1:1 ratio.

Table 2: Effect of mating ratio on hatchability parameters of Japanese quails

Parameters	1:1	1:2	1:3	1:4	SEM	LOS
Pclr	0.00^{d}	20.54^{c}	21.04^{b}	26.40^{a}	0.04	**
Pdig	3.60^{d}	5.28^{c}	18.64^{a}	14.21^{b}	0.05	**
Pdis	17.60^{a}	15.75^{c}	12.72^{d}	16.65^{b}	0.07	**
Pfert	100.00^{a}	79.50^{b}	78.96^{c}	73.63^{d}	0.04	**
Phatch	78.90^{b}	79.00^{a}	68.64^{d}	69.15^{c}	0.06	**

Means with different superscript within the same column are significantly different, $P \leq 0.01$, Pclr= percentage clear, Pdig= Percentage dead in germ, Pdis= percentage dead in shell, Pfert= Percentage fertile, Phatch= Percntage hatched, LOS= level of significance, SEM= standard error of mean. LOS= level of significance, Significant difference at 1% level of probability **** (**$P<0.01$).

Interaction between age and mating ratio on hatchability

The interaction between age and mating ratio on hatching parameters of Japanese quails are shown in Table 3. There was significant ($P<0.01$) effect of interaction between age and mating ratio on hatching parameters of Japanese quails. The young breeders aged at 1:1, 1:2, 1:3 and 1:4 had the following values for number of hatched chicks 4.00, 5.50, 11.00 and 13.50, respectively while the old stocks at had 5.50, 8.50, 8.00 and 11.50, respectively.

The young breeders aged at 1:1, 1:2, 1:3 and 1:4 had the following values: Infertility had 0.00, 26.79, 21.78 and 25.00%; dead in germ had 0.00, 5.56, 14.66 and 15.26%, respectively; dead in shell had 21.00, 11.11, 9.38 and 15.39%, respectively; fertility had 100.00, 73.21, 78.22 and 75.00%, respectively and hatchability had 79.20, 83.33, 75.96 and 69.34% respectively. The results of fertility obtained were in agreement with Gabriel *et al.* (2001) who reported a significant interaction between age and mating ratios. The results also were similar with the report of Uluocak and Okan (1993).

Table 3: Interaction between age and mating ration on hatchability parameters of Japanese quails

Treatment	1:1	1:2	1:3	1:4	1:1	1:2	1:3	1:4	SEM	LOS
Pclr	0.00^{g}	26.79^{b}	21.78^{d}	25.00^{c}	0.00^{g}	14.29^{f}	20.30^{e}	27.75^{a}	0.03	**
Pdig	0.00^{g}	5.56^{e}	14.66^{c}	15.26^{b}	7.14^{d}	5.00^{f}	22.62^{a}	13.16^{c}	0.04	**
Pdis	21.00^{a}	11.11^{g}	9.38^{h}	15.39^{e}	14.29^{f}	20.38^{b}	16.07^{d}	17.90^{c}	0.05	**
Pfert	100.00^{a}	73.21^{f}	78.22^{d}	75.00^{e}	100.00^{a}	85.71^{b}	79.70^{c}	72.25^{g}	0.03	**
Phatch	79.20^{b}	83.33^{a}	75.96^{d}	69.34^{f}	78.57^{c}	74.62^{e}	61.31^{h}	68.95^{g}	0.04	**

Age1 (young: 8wk old) Age 2(old: 24wk old)
Mean with different superscript within the same row are significantly different, Significant difference at 1% level of probability ****(**$P<0.01$). , Noset = number of egg set, Noclr = number of clear egg, Nodig = number dead in germ, Nodis = number dead in shell, Nofert =Number of fertile egg, Nohatch = Number of hatched eggs, Pclr = percentage clear, Pdig = Percentage dead in germ, Pdis = percentage dead in shell, Pfert = Percentage fertile, Phatch = Percntage hatch, LOS = level of significance, SEM = standard error of mean.

CONCLUSION AND RECOMMENDATIONS

Age is found to have significant effect on hatching characteristics between 8 and 24 week old quails with young Japanese quails, having the highest hatchability of 76.95%

Male to Female ratio was found to be significant important on reproduction characteristics in quails with ratio 1:2 having the highest hatchability of 79.50%.

The interaction between age and mating ratios had significant effect on hatching parameters of Japanese quails with young age group (8week) interacting with mating ratio 1:2 having the hatchability of 83.33%. For better hatchability of fertile eggs and better economic returns, breeder farm managers should use 1:2 males to female ratios of 8 weeks old as breeder stock.

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