THE EFFECT OF AGE AND EGG SIZE OF JAPANESE QUAILS ON FERTILITY AND HATCHABILITY

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ABSTRACT
288-six weeks old Japanese quails at the point of lay were used to determine the effect of age and egg size on the fertility and hatchability of quail eggs after adjusting for three weeks. Eggs were taken daily from the birds with a mating ratio of one cock to four hens for a period of five days when the quails attained 9, 13, 17 weeks old respectively and sorted on the basis of small (<9g), medium (9-10g) and large eggs (>10g) using a sensitive electronic scale. The eggs were stored in a temperature of 15^{o}C before setting in the incubator to inhibit embryonic development in an experiment that lasted for 12 weeks. The small, medium and large eggs collected at the corresponding ages of 9, 13 and 17 weeks were assigned into a 3 x 3 factorial arrangement in a completely randomized design having six replicates each. Results obtained revealed that percent fertility was highly significantly (P<0.01) affected by age with a fertility of 92.90% at 13 weeks followed by 89.92%, 82.91% at 9 and 17 weeks. The percent hatchability was significantly (P<0.05) affected by egg size and the best recorded in the medium eggs with 69.58% in relation to the large and small eggs having 64.95% and 63.62%, respectively. The fertility and hatchability were neither affected (p>0.05) by the interaction effects of age and egg size. In conclusion, the age of quails had significant effect on fertility of quail eggs whereas the hatchability was affected by egg size.
Keywords: Japanese quails, age, egg size, fertility, hatchability.

INTRODUCTION
Fertility and hatchability of chicken eggs is determined by an array of factors such as physiological, social, environmental and genetic makeup of the birds (Islam *et al.,* 2002). The reproductive performance of livestock particularly avian is severely affected by the age of the bird (Brillard, 2003). The author reported that the decline in fertility of the hens may be related to the inability of the hens to retain spermatozoa in the oviduct while the fertility of the cocks is a function of its ability to successfully mate and deposit adequate quality and quantity of semen in the hen's reproductive tract. A reoccurring setback observed with the commercial broiler breeders is the sharp decline recorded in its fertility at the declining phase of its laying period which occurs as the hens attain 50 weeks of age (Walsh and Brake, 1997). Munir and Mohammed (2010) reported that there was an increased percent fertility and hatchability in Arbor acre and Lohman brown hybrid layers between the ages of 24-45 weeks which was followed by a decrease in the fertility and hatchability when the birds increased in age from 50-65 weeks. The factors which affects both sexes has its peculiarity with the age of the bird. The influence of age relating it with other factors as they affect fertility and hatchability of eggs is not clearly understood (Bramwell, 2009).
In the findings of Abiola*et al.* (2008), the author opined that from the three categories of small, medium and large sized eggs of broiler chickens, the best hatchability of 96.67% was obtained in the average eggs compared with the large and small eggs. There is paucity of information regarding the factors affecting the fertility and hatchability of quail eggs. The precise causes are yet to beascertained. The predisposing factors in commercial poultry birds may also apply to quail eggs (Gonzalez *et al.,* 1999). This work was designed to substantiate the effect of age and egg size of Japanese quails on its fertility and hatchability.

MATERIALS AND METHODS
The experiment were conducted in the poultry unit, Teaching and Research Farm of Ahmadu Bello University, Samaru, Zaria and the hatchery unit, College of Agriculture, Mando, Kaduna respectively. According to Akpa*et al.* (2002), Zaria is within Latitude 11^{o} 12^{1}N and longitude 7^{o} 12^{1}E. The altitude is 610m above the sea level and located in the Northern Guinea Savannah zone of Nigeria. The National Veterinary Research Institute (NVRI) Vom, Plateau state, Nigeria supplied the quails used for

this study.The number of Japanese quails used for the study was 288-six week's old unsexed Japanese quails with a mating ratio of one cock to four hens which were raised in cages partitioned into $0.5m^2$ to house each group of four quails (a cock and four hens). The quails were fed a formulated diet of 23% crude protein from six to eighteen weeks of age. The management practices involved in raising the birds with regard to the feeding, lighting and watering were the same in the course of the twelve week experimental period. Eggs were taken daily from the birds for a period of five days when the quails were nine, thirteen and seventeen weeks old respectively and stored in a room with a temperature of 15^oC prior to setting in the incubator to inhibit embryonic development. The egg classification were as follows; eggs weighing below nine, nine to ten and above ten grams were classified as small, medium and large eggs using an electronic scale at the corresponding age taken. Each batch of eggs from the corresponding ages together with the different egg sizes were individually set on marked trays with six replicates and each having a minimum of 80 eggs. The eggs were further set in the incubator for 15 days and hatched on the 18^{th} day. Candling of the eggs was carried out on the 15^{th} day as follows; the infertile eggs were removed before onward transfer to the hatcher and the chicks were hatched on the 18^{th} day. The fertility and hatchability were determined as follows:

Percent fertility = Total fertile eggs/Total eggs set in the incubator x 100

Percent hatchability = Total chicks hatched/ Total fertile eggs from the incubator x 100

The small, medium and large eggs collected at the corresponding ages of nine, thirteen and seventeen weeks were assigned into a 3 x 3 factorial arrangement in a completely randomized design.

Statistical Analysis

The generated data from the experiment was analyzed using the General Linear Model Procedure of SAS (1993). The least significant difference was used to separate the means in the treatment groups where significant differences were observed.

The model used for the analysis of data generated in this study is shown below:

$Y_{ijkl} = \mu + A_i + S_j + (AS)_k + E_{ijkl}$

Where: Y_{ijkl} = Response variable (fertility or hatchability) as the case were:

μ = Overall mean

A_i = Effect of i_{th} age of quail hens

S_j = Effect of j_{th} egg size

AS_k = Interaction effect of age of quail hens and egg sizes on fertility or hatchability

E_{ijkl} = Random error

RESULTS

The effect of age and egg size on the percent fertility and percent hatchability is presented on Table 1. Percent fertility was highly significantly ($P<0.01$) affected by age, whereas egg size and the interaction effect of age and egg size had no significant ($P>0.05$) effect on the percent fertility of the quail eggs. The pattern revealed that as the birds increased in age from 9 to 13 weeks, there was an increase in the percent fertility and subsequently declined at 17 weeks as the birds advanced in age suggesting that the best fertility is obtained in quails at 13 weeks of age after which there is a gradual decline. The percent hatchability was significantly ($P<0.05$) affected by egg size and was neither affected by the age or the interaction effects of age and egg size. The best hatchability was obtained in the medium sized eggs followed by the large and small sized eggs respectively.

DISCUSSION

The increase in the percent fertility as the quails increased in age could be as a result of higher sexual activity at the 9^{th} and 13^{th} week while the decrease at the 17^{th} week could be as a result of decreased sexual activity as birds advanced in age. This is in agreement with the report of Bramwell (2009), that the decrease in fertility and hatchability with increasing hen age may be due to a decline in the ability of the older hens to retain sperm in the special sperm host glands of the oviduct and the ability of the cock to successfully mate and deposit adequate quality and quantity of semen in the hen's reproductive tract. The author noted that, in all avian species, as well as in other animals, increasing age has an adverse effect on reproductive performance.Abiola*et al*. (2008) reported that younger flocks in broiler parents (aged between 29 and 41 weeks) compared with older flocks (aged between 52 and 68 weeks) achieved considerably higher intensity of laying and produced more fertilized eggs. The higher percent hatchability recorded in the medium sized eggs in relation to the large and small eggs in Japanese

quails implies that hatchability of quail eggs is a function of the egg size. This is in line with the findings of Gonzalez *et al*. (1999) in a related study who suggested the setting of eggs of average weight in other to achieve good hatchability. These assertions also corroborates the findings of Abiola*et al.* (2008) who reported the highest hatchability of 96.67% in medium eggs and the lowest of 82.88% for large eggs in broilers. The range in the percent hatchability of 61.84%-72.45% obtained for Japanese quails in this study conformed to the range of 62.63 to 71.19% reported by Musa *et al*.(2007) and Bawa*et al*. (2011), respectively.

CONCLUSION AND RECOMMENDATION

It can be concluded that in Japanese quails, the peak in fertility is 9 to13 weeks with the value of 89.92-92.90% followed by a gradual decline of 82.91% after 17 weeks of age. The best hatchability is obtained in the medium sized eggs followed by the large and small eggs. In Japanese quails, age plays a critical role in the fertility of the eggs whereas hatchability is a function of the egg size. The fertility and hatchability were neither affected by the interaction effects of age and egg size respectively.

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Table 1:Effect of Age and Egg size on Percent Fertility and Hatchability of Japanese Quails

Factor	Fertility %	Hatchability %
Age(weeks)	**	NS
	LSMeans±SE	LSMeans±SE
9	89.92[a] ± 2.05	64.93 ± 1.65
13	92.90[a] ± 2.05	65.82± 1.65
17	82.91[b] ± 2.05	67.40± 1.65
Egg size	NS	*
Small	86.12 ± 2.05	65.74[b] ± 1.56
Medium	90.78 ± 2.05	69.58[a] ± 1.56
Large	88.83 ± 2.05	65.95[b] ± 1.56
Interaction	LSMeans ± SE	LSMeans ± SE
Age X Egg size	NS	NS
9 X Small	82.22 ± 3.56	63.35 ± 2.86
9 X Medium	93.33 ± 3.56	67.63 ± 2.86
9 X Large	94.22 ± 3.56	63.79 ± 2.86
13 X Small	92.82 ± 3.56	61.84 ± 2.86
13 X Medium	92.77 ± 3.56	72.45 ± 2.86
13 X Large	93.10 ± 3.56	63.17 ± 2.86
17 X Small	83.33 ± 3.56	65.67 ± 2.86
17 X Medium	86.25 ± 3.56	68.65 ± 2.86
17 X Large	79.16 ± 3.56	67.87 ± 2.86

SE=Standard error;* = P< 0.05; ** = P< 0.01; [a,b]Means with different superscript in the same column are significantly (P<0.05) different; NS=Non Significant(P> 0.05);%=Percent.