ISSN 2320-1355

JOURNAL OF GLOBAL BIOSCIENCES

Volume 3, Number 7, 2014

Website: www.mutagens.co.in
E-mail: submit@mutagens.co.in
researchsubmission@hotmail.com

Journal of Global Biosciences
ISSN 2320-1355
Volume 3, Number 7, 2014, pp. 1105-1110
Website: www.mutagens.co.in
E-mail: submit@mutagens.co.in
researchsubmission@hotmail.com

Research Paper

HATCHING PERFORMANCE OF PURE BRED JAPANESE QUAIL BREEDERS UNDER CAGE AND DEEP LITTER SYSTEMS OF REARING

Arumugam, R., R. Prabakaran and T. Sivakumar

Department of Livestock Production and Management,
Madras Veterinary College,
Tamil Nadu Veterinary and Animal Sciences University,
Chennai - 600 007.

Abstract

A study was conducted to assess the comparative hatching performance of Japanese quail pure bred parent breeders under deep litter and cage systems of management. Significant (P≤0.01) differences were observed in hatchability on total eggs set between deep litter and cage systems of rearing (55.44 ± 1.25 *vs* 50.81± 1.54). Age effect was also highly significant (P≤0.01) with the same at 20 weeks being the best. System of rearing did not influence the fertility levels significantly (P>0.05). However, age was found to have significant (P≤0.05) effect on the fertility, the values at 32 weeks was much higher for deep litter compared to cage system of rearing. Deep litter rearing resulted in significantly (P≤0.01) higher hatchability on total fertile eggs set. Age had a significant (P≤0.01) influence on the hatchability on total fertile eggs set. Significantly (P≤0.01) higher embryonic mortality was recorded for cage rearing compared to deep litter system (16.73 ± 1.25 *vs* 11.85 ± 0.65). Age was found to have significant (P≤0.05) influence on the embryonic mortality. System of rearing was not found to influence the dead-in-shell significantly (P>0.05) and the respective figures for deep litter and cage rearing were 11.51 ± 1.02 and 10.84 ± 0.10.

Key words: Japanese quail, breeder performance, fertility, hatchability, rearing system.

INTRODUCTION

The Japanese quail, Coturnix japonica, is a migratory, gallineous, ground dwelling game bird native to east Asia and Japan. They were first domesticated in the eleventh century as songbirds by the emperors of Japan. Quails are blessed with several desirable characters like fast growth, early sexual maturity, high rate of egg production, short generation interval, requirement of less floor space, short incubation period and less susceptibility to diseases. By 1910, their meat and eggs had become popular food items in that country. The brown-coloured Japanese Quails *(Coturnix Coturnix Japonica)* are bred for meat or used for commercial Quail production in India. Japanese quail are highly prolific with shorter generation interval. Housing systems have a strong influence on poultry production. In many studies, egg production of hens housed in conventional cages was higher than of those housed in alternative systems such as aviaries, floor pens or free range. In alternative housing systems, egg production is subjected to higher variations, making it less stable and predictable than in conventional cages. The proportion of dirty eggs is often higher in alternative housing systems than in conventional cages (Vits *et al.,*

2005). Tauson (1998) reported that under cage system of management, dust and ammonia levels were reduced, providing a better working environment. Rajendran and Mohanty (2003) opined that the cage system appeared to be more efficient than deep litter system in producing eggs and also reported that it would be possible to save feed cost and increase feed efficiency under cage system of management. Californian system of cage rearing is popular and widely adopted for housing of commercial layer type chicken. It is also common practice in broiler breeder management facilitating artificial insemination and breeder record maintenance. Of late, raised platform cages are erected that facilitate easy manure clearance (Ramesh Saraavana Kumar, 1998). Generally quails are reared in multi-tier cages both during growing and laying periods. The convenience in handling and conservation of space and energy are major advantages with this system. However, quails are also being reared on floor equally well (Padmakumar et al., 2000). A high level relation between the egg weight and the one-day old chick weight was found in various studies (Kselen and Pannia, 1976; Kucukyilmaz et al., 2001). Yildirim and Yetisir (1998) researched the effects of the egg weight of Japanese quails on the chick weight. Sachdev et al. (1985) found a higher fertility and the hatchability of fertile eggs of Japanese quails in heavy egg group (10.1-11.00) than the light egg group (7.01-8.90g). Sarica and Soley (1995) observed the highest fertility and hatchability of incubated eggs of Japanese quails with the eggs in the weight of 11.6g and over also they found the highest hatchability of fertile eggs with lighter eggs in the weight of 10.6-11.5g. However, there are insufficient reports on the performance of Japanese quail breeders on hatching performance under different housing management. Hence, an experiment was designed to evaluate the effect of cage and deep litter systems of housing management on hatching performance of Japanese quail breeders under field conditions.

MATERIALS AND METHODS

The study was conducted in a private commercial Japanese quail breeder farm in Coimbatore district of Tamil Nadu to assess the hatching performance of pure line Japanese quail breeders under cage and deep litter systems of housing management. Pure bred grand parent breeders of meat type Japanese quail (under selection for high four week body weight) were reared under cage or deep litter system of management from 5-32 weeks of age. A total of 1584 adult Japanese quail birds (1152 females and 432 males) were selected at the age of four weeks and randomly divided into two treatment groups of equal numbers. Birds under each treatment were further allotted randomly into 4 replicate groups in equal numbers with a breeding ratio of eight females to three males and were reared upto 32 weeks of age under cage or deep litter system. A floor space of 225 cm^2 per bird was provided under deep litter system and under cage system, 11 birds (3 males and 8 females) were housed in a breeder cage unit of 2025 cm^2 each, offering a floor space of 184 cm^2 per bird. All the birds were fed with the same quail breeder ration (187.90 g crude protein, 10.83 MJ metabolizable energy and 28.20 g calcium, per kg of feed) *ad libitum* and had free access to wholesome water throughout the experimental period. A total of 15 hours of light (photo period) was provided daily from 7-32 weeks of age.

The hatching eggs from the breeder stock were collected four times daily and the eggs collected during three days in each 28 days period of the experimental period was subjected for fertility and hatchability studies (Abdul Mujeer, 1992). Based on the data, fertility, hatchability on total eggs and fertile eggs set, embryonic mortality and dead-in-shells were calculated and were expressed in per cent. All the percentage values in the experiment were transformed to their arcsine roots before subjecting them to statistical analysis (Snedecor and Cochran, 1989).

RESULTS AND DISCUSSION

Hatchability on total eggs set

Significant ($P \leq 0.01$) differences were observed in hatchability on total eggs set between deep litter and cage systems of rearing with the values being 55.44 ± 1.25 *vs* 50.81 ± 1.54 respectively (Table 1). Age effect was also highly significant ($P \leq 0.01$) with the same at 20 weeks being the best (59.09 ± 1.65) and the values at 16 and 28 weeks of age being the lowest (49.23 ± 1.33 and 48.69 ± 4.41 respectively). Deep litter rearing was found to result in higher hatchability.

Contrary to the findings, Chidananda *et al.* (1986) Abdul Mujeer (1992) and Narahari *et al.* (2002) stated that hatchability on total eggs set was higher under cage rearing. Age was also found to be a significant (P≤0.01) factor that had a bearing on total per cent hatchability. Hatchability on total eggs set noticed in this study were less than those reported by Seker *et al.* (2006) and comparable to those obtained by Prabakaran *et al.* (1992) and Kucukyilmaz *et al.* (2001). This could be explained by the earlier findings that selection for high body weight had negative influence on hatchability (Blohowiak *et al.* 1984).

Table 1: Effect of System of rearing and Age on Fertility and Hatchability of pure bred Japanese quail Breeder eggs

Age in weeks	Fertility			Hatchability on Fertile eggs set			Hatchability on Total eggs set		
	Deep litter	Cage	Over all Mean** (age)	Deep litter	Cage	Over all Mean** (age)	Deep litter	Cage	Over all Mean** (age)
12	70.22 ± 3.96	80.90 ± 2.93	75.56^{a} ± 2.85	76.29 ± 1.25	67.75 ± 2.28	72.02^{ab} ± 1.79	56.90 ± 1.74	54.83 ± 2.71	55.87^{ab} ± 1.56
16	72.64 ± 2.30	74.42 ± 2.23	73.53^{a} ± 1.55	68.99 ± 1.93	64.70 ± 2.68	66.84^{b} ± 1.70	50.56 ± 2.34	47.90 ± 1.28	49.23^{b} ± 1.33
20	75.68 ± 3.88	80.86 ± 1.35	78.27^{a} ± 2.11	75.96 ± 1.39	71.69 ± 2.12	73.83^{ab} ± 1.37	60.20 ± 2.74	57.98 ± 2.01	59.09^{a} ± 1.65
24	71.01 ± 3.48	70.06 ± 0.71	70.54^{ab} ± 1.60	70.89 ± 0.95	65.76 ± 4.65	68.33^{ab} ± 2.41	54.33 ± 1.60	46.14 ± 3.70	50.23^{ab} ± 2.57
28	61.42 ± 6.38	63.91 ± 2.77	62.41^{b} ± 3.65	78.52 ± 2.55	68.27 ± 13.19	74.42^{a} ± 5.07	51.83 ± 4.15	43.99 ± 10.31	48.69^{b} ± 4.41
32	80.30 ± 7.68	64.24 ± 3.51	72.27^{ab} ± 5.21	77.62 ± 2.92	67.75 ± 5.16	72.68^{ab} ± 3.45	57.47 ± 4.97	43.48 ± 3.85	50.48^{ab} ± 4.20
Overall* Mean (system)	72.20 ± 1.85	74.92 ± 1.59		74.39^{A} ± 0.96	67.77^{B} ± 1.42		55.44^{A} ± 1.25	50.81^{B} ± 1.54	

* *Means bearing different superscripts differ significantly (P≤ 0.01*)
***Means bearing atleast one common superscript do not differ significantly(P≥ 0.01)*

Fertility

Fertility under both deep litter and cage rearing systems (Table 1) indicated that system of rearing did not influence the fertility levels significantly (P>0.05). The finding was significant in that wire flooring for cages did not adversely affect mating among the Japanese quail breeders and flock mating with the presence of more number of males in floor pen under deep litter rearing (72.20 ± 1.85) did not offer any specific advantage over the presence of limited number of males in each cage unit(74.92 ± 1.59). However, age was found to have significant (P≤0.05) effect on the same, fertility at 32 weeks was much higher for deep litter compared to cage system of rearing. Fertility levels obtained in this study were comparable to those reported by Narahari *et al.* (2002), and however, better than the values observed by Kucukyilmaz *et al.* (2001). The results also contradict the findings of Asasi and Jaafar (2000) that the fertility was as low as 62.00 when a 1:3 sex ratio of male to females was employed.

Hatchability on fertile eggs set

Hatchability on total fertile eggs set (Table 1) indicated that deep litter rearing resulted in significantly (P≤0.01) higher hatchability on total fertile eggs (74.39 ± 0.96 *vs* 67.77 ± 1.42). However, Chidananda *et al.* (1986) reported that hatchability on fertile eggs set was higher in cage than deep litter rearing of Japanese quail breeders. Aydin *et al.* (2006) observed almost comparable performance. The difference between genetic background of the stocks employed could offer an explanation for the variation witnessed apart from other conditions of

the study. Age had a significant (P≤0.01) influence on the parameter. Ottinger et al. (1983) opined that age related reproductive decline in Japanese quail may have behavioural as well as endocrine basis.

Embryonic mortality

Significantly (P≤0.01) higher embryonic mortality was recorded for cage rearing (Table 2) compared to deep litter system (16.73 ± 1.25 *vs* 11.85 ± 0.65). Age was found to have significant (P≤0.05) influence on the parameter, embryonic mortality at 12 weeks was significantly higher than the respective values at comparatively older ages of 24, 28 and 32 weeks of age. Narahari *et al*. (2002) also indicated marginally higher embryonic mortality in cage reared birds compared to deep litter rearing. Unnoticed minor cracks possible under cage rearing normally undergo unnoticed before setting which would have led to this difference.

Table 2: Effect of System of rearing and Age on Embryonic mortality of pure bred Japanese quail Breeder eggs

Age in weeks	Deep Litter	Cage	Overall Mean** (age)
12	14.01 ± 1.91	22.54 ± 3.24	18.27^{b} ± 2.20
16	12.47 ± 0.75	16.25 ± 2.76	14.36^{ab} ± 1.48
20	12.57 ± 1.20	15.35 ± 1.50	13.96^{ab} ± 1.01
24	10.96 ± 0.93	13.08 ± 0.81	12.02^{a} ± 0.73
28	8.52 ± 1.53	14.12 ± 7.13	10.76^{a} ± 2.77
32	9.08 ± 1.66	14.18 ± 1.39	11.63^{a} ± 1.50
Overall Mean* (system)	11.85^{A} ± 0.65	16.73^{B} ± 1.25	

* *Means bearing different superscripts differ significantly (P≤ 0.01*)
***Means bearing atleast one common superscript do not differ significantly(P≥ 0.01)*

Dead-in-shell

System of rearing was not found to influence the dead-in-shell significantly (P>0.05) and the respective figures for deep litter and cage rearing were 11.51 ± 1.02 and 10.84 ± 0.10. Dead-in-shell values were comparable with those reported by Bandyopadhyay *et al.* (1992) and lower than those by Kucukyilmaz *et al.* (2001).

CONCLUSIONS

Comparative hatching performance of Japanese quail pure line breeders (under selection for high four week body weight) under deep litter and cage system of management was studied in a private commercial Japanese quail breeder farm-cum-hatchery. A floor space allowance of 225 cm^2 per bird was allowed on deep litter and 184 cm^2 per bird in cages. A total of 1584 Japanese quail breeders were selected at the age of 4 weeks and randomly divided into two treatment groups of equal numbers. Birds under each treatment were further allotted randomly into 4 replicate groups in equal numbers with a breeding ratio of 8 females to 3 males and were reared upto 32 weeks of age. Data on reproduction parameters like hatchability on total eggs set and fertile eggs set, fertility, embryonic mortality and dead-in-shell were collected from 5-32 weeks of age and subjected to statistical analysis. Hatchability on total eggs set was found to be significantly higher for deep litter rearing (55.44 ± 1.25 *vs* 50.81 ± 1.54). Hatchability on fertile eggs set also showed similar tendencies (74.39 ± 0.96 *vs* 67.77 ± 1.42). Cage system was found to result in higher per cent fertility (74.92 ± 1.59) compared to deep litter system of housing (72.20 ± 1.85), however, the difference was not significant (P≤0.01). Cage rearing resulted in higher embryonic mortality. Systems of rearing did not bear any significance on dead-in-shell.

ACKNOWLEDGEMENT

The authors thank the Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu for the facilities provided.

REFERENCES

1. Abdul Mujeer, K., 1992. Factors influencing the hatching performance of Japanese quail eggs. Ph.D thesis submitted to Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India.
2. Asasi, K. and Jaafar, A.J., 2000. The effect of sex ratio on egg production, fertility and hatchability of Japanese quail. *Pajouhosh-va-sazandegi*, 4(45): 128-131.
3. Aydin, R., Karaman,M., Toprak, H.H.C., Ozugur, A.K., Aydin, D. and Cicek, T. 2006. The effect of long-term feeding of conjugated linoleic acid on fertility in Japanese quail. *South African Journal of Animal Science*, 36(2): 99-104.
4. Bandyopadhyay, U.K., Ahuja, S.D., Ram Gopal and Kundu, A. 1992. Hatchability traits of Japanese quail at different cage floor spaces. *Indian J. Poult. Sci*., 27(4): 241-242.
5. Blohowiak, C.C., Dunnington, E.A., Marks, H.L. and Siegel, P.B. 1984. Body size, reproductive behaviour and fertility in three genetic lines of Japanese quail. *Poult. Sci*., 63: 847-854.
6. Chidananda, B.L.., Prathapkumar, K.S., Sreenivasaiah, P.V., Ramappa, B.S. and Lokanath, G.R. 1986. Comparative performance of Japanese quail on cage and deep litter (2) egg production and reproduction traits. *Indian J. Poult. Sci.*, 21(2): 91-96.
7. Kselen, L.V.I. and L.V.I. Pannia, 1976. The correlation of egg weight with hatching weight and 56 days weight of broiler fowls. Anim. Breed. Abst., 44: 2:888.
8. Kucukyilmaz, K., Baser, E., Erensayin, C., Orhan, H. and Arat, E. 2001. Effect of egg weight on the hatchability, fattening performance and egg yield traits of Japanese quail. Hayvancilik Arastirma Dergisi, 11(1): 6-12.
9. Narahari, D., Mujeer, K.A. and Rajini, R.A. 2002. Pre-oviposition factors influencing the fertility and hatchability in Japanese quail. *Indian J. Anim. Sci.,* 72(9): 756-761.
10. Ottinger, M.A., Duchala, C.S. and Masson, M. 1983. Age-related reproductive decline in the male Japanese quail. *Horm. Behav*., 17(2): 197-207.
11. Padmakumar,B., Reghunanthan Nair,G., Ramakrishnan, A., Unni, A.K.K. and Ravindranathan, N. 2000. Effect of floor density on production performance of Japanese quails reared in cages and deep litter. *J. Veterinary and Animal Sciences*, 31: 37-39.
12. Prabakaran, R., Mujeer, K.A., Srinivasan, G., Jayaprasad, I.A. and Sundararasu, V. 1992. Effect of system of mating and season on the reproductive performance of Japanese quail. *Indian J. Poult. Sci.*, 27(2): 100-102.
13. Rajendran, K. and Samarendu Mohanty. 2003. Comparative economic analysis and constraints in egg production under cage *vs* deep litter systems of rearing in India. *International Journal of Poultry Science,* 2(2): 153-158.
14. Ramesh Saravana Kumar. 1998. Effect of housing pattern, cage design, feed and microenvironment on the performance of commercial layers. Ph.D. thesis submitted to Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India
15. Sachdev, A.K., Ahuja,S.D., Thomas, P.C. and Agrawal, S.K. 1985. Effect of egg weight and duration storage on the weight loss, fertility and hatchability traits in Japanese quail. *Ind. J. Poult. Sci.,* 20: 19-22.
16. Sarica, M. and Soley, F. 1995. The effect of hatching egg weight on the hatchability, growing and egg production traits of japanese quail (*Coturnix coturnix japonica*). *J. Agri. Faculty of O.M.U.,* 10: 19-30.
17. Seker, I., Bayraktar, M. and Kul, S. 2006. Effect of pre-incubation long-term storage and warming on hatchability of Japanese quail eggs (*coturnix coturnix japonica*). *Archiv fur Geflugelkunde*, 70(1): 35-40.
18. Snedecor, G.W. and Cochran, W.G. 1989. Statistical Methods. 8th ed. Oxford and IBH publishing Co., Calcutta.
19. Tauson, R. 1998. Health and production in improved cage designs. *Poult. Sci*., 77: 1820-1827.
20. Vits, A., D.Weitzenburger, H.Hamann and O.Distl, 2005. Production, egg quality, bone strength, claw length and keel bone deformities of laying hens housed in furnished cages with different group sizes. *Poult. Sci*., 84: 1511-1519.

21. Yildirim, I. and Yetisir,R. 1998. Effects of hatching egg weight and parental age on the hatching weight and 6 week live weight in Japanese quail (*Coturnix coturnix japonica*). *Turkish J. Vet. and Anim. Sci.,* 22: 315-319.