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Fertility Performance in the Eggs Laid after Removing of Japanese Quail Males in Heat Stress Conditions

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Abstract: This experiment was carried out to determine the fertility performance and duration of fertility in the eggs laid after removing of male from cage reared under heat stress in the Japanese quails. In the study, 24 male and 72 female quails at 6 weeks of age were randomly divided into two groups (control and trial). Trial group was kept at high ambient temperature (33-42°C) and control group propagated in a 17-25°C environmental condition. The effects of heat stress on feed consumption, feed efficiency, egg production, egg weight were decreased. Also fertility ratio of the eggs laid after third day of removing of male were reduced ($p<0.01$). However, hatchability of fertile eggs and embryonic mortality were not statistically significant. As a result, the eggs laid after fourth day of removing of male in a high environmental temperature should not be incubated because of low fertility ratio.

Key words: Heat stress, duration of fertility, hatchability, quail

INTRODUCTION

High ambient temperatures can have a major impact on the welfare and performance of poultry. When high temperatures are coupled with high humidity, the combination can become lethal. Heat stress not only causes serious welfare conditions of suffering and death in the birds, but also results in reduced or lost production that adversely affects the profit from the enterprise Hassan *et al.*[1]; Mcdaniel *et al.*[2]; Smith and Oliver[3]. During heat stress, a behavioral, physiological, hormonal and molecular change also occurs Etches *et al*[4].

Japanese quails are hardy birds that thrive in small cages and are fairly disease resistant. They are mature in about 6 weeks and usually in full egg production by 50 days of age. With proper care, hens should lay 200 eggs in their first year of lay. Their generation time is short, sexual maturity is early, maintenance costs is low and body size is small. Therefore, quail are considered a good and economical source of animal protein Altýnel *et al.*[5]; Nazlýgül *et al.*[6] and Seker[7]. They have been used also as a laboratory animal as an avian model for biomedical research since 1959 Ichilcik and Austin [8].

There are many studies about heat stress in Japanese quails and poultry. However, few studies observed the effect of heat stress on fertility, hatchability and embryonic mortality. To the authors' knowledge no research on duration of fertility in the eggs laid after removing of male in the heat environment has been conducted. More information is needed concerning productive and reproductive performance of poultry in high temperature conditions Hassan *et al.*[1] and Mcdaniel *et al*[9]. The aim of this study was to therefore determine performance and duration of fertility in the eggs laid after removing of male in the heat stress conditions in Japanese quail.

MATERIALS AND METHODS

The study was conducted in April and May. Twenty four male and seventy two female at 6 weeks old Japanese quails (Coturnix coturnix japonica) were used. The birds were randomly assigned to one control and one trial groups, comprising three replicates of 4 male 12 female each.

Experimental group were housed in a room of the same building at 33-42°C environmental temperatures which heated in electrical heater while control group kept in 17-25°C. Initially, the quails were exposed to a 13 h light period. The light period was increased 1 h every week until it was fixed at 16 h per day. All males of two group were removed in the fourth week of the experiment and then the eggs of both groups' collected daily for 2 weeks, stored at 15°C for 1 day and incubated

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Table 1: Ingredients and chemical composition of the diets for laying Japanese quails

Ingredients	(g kg^{-1})	Chemical composition	(g kg^{-1})
Yellow corn	470	Dry matter	894.9
Wheat	80	Crude protein	206.0
Soybean meal	293	Calcium	33.9
Fish meal	15	Total phosphorus	5.7
Vegetable oil	46.0	*Calculated values*	
Calcium carbonate	77	ME (MJ kg^{-1})	12.54
Dicalcium phosphate	13	Lysine	11.2
Salt	3	Methionine+Cystine	7.1
DL-methionine	0.5		
Vitamin mineral premix[a]	2.5		

[a]Vitamin mineral premix (provided the following per kg diet): Vitamin A, 12500 IU; Vitamin D3, 1500 IU; Vitamin E, 31.25 mg; Vitamin K3, 3.75 mg; Vitamin B1, 2.5 mg; Vitamin B2, 7.5 mg; Niacin 25 mg; Cal. D-pantothenate 10 mg; Vitamin B6, 5 mg; Vitamin B12, 0.019 mg; Folic acid 1 mg; Choline chloride 250 mg; Mn 100 mg; Fe 75 mg; Zn 75 mg; Cu 6.25 mg; Co 0.25 mg; I, 1.25 mg; Se 0.19 mg.

at 37,5°C; 70% RH. After hatching, the number of chicks and unhatched eggs were recorded. Then the number of fertile, infertile eggs, early dead and late dead were determined by breaking of the unhatched eggs. Quails were fed a basal diet. Chemical compositions of the diets were analyzed using the international procedures of AOAC[10]. Ingredients and chemical compositions of the basal diets are shown in Table 1. The diets and water were given for ad libitum consumption throughout the experiment.

Feed consumption data were recorded at weekly intervals. Feed conversion ratio was also calculated. Temperature and humidity in the poultry house was recorded twelve times a day with a TESTO 175 electronic instrument. Average ambient relative humidity and mean value of daily temperature in the control and trial hen house were 46±5,6 and 48± 4.1%, 20±3,6 and 37±2,8°C, respectively.

Data of daily egg production, egg weight, feed efficiency and feed intake were statistically analyzed by Independent Samples t test. Other data were calculated by Chi-square tests in SPSS[11].

RESULTS AND DISCUSSION

Effects of heat stress on the egg production, egg weight, feed consumption, feed efficiency and productivity characters in the eggs after removing of male in laying quails were shown Table 2 and 3.

High ambient temperature significantly depressed daily egg production ($p<0.01$), egg weight ($p<0.05$), feed efficiency ($p<0.05$) and feed consumption ($p<0.001$). Decreases of egg production, egg weight and feed consumption in high environmental temperature are also declared previously Avci *et al*[12-15].

The high environmental temperature stress results in elevation of blood cortisol concentrations in blood due

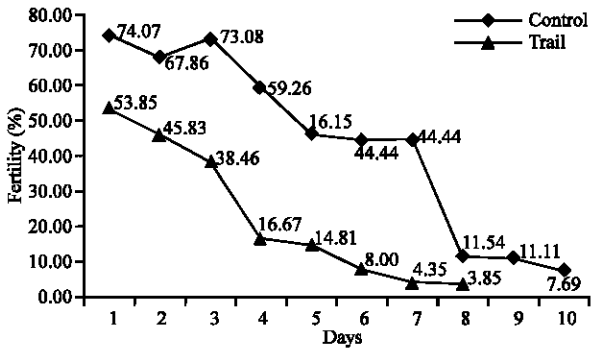

Fig. 1: Duration and persentage of fertility in the eggs laid after removing of male (%)

Table 2: The effects of heat stress on fertility performance in the eggs laid after removing of male in Japanese quails.

Parameters	Control	Trial	X^2 or P value
N	36	36	
Duration of fertility (day)	10	8	--
Hatchability of fertile eggs (%)	78.81	74.46	NS
Early embryonic death%	5.08	6.4	NS
Late embryonic death (%)	16.1	17	NS
Total embryonic death (%)	21.2	25	NS
Daily egg production mean (egg)	30.21±1.18	27.5±2.59	**
Egg weight (g)	11.3±0.1	10.7±0.1	*
Feed efficiency (g)	3.09±.004	3.24±0.035	*
Feed consumption (g)	29.8±0.05	26.4±0.04	***

NS $p>0.05$, *$p<0.05$, **$p<0.01$, *** $p<0.001$

to enhanced secretion of CRH in the hypothalamus and results with feed intake depression Miller and Heath[16,17]. High ambient temperature also decreases serum and tissue vitamin and mineral concentration in poultry Hassan *et al*.[13] and increases excretion of minerals. Ensminger[18] and Wallis *et al*.[19] reported that digestibility of amino acids was decreased by high environmental temperature in broiler. These factors Cause may decrease of feed intake, feed efficiency, egg weight and egg production in poultry.

Maximum duration of fertility for the control and trial laying quails has been determined as 10 and 8 day, respectively. Percentage of fertility dropped drastically in the eggs after removing of male in both groups. There was no statistical difference in the percentage of fertility between groups at the first three days. But following third day the percentages of fertility were significantly lower ($X^{[2]}<0.01$ or $X^{[2]}<0.05$) in trial group. These results show that heat stress reduced duration of fertility and in agreement with studies Mcdaniel *et al*[2,9,20]. As seen in the Table 3 and Fig. 1 fertility ratio of trial group decrease to below 20% after fourth day. The same fertility ratio in the control group is obtained at the eighth day. Joshi *et al*[20]. found that elevated ambient temperatures of 32°C decreased semen volume, sperm concentration, number

Table 3:Percentage of fertility in the eggs laid after removing of male (%)

	Days after removing of male													
Grups	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	74.07	67.86	73.08	59.26	46.15	44.44	44.44	11.54	11.11	7.69	0	0	0	0
Trial	53.85	45.83	38.46	16.67	14.81	8.00	4.35	3.85	0	0	0	0	0	0
X^2	Ns	Ns	Ns	**	*	*	**	--						

NS p>0.05, *X^2<0.05, ** X^2<0.01

of live sperm and motility. McDaniel *et al*[9] found that heat stress increased the percentage of dead sperm. These findings support our results, which showed that the percentage fertility decreased under heat stress condition. The physiological mechanisms that result in heat stress infertility are not completely understood, but most logically explained by increased body temperature. McDaniel *et al.*[9] hypothesized that during the heat stress period, the increase in body temperature has a negative effect on gamete formation and the fertilization. McDaniel *et al.*[9] proved that fewer sperm from heat stressed birds are stored in the hen's oviduct and penetrate the ovum. It is possible that in the testes of the males after heat stress, abnormal meiotic division may occur during spermatogenesis. This would result in abnormal sperm which may be able to penetrate the ovum but unable to complete the fertilization process.

Hatchability of fertile eggs and total embryonic mortality during incubation were 74,41 and 78,81, 21,2 and 25,0% in control and trail group, respectively. Mean differences were not statistically significant. These results are higher with observation of Hassan *et al.*[13] who found the fertility and total embryonic mortality during incubation in morning feeding and afternoon feeding as 36,8 and 55,5 and 21,2 and 25,0%, respectively. The differences can be attributable to hatchery conditions variability and quails line.

CONCLUSION

It can be concluded from this experiment that the eggs laid after the forth day of removing of male reared under heat stress should not be incubated because of low fertility ratio.

REFERENCES

1. Hassan, S.M., M.E. Mady, A.L. Cartwright, H.M. Sabri and M.S. Mobarak, 2003. Effect of acetyl salicylic acid in drinking water on reproductive performance of Japanese quails. Poultry Scienc, 82: 1174-1180.
2. Mcdaniel, C.D., J.E. Hood and H.M. Parker, 2004. An Attempt at Alleviating Heat Stress Infertility in Male Broiler Breeder Chickens with Dietary Ascorbic Acid Intl. J. Poultry Sci., 3: 9, 593-602.
3. Smith, A.J. and O. Oliver, 1972. Some nutritional problems associated with egg production at high environmental temperatures I. The effect of environmental temperatures and rationing treatments in the productivity of pullets fed on diets of differing energy content. Rhod. J. Agric. Res., 10: 3-20.
4. Etches, R., J.M. John and A.M.V., 1995. Gibbins: Behavioral, Physiological, Neuroendocrine and Molecular Responses to Heat Stress. In: Daghir, N.J. (Ed.), Poultry Production in Hot Climates. CAB International, Wallingford, pp: 31-65.
5. Altinel, A., H. Gune°, T. Kirmizibayra and T. Çörekçi Bilal, 1996. Study on egg quality and traits in Japanese quail (coturnix coturnix japonica). Istanbul Univ. J. Vet. Fac., 22: 1, 203-213.
6. Nazligül, A., K. Türkyilmaz and H.E. Bardakçioğlu, 2001. A Study on Some Production Traits and Egg Quality Characteristics of Japanese Quail Turk. J. Vet. Anim. Sci., 25: 1007-1013.
7. Şeker, Ý., 2003. The Effects of The Different Factors on Fertility And Hatchability of Hatching Eggs in Quails. YYÜ J. Vet. Fac., 14: 2, 42-46.
8. Ichilcik, R. and J.C. Austin, 1978. The Japanese quail (coturnix coturnix japonica) as a laboratory animal. J. S. Afr. Vet. Assoc., 49: 3, 203-207.
9. Mcdaniel, C.D., R.K. Bramwell and J.R.B. Howarth, 1996. The male contribution to broiler breeder heat-induced infertility as determined by sperm-egg penetration and sperm storage within the hens oviduct. Poult. Sci., 75: 1546-1554.
10. AOAC, 1984. Official Methods of Analysis of the Association of Official Analytical Chemistry, 14th Edn., Virginia.
11. Spss: Spss, 1998. for Windows 9.3 Base System User's Guide. Release 9.0 Copyright by SPSS Inc. Printed, USA.
12. Avci, M., M. Yerturk and O. Kaplan, 2005. Effect of vitamin E on egg production and egg quality in Japanese quails. Ýndian. J. Vet., 82: 969-971.
13. Hassan, S.M., M.E. Mady, A.L. Cartwright, H.M. Sabri and M.S. Mobarak, 2003. Effect of feeding time on the reproductive performance of Japanese quail (coturnix coturnix japonica) Poultry Sci., 82: 7, 1188-1192.

14. Sahin, K. and O. Kucuk, 2003. Zinc supplementation alleviates heat stress in laying Japanese quail The J. Nut. Health Module, pp: 2808-2811.
15. Sahin, K., O. Ozbey, M. Onderci, G. Cikim and M.H. Aysondu, 2002. Chromium supplementation can alleviate negative effects of heat stress on egg quality and some serum metabolites of laying Japanese quail. The J. Nut. Health Module, pp: 1265-1268.
16. Miller, S.H. and J.E. Heath, 1970. Thermo-responsiveness of the preoptic region of the brain in house sparrows. Science, 168: 1008-1010.
17. Peguri, A. and C. Coon, 1991. Effect of temperature and dietary energy on performance. Poultry Sci., 70: 126-138.
18. Ensminger, M.E., J.E. Oldfield and W.W. Heinemann, 1990. Feeds and Nutrition, Ensminger publishing Company, Clovis, CA, pp: 8-110.
19. Wallis, I.R. and D. Balnave, 1984. The influence of environmental temperature, age and sex on the digestibility of amine acids in growing broiler chickens. Br. Poul. Sci., 25: 401-407.
20. Joshi, P.C., B. Panda and B.C. Joshi, 1980. Effect of ambient temperature on semen characteristics of White Leghorn male chickens. Ind. Vet. J., 57: 52-56.