Global Journal of Medical Research: G
Veterinary Science and Veterinary Medicine
Volume 18 Issue 2 Version 1.0 Year 2018
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4618 & Print ISSN: 0975-5888

The Effects of Light on Egg Yield in Quail (Coturnix coturnix) under Laboratory Conditions

By Harun Cerit, Hidir Demir & Engin Kozak
Istanbul University

Abstract- An egg has all the nutrients that people need. They have the richest proteins found in foods, contain proteins that cannot be secreted by the body and must be taken from the outside. The present study was conducted to show how aging and lighting can affect the yield and quality of egg. In thi study, six female quails under 40 groups were used to investigate the egg yield and weight of the egg that stars with the first ovulation and for a period of 12 months. Egg counts and weight of quails that were kept in separate and individual cages. Two groups were investigated for 20W florescence light and daylight conditions separately. Yearly average egg yield of 282.42 calculated as population average was distributed along days 0-124, 125-248 and 249-372 as 39.85%, 34.66%, and 25.49% respectively. The ratios of the percentage of eggs obtained between days 125-248 and 249-372 to day's 0-124 were calculated as 92.59% and 72.53% respectively It is concluded that egg yield with an average of 282.42 eggs per quail for 12 months following the age of first ovulation was stable until month 8.

Keywords: *egg, light, wavelength, quality, yield.*

GJMR-G Classification: *NLMC Code: WA 360*

Strictly as per the compliance and regulations of:

The Effects of Light on Egg Yield in Quail (Coturnix coturnix) under Laboratory Conditions

Harun Cerit [α], Hidir Demir [σ] & Engin Kozak [ρ]

Abstract- An egg has all the nutrients that people need. They have the richest proteins found in foods, contain proteins that cannot be secreted by the body and must be taken from the outside. The present study was conducted to show how aging and lighting can affect the yield and quality of egg. In this study, six female quails under 40 groups were used to investigate the egg yield and weight of the egg that stars with the first ovulation and for a period of 12 months. Egg counts and weight of quails that were kept in separate and individual cages. Two groups were investigated for 20W florescence light and daylight conditions separately. Yearly average egg yield of 282.42 calculated as population average was distributed along days 0-124, 125-248 and 249-372 as 39.85%, 34.66%, and 25.49% respectively. The ratios of the percentage of eggs obtained between days 125-248 and 249-372 to day's 0-124 were calculated as 92.59% and 72.53% respectively It is concluded that egg yield with an average of 282.42 eggs per quail for 12 months following the age of first ovulation was stable until month 8.

Keywords: egg, light, wavelength, quality, yield.

I. Introduction

a) Egg Yield and Egg Weight

Eggs are particularly important for humans as a source of nutrition and for birds as a way to maintain the survival and continuation of their species. As such, it would be desirable for farm animals to have high egg yields along with their ability to draw benefit from food as well as rapid development. While producers nowadays look for egg yields both high in quantity and quality while remaining economically viable, consumers are more interested in tangible features such as weight and size. One would not be wrong to think that bigger eggs would be more nutritious, albeit, it would also be necessary to assume that there would be a change in egg weight and the relative values of egg white [1, 2, 3].

However, aging can have an impact on the quantity, chemical composition and physical structure of eggs in birds. In quails, aging leads to an increase in egg quantity and weight which in turn alter the inner and outer structure of the egg [2, 4]. It is noted that the increase in egg weight alters the egg's inner composition, decreases the percentage of egg yolk and at the same rate, increases the percentage of egg white. Changes in egg's inner and outer composition effectively determine the final results obtained after incubation [5].

The effects of aging are important in the determination of the duration during which a herd of quails kept either for breeding or egg production is economically viable. Wilson who raised quails by keeping them in separate and individual cages, feeding them with turkey starting feed, under 14-hour lighting conditions and investigated the egg yield for 52 weeks found that at the first month, egg yield was 70% whereas it reached and peaked at 80% by the second month[6]. In the same study, the average egg weight corresponded was found to be 7% of the animal's weight which was 9.1g.Sreenivasaiah and Joshi, in their study where they investigated the effects of age and season on the egg production and weight in quails, found that for quails that hatched during winter and summer the egg yields were 63.9% and 69.3% respectively, the average egg weights were 9.47 and 10.15, respectively and didn't find any significant effect of seasons and age on egg yield [7]. Kobayashi, in their study where they studied the effect of 14-hour long and continuous lighting and light intensity on quails, found the egg yield percentages for the intensities of 69cd and 104cd to be 89% and 90% respectively for 14-hour lighting, 82%-88% respectively for 24-hour lighting [8].

In a study conducted by Okamoto on two experimental groups and one control group with a weight-based selection every six weeks for 14 weeks, found the average yield ratios to be around 82.4%, 77.0% and 93.1% [9].

In another study done by Gebhardt-Henrich and Marks, they investigated egg weight under two different feeding conditions: ad-libitum and limited feeding. Under these two conditions, the average egg weight for the control group was found to be 9.25g and 8.62g respectively, whereas for the group on which a weight-based selection was done every four weeks, the values were 11.57g and 11.19g respectively [10].

Uluocakwho investigated the effects of raising egg-producing quails with or without a male on egg yield reported that, for the group weighing 180g, egg yield during the 10-week period following the first ovulation was 88.09% for the group with a male, and 89.18% for the group without a male, whereas egg weight was 11.05 and 10.92 respectively[11].

Author α σ ρ: This article is an excerpt of the study supported by the Istanbul University Scientific Researches Project Unit with Issue Number of Bilims eletkinlik/6787/2010.
e-mail: hidir@istanbul.edu.tr

Uluocak who also studied the effects of ageing on egg features in quails found that the average egg weight values for 2nd, 3rd, 4th and 5th months to be 10.3g, 11.6g, 11.9g and 12.3g respectively, noting a significant change in egg weight and quality with age for the duration of the investigation period[11].

In a study conducted by Altinel on the relationship between egg quality and several characteristics of interest and the effects of the age of ovulation on the latter, a feeding program was applied with feeds containing 22% raw protein and 3100 kcal/kg metabolic energy for 5 week safter hatching and 16% raw protein and 2900 kcal/kg metabolic energy for the remainder of the study. Average egg weights for the 1st, 2nd and 3rd months after the first year of hatching were 11.108g, 11.643g, and 11.960g respectively while average egg weight for the 14-week period was 11.491. In the same study, it was reported that the values for total egg weight, yolk, white and shell weights increased with age, peaking at week 16[2].

There aren't enough studies regarding the effects of lighting duration on quails. The aim of this study is to understand the effects of lighting on the egg yield and weight of ovulating quails.

II. Material & Method

Starting with the first ovulation and for 12 months, egg count and weight of quails that were kept in separate and individual cages. Six female quails under 40 groups were used to investigate the egg yield and weight. Daily egg yield per quail was calculated as the ratio of daily egg production over the number of caged quails. For each quail, the ratio of monthly egg yield over yearly egg yield was calculated individually. The month with the highest egg yield was designated as the peak yield and the ratios between egg yields from non-peak months and the peak yield were calculated. The lasting potential of egg yield was studied by dividing the yield periods in 3; days 0-124, 125-248 and 249-372 and was calculated by dividing the egg yields of days 125-248 and 249-372 with that of the first 124 days. 72,864 quail eggs were used for egg weight determination.

Group 1: The animals were kept in rooms lit without any interruption via 2x20W fluorescent lamps for 5 weeks.

Group 2 (Control Group): Rooms were lit via regular daylight with a normal duration for five weeks.

III. Results and Discussion

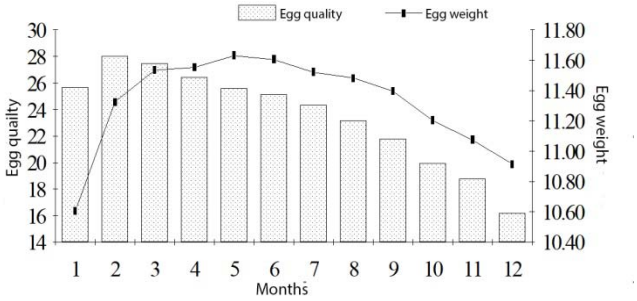
In this study, egg yields and weights of quails starting with their age of first ovulation were studied. After the determination of quails' age of first ovulation, they were kept in individual cages until the end of the ovulation period. Egg quantities and weights were recorded each day for the duration of the ovulation period. Table 1 shows the egg yields of 258 quails during the 12-month period as well as the evaluation of variation between the average values and Graph 2 shows the variations in egg yield and weight during the same period.

Table1: Egg yield and weight parameters of quails for a 1-year ovulation period

Ovulation period (months)	Egg Count (n)	Egg Yield (Quantity)		Yield Percentage (%)	Egg Weight (g)	
		x	s_x		x	s_x
1	6618	25.65^{bc}	0.313	84.10	10.60^{h}	0.017
2	7229	28.02^{a}	0.265	91.87	11.33^{d}	0.013
3	7083	27.45^{ab}	0.342	90.01	11.53^{bc}	0.015
4	6814	26.41^{abc}	0.363	86.59	11.55^{abc}	0.014
5	6600	25.58^{bc}	0.386	83.87	11.63^{a}	0.022
6	6486	25.14^{cd}	0.433	82.43	11.61^{ab}	0.021
7	6275	24.32^{cd}	0.435	79.74	11.53^{bc}	0.014
8	5979	23.17^{de}	0.492	75.98	11.49^{c}	0.022
9	5617	21.77^{ef}	0.599	71.38	11.39^{d}	0.023
10	5144	19.94^{fg}	0.621	65.37	11.20^{e}	0.026
11	4847	18.79^{g}	0.649	61.60	11.07^{f}	0.016
12	4172	16.17^{h}	0.678	53.02	10.91^{g}	0.018
Total	72864	282.42	3.659	76.87	11.34	0.005

*a-h: Averages with differing superscripts are significantly different (P*0.001).*

Monthly egg production of the quails for 12 months is 6618, 7229, 7083, 6814, 6600, 6486, 6275, 5979, 5617, 5144, 4847 and 4172 eggs respectively. Monthly yield averages per quail are 25.65, 28.12, 27.45, 26.41, 25.58, 25.14, 24.32, 23.17, 21.77, 19.94, 18.79 and 16.17 eggs respectively with an overall of 282.42 eggs for the whole 12-month period.



Graph 1: Egg yields and weights of quails during ovulation

As shown in Table 1 and Graph 1, egg yield reaches its highest at month 2 and especially after month 5, it shows a slow decline with aging until the end of the ovulation period. There is no statistically significant variation in the egg yield between months 2 and 5. Graph 2 also shows us that reaching a peak in egg yield in such a short time indicates the presence of a highly stable egg yield in quails for the first six months. Egg production continuity of 92.59% for the first eight months also supports this finding. The month with the highest yield observed in this study is in accord with the findings reported [6, 12, 13].

The egg yield ratio of 76.87% per quail for12 months is found to be higher than the findings reported by Sreenivasaiah and Joshi [7], lower than those reported by Ludrowsky [15], and similar to the results given by Sundaram [17].The egg yield of 86.59% at the fourth month after the age of first ovulation was found to be higher than the egg yield values of groups subjected to selection that was reported[9,19,20,21], lower than the egg yield value of the control group reported and similar to the egg yield values reported [8,22].

The value reported by Kocak for six-month period is similar to the findings in this study. [23]

The egg yield values reported by Prabakaranin their study where they raised quails both in pairs and as a group were lower than the findings of this study for the same periods [24].

Table 2 shows the monthly egg yield distribution of the year-long ovulations of quails whereas Table 3 shows the egg yield continuity. The monthly egg yields appeared to be at their highest at month 2. As a result, the egg yield value of 258 quails for the 2nd month was taken as the peak value, and the ratios between monthly egg yield values and the peak value were calculated (Table 2).

Table 2: Monthly distribution of annual egg yield

Ovulation period (month)	Quail count	Egg Yield (quantity)		Monthly/1-Year Egg Yield Ratio	Monthly/ Highest Yield Ratio
		Daylight	Light		
1	258	25.65	26.8	9.08	0.92
2	258	28.02	29.7	9.92	1.00
3	258	27.45	29.5	9.72	0.98
4	258	26.41	28.1	9.35	0.94
5	258	25.58	27.3	9.06	0.91
6	258	25.14	26.4	8.90	0.90
7	258	24.32	26.1	8.61	0.87
8	258	23.17	25.4	8.21	0.83
9	258	21.77	22.6	7.71	0.78
10	258	19.94		7.06	0.71
11	258	18.79		6.65	0.67
12	258	16.17		5.73	0.58
Total	258	282.42		100.00	-

Yearly average egg yield of 282.42 calculated as population average was distributed along days 0-124, 125-248 and 249-372 as 39.85%, 34.66%, and 25.49% respectively. The ratios of the percentage of eggs obtained between days 125-248 and 249-372 to day's 0-124 were calculated as 92.59% and 72.53% respectively (Table 3). According to these results, the egg yield continuity of quails appears to develop quite well especially between days 0-248.

Table 3: Egg yield continuity

Ovulation Period (days)	Egg yield (eggs)		Individual egg yield/ Total egg yield		Individual egg yield/ Egg yields between days0-124	
	x	s_x	%	s_x	%	s_x
0-124	107.53	0.091	39.85	0.063		
125-248	98.22	0.141	34.66	0.036	92.59	0.187
249-372	76.67	0.255	25.49	0.075	72.53	0.279

Table 4: Degrees of heritability of egg yields of the quail population

Characteristic of Interest	Group #	Offspring #	x	s_x	h^2	s_h^2
Egg yield (eggs)	40	258	282.42	3.659	0.19	0.105

When compared to the average estimated degree of heritability of quails, the degree of heritability of egg yield estimated at 0.19 for this population demonstrates the unfeasibility of selection for the improvement of this property.

In this study, the monthly average of egg yields for the period of 12-months were 10.60g, 11.33g, 11.53g, 11.55g, 11.63g, 11.61g, 11.53g, 11.49g, 11.39g, 11.20g, 11.07g, and 10.91g respectively with an overall average of 11.34g (Table 1). Steady growth in egg weight can be observed from first ovulation until month 6 (Graph 2). A decrease in egg weight was observed in accordance with the decline in egg yield following month 6. Egg weight also reached its peak at month 5. The peaks have later date than the one reported by Yannakopoulos and Tserveni-Gousi[4]and in accord with the one reported by Ludrowsky[15]. However, the month after which egg weight started to decrease is later than those reported by the abovementioned authors. It can be seen in Graph 2 and Table 1 that there is no statistically significant variation in egg weight between months 3 and 7 despite an observed decline in egg yield. As a result of aging, a steady decrease in egg weight was observed following month 8.

IV. Results

Among quails investigated in this study, the continuity of egg yield with an average of 282.42 eggs per quail for12 months following the age of first ovulation was stable until month 8. This value steadily decreased after this period as a result of aging. Increase in egg weight appears to be in accord with egg yield. Based on these findings, it can be concluded that it would be economically viable to keep the population of quails for egg production between the age of first ovulation and the 8th month of ovulation.

When the estimated degrees of heritability of the egg yields of the quail (Coturnix coturnix japonica) population found at the University of Istanbul Faculty of Veterinary, Zootechny, Quail Research Unit are taken into account, it can be concluded that a selection made based on individual animal weight values at week 5 would be more effective in creating a faster genetic progression when compared to other weeks.

This study as a whole can be said to possess preliminary information regarding the determination of selection programs suitable for quail husbandry. Furthermore, knowing that it is necessary to study phenotypic and genetic correlations to create successful selection programs, this study demonstrates the need for further research with a wider scope. Finally, findings and results obtained within this study have the potential to shed light on the establishment of more viable conditions and principles regarding quail husbandry.

References Références Referencias

1. Beylyavin, G.G. "Physical Characteristics of Intact and Cracked Eggs." Tandfonline, British Poultry Science, 3 Apr. 2008.
2. Altinel, A., et al. "Japon bıldırcınlarında (Coturnix coturnix Japonica) yumurta kalitesi ve özellikleri üzerinde arastırmalar." İstanbul Univ Vet Fak Derg 22.1 (1996): 203-213.
3. Alkan, Sezai, et al. "Effects of selection for body weight and egg production on egg quality traits in Japanese quails (Coturnix coturnix japonica) of different lines and relationships between these traits." Kafkas Universities Veterinary Faculties Dergisi 16.2 (2010): 239-244.
4. L.TSERVENI-GOUSI, A. "Research Note: Effect of Breeder Quail Age and Egg Weight on Chick

Weight." OUP Academic, Oxford University Press, 1 Sept. 1987.
5. Soares, M.C, and L Roque. "Effects of Eggshell Quality and Broiler Breeder Age on Hatchability." OUP Academic, Oxford University Press, 1 Dec. 1994.
6. Wilson, et al. "Evaluation of Coturnix (Japanese Quail) as Pilot Animal for Poultry." OUP Academic, Oxford University Press, 1 May 1961.
7. Sreenivasaiah, P. V., and H. B. Joshi. "Influence of hatching season on egg production characteristics in Japanese quails (Coturnix coturnix Japonica)." Kerala Journal of Veterinary Science (India) (1986).
8. KOBAYASHI, Shin, et al. "Influence of light intensity on egg production in Japanese quail under 14L: 10D and continuous lighting." Japanese poultry science 26.4 (1989): 235-244.
9. OKAMOTO, Satoru, Shin KOBAYASHI, and Teruo MATSUO. "Feed conversion to body weight gain and egg production in large and small Japanese quail lines selected for 6-week body weight." Japanese Poultry Science 26.4 (1989): 227-234.
10. GEBHARDT-HENRICH, SABINE G., and H. L. Marks. "Effects of feed restriction on growth and reproduction in randombred and selected lines of Japanese quail." Poultry science 74.2 (1995): 402-406.
11. Unlock, A. N., et al. "bıldırcın yumurtalarında yaşla birlikte bazı kalite özelliklerindeki değişim." Hayvancılık296 Ulusal Kongresi, Bildiriler 1 (1996): 438-445.
12. Woodard, Allen Earl, Hans Abplanalp, and Wilbor Owens Wilson. "Japanese quail husbandry in the laboratory (Coturnix coturnix japonica)." Japanese quail husbandry in the laboratory (Coturnix coturnix japónica). (1965).
13. Gildersleeve, R. P., et al. "Egg production in four generations of paired Japanese quail." Poultry science 66.2 (1987): 227-230.
14. Sachdev, A. K., S. D. Ahuja, and Ram Gopal. "FEED consumption, egg-production and b egg-quality traits as influenced by cage-tier locations of japanese quail." indian journal of animal sciences 59.7 (1989): 860-865.
15. Ludrovsky, F., Bodo, I., Janan, J., Rill, Z. and Takacs, E.:Comparision of egg production in various types of Japanese quails. Proceedings 19th World´s Poultry Congress, Amsterdam, 19-24 September, 3, 384.
16. Tikk, V., and H. Tikk. "The quail industry of Estonia." World's Poultry Science Journal 49.1 (1993): 65-68.
17. Sundaram, T. S. T. (1989): Comparative egg production efficiency of chickens and ducks, quails. Poultry International, 28 (5), 60.
18. Chrappa, V., V. Sabo, and K. Boda. "Feeding (recycling) of quail's excrements with different energy contents in feed mixtures for Japanese quails." Zivocisna Vyroba-UZPI (Czech Republic) (1993).
19. Yücelen, Y. ve Alarslan, F. Ö. (1986): Enerji düzeyleri farklı rasyonların bıldırcınlarda yumurta verimi ve yumurtadan çıkış gücü üzerine etkileri. Ankara Üniv. Ziraat Fak. Yıllığı, 37 (2), 240-250.
20. Sarıçiçek, B. Z., M. Sarıca, and G. Erener. "Değişik bitkisel protein kaynaklarının bıldırcınların verim özelliklerine etkileri (I. Gelişme özellikleri)." Ondokuzmayıs Üniv. Zir. Fak. Derg 9.3 (1994): 119-127.
21. Darden, J. R., and H. L. Marks. "Divergent selection for growth in Japanese quail under split and completes nutritional environments. 1. Genetic and correlated responses to selection." Poultry Science 67.4 (1988): 519-529.
22. Uluocak, A. N., Okan, F. ve Ayaşan, T. (1996a): Yumurtacı bıldırcınların erkekli veya erkeksiz barındırılmalarının yogurt verim özelliklerine etkileri. Hayvancılık ´96 Ulusal Kongresi, 18-20 Eylül, Bildiriler.
23. Koçak, Ç. Ö. Altan, and Y. Akbaş. "Japon bıldırcınlarının çeşitli verim özellikleri üzerinde araştırmalar." Tr. J. Vet. Anim. Sci 19 (1995): 65-71.
24. Prabakaran, R., et al. "Effect of system of mating and season on the reproductive performance of Japanese quail." Indian Journal of Poultry Science 27.2 (1992): 100-102.