

Feather-Plucking in Blue-Breasted Quails (*Synoicus chinensis*): An Abnormal Behavior Associated with Courtship Feeding?

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Abstract

Twenty pairs of blue-breasted quail were utilized in this study. Lettuce was provided daily to the quails beginning at 70 days of age. Observations of feather plucking, feather eating behavior, and feather condition scores were made at 65 and 100 days of age. Furthermore, the number of fertile eggs from the first ten eggs was recorded during the periods of 52-70 days and 95-115 days of age.

This study examines the relationship between feather plucking and courtship feeding in blue-breasted quail. It was hypothesised that the plucking behaviour observed in both males and females may be linked to courtship feeding, with males offering plucked feathers to females. However, statistical analysis revealed no significant correlation between feather condition scores and the number of fertilized eggs at both 52-70 days and 95-115 days ($P > 0.05$). The results suggest that while feather plucking, followed by its consumption by females, may be linked to courtship feeding, it remains unclear whether this behavior directly influences reproductive success in this species, as no significant correlation was found in this study.

Key Words: blue-breasted quail, feather plucking, courtship feeding, abnormal behavior

Mavi Göğüslü Bildircinlarda (*Synoicus chinensis*) Tüy Yolma: Kur Beslenmesiyle İlişkili Anormal Bir Davranış mı?

Özet

Bu çalışmada yirmi çift mavi göğüslü bildircin kullanılmıştır. Bildircinlere 70 günlük yaştan itibaren her gün marul verilmiştir. Tüy yolma, tüy yeme davranışı ve tüy kondisyon skorları 65 ve 100 günlük yaşlarda gözlemlenmiştir. Ayrıca, ilk on yumurtadan elde edilen dömlü yumurta sayısı 52-70 günlük ve 95-115 günlük yaş dönemlerinde kaydedilmiştir.

Bu çalışma, mavi göğüslü bildircinlerde tüy yolma ile kur beslenmesi arasındaki ilişkiyi incelemektedir. Hem erkeklerde hem de dişilerde gözlenen tüy yolma davranışının, erkeklerin dişilere yolunan tüyleri sunmasıyla kur beslenmesiyle bağlantılı olabileceği varsayılmıştır. Bununla birlikte, istatistiksel analiz, tüy kondisyon skorları ile hem 52-70 gün hem de 95-115 gündeki döllenmiş yumurta sayısı arasında anlamlı bir korelasyon olmadığını ortaya koymuştur ($P > 0.05$). Sonuçlar, tüy yolmanın ve ardından dişiler tarafından tüketilmesinin kur beslenmesiyle bağlantılı olabileceğini düşündürse de, bu çalışmada anlamlı bir korelasyon bulunmadığından, bu davranışın bu türde üreme başarısını doğrudan etkileyip etkilemediği belirsizliğini korumaktadır.

Anahtar Kelimeler: mavi göğüslü bildircin, tüy yolma, kur beslenmesi, anormal davranış

Introduction

Courtship feeding in birds occurs during the breeding season, with males providing food to females over an extended period, starting before egg-laying and continuing through incubation until the eggs reach an optimal temperature for development (Roughgarden, 2013). This behavior is often viewed as a form of paternal investment, where males supply females with nutritional resources that may enhance reproductive success by increasing fecundity. Through courtship feeding, males may also influence the timing of copulation, thereby promoting the production of larger ejaculates, inducing female refractory periods, accelerating oviposition, and ultimately maximizing reproductive success (Albo and Costa, 2010; Albo et al., 2013). On the other hand, while males may attract females by offering food, thereby improving their chances of mating, the production of these gifts is resource- and time-intensive, which can negatively impact male fitness. Females, in turn, can increase their fitness by receiving nutritionally valuable gifts; however, rejecting males without foods may result in missed mating opportunities. Given that the nutritional value of these resources is not fully understood, certain courtship feeding behaviors may enhance male reproductive success without directly benefiting females nutritionally. Consequently, the reproductive interests of both sexes may not always align, leading to sexual conflict where the fitness goals of each sex are in opposition, preventing either from achieving an optimal outcome (Parker, 2006).



The pecking behavior, which consists of targeting the feathers of other birds and sometimes pulling out and consuming them (Blokhuys, 1989), is believed to facilitate digestion, although birds are unable to digest keratin, rendering feathers nutritionally insignificant (McKeegan and Savory, 1999; Mens et al., 2020). Five types of pecking are identified: aggressive pecking, gentle feather pecking without removal of feathers, severe feather pecking leading to feather loss, tissue pecking in denuded areas, and vent pecking (Savory, 1995). Gentle feather pecking and severe feather pecking are abnormal and destructive behaviors, typically seen only in captive birds (Mens et al., 2020). Severe feather pecking, tissue pecking, and vent pecking are considered injurious pecking and can lead to cannibalism. Aggressive pecking, however, is a natural behavior with a clear purpose and is not comparable to the other types. Directed at the head and neck of conspecifics, aggressive pecking is used by birds to establish a stable dominance hierarchy, known as the pecking order (Savory, 1995). Two primary hypotheses have been proposed to explain the occurrence of feather pecking: the lack of ground pecking for foraging behavior (Blokhuys, 1986) and the lack of pecking during dustbathing behavior (Vestergaard and Lisborg, 1993). Both hypotheses suggest that the lack of adequate foraging or dustbathing substrates in the environment may create an obstruction, or that the bird's strong motivation to engage in ground pecking behavior remains unfulfilled. This frustration, resulting from the inability to express motivated behavior, can lead to the redirection of pecking towards alternative targets such as feathers and/or conspecifics. As a direct consequence, frustration may contribute to feather pecking, or indirectly exacerbate stress, which further promotes the behavior (Mens et al., 2020). The currently more widely accepted directed foraging hypothesis posits that feather pecking is not an act of aggression, but rather a form of directed foraging behavior. This may occur when birds misperceive feathers as an appropriate foraging substrate (Riber et al., 2007).

In the ethogram of blue-breasted quail, courtship feeding behavior is identified as tidbitting, a behavior exhibited exclusively by males (Schleidt et al., 1998). Feather plucking in blue-breasted quail is a problem typically observed in overcrowded flocks, whereas it occurs rarely in smaller groups (Landry, 2015).

This study aims to investigate the relationship between feather pecking and courtship feeding in male and female blue-breasted quail in captivity. It hypothesizes that feather pecking in males, followed by courtship feeding (tidbitting), may result from redirected foraging behavior, where males offer food after engaging in feather pecking. The study seeks to provide insights into how feather pecking and courtship feeding behaviors are interconnected and how these interactions may influence reproductive behaviors and maladaptive behaviors in captive conditions.

Materials and Methods

Bird Management and Husbandry

The study was conducted at the Animal Breeding Laboratory of the Faculty of Agriculture, Isparta University of Applied Sciences, in Isparta, Turkey. Fertilized blue-breasted quail (*Syrioicus chinensis*) eggs were incubated at 37.5°C with approximately 50% relative humidity for the first fourteen days, followed by incubation at 37.1°C with approximately 60% relative humidity for the final three days. The chicks hatched after 17 days of incubation. The chicks were initially housed in brooders. The brooder temperature was maintained at 41±1 °C, while areas not directly exposed to heat radiation remained at approximately 35 °C during the first two weeks. Thereafter, the temperature was gradually reduced by 2 °C every two days until it reached 20 °C. Chicks were exposed to continuous 24-hour lighting for the first five weeks.

At the end of five weeks of age, the quails were separated by sex and housed in cages (33×40 cm) with six quails per cage. As the laying period began, one male and one female were randomly paired and housed together in the same cages. A total of 20 pairs (20 males and 20 females) of blue-breasted quail were used in this study. The breeding room maintained an ambient temperature ranging from 20 to 25 °C, with a relative humidity of 60–70% and a natural photoperiod of 14 hours of light and 10 hours of darkness (14L:10D) for the remainder of the experiment.

The feed for blue-breasted quails contained 20% crude protein and 2800 kcal of metabolizable energy per kg until four weeks of age, after which it was adjusted to 17% CP and 2750 kcal of ME/kg for the remainder of the study. The cages were equipped with improvised feeders and drinkers, ensuring ad libitum access to water and feed.

Study design and traits

The first 10 eggs laid by the female quails, housed in pairs, between days 52 and 70 were checked for fertility. In addition, feather plucking and feather eating behaviors of both male and female quail pairs were observed between 15:00 and 17:00 at 65 days of age. Furthermore, feather condition scores at the same age were assessed using a scale adapted from Khalil et al. (2015), ranging from 1 (completely feathered) to 5 (featherless), based on observations of the condition of the feathers on the head, neck, and back. Total values for each bird could range from a minimum of 3 (fully feathered) to a maximum of 15 (featherless), calculated by summing the values of the three areas.



After 70 days of age, lettuce was given daily to reduce feather plucking and feather eating behaviors. Similar observations and measurements were repeated for quails at 100 days of age. In addition, fertility checks were performed separately for the first 10 eggs laid at 95 and 115 days of age. A total of 400 eggs were used to determine fertility.

Statistical analysis

The correlation between feather condition scores of male and female and fertile egg number was analysed using Kendall's tau-b, two-tailed test. Statistical analyses were conducted using the SPSS software (version 27.0; IBM Corporation, Armonk, USA).

Results and Discussion

Figure 1 presents the number of quails exhibiting feather plucking and eating behaviour within the twenty pairs, along with the corresponding pair numbers. As depicted in Figure 1, feather plucking behaviour was exhibited by two male individuals at 65 days of age, while at 100 days of age, this behaviour was no longer observed. Similarly, at 65 days of age, two female individuals demonstrated feather plucking behaviour, whereas at 100 days of age, males in the pairs were noted to engage in feather plucking. Feather eating behaviour was exclusively observed in female individuals and occurred after feathers were presented by males. In addition, a 65-day-old female and a 100-day-old female were observed consuming feathers plucked from their mates. In one instance, a female at 65 days of age plucked a large area of feathers from the male's back without consuming them. The feather plucking behaviour observed among females during the early age period may potentially be attributed to stress associated with mate formation and the necessity of feed presentation during mating. At 100 days of age, plucking occurred in one female and one male in separate pairs, and in these pairs the feathers were consumed by the females.

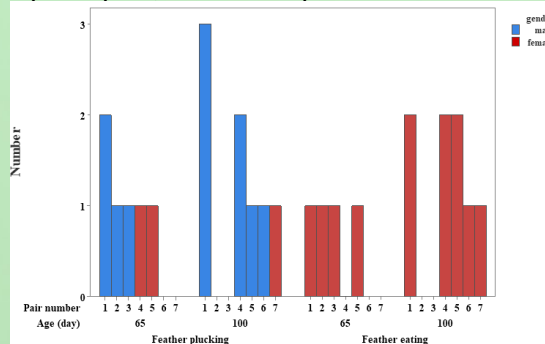


Figure 1. Feather plucking and eating in blue-breasted quail

The results suggest that feather-plucking behavior can develop immediately after pairing. Although this behavior was observed in both males and females, it was noted that the males presented the feathers they plucked to the females as courtship food, which the females subsequently consumed. In other words, the male quail offers the feathers plucked from its mate back to the mate, while the female quail may consume the feathers plucked from the male. On the other hand, Odén et al. (1999) reported that no a male towards a female feather pecking was observed in laying hens. In this study, outside of observation hours, when the female was not interested in the feather offered, the male quail was able to consume the plucked feather.

Hereditary influences, dietary composition, environmental conditions, and husbandry strategies are key determinants in the multifactorial etiology of feather plucking (Schreiter et al., 2020). However in this study, in blue-breasted quail, feather plucking was observed in certain individuals, while absent in others.

The correlation analysis between the feather condition scores of male and female and fertile egg number at 52-70 and 95-115 days is presented in Table 1 and 2, respectively.

Table 1. Correlation coefficients between feather condition scores and fertile egg number at 52-70 days

	Fertile egg number	Male feather score
Male feather score	0.053 (0.792)	
Female feather score	0.185 (0.360)	0.127 (0.522)

The *P*-values are presented in parentheses.

It has long been suggested that hens with increased feather loss on their backs tend to have higher reproductive success compared to those with greater feather coverage (Shi et al., 2019). Nonetheless, in this research, the Kendall's Tau correlation coefficients, based on data from 20 individuals at 52-70 day, non-significant correlations between the variables: fertile egg number and male feather score ($\tau = 0.053$, $P = 0.792$), fertile egg number and female feather score ($\tau = 0.185$, $P = 0.360$), and male feather score and female feather score ($\tau = 0.127$, $P = 0.522$), suggesting no significant relationships.



Table 2. Correlation coefficients between feather condition scores and fertile egg number at 95-115 days

	Fertile egg number	Male feather score
Male feather score	0.233 (0.250)	
Female feather score	0.168 (0.383)	0.308 (0.110)

The *P*-values are presented in parentheses.

In the previous analysis of individuals aged 52-70 years, no significant correlations were found between the variables (Table 1). Similarly, in the current analysis of individuals aged 95-115 days, there were no significant positive relationships, as indicated by the Kendall's Tau correlation coefficients: fertile egg number and male feather score ($\tau = 0.233$, $P = 0.250$), fertile egg number and female feather score ($\tau = 0.168$, $P = 0.383$), and male and female feather scores ($\tau = 0.308$, $P = 0.110$). Overall, these results suggest that there are no statistically significant associations between the variables.

Feather plucking and/or eating in cage-reared blue-breasted quail may have been motivated by courtship feeding as well as misperception of feathers as a suitable foraging ground. On the other hand, the correlations between the feather condition score and the number of fertilised eggs were not statistically significant. However, it is particularly noteworthy in this species that some male quail present plucked feathers to females in a manner resembling courtship feeding.

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