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The influence of photoperiods on behaviour of quail under different housing systems

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Abstract
This experiment was conducted to investigate the effect of different day times on some maintenance behaviour of Japanese quail (Coturnix Coturnix Japonica). The experiment was carried out at faculty of Veterinary Medicine poultry farm, Zagazig University, Egypt. 120 quail of one day old chick were divided randomly into two equal group (60 birds of each) one group were housed at floor system and the other at cage system. From the obtained results the diurnal variation had a significant effect on feeding behaviour. The ingestive behaviour was increased with floor managed quail at early morning. There was a non-significant difference in walking time between different day times. The wall pecking time wasn't affected with the diurnal hours. We concluded that there was a positive correlation coefficient between the ingestive behaviour of quail and the different diurnal hours as it increase with early morning at floor housed quail. The crouching time was increased with mid-day at battery managed quail.

Keywords: Behaviour, circadian rhythms, housing systems, photoperiods, quail

Introduction
Circadian rhythms are the most important factor that affects the behaviour of the birds which controlled by mean of endogenous diurnal clock [1]. Floor housing system is better for satisfaction of the bird's motivation for activity, dust bathing and other important behavioural activities than cage [2]. The increase of activities in the morning may be due to decrease of temperature stress [3]. Measuring welfare of farm animals requires consideration of a variety of parameters and methods. The classical approach to use physiological parameters to assess welfare is considered more objective as they measure the real-time health status of an animal. Nevertheless, good welfare does not only include physical health of an individual but also the mental wellbeing [4]. In the Japanese quail, the eyes activity rhythm such that the interval of activity proceeds contain circadian oscillators that control circadian behaviour the time of injection cause arrhythmicity [5].

Material and Methods
This work was carried out at the faculty of Veterinary medicine poultry farm, Zagazig University, Sharkia, Egypt. This experiment was conducted to investigate the effect of different day times on some maintenance behaviour of Japanese quail (Coturnix Coturnix Japonica).

Birds used and management
A total of 120 one-day old quail chicks were obtained from a commercial chick producer and were used in the experiment. They were randomly divided into two equal experimental groups each consisting of 3 replicates of 20 chicks each and were compared 3 periods of day early morning, mid-day and late afternoon on each housing system.
In the first group, the chicks were reared in floor pens which covered with layer of saw dust (10cm depth), while the other group, chicks were reared in multi-decked cage system as welded wire with close mesh to provide secure footing avoiding leg damage and escape [6].
Food and water were available were available ad-libitum throughout the experiment where feed according to [7] as Yellow corn 56.10, Crude protein 24.9%, Soybean meal 32.73, Crude

fiber 3.45%, Fish meal 5.50, Metabolized energy 3909 MJ/kg, Other feed additives 1.9, Calcium & Phosphorus 1.23%.
The temperature was maintained at about 35 °C during the first week of brooding then decreased by about 3-5 °C weekly by till full feather (3-4 weeks).
The birds were identified by different colored wing band on each group.

Medication
Two intervals source of vit. AD_3 E, Ca, ph in addition to anti-coccidial drugs were administrated.

Observation technique
Behavioural observation was done by using a focal sample technique, videotaping [8]. The behavioural observation in both system floor and cage were recorded at 6 minutes interval through 12 hour observation period/week to represent different day times; P1(Early morning: 7-11h), P2 (Mid-day: 11-15h) and P3 (Late afternoon 15h-19h).

Behavioural patterns: [4]

Table 1: The observed behavioural patterns were recorded as shown in

Behaviour	Definition
1-ingestive: a-feeding b-drinking	Head extended towards available feed resources while beak in or above the drinker appears to be manipulating or ingesting feed quails obtained water from drinking resource
2- Standing behaviour	Quails were standing idle and not engaged in any activity.
3- Walking	Moves forward taking one or more steps
4- Running	Moving rapidly not walking
5-Crouching	Quails lying on the ground.
6-Comfort behaviour: a-Feather preening **b) Other comfort behaviour**: Wing flapping Body shaking Head shaking	 Birds clean and care about their plumage with their beak using short and repeated action while standing or sitting. in which the bird stretches its full height and flaps its wings repeatedly. in which the bird shakes its body vigorously The head is titled to one side and shaken vigorously in circular fashion.
7-Abnormal behaviour [6]: **a**-Flying up b-Wall pecking c- Feed wastage d-Aggressive pecking e- Food wastage	A quail's foot is more than 10cm above the floor with exception; flying up behaviour was only recorded if it lasted for 3sec without interruption. pecking at edible objects like the wall of battery. The birds used its head and beak to thrown out the feed out the feeder resulting in high wastage. The ambivalent behaviour (characterized by an aggressive action followed immediately by submissive posture) during feeding competition was observed in both the unstable and stable grouping of caged quail Quails waste the feed by scratching at the feeder with it's legs by jumping in or out the feeder

Results

Table 1: The effect of photoperiods on ingestive behaviour of quail under different housing systems

	Housing system	Feeding time (Sec/hr)	Feeding frequency	Drinking frequency
P1	Battery	9.75±1.2	7.00±0.58	3.63±0.45
	Floor	15.0±3.0	9.66±1.88	5.00±0.66
	P-value	0.12	0.19	0.10
P2	Battery	7.35±1.59	6.98±0.79	2.03±0.50
	Floor	9.69±1.8	7.83±1.43	2.77±0.47
	P-value	0.34	0.61	0.3
P3	Battery	10.70±1.56	8.92±0.72	3.58±0.69
	Floor	9.67±0.32	7.50±0.43	2.33±0.45
	P-value	0.52	0.11	0.15

P1(Early morning: 7-11h), P2 (Mid-day: 11-15h) and P3 (Late afternoon 15h-19h).

Table 2: The effect of photoperiods on kienetic behaviour of quail under different housing systems

	Housing system	standing time (Sec/hr)	standing frequency	Walking time(Sec/hr)	Run frequency
P1	Battery	3.63±0.45	10.43±2.21	8.91±1.27	6.77±0.64
	Floor	4.63±0.65	5.00±0.66	7.41±0.82	3.37±0.33
	P-value	0.23	0.03	0.33	0.00
P2	Battery	2.03±0.50	14.32±2.64	12.13±1.72	11.66±1.9
	Floor	2.62±0.51	8.34±0.94	9.75±0.61	4.15±0.61
	P-value	0.42	0.06	0.23	0.003
P3	Battery	3.58±0.69	9.59±1.25	9.72±1.12	5.61±0.84
	Floor	2.33±0.45	7.71±1.86	9.38±1.72	5.27±0.42
	P-value	0.15	0.41	0.87	0.72

P1(Early morning: 7-11h), P2 (Mid-day: 11-15h) and P3 (Late afternoon 15h-19h).

Table 3: The effect of photoperiods on resting behaviour of quail under different housing systems

	Housing system	Crouching time (Sec/hr)	Preening	Other comfort
P1	Battery	8.13±0.81	0.13±0.06	23.94±1.89
	Floor	6.66±0.72	0.50±0.04	7.78±0.19
	P-value	0.19	0.00	0.00
P2	Battery	17.61±3.37	0.87±0.38	16.75±2.32
	Floor	7.21±0.93	0.40±0.15	7.62±0.33
	P-value	0.013	0.29	0.002
P3	Battery	8.25±1.24	0.60±0.31	19.02±2.34
	Floor	9.11±1.71	0.11±0.04	8.59±2.63
	P-value	0.68	0.13	0.009

P1(Early morning: 7-11h), P2 (Mid-day: 11-15h) and P3 (Late afternoon 15h-19h).

Table 4: The effect of photoperiods on some behavioural disorders of quail under different housing systems

	Housing system	Wall pecking time (Sec/hr)	Wall pecking frequency	Aggression	Fear	Food wastage
P1	Battery	4.63±0.47	3.00±0.51	0.80±0.31	1.61±0.91	1.16±0.52
	Floor	1.30±0.05	1.36±0.51	0.08±0.04	7.54±1.03	9.44±1.60
	P-value	0.00	0.04	0.037	0.001	0.00
P2	Battery	4.33±0.81	2.27±0.37	0.62±0.27	0.86±0.20	1.05±0.32
	Floor	2.43±0.39	0.87±0.17	0.59±0.21	0.59±0.14	0.78±0.28
	P-value	0.06	0.006	0.93	0.29	0.5
P3	Battery	4.11±0.33	3.10±0.94	1.10±0.58	0.61±0.20	0.88±0.31
	Floor	1.86±0.62	0.77±0.31	0.66±0.19	4.43±0.52	5.11±0.68
	P-value	0.006	.033	0.48	0.00	0.00

P1(Early morning: 7-11h), P2 (Mid-day: 11-15h) and P3 (Late afternoon 15h-19h).

Table 5: The correlation coefficient between different photoperiods and behaviour of quail.

Behaviour traits	Correlation Coefficient p1	Correlation Coefficient p2	Correlation Coefficient p3
Feeding time	0.354+	+0.161	-0.097
Feeding frequency	+0.258	+0.097	-0.419
Drinking time	+0.140	+0.236	-0.387
Standing time	-0.579	-0.311	-0.161
Standing frequency	-0.183	-0.268	-0.011
Walking time	-0.806	-0.804	-0.097
Walking frequency	-0.225	-0.686	+0.161
Running frequency	+0.787	-0.166	-0.289
Crouching time	-0.868	-0.742	-0.613
Crouching frequency	-0.879	-0.463	-0.548
Preening	-0.388	-0.648	-0.582
Other comfort	-0.389	+0.130	+0.011
Wall pecking time	+0.744	-0.185	+0.874
Wall pecking frequency	+0.874	-0.294	+0.872
Aggression	+0.155	-0.033	-0.741
Fear	-0.166	+0.058	-0.481
Food wastage	-0.11	-0.033	-0.130

P1(Early morning: 7-11h), P2 (Mid-day: 11-15h) and P3 (Late afternoon 15h-19h).

Discussion

The obtained results at Table (1) showed that the diurnal variation had a significant effect on feeding behaviour. The ingestive behaviour was increased with floor managed quail at early morning.

While quail reared at battery system showed the highest level of ingestive behaviour at late afternoon. These results were similar to that obtained with [9, 3, 10] who mentioned that the ingestive behaviour was higher at morning than other times of photoperiods, this may be due to a decrease of heat stress.

In contrast [1] found that the feeding time of ornamental birds was increased at mid-day than early morning and late afternoon, while [11] mentioned that the diurnal hours have weakly impact on the behaviour of birds.

There were non-significant differences in standing time between different daytimes at both housing systems as shown in Table [2]

While the standing frequency was increased with battery system at all day times especially at mid-day in compared with floor system. These results in agreement with [12] and disagree with [1, 13].

There were non-significant differences in walking time between different day times, although the highest result was recorded at battery system at mid-day. Bird's activity varies over the times of day, which decreases with increased temperature, stocking density leading to decrease walking ability [14].

Concerning to the crouching time, it was increased with mid-day at battery managed quail than floor reared ones as shown in table (3) the highest level of crouching time recorded by quail reared at floor litter and at late afternoon. These results were similar to that obtained by [9, 3, 10, 15, 1].

The preening wasn't affected with different day times at both housing systems. While other comfort behaviour was increased with early morning at cage reared quails.

These results were consistent with [1], while the results were argued with [9] who observed that preening and dust bathing were highest level with late evening.

The most behavioural patterns of birds were greatly affected with circadian rhythms [16] Results in table (4) showed that diurnal hours had no significant effect on wall pecking behaviour, These results supported by [17, 18, 19]. While the results were incompatibled with [20, 21, 5].

The aggression wasn't affected by Cirdanian rhythms at both housing systems.

While fear and food wastage were increased at morning was may be due to increase the activity of bird at this time of day. [11, 22, 23] found that The Circadian rythms have great impact on behaviour of birds at different environmental sites.

Results in table (5) clarified that there was a positive Correlation coefficient between the ingestive behaviour of quail and the different diurnal hours as it increase with early morning and mid-day.

These results were in line with [1] and were contraryed to [24] as who stated that the feeding behaviour occur few hours after light go on and late afternoon.

[3] found that there was no correlation between circadian rythms and other behaviour of birds.

There was a non-correlation between standing, walking, crouching, preening and day times. In spite of [25] showed differ. There were a negative correlation co-efficient with wall peck and mid-day, while there with other comfort and fear behaviour.

While no correlation with day times and abnormal feed wastage behaviour.

Conclusion

We concluded that the ingestive behaviour was increased with floor managed quail at early morning while quail reared at battery system showed the highest level of ingestive behaviour at late afternoon. The crouching time was increased with mid-day at battery managed quail. There was a non-significant difference in standing time between the different daytimes.

Conflict of interests

None of the authors have any conflict of interest of declare.

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