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Investigating the Physiological Timing of the Body System Using Birds (COCK)

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Abstract: *The physiological timing of the body system using birds (cock) has been investigated. The circadian clock controlled the crowing of cocks, which in many cultures, symbolize the break of dawn. One cock announces the break of dawn, while others within the environment follows immediately. Birds (chicken) are one social animal that respect hierarchy even in their smaller groups. It was observed that, when chickens are kept in a small group, the higher ranking cock determined the timing of the break of dawn crowing. Locally inbred native cock was used for this study. Four groups cages were consider, which consist of four cocks (roosters) per individual experimental cages. This is done to analyze the relationship between crowing behavior and social ranking. From the results of this study, we observed that, the highest ranking cocks from all the experimental cages crow more than the subordinates cock under both conditions of 12hnL12hdimL condition. When we removed the highest ranking cock which was marked blue from the cage, we observed that, the second rank cock (marked black) become the first to crow followed by the other subordinate cocks in ascending order of their social ranking*

Keywords: *Cock, circadian clock, social ranking, crowing, highest rank cock, subordinate cock, dim light, no light.*

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I. Introduction

A male bird (chicken) is made up of the cockerel and cock or rooster, with the younger being the cockerel and the adult being the cock also known as the rooster (Hugh Rawson, 2006). The circadian clock controlled the crowing of cocks, which in many cultures, symbolize the break of dawn. One cock announces the break of dawn, while others within the environment follows immediately. Birds (chicken) are one social animal that respect hierarchy even in their smaller groups. It was observed that, when chickens are kept in a small group, the higher ranking cock determined the timing of the break of dawn crowing.

Most importantly, the higher ranked cock will first start the crowing, and then the subordinates will follow in a descending order of social ranking. When a group physically removed a top-ranking cock, the second ranked cock will start initiating predawn crowing. The existences of dominant cock significantly influence the numbers of predawn crow among the subordinates. But, some crows are induced by external stimuli which are independent of social ranking, which confirmed that, the subordinates cock has got the ability to crow. However, the timing of subordinate's break of dawn crowing is highly dependent on that of the highest ranking cock, though, from time to time their body temperature rhythm differed among individuals and their crowing rhythm (Peake H, et al. 1996). In every group, the subordinates always give priority to the top ranking cock to announce the break of dawn, while the subordinates cock wait patiently for the highest rank cock to first crow every morning before the subordinates start crowing, even though they compromise their circadian clock due to social reason (Peake H, et al. 1996).

When one cock crow to signal the break of dawn, other cocks in the neighborhood will then have chance of crowing (Koene, P. 2009). Chicken as a highly social animals,(Wood-Gush, D.G.M. 2007), advertise their territories by means of crowing, thereby avoiding the danger of having a direct aggressive contact with others(Collins, N.E. 2006). Chickens develop a linear and fixed hierarchy, when the group size is not large enough to recognize others, which is the "pecking order" (Wood-Gush, D.G.M. 2009). Their social hierarchy influences the behavior of each cock, in such group, the higher ranking cock always have priority for mating, resources and food in the group (Wood-Gush, D.G.M. 2007), however, in chicken, the pecking order forms the basis of their social behavior.

Oftentimes during the day, a cock normally perch high usually 3 to 6 feet above the ground, to watch over his group and at the event of predators getting closer to his group, he sounds a distinctive alarm call and crow frequently to maintain his territory (Read, Gina. 2008).

Since the time of the Indus civilization (B.C. 2600–1800), cock crowing has informed human being of the break of dawn (Peake H, et al. 1993). The circadian clock and internal biological clock regulate the timing of

the cock predawn crowing in 24 hours period. Though, some external stimuli such as crowing by other individuals cock and light can also induce crowing, the circadian clock also controlled this induction (Shimmura T, et al.2013). This study will try to address this problem with the view of correcting the impression that, one can sleep and wake with the aid of arm clock. The study will also analyze the physiological timing of cock crowing.

II. Materials And Methods

Cocks and the experimental setup.

Locally inbred native cock was used for this study. Four groups cages were consider, which consist of four cocks (roosters) per individual experimental cages. This is done to analyze the relationship between crowing behavior and social ranking.

Data was collected under a 12 hours dim light (12hdimL) condition for one week, and under 12 hours no light (12hnL) condition for another one week period making a total of fourteen days. The cocks body temperature rhythm was examine under no light and dim light condition to monitor their circadian clock. All the cocks was mark with different colors as to differentiate each. The highest rank cock was marked with blue color, the second rank cock was mark with black color, the third rank with green while the fourth rank cock was mark with white color.

III. Results And Discussion

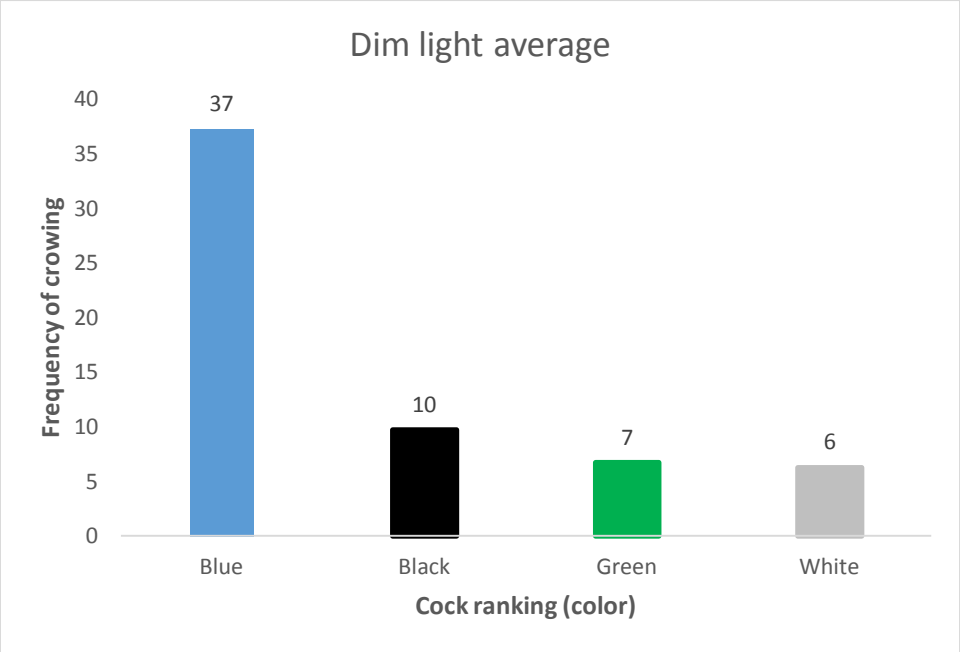

Figure1; Average of seven days of Dim light.

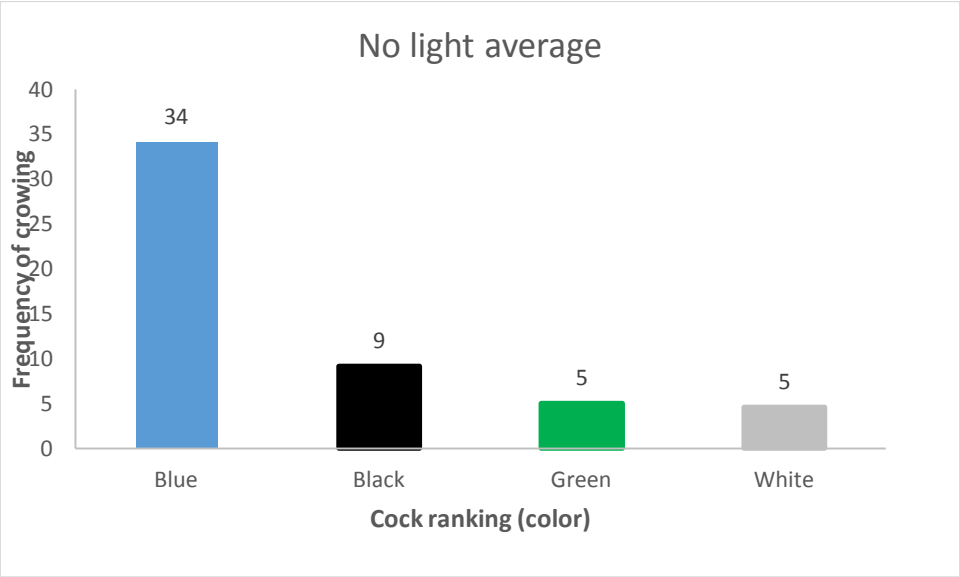

Figure 2; Average of seven days with No light

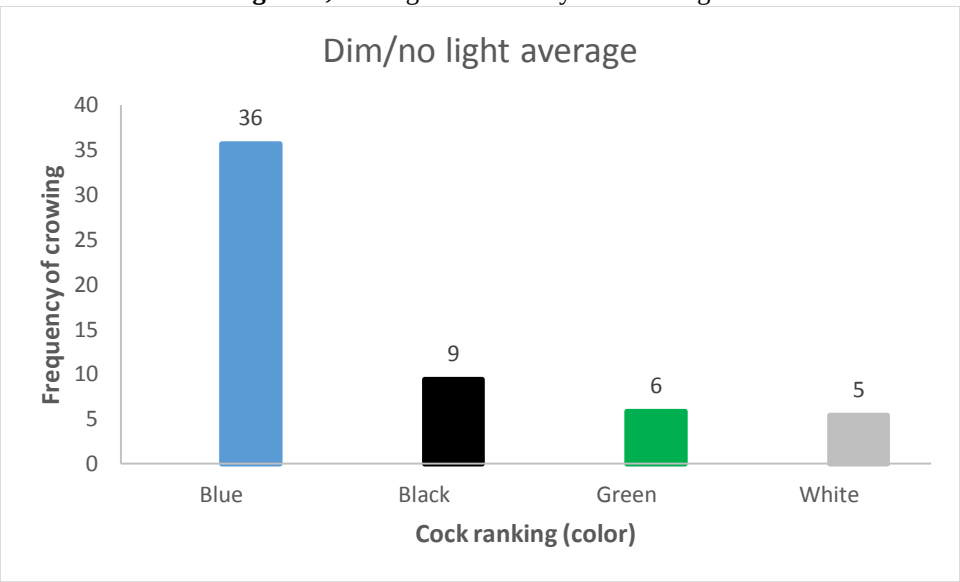

Figure 3; Average of both Dim light and No light

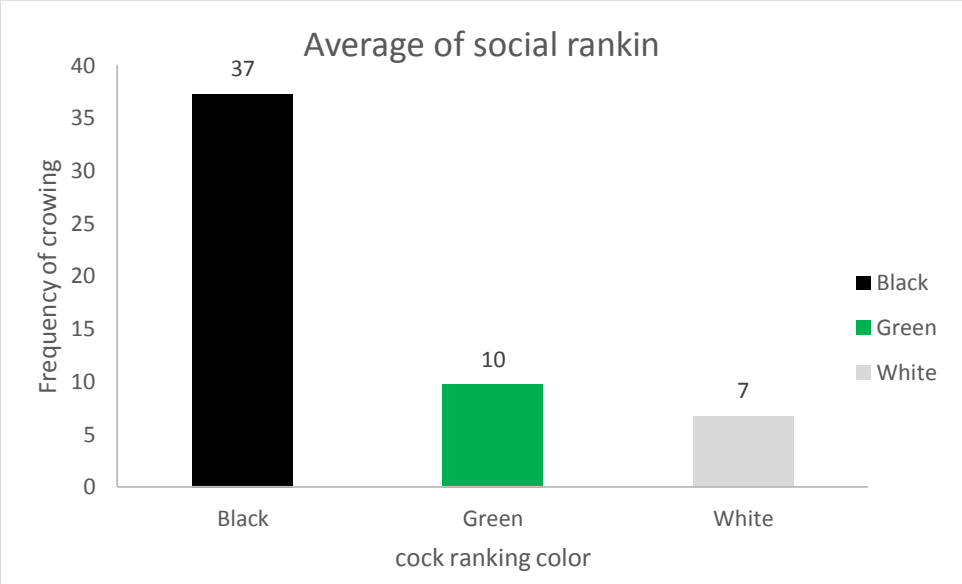

Fig 4. Average of social ranking

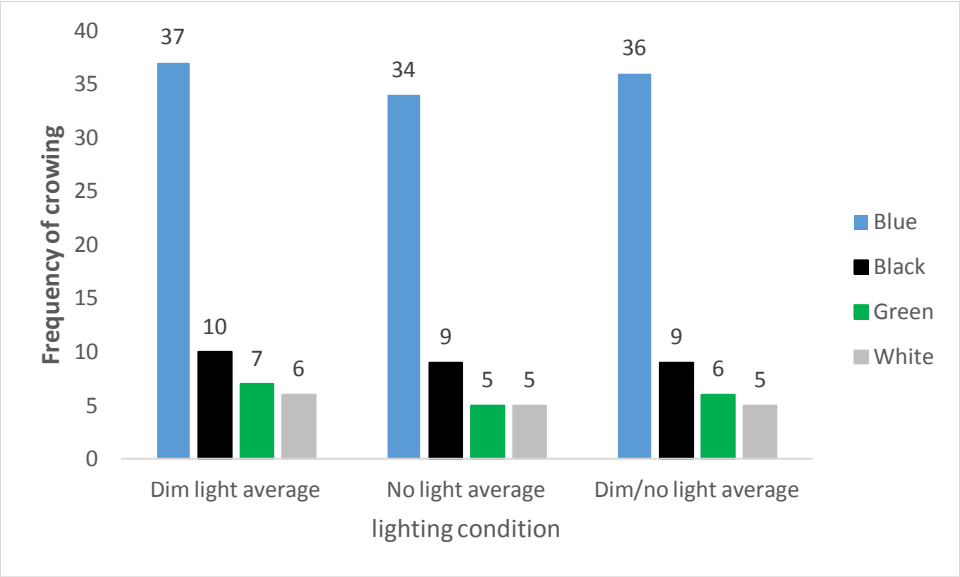

Figure 5; Summary of social ranking.

Correlations[b]

		A= Dim light	B=No light	C=Dim/No light
A	Pearson Correlation	1		
	Sig. (2-tailed)			
B	Pearson Correlation	.999**	1	
	Sig. (2-tailed)	.001		
C	Pearson Correlation	1.000**	.999**	1
	Sig. (2-tailed)	.000	.001	

**. Correlation is significant at the 0.01 level (2-tailed).
b. Listwise N=4

Table 1: Correlation matrix of the social ranking summary.

ANOVA
values

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.167	2	3.083	.015	.985
Within Groups	1892.750	9	210.306		
Total	1898.917	11			

Table 2: The ANOVA Values.

IV. Discussion Of Results

From the results shown above, we observed that, the highest ranking cocks from all the experimental cages crow more than the subordinates cock under both conditions of 12hnL12hdimL condition, as shown in (Figs 1-3). The highest ranking cock always been the first to start crowing every morning followed by the lower ranking cock in descending order of social rank (Fig. 1-5). When we looked at the crowing pattern in detail, we observed that, the subordinates cocks followed the highest ranking cock to crow within a few tens of seconds. We also observed that, the lower ranking cock crowed less than the highest ranking cock within this short period of research. Though, the timing of first crowing by the highest ranking changes each day, the timing of subordinates crowing also changes with respect to a change in the highest rank cock (Figs 1-5).

When we removed the highest ranking cock which was marked blue from the cage, we observed that, the second rank cock (marked black) become the first to crow followed by the other subordinate cocks in ascending order of their social ranking. This results agreed with previous studies, that shows that when a top ranking cock is physically removed from a group, the second rank cock takes charge of the group and have priority to crow first before the subordinates (Fig. 4).

Using correlation matrix to know the relationship between dim light condition, no light condition and dim/no light condition, at 0.01 of significant level, we observed that, the correlation between dim light and no light is (r= 0.999), the correlation between dim light and dim/no light is (r=1.000), correlation between no light and dim/no light is 0.999 as indicated in Table 1.

The ANOVA table above shows the **F-ratio** of 0.015 and the **P-value** or significant value of 0.985 at 0.015 level of significance. The ANOVA test shows that, there is no significant difference between dim light, no light and dim/no light.

V. Conclusion

Investigating the physiological timing of the body system using cock, was carried out using four experimental cages. Each cage contains four birds of different ages, as to determine hierarchy in social ranking. The cocks in each cages was colored with different colors as means of identification. The highest rank cock was colored blue, second rank black, third rank green and the fourth rank was white.

We observed that, the highest ranking cocks in all the group has the priority to crow first every morning, followed by the subordinate cocks in descending order of social ranking. We also notice that, the highest rank cock crow higher than every other cocks in each of the cages as shown in the results.

Acknowledgement

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