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Association of open field behavior with blood and semen characteristics in roosters: an alternative animal model

Mohammad Mehdi Ommati[a,b], Reza Heidari[c], Mohammad Javad Zamiri[a,*], Sajjad Shojaee[a], Amir Akhlaghi[a], Samira Sabouri[d]

[a] *Department of Animal Sciences, College of Agriculture, Shiraz University, Shiraz, Iran*
[b] *Shanxi Key Laboratory of Ecological Animal Science and Environmental Medicine, Shanxi Agricultural University, Taigu, Shanxi 030801, People's Republic of China*
[c] *Pharmaceutical Sciences Research Center, Shiraz University of Medical Sciences, Shiraz, Iran*
[d] *Department of Clinical Psychology, Roudehen branch, Islamic Azad University, Roudehen, Iran*

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KEYWORDS
Blood attributes;
Fear response;
H:L ratio;
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Abstract
Introduction: The paucity of literature is addressed regarding the correlation between open field as an individual behavioral trait on reproductive capacity in animals.
Materials and methods: To address this, Nine-month-old indigenous roosters were housed in individual cages. Each animal was observed twice a week for ten minutes before feeding in an open field apparatus for two weeks (7:00–12:00 PM).
Results: Interestingly, it was found that rooster's semen characteristics were correlated with their open field behavior. On the other hand, plasma glucose level as a blood attribute was more correlated with semen characteristics. The open field monitoring also revealed that the roosters with the lowest delay to their first pace had the highest sperm forward motility and lower sperm abnormality. The heterophil to lymphocyte ratio (H:L) was found to be low when pace bout and pace numbers were 20 and 35, respectively. The negative correlation between H:L ratio and semen characteristics (live sperm percentage, sperm concentration, and membrane integrity) may be an indication of poor reproductive performance in fearful roosters with higher H:L ratio.
Conclusions: The data suggested a relationship between open field behavior indices and some reproductive parameters in roosters. The results might be applicable for selection of more reproductive animals. Hence, the rooster may also be useful model for similar studies in other species.

* Corresponding author.
E-mail address: mjzamiri@gmail.com (M.J. Zamiri).

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PALABRAS CLAVE
Atributos de sangre;
Respuestas de miedo;
Relación entre heterófilos y linfocitos;
Campo abierto;
Características del semen

Asociación entre la conducta de gallos en campo abierto con sus características de sangre y de semen: un modelo animal alternativo

Resumen
Introducción: Existe poca literatura que analice la relación entre el comportamiento individual en animales en campo abierto y su capacidad reproductiva.
Material y métodos: Para cubrir esta laguna se trabajó con gallos de 9 meses de edad que fueron encerrados en jaulas individuales. Cada animal se observó 2 veces a la semana, durante 10 min, en una zona de campo abierto durante 2 semanas, antes de la alimentación (07:00-12:00 p.m.).
Resultados: Curiosamente, se encontró que la característica del semen de los gallos se correlacionaba con su comportamiento en campo abierto. Por otro lado, el nivel de glucosa en plasma, como un atributo de la sangre, se correlacionaba con las características del semen. La monitorización en campo abierto también reveló que los gallos con la menor demora en su primer canto tuvieron la mayor motilidad de los espermatozoides y la menor alteración del esperma. El nivel más bajo de la relación entre heterófilos y linfocitos (H: L) fue encontrado cuando los números de cantos y el ritmo eran 20 y 35, respectivamente. La correlación negativa entre el índice H:L y las características del semen (porcentaje de espermatozoides vivos, concentración de espermatozoides, e integridad de la membrana) puede ser un indicio de mal desempeño reproductivo de gallos con mayor índice H:L.
Conclusiones: Los datos indican que existe relación entre los índices de comportamiento en campo abierto y algunos parámetros reproductivos de los gallos. Los resultados podrían ser aplicables para la selección de los animales más reproductivos. El gallo también puede ser útil como un modelo para estudios similares en otras especies.

Introduction

Stressful situations, through psychological and physiological disturbances, affect fertility in humans[1] and animals.[2] Many factors such as individual condition, emotional strength, coping strategy, and race might affect fertility. It has been found that, Distress and fear affect both the health and welfare of farm animals.[3] Open field behavior is a measure of fear, and it is generally accepted that immobility in the open field is an indicative of fearfulness, while locomotor activity indicates the lack of fear.[4,5] In caged laying hens, startle reflexes, induced by sudden noises or frightening visual stimuli, may cause physical damage to limbs, sudden discharge of energy and even death; furthermore, increased corticosterone secretion due to fear and stress may cause immunosuppression.[6] The profile of leucocytes is changed in the chicken due to stress. Except for the evaluation of corticosterone level for assessing the stress level in poultry, determination of the ratio of heterophils to lymphocytes (H:L) can be used[7,8] which is highly heritable.[9,10] Fasting, frustration, water deprivation and crowding increase the H:L ratio.[11] Determining the H:L ratio has several advantages in comparison with measuring corticosterone levels; including the lower cost and need for smaller sample volume.[12] Therefore we used H:L ratio to determine the stress levels.

Fear and open field activity are also associated with the reactive and proactive coping strategies; the reactive coper's behavior is directed by current clues in the environment and response stronger to environmental stimuli, whereas the proactive coper's animal seem to behave more, according to their past experiences and easily develop routines.[13,14] It is proposed that reactive copers are more adaptive to the changes in the environment, while proactive copers are more comfortable in predictable and unchanging environments.[13,15] As previously mentioned, proactive animals establish routines and are more vulnerable to the development of abnormal behaviors.[13,14] These animals are also more afraid and have less locomotor activity in the open field.[16] Open field activity is heritable, and divergent selection for this trait has been carried out in species such as rabbits,[9] mice[10,17] and chickens.[18] It has been proposed that selection against fear is a more rapid, effective, economical and reliable method in breeding programs.[19] Because poultry farming is a very large industry, small changes in fertility, especially in males – due to a smaller number of males and then their greater contribution to flock fertility – could have significant economic impact. It has also been revealed that fear affected sexual behavior in cattle and sheep.[20,21] Despite of literature available on the physiological and neurobiological difference between low and high fear index animals,[22,23] there have been little, if any, endeavor in elucidating the probable effect of open field as an individual behavioral trait on reproductive capacity in animals. Then this investigation aimed to determine the association between open field behavioral indices (pace bout, pace number, first pace, peck bout, peck number, first peck, crow number, and coming forward), semen characteristics (sperm forward motility, live and abnormal sperm, sperm concentration, sperm membrane integrity), and some blood biochemical attributes.

As shown in Fig. A.1 (Appendix 1), the association of sperm motility, concentration, viability, abnormality and membrane integrity and the selected blood parameters with open field behavior in Iranian native breeder roosters were

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