The Titer of Immunity and Signs of Welfare Due to Changes in Group Size in Two Strains of Lohmann Classic Layers

Hesham H. Mohammed¹ and Ibrahim F. Rehan², *

¹Department of Veterinary Public Health, Faculty of Veterinary Medicine, Zagazig University, El-Zeraa St. 114; 44511, Zagazig, Egypt, ²Department of Animal Behavior and Husbandry, Faculty of Veterinary Medicine, South Valley University, Qena, 83523, Egypt.

Abstract

This study examined the effect of the different group sizes on the titers of some immunological indicators and welfare status in two strains of Lohmann layers. A total 558 layers (279 Lohmann brown and 279 Lohmann selected leghorn), aged 50 weeks were homogenously classified into four groups, where 360 birds (180 Lohmann brown and 180 Lohmann selected leghorn) in 6 cages (60 layers/cage “5 m²”) and 198 birds (99 Lohmann brown and 99 Lohmann selected leghorn) (33 layers/cage “2.8 m²”) with the same floor space relatively. The antibody titer of avian encephalomyelitis, avian meta-pneumonia, infectious bronchitis and mycoplasma synovia were higher in small group (33 birds) than large group size (60 birds). However, the differences didn’t reach the significance. In the other hand, the Lohmann selected leghorn was more susceptible to avian encephalomyelitis, infectious bronchitis and mycoplasma synovia due to the increase in its antibody titers, while the antibody titers of avian meta-pneumonia and mycoplasma gallisepticum were higher in Lohmann brown. In large group size, the scores of plumage condition were referred to the best, especially in Lohmann brown. Furthermore, the changes in feet condition in Lohmann brown were better than Lohmann selected leghorn, especially in large group. In order to achieve the full genetic growth potential, layers must be reared under optimal group size. Therefore, any deviation of the optimum management condition of layers may impair their performance, cause immunosupression, and change their physiological responses leading to increase their susceptibility to diseases.

Keywords: Group Size, Layer, Immunity, Plumage, Feet.

Received: May 30, 2018  Accepted: June 21, 2018  Published: June 30, 2018

*Corresponding Author: Ibrahim F. Rehan  E-mail: Ibrahim.rehan@vet.svu.edu.eg

Citation: Mohammed and Rehan, 2018. The Titer of Immunity and Signs of Welfare Due to Changes in Group Size in Two Strains of Lohmann Classic Layers. SVU-IJVS, 1 (1): 82-89.

Copyright: This is an open access article distributed under the terms of the creative common attribution license, which permits unrestricted use, distribution and reproduction in any medium provided the original author and source are created.

Competing interest: The authors have declared that no competing interest exists.
Introduction

Today, the poultry industry is believed to achieve perpetual and instant production of the best available sources of animal protein, and the increase towards poultry welfare in farms has led to studying the management. The poultry industry faces new challenges and changes to adapt to new market interests, new regulations, and to continue improving the productivity as well as the welfare of birds. Poor welfare often reduces productivity and profitability of layers, there was economic reason for monitoring and improving the welfare of farmed animals (Blokhuis et al., 2013). Improvements regarding the welfare of laying hens can be achieved by development and enhancement of environmental factors such as management practices (Malin, 2015). Group size is a common practice to vary stocking density by adjusting the number of hens in a fixed space (Guo et al., 2012). Hence, the effect of group size may play a role in the welfare, and performance of hens in caging systems. There were several studies paying attention on the influence of group size on layer's performance (Craig et al., 1986 and Benyi et al., 2006), egg quality (Fulvia et al., 2014) and feed conversion ratio (Sirovnik et al., 2018). Laying hen welfare may also be greatly affected by breeding goals, so selective breeding for desired traits may help to improve welfare (Lay et al., 2011) and is considered the main cause in variation of productivity and mortality rate of layers (Aerni et al., 2005 and Larsen et al., 2018). It was found that a hen's appearance and phenotypic change are relevant enough to affect bird growth and egg production (Marin et al., 2014). There were several studies studied the effect of strain of Lohmann layer on plumage condition (Mohammed, 2012) and behavior (Mohammed and Enas, 2016 and Riddle et al., 2018). For that reason, the objectives of the current study were to assess the titer of immunity and signs of welfare due to changes in group size between two commercial layer lines; Lohmann brown (LB) and Lohmann selected leghorn (LSL).

Materials and methods

Experimental animals and management

The experimental procedures were done in accordance with the Ethics and Animal Welfare Committee at the Poultry Research Unit, Faculty of Veterinary Medicine, Zagazig University, Egypt. The study was conducted in furnished cages with nest, plastic mat and perch on two batches of Lohmann brown (LB) and Lohmann selected leghorn (LSL) in two different group sizes (33 and 60 birds). A total 558 layers (279 Lohmann brown, 279 Lohmann selected leghorn), aged 50 weeks were homogenously classified in to four groups, where 360 birds (180 Lohmann brown and 180 Lohmann selected leghorn) in 6 cages (60 layers/cage “5 m2”) and 198 birds (99 Lohmann brown and 99 Lohmann selected leghorn) (33 layers/cage “2.8 m2”) with the same floor space relatively. During the study, a 16 hour's lighting schedule was applied from incandescent lamp. Water was provided ad libitum, while the basal layer diet was formulated to meet layer nutrient requirements (AOAC, 2002).

The titers of immunity

All data were recorded for all groups throughout the experimental period (12 weeks), where the antibody titer of avian encephalomyelitis, avian meta-pneumonia, infectious bronchitis, mycoplasma gallisepticum and mycoplasma synovia were assessed three times throughout experimental period (at 51, 55 and 59 weeks respectively) via enzyme-linked immunosorbent assay (ELISA). That was done after collecting random blood samples from wing vein in 60 birds from each strain. Serum was separated from blood samples by centrifugation at 15,000 × g for 3 min and stored at −80°C until the day of analysis and all serum samples were read against
positive and negative control antisera (Mohammed et al., 2016).

**Signs of welfare (plumage and feet conditions)**

Evaluation of the plumage and feet condition was scored monthly for 15 birds per cage randomly by using Tauson scale, (Mohammed, 2012 and Mohammed et al., 2017). The scoring system in Tauson scale was ranged from 1 to 4, where 4 was the best condition (completely feathered and healthy feet) and 1 was the worst (Featherless with changes in feet, as fracture nail and toe hyperkeratosis).

**Statistical analysis**

All statistical procedures were performed using the SAS Statistical Package (SAS, 2002). The differences among means of the data were analysed using parametric T-test.

**Results**

The results in Fig. 1, 2, 3, 4 and 5 included the titer of antibodies of avian encephalomyelitis, avian meta-pneumonia, infectious bronchitis, mycoplasma gallisepticum and mycoplasma synovia. The antibody titers of avian encephalomyelitis, infectious bronchitis and mycoplasma synovia were higher in small group than large one of LSL strain, as shown in Fig. 1, 3 and 5, respectively, but the differences didn't reach the significance. While Fig. 2 and 4 revealed increase of susceptibility of LB strain to avian meta-pneumonia and mycoplasma gallisepticum, where its antibody titers were higher in large one strain than small one of LB. Furthermore, Fig. 6 showed the effect of different group size on the plumage and feet condition in two strains of Lohmann classic layers under different group size. The scores of plumage and feet condition were higher in large group than small one of LB strain and these scores confirm positive impact of group size on plumage and feet condition. However, LSL hens showed a worse plumage and feed condition than LB, as shown in Fig (6). Our results confirmed that changing the housing condition and strain will maximize the risk factors influenced health and welfare status of layers.

**Fig. 1.** Effect of group size on the titer of avian encephalomyelitis in two strains of Lohmann classic layers. The antibody titer of avian encephalomyelitis was higher in small group than large one of LSL strain. LB, Lohmann brown; LSL, Lohmann selected leghorn.

**Fig. 2.** Effect of group size on the titer of avian meta-pneumonia in two strains of Lohmann classic layers. The antibody titer of avian meta-pneumonia was higher in large group than small one of LB strain. LB, Lohmann brown; LSL, Lohmann selected leghorn.
Fig. 6. Plumage and feet condition in two strains of Lohmann classic layers under different group size. The scores of plumage and feet condition were higher in large group than small one of LB strain. LB, Lohmann brown; LSL, Lohmann selected leghorn.

Fig. 3. Effect of group size on the titer of infectious bronchitis in two strains of Lohmann classic layers. The antibody titer of infectious bronchitis was higher in small group than large one of LSL strain. LB, Lohmann brown; LSL, Lohmann selected leghorn.

Fig. 4. Effect of group size on the titer of mycoplasma gallisepticum in two strains of Lohmann classic layers. The antibody titer of mycoplasma gallisepticum was higher in large group than small one of LB strain. LB, Lohmann brown; LSL, Lohmann selected leghorn.

Fig. 5. Effect of group size on the titer of mycoplasma synovia in two strains of Lohmann classic layers. The antibody titer of mycoplasma synovia was higher in small group than large one of LSL strain. LB, Lohmann brown; LSL, Lohmann selected leghorn.
Discussion

Because the Lohmann selected leghorn (LSL) and Lohmann brown (LB) layer lines have been identified for high egg production, these are belonging to the worldwide leading commercial layer lines. Therefore, the present study examined the effect of group size on the titer of immunity and signs of welfare in the both strains of Lohmann classic layers. Group size is a common practice to vary stocking density by adjusting the number of hens in a fixed space. The results in Fig. 1, 2, 3 and 5 included the upregulation of the titer of antibodies of avian encephalomyelitis, avian meta-pneumonia, infectious bronchitis and mycoplasma synovia. These titers were higher in small group (33 birds) than large group size (60 birds). Our results revealed the higher susceptibility of layers to previous diseases in small groups and the question of group size has aroused great interest worldwide as it can have several practice implications on laying hens production (Wall, 2011). As general, there was no difference in susceptibility of layers to mycoplasma gallisepticum, although the differences between the LB and LSL. It was found that smaller flocks had higher survivality than those of larger flocks (Tid and Ambrosen, 1988). Therefore, any deviation of optimum management condition of layers may impair their performance and change their physiological responses (Mohammed et al., 2016). In the other hand, LSL was more susceptible to avian encephalomyelitis, infectious bronchitis and mycoplasma synovia due to the increase in its antibody titers (Fig 1, 3 and 5), while the antibody titers of avian meta-pneumonia and mycoplasma gallisepticum were higher in LB, as mentioned previously in Fig. 2 and 4. Difference in immunological patterns between LSL and LB might relate to the hen’s serum heterophil/lymphocyte ratios and stress modulation for egg laying in housing system (Rautenschlein et al., 2011, and Lentfer et al., 2015). Moreover, several studies have compared poultry strain differences in combination with other factors such as age, sex, gene expression, and management factors that influence the yield of poultry (Woyengo et al., 2010, Abdullah et al., 2010, Lopez et al., 2011, Habig et al., 2012, and Riddle et al., 2018). Fig (6) described the conditions of plumage and feet, where it was the best in layers reared in large group especially in Lohmann brown. That confirms the positive impact of group size on plumage and feet condition, as previously reported (Bilcik and Keeling, 1999, and Allen and Perry 1975). Likewise, hyper keratotic alterations have been observed in the small group of LB line (Weitzenbürger et al., 2006) due to the use of perches and grasping the wire floor of furnished cages. Our results may be due to the increase of allelomimetic, comfort behavior among birds in large group (Mohamed and Mohamed, 2013). Moreover, good signs of health and welfare in LB agreed with (Hughes and Duncan, 1972, Jonsen et al., 1998 and Mohammed, 2012). However, LSL hens showed a worse plumage and feed condition than LB. It may be due to the more increasing in comfort behavior in LB (Wall et al., 2008) or related to its genetic resistance to infection than LSL (Kaufmann et al., 2011). Our findings provide gene implications involved in economically important line characteristics of commercial laying hens.

In conclusion, to achieve the full genetic growth potential, layers must be reared under optimal management conditions to improve their welfare and productivity. Any deviation of this optimization protocol may impair their performance, cause immunosuppression, and change their physiological responses leading to increase their susceptibility to diseases.
Acknowledgments

The authors would like to express sincere thanks to South Valley University, Egypt for supporting this work.

Abbreviations

LB, Lohmann brown; LSL, Lohmann selected leghorn and ELISA, enzyme-linked immunosorbent assay.

Contributions

Hesham H. Mohammed and Ibrahim F. Rehan were mutually contributed to design the study protocol, edit, and approve the final manuscript as submitted.

References


AOAC (2002). Official Methods of Analysis. Association Official Analytical Chemists, Gaithersburg, USA.


Mohamed HH, Mohamed EM (2013). Studying the behaviour and performance of balady male goats managed in different group sizes with the same individual floor space under Egyptian conditions. Benha Veterinary Medical Journal, 24(1): 34-42.


Tind E, Ambrosen T (1988). Laying hen kept in cages, the effect cage shape, group size and unit area. Poultry Abstracts.


