Effects of domestication on social support in chickens (Gallus gallus)

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This report is a degree thesis at the Bachelors level (16 ECTS credits) performed by the author in collaboration with two study colleagues, Caroline Bergvall and Sofia Nilsson. This cooperation included the planning of the study, the collection of data and analyses. Thereafter each student has written and structured the report in all its parts individually.
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**Keyword:**

Social support, White Leghorn, red junglefowl, domestication, social behaviour
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1 Abstract

Social support is thought to give animals benefits from social partners, such as improved coping with challenges. The aim of this study was to investigate differences in social support in the red junglefowl (RJF) and a domestic layer strain, the White Leghorn (WL). A runway test consisting of two compartments with unfamiliar and familiar stimulus animals was used to measure social motivation before and after a stressful experience. Total number of test animals was 56 divided into four groups; male and female WL as well as male and female RJF. Results showed that females preferred to stay close to familiar conspecifics after stress treatment. Before stress treatment there was little difference between either sex of WL while RJF males and females chose different zones. Females preferred familiar conspecifics, indicating that they rely more on familiar social stimuli for social support. Males of the two breeds behaved differently towards stimulus animals. WL males showed aggression towards familiar stimulus animals while RJF males directed aggression towards unfamiliar stimulus animals. Indication of sexual behavioural dimorphism was supported while further research is needed in domestication effects on social support in chickens.

2 Introduction

Social support is the concept that individuals within a species gain benefits from social partners, the benefits being that these individuals cope better with challenges, e.g. stressful experiences (Rault, 2012). There has been little research on the effects of social support on farm animal welfare. This is surprising considering the positive effects that social support apparently has on several highly social species (Kikusui et al., 2006). Marin et al. (2001) have shown that domestic chicks increase their motivation to restore contact with conspecifics after a stressful experience and prefer to stay close to familiar rather than unfamiliar conspecifics.

Stress can be explained as disruption of homeostasis and involves the activation of the HPA-axis and sympathetic nervous system. Different stimuli act as stressors and the stress response is activated when these stimuli reach a threshold.

Domestication has altered behaviour of animals by reducing sensitivity to environmental change among other things (Price, 1999). It is the process that occurs when animals become adapted to humans and the captive
environment that they provide (Price 1984). This happens through genetic changes and environmental influence on development during generations. Previous studies indicate that during domestication there has been a selection, conscious or unconscious, towards decreased fearfulness in chickens (Campler et al., 2009). Perhaps domestication has altered the need for social support in chickens, so that domestic chickens are less inclined to seek social support than their ancestors, the red junglefowl, in stressful situations. Since stress is activated by stimuli and domestication has lowered thresholds to certain stimuli (Price, 1999) rather than completely eliminating certain responses or behaviours it can be expected that thresholds for stressors are higher in domesticated animals.

The focus of this study was on comparison between social support in red junglefowl (*Gallus gallus*) and the domesticated White Leghorn. The red junglefowl is the ancestor of all domesticated chickens (Collias and Collias, 1996; West and Zhou, 1988) and White Leghorn is a layer strain commonly used in egg production. In natural conditions they form smaller groups of four to thirty individuals (Collias and Collias, 1996). Commercial settings house chickens at high densities. It is not uncommon to house thousands of chickens in one setting. These conditions force animals to alter their social strategies (D’Eath and Keeling, 2003).

The aim of this study was to investigate whether there is a difference in social support between red junglefowl and White Leghorn. The hypothesis was that red junglefowl would show more interest in unfamiliar conspecifics prior to stress treatment compared to White Leghorn since White Leghorns have been selected for housing in large groups where social identity of conspecifics might be less important. White Leghorns were expected not to show any preference for specific individuals (familiar or unfamiliar) after stress treatment for the same reason and because they have been selected for lower fearfulness, whereas red junglefowl were expected to show higher preference for familiar conspecifics.

3 Materials & methods

3.1 Facilities

All tests were performed at the Wood-Gush research facility at Vreta outside Linköping.

3.2 Animals and housing

Two breeds of chickens were used as test animals. These breeds were red junglefowl (RJF) and White Leghorn layers (WL). A total of 56 test
animals were used, that is 14 of each RJF males, RJF females, WL males and WL females. Additionally adult familiar and unfamiliar stimulus animals were used.

Familiar animals were kept in the same home pens as the test animals and unfamiliar animals in a separate home pen where no contact whatsoever could occur. These pens measured 300 x 250 x 300 m (length x width x height). Temperature was kept between 19 and 27 °C with a light schedule of 12 hours light and 12 hours dark. Light intensity at light periods was 5-8 lux. Pens were equipped with perches and nest boxes. Wood chips were used for bedding material. Food and water was provided ad libitum.

The unfamiliar animals were a cross between RJF and WL. Familiar stimulus animals were either RJF or WL. As familiar stimulus animals only chickens of the same breed as the test animal in any test were used. Test animals and familiar stimulus animals were 62-65 weeks old over the duration of the test and unfamiliar stimulus animals were 22-29 weeks old.

3.3 Behaviour test

The purpose of the behaviour test was to measure social motivation in chickens before and after a stressful experience. Two compartments at each end of a runway arena contained either familiar or unfamiliar stimulus animals. Test animals were to be dropped at the centre of the runway and thereafter allowed to freely explore the runway. Total time in each of three zones before and after stress treatment was measured.

All animals were tested only once but some animals were used both as test and stimulus animals, this due to a limited amount of chickens, this especially concerned RJF of both sexes. Any animal that was used as either test or stimulus animal had at least three days in between being used as test animal and stimulus animal. Unfamiliar stimulus animals were only used once to be sure of that the animals were not familiar with each other.

Prior to the behaviour test, four test animals (two WL and two RJF) were moved to a habituation box where they were kept for two hours. The size of this habituation box was 90 x 90 x 180 cm (length x width x height). Food and water was provided ad libitum. The test arena consisted of a runway with two compartments at each end. In these compartments familiar and unfamiliar stimulus animals were placed separately.

Measurements of the arena were 290 x 90 x 180 cm (l x w x h). It was
built out of cardboard and wire mesh on wooden frames. The compartments within the arena measured 55 x 90 x 180 cm and two stimulus birds were placed in each compartment together with water and food. Test animals and stimulus animals were separated physically but not visually since they were able to see conspecifics through the wire mesh. The floor of the arena was covered with wood chips and duct tape was used to mark three zones that measured 60 x 90 x 180 cm. These zones were a centre zone and the two zones close to either familiar or unfamiliar stimulus animals. Stimulus animals were brought to the arena 15 minutes prior to testing.

At the start of each test the test animals were placed in the centre of the arena. They were allowed to freely explore the arena for 300 s. after which they were subjected to a stress treatment (restraint in bag net) for 180 s. After this time the test animals were rereleased to the arena and allowed to explore for another 300 s. Measurements were taken continuously through both 300 s. periods, where the time spent in each zone was measured with a stopwatch. Location of the stimulus animals was balanced throughout the test, i.e. in half the trials familiar stimulus animals were to the right and in the other half to the left and vice versa for unfamiliar stimulus animals.

3.4 Statistical analysis

A normal distribution of the data was assumed. An ANOVA (general linear model) was performed to analyze main effects of breed and sex as well as interactive effects of breed and sex. The program used was SPSS Statistics 19.0.0. Tests were performed at the 5 % level of significance.

4 Results

4.1 Before stress treatment

There was an effect of sex found on the tendency to stay in the unfamiliar (U) and central (C) zone before stress treatment (Fig 1. F_{1,52}=8,859, P<0,05 and F_{1,52}=11,865, P<0,05). Other means did not differ significantly (P>0,05).
Figure 1. Mean time in seconds (±SD) spent in unfamiliar, familiar and central zones by WL (n=14/14; males/females) and RJF (n=14/14; males/females) before stress treatment.

An interaction between sex and breed was found in U and C before stress treatment (Fig 2. $F_{1,52}=11.274$, $P<0.05$ and $F_{1,52}=10.285$, $P<0.05$). For C there was a tendency towards a breed effect ($F_{1,52}=3.192$, $P=0.08$).
Figure 2. Estimated marginal means of time in seconds spent in central and unfamiliar zones by WL (n=14/14; males/females) and RJF (n=14/14; males/females) before stress treatment.

4.2 After stress treatment

After stress treatment an effect of sex was found in both the familiar zone (F) and U (Fig. 3, F$_{1,52}$=8,053, P<0.01 and F$_{1,52}$=16,921, P<0.001). Other means did not differ significantly (P>0.05).
Figure 3. Mean time in seconds (±SD) spent in unfamiliar, familiar and central zones by WL (n=14/14; males/females) and RJF (n=14/14; males/females) after stress treatment.

4.3 Differences in time spent in different zones

In C there was an effect found in both breed and sex (Fig. 4, $F_{1,52}=9.255$, $P<0.01$ and $F_{1,52}=5.043$, $P<0.05$). An effect of sex was found in F (Fig. 4, $F_{1,52}=4.568$, $P<0.05$) while there were no significant differences in other means ($P>0.05$).
Figure 4. Mean time differences in seconds (±SD) spent in unfamiliar, familiar and central zones by WL (n=14/14; males/females) and RJF (n=14/14; males/females) after stress treatment. The difference is mean time before stress treatment subtracted from mean time after stress treatment. Thus, mean time difference indicates if individuals spent more (positive value) or less (negative value) time in different zones after stress treatment.

4.4 Additional observations

A difference in behaviour between WL and RJF in some males was observed. Some WL males lunged aggressively towards the wire mesh between them and the compartment with familiar stimulus animals. RJF males on the other hand displayed a behaviour referred to as “waltzing” towards unfamiliar stimulus birds. Waltzing is when a bird moves sideways shaking lightly with its wings slightly away from the body. WL
were never observed waltzing towards any stimulus birds or lunging aggressively towards unfamiliar stimulus animals. RJF were never observed lunging aggressively towards any stimulus animals or waltzing towards familiar stimulus animals. Additionally, females of either breed were not observed displaying any of these behaviours.

5 Discussion

The aim of this study was to investigate possible differences in social support in red junglefowl (RJF) and the domestic White Leghorn (WL) layer. Results indicate that RJF use social support more in stressful situations. Also, behavioural sexual dimorphism may have decreased to some extent during domestication.

Overall the results showed very few significant differences. Only once was a significant breed effect found. That was for the difference in time spent in C where RJF spent less time in C after stress treatment compared to WL. RJF seem to have allocated more of their time to F rather than U (Fig. 4). Results from previous studies have indicated that RJF tend to show higher levels of fear than WL (Campler et al., 2009). Social support helps individuals cope with stressful experiences (Rault, 2012). There might be a connection between the results obtained here and the elevated fear in RJF. Maybe RJF are in greater need of social support when stressed, regardless of familiarity to conspecifics, compared to WL. Though, this seems to be more important for females than to males (Fig. 4).

Although not a significant effect, there was a tendency (P=0.08) towards RJF spending more time in C before stress treatment (Fig. 1). Female RJF spent a lot more time in C. Overall females spent more time than males in C before stress treatment. Perhaps females are less explorative towards other individuals than males are. Interactions between breed and sex were found for C and U before stress treatment (Fig. 2). As noted above, there was a tendency for a sex effect in C. From the figure one can see that WL males and females behaved quite similar while RJF males and females differed in their time spent in C and U. This could indicate that differences between sexes in social behaviour have decreased as a result of selection for higher production.

There were quite a few differences between males and females in the results. Males and females seem to have different needs considering social support, as has been found by other studies (Vallortigara et al., 1990; Vallortigara, 1992). Females increased their time in F after stress treatment (Fig. 4) and spent more time there compared to males (Fig. 3).
This indicates that females prefer familiar conspecifics in stressful situations or perhaps they are better at recognizing familiar individuals than are males. Selection might have a different effect on male and female social behaviour, Schütz et al. (2001) found that male WL behaved more aggressively towards humans during handling.

Individual variation between chickens was great and this is the reason for the high error bars in virtually all graphs. This makes it hard to draw any conclusions though it can still give an indication of what results would have been obtained with a larger data set. The number of test animals available in this study was a limitation. It is important to point out however that other studies have managed well with a smaller amount of animals, e.g. Eklund and Jensen (2011) who used a total of 60 animals divided in four groups of the same size according to sex and breed. They found differences in WL and RJF indicating that domestication has caused subtle changes in social behaviour of chickens. However as far as statistics go, a larger data set is always preferable when standard errors are high. Although there might have been some other faulty factors affecting the results. One possible explanation is that observations of the study were performed on location and test animals as well as stimulus animals could see the observers. This could have been done in another fashion, e.g. videotaping if there had been more time for the project or space to stand out of sight in other ways.

Previous studies have shown that WL and RJF prefer to stay close to individuals of the same breed (Väisänen and Jensen, 2004). In the present study unfamiliar stimulus animals were a cross between RJF and WL. This is likely to have affected the results and it would be interesting to replicate the experiment with unfamiliar stimulus animals of the same breed as the test animal. The study by Väisänen and Jensen (2004) also showed that both WL and RJF preferred familiar individuals of the same breed to familiar individuals of the other breed. This gives a valid point out of replicating the study with unfamiliar stimulus animals of the same breed since standardization should be key in any experiment of this kind. Design of the runway arena seems to have different effects depending on e.g. if the runway has one or two compartments for stimulus animals (Guzman and Marin, 2008). Perhaps neither arena is the best choice in studies of social motivation. Guzman and Marin (2008) agree that the best experimental design for this kind of experiments is yet to come.

An interesting observation made during the study was that RJF and WL males behaved differently towards conspecifics in either familiar or unfamiliar compartments of the runway. RJF males “waltzed” towards unfamiliar stimulus animals and WL males lunged aggressively towards
familiar stimulus animals. Waltzing is a display behaviour carried out by males when courting females or in agonistic encounters with other males (Wood-Gush, 1956). In that respect, the waltzing behaviour is not unexpected. Actually it indicates that RJF managed to identify unfamiliar stimulus animals as unfamiliar. Why WL behaved aggressively towards familiar and not unfamiliar stimulus animals is unclear. WL have been found to show higher and prolonged aggression in re-grouping indicating they might be more susceptible to social stress and less prone to cope with group disruptions than RJF (Väisänen et al., 2005).

In conclusion, the present study did not support the findings of previous studies where domestication seems to have altered the need for social support after stressful experiences. However, sex differences were found in this and other studies, supporting the idea that males and females have a behavioural sexual dimorphism. Due to a limitation in the amount of test animals and the great individual variation between individuals further research is encouraged. Especially interesting would be to investigate if unfamiliar stimulus animals of the same breed would alter the behaviour of chickens in a similar test.

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