Infection Modifies the Effects of Stress on Immune Function in Birds
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Abstract
A paradox of the immune response to stress is that under stress, the ratios of phagocytic leukocytes increases, but the ability of blood cells to kill bacteria decreases. In this study, house finches, *Carpodacus mexicanus*, infected with *Mycoplasma gallisepticum* and ones with no obvious infection were captured to study this paradox. This bacterial infection is common among finches and can be spotted by the development of red, swollen eyes. The effect of stress from capturing and holding wild house finches for two hours was assessed by counting white blood cells and running an assay in which plasma is exposed to *E. coli* to measure the innate killing ability of blood. The ratio of heterophils to lymphocytes is an accurate measure of stress and is frequently used in stress studies, and this ratio was compared in pre-stress and post-stress samples from the same bird. The results of this study show that the two hour holding period increased the stress levels of both infected and uninfected birds, and that an existing infection alters the effects of stress on immune function. This study will add to the current understanding of how stress affects an animal’s immune function and, therefore, risk of infection.

Key Questions
The main questions addressed by this study are:

- How does holding a bird for two hours affect stress level as measured by the change in its heterophil to lymphocyte ratio?
- How does stress affect immune function and white blood cell counts in birds infected with a pathogen versus those uninfected?

Background
- White blood cells are part of the first line of defense against infection. All animals, including humans, have five white blood cell types. Lymphocytes are a common type of white blood cell that responds to attacks on the immune system. In birds, heterophils are the main type of phagocytic cell, meaning they engulf and destroy infectious material. Other white blood cells present include monocytes, basophils, and eosinophils.
- House finches are small songbirds, or passerines. They can be found throughout the country, in urban areas and backyards. They are also highly susceptible to a bacterial infection called mycoplasmal conjunctivitis (*Mycoplasma gallisepticum*). With this infection, the birds develop swollen, red eyes filled with fluid, making it easy to tell whether or not birds are infected with the disease.

Methods
- 35 birds, 9 of which were infected, were trapped over a one month period during the summer of 2011, using mist nets around feeders.
- The birds were held for 2 hours (in paper bags with air holes), then a second blood sample was collected and another smear made.
- The plasma from each blood sample was saved in a -80°C freezer.
- A standard white blood cell count was done for each slide.
- With this infection, the birds develop swollen, red eyes filled with fluid, making it easy to tell whether or not birds are infected with the disease.

Results
- Initial stress levels of infected birds were similar to the final stress levels of uninfected birds, and there was no effect of infection on stress levels. The same pattern was observed for number of heterophils, with infected birds showing no response to stress, and uninfected birds showing a significant decline with stress (Fig. 2).

Conclusions
- Initial stress levels of infected birds were similar to the final stress level of uninfected birds (Fig. 1). The infected birds’ stress level then increased to even higher levels with holding. This shows that having an infection is a source of stress for the bird and an added disturbance increases that stress level further.

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