Aversion of chickens to various lethal gas mixtures

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Abstract

In the event of a notifiable disease outbreak, poultry may need to be culled in situ. This should be performed swiftly and humanely to prevent further spread of the pathogen while preserving the welfare of the animals prior to death. Here, we examined the aversion of broiler chicks (Gallus domesticus) to three lethal gas mixtures at various concentrations to determine the least aversive mix that could be used in whole-house gassing. For 1 h, individual chicks (n = 36) were allowed to place their heads inside three feeding and drinking stations (FDS) in order to access food and water. Each FDS was filled with a different gas mixture, and birds could access each FDS as much as they liked. Twelve chicks each were tested at low (50% carbon dioxide [CO2] in air, 70% argon [Ar] in CO2, 70% nitrogen [N2] in CO2), medium (55% CO2 in air, 80% Ar in CO2, 80% N2 in CO2) or high (60% CO2 in air, 90% Ar in CO2, 90% N2 in CO2) concentrations of gas mixtures. Aversion was assessed based on the time birds spent with head in each FDS (with more time indicating less aversive), and the frequency of head shakes relative to time spent with head in the FDS (with a lower proportion indicating less aversive). Data were analysed by ANOVA. On average, birds spent < 3 min with their head in any FDS. Mixtures containing 90% Ar or N2 in CO2 and 80% argon in CO2 were least aversive and mixtures containing 70% N2 in CO2 and 60% CO2 in air were most aversive, based on time spent with head in. Head shakes s–1 were more frequent with low concentration gas mixtures compared to high concentrations, and with all CO2 in air mixtures, which suggests that the intensity of head shaking is related to the concentrations of CO2. From these results, one concentration of each of the three gas mixtures (90% N2 in CO2, 80% Ar in CO2, and 50% CO2 in air) were chosen for assessment on a further 12 birds and the results showed that both inert gas mixtures were less aversive than 50% CO2 in air based on time spent with head in. Frequency of head shakes s–1 did not differ between the three mixtures. Birds found all gases aversive, however it is concluded that inert gas in CO2 mixtures were least aversive compared to CO2 in air and these gases also caused less signs of respiratory discomfort.

Keywords: animal welfare, aversion, chickens, disease outbreak, lethal gas mixtures, preference testing

Introduction

Worldwide, outbreaks of contagious diseases among farm animal species are becoming a familiar occurrence. Over the last decade, the UK and other parts of Europe have experienced foot and mouth disease, avian influenza, and blue tongue, all of which, in the EU, are notifiable diseases (Defra 2008b). It is essential that measures, such as culling, exist to reduce the risk of disease transmission to other susceptible animals and, if the disease is zoonotic, humans. Additionally, culling diseased animals can be necessary to eliminate pain and suffering, particularly where no cure is available. However, controlling and culling large numbers of animals is not a simple task, as was highlighted during the 2003 outbreaks of avian influenza in Europe and outbreaks in the UK (Defra 2008a). The most common methods of killing large flocks of birds in those cases was to expose birds to lethal concentrations of gases administered either directly into the house or removing birds to containers positioned outside the house into which gas was introduced. Whole-house gassing methods either used carbon dioxide (CO2) or carbon monoxide (CO), while containerised gassing used either CO2 in air or an inert gas (argon or nitrogen) and CO2 mixture (Gerritzen & Lambooij 2004). The major advantages of whole-house gassing are that birds need not be handled prior to death, which is a significant bird welfare benefit, and that catching staff need not enter the house and come into direct contact with the infected environment, materials and birds. (For a full review, see Raj et al [2006]). In addition, gas mixtures have been used for stunning poultry, pigs (Sus scrofa) and lambs (Ovis aries) prior to slaughter (Hoen & Lankhaar 1999; Raj 1999; Machold et al 2003; Linares & Vergara 2009).

Regardless of the method used during gas culling or stunning, there is some concern that animal welfare could be compromised, because birds may suffer between the introduction of a gas or gas mixture and the onset of unconsciousness. Humans report feelings of breathlessness and a sense of suffocation and even pain when they inhale 50% CO2 in