RESEARCH ABSTRACT

ANIMAL WELFARE

Title: Acute and chronic effects of ammonia on inflammation, immunology, endocrine function, performance, and behavior of nursery pigs - **NPB #03-159**

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Date Received: August 27, 2004

Abstract: The objective was to determine acute or chronic effects of moderate (35 ppm) and high (50 ppm) concentrations of atmospheric ammonia (NH_3) on welfare of newly weaned pigs. Welfare measures included, inflammatory, immunological, hematological, metabolic, and stress parameters, as well as performance, and behavior. Two experiments were conducted using eight groups of 24 nursery pigs (per group) in environmental gas exposure chambers. Exp. 1 was an investigation in the chronic effects (20 d) and Exp. 2 in the acute effects (96 hrs post exposure) of atmospheric ammonia on pig welfare. Both, Exp. 1 and Exp. 2 were divided into two studies (48 pigs per study): the first study compared ammonia exposure of 50 vs. 0 ppm (control) and the second study 35 vs. 0 ppm. In Exp. 1 blood samples were obtained at d -1, 8, and 20 to be analyzed for hematological (blood cell differentials) and metabolic parameters (BUN, glucose, lactate, ammonia), cortisol, and haptoglobin. Pigs in Exp. 2 were bled to measure acute concentrations of cortisol, haptoglobin, as well as the pro-inflammatory cytokines TNF-α and IL-4. Blood samples were drawn before exposure at -72 h and again at 2, 4, 8, 12, 24 and 96 h after exposure to ammonia. Performance parameters (BW, DMI, ADG, and F:G) were measured and calculated in Exp. 1 for d –1, 8 and 20. Behaviors (body posture, feeding, and aggression) were video filmed and analyzed on d 3 and 19 of Exp. 1.

Exposure to ammonia did affect hematological and immunological parameters. Total white blood cells concentration, lymphocytes, and monocytes were approximately doubled ($P < 0.05$) in pigs exposed to 35 ppm vs. control animals. Other hematological (hemoglobin, hematocrit, mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration) and metabolic (BUN blood ammonia, glucose, and lactate) parameters were similar between pigs that were exposed to ammonia vs. control animals. The acute phase protein haptoglobin was twice as high in 50 ppm ammonia exposed pigs compared to the control animals at d 8 and 20 (study 1) but not different between 35 ppm vs. control pigs (study 2). Pigs that were chronically exposed to ammonia (both 50 and 35 ppm, in study 1 and 2, respectively) showed increased ($P < 0.05$) cortisol concentrations on d 20 compared to control animals. Nursery pigs responded to acute ammonia exposure (with both 50 and 35 ppm) with an increase ($P < 0.05$) in serum cortisol. Ammonia exposed vs. control pigs were similar with respect to most of the performance variables. However, pigs exposed to 50 ppm of ammonia vs. the control tended to decrease DMI ($P = 0.096$) and feeding behavior ($P = 0.059$). In summary, exposure to 35 and 50 ppm atmospheric ammonia has affected systemic responses and increased cytological and biochemical markers of injury and inflammation like haptoglobin, total white blood cells, lymphocytes, and monocytes. Atmospheric ammonia also increased cortisol concentrations and tended to decrease feeding behavior resulting in a trend for lower dry matter intake.