Effect of Piglet Age on Distress Associated with Gas Euthanasia, Neonate vs. Weaned

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Summary and Implications

The objective of this study was to compare the effectiveness of euthanasia gases administered to 2 age groups of piglets: neonates (less than 3 days, n=160, BW 2.61 ± 0.81 kg) and weaned (16 to 24 days, n=160, BW 4.62 ± 0.76 kg). Two different gases were explored in this study: 100% CO_2 and a 50:50 CO_2:Argon (CA) gas mixture. Each gas was administered at 3 flow rates: 35%, 50% and Prefill + 20%, chamber volume exchange rate per minute. Latencies, durations and occurrence of behavior and physiologic changes were observed using direct observation and video. Neonate piglets were euthanized as quickly as or faster than weaned piglets for all gases and flow rates. For the neonate relative to the weaned piglet, average loss of posture over all gas treatments was 99 vs. 142 (seconds) and last movement was 360 vs. 392 (seconds). Neonates also displayed fewer incidences and shorter durations of behavioral indicators of distress and sensation relative to the weaned piglets. Thus concerns for gas euthanasia, when applied appropriately, are not greater for the neonate relative to the weaned piglet. Additionally, procedures developed to euthanize weaned piglets will likely be successful when applied for the neonate, but not viceversa.

Introduction

The U.S. swine industry euthanizes millions of piglets annually when their chances of survival are low and they are suffering due to injury or illness. The industry is in need of tools to accomplish euthanasia quickly, economically and safely, with a repeatable humane process. The goal of gas euthanasia is to provide a quick and painless transition to death. Carbon dioxide (CO_2) gas is an accepted method to euthanize young pigs and over the past few years has been utilized more. CO_2 is economical, relatively safe and readily available. Anecdotal information from swine caregivers suggests euthanasia of neonate aged piglets is more difficult and takes longer than older piglets. It is important that these differences be explored to develop best management practices for on farm euthanasia that is safe, repeatable, and causes minimal distress to the piglet. Therefore the objective of this study was to compare the effectiveness of gases administered for euthanasia between two age groups of piglets, neonates and weaned.

Materials and Methods

The protocol for this experiment was approved by the Iowa State University Institutional Animal Care and Use Committee. The experiment was conducted from May to September, 2010.

Animals and housing: Two age groups of piglets were examined: neonates and weaned. Piglets were sourced from the Iowa State University Swine Nutrition Farm and from a commercial producer. Pigs were of white crossbred production lines.

Experimental design: The experiment is a 2x2x3 factorial design, in which 2 age groups were each examined with two different gas types (CO2 and a CO2:Argon gas mixture), and three flow rates (35%, 50% and Prefill + 20%, chamber volume exchange rate per minute).

Treatments: TRT 1: **Neonatal piglets** (n = 160) were defined as less than 3 days of age, and on the day of trial had a bodyweight of 2.61 ± 0.81 kg. TRT 2: **Weaned piglets** (n = 160) were 16 to 24 days of age with a bodyweight of 4.62 ± 0.76 kg. Piglet pairs, matched from litter (neonates) or pen (weaned) were utilized to reduce the behavior disturbances that may occur if they were isolated or placed in the box with a non-familiar conspecific.

Euthanasia protocol: The piglets were placed into a plastic chamber (inside dimensions 43 wide, x 60 long, x 30 height, cm), which had 4 opaque sides and 2 clear sides allowing direct observation. The floor was fitted with a black rubber mat to prevent piglets slipping. Gas was supplied utilizing a Euthanex AgPro System™ (V-ast, Mason City, IA; Figure 1). Constant gas flow was provided by a compressed gas regulator (Western Enterprises, Westlake, OH). Between each treatment the chamber was blown out with ambient air.

Figure 1. Euthanex AgPro™

Behavior measures: Behavioral and physiologic indicators of sensation and distress were observed directly and with video observation for behavioral indicators of loss of consciousness, death, and indicators of sensation and distress (Table 1).

Table 1. Behavioral and physiologic indicators of sensation and distress scored live and with video.

Parameter	Definition
Loss of posture (LP)	Piglet is slumped down, making no attempt to right itself, follows a period of attempts to maintain posture; loss of attitude of position of the body
Last movement (LM)	No movement is observed by the piglet of any type
Gasping (GASP)	Rhythmic breaths characterized by very prominent and deep thoracic movements, with long latency between, may involve stretching of the neck; often occurs right before or after loss of posture
Open Mouth Breathing (OMB)	Piglets mouth is open, taking in quick breaths, with distinct thoracic movements; panting; upper and lower jaw being held open with the top lip pulled back, exposing gums or teeth and panting (pronounced inhalation and exhalation observed at the flanks
Defecation (DEF)	Elimination of feces from the body[4]
Nasal Discharge (ND)	Fluid discharge from the nasal cavity, may be viscous

Statistical analysis: Analyses of data were performed in R (v2.12.0, The R Foundation for Statistical Computing) as the Univariate product-limit estimation of the survival curves, to determine significant differences. Values are given as raw means and percentages.

Results and Discussion

Neonate piglets were euthanized as quickly as or faster than weaned piglets for all gases and flow rates (Table 2). The main effect of age was observed for the proportion of piglets displaying 2 of the behavioral indicators of sensation or distress, DEF and ND (Table 3), whereas differences were not observed for OMB. Differences were also observed in the duration of displayed behavior OMB (Table 4) for neonates and weaned piglets. In conclusion, differences were observed between the two age groups, with neonates succumbing to the effects of the gas quicker than weaned piglets. Additionally, prevalence and duration of displayed behaviors of sensation and distress were lower in the neonate piglet relative to the weaned piglet.

Table 2. Least square means for latency (seconds) to behavioral indicators of efficacy of gas euthanasia process by age.

	Age		
Parameter	**Neonate[1]**	**Weaned[2]**	***P*-value**
LP	99	142	0.001
LM	360	392	0.05
GASP	97	139	<0.001

[1] piglet < 72 hours old (n=160); [2]piglet 16-24 days old (n=160)

Table 3. Least square means for percentage of piglets displaying behavioral indicators of sensation and distress.

	Age		
Parameter	**Neonate[1]**	**Weaned[2]**	***P-value***
DEF	23	46	<0.001
ND	4	14	0.017
OMB	97	94	0.116

[1] piglet < 72 hours old (n=160); [2]piglet 16-24 days old (n=160)

Table 4. Least square means for duration of a behavioral indicator of sensation and distress in the piglet.

	Age		
Parameter	**Neonate**	**Weaned**	***P*-value**
OMB	25.9	37.4	<0.001

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