# ACCURACY OF HALOTHANE ANESTHESIA AS A DETECTOR OF PORCINE STRESS SUSCEPTIBLE SWINE

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## Introduction:

The Porcine Stress Syndrome (PSS) has been described as a condition that most often affects pigs at approximately 80 kg or over 4 months of age[1]. The PSS is characterized by sudden death usually occurring on individuals with heavy muscle structure, compact conformation and low backfat thickness. Pigs which die due to this syndrome tend to produce pale, soft and exudative carcasses.[2] The etiology of PSS has been suggested to be inherited by an autosomal recessive with variable penetrance and expressivity.[3,4,5] A similar condition occurring in humans is known as miligant hyperthermia. The mechanisms involved in the development of the PSS have been previously described.[6] Skeletal muscle is the primary defective tissue. When the syndrome is triggered, there is a rapid depletion of skeletal muscle ATP, rapid production of lactic acid and development of extreme muscle rigidity and heat. The anesthetic halothane is able to depress all functions of the central nervous system at all levels or gradations until coma or death is produced. Halothane can be used satisfactorily as anesthetic in normal swine, however in PSS pigs causes abnormalities in skeletal muscle regulation by the sarcoplasmic reticulum and in mitochondrial respiratory capacity.[7] In 1974 Christian reported that halothane screening at weaning time could be an excellent tool in detecting PSS hogs.[8]

## Objectives:

The objectives of this study were to determine the accuracy of halothane response under four different situations (treatments) each of which resembles possible field conditions under which the test may be employed.

## Materials and Methods:

Forty-eight 76 day-old pigs (Yorkshire and Yorkshire crossbred) were utilized. Pigs were classified as PSS by halothane screening. Creatine Phosphokinase (CPK) levels in blood and blood type (H and A-O) systems were also measured. Twenty-five pigs were classified as stress susceptible (12 gilts and 13 barrows) and 23 as stress resistant (11 gilts and 12 barrows). The pigs were divided in 8 groups. Groups I and II consisted of 6 PSS pigs each, groups III and IV consisted of 6 PSS gilts each, groups V and VI were composed of 5 and 7 stresss resistant barrows respectively, and groups VII and VIII were made up of 6 PSS gilts each. One of four treatments was administered before halothane screening: a) control (no stress for 24 hrs.) b) starvation (24 hrs.), c) exercise (rapid movement of the animals for 100 meters), and d) transportation stress (5km). An anesthetic machine[a] was used for halothane screening. The following parameters were measured: a) halothane time in seconds, b) rigidity, recorded as severe, moderate or absent and scored with the numerals 1,2 or 3 respectively, c) resistance score, measured as fighting to the halothane anesthesia, this was recorded as absent or present and scored with the numerals 1 or 2 respectively, d) CPK levels in serum and in whole blood, determined by the Sigma and Antonik procedures, respectively, and e) stress susceptibility, recorded as positive or negative and scored with the numerals 1 or 2 respectively. the experimental design consisted of two 4X4 latin squares balanced for residual effects. One square consisted of stress susceptible pigs and the other of stress resistant animals. Each week after the administration of the appropriate treatment the pens were screened with halothane in random order. The stress resistant pigs (SRP) received the halothane for 3 minutes, while the PSS pigs received the halothane until muscle rigidity appeared. Halothane concentration was held at 6% and the oxygen flow rate at 1 liter per minute.

## Results and Discussions:

Muscular rigidity appeared within 3 minutes after exposure in PSS pigs, while the resistant animals showed no rigidity for a period of 3 minutes. Of the 99 halothane screening of PSS pigs only in 4 occasions the results were contradictory to the original classification. In all cases, the negative response was preceeded by the starvation treatment. Thirteen of the 92 halothane screening of SRP pigs were contradictory to the original classification. Only 17 of the total 191 halothane screening had conflicting results. The probability of correct classification was 95% for all pigs, 98% for the positive group and 92% for the negative group when subsequent results were compared to those of the initial screening (Table 1). The PSS pigs were shorter in halothane exposure time ($P<.01$) and recieved lower rigidity scores ($P<.01$). Positive reacting animals were higher in both Antonik and Sigma CPK levels ($P<.01$). Gilts required longer exposure time to develop rigidity ($P<.01$) than did barrows and expressed more resistance to the gas ($P<.01$). Rigidity score was also significantly ($P<.01$) associated with CPK levels. Starvation prior to exposure lengthened halothane exposure time ($P<.01$). Two pigs died of overexposure.

Table 1. Accuracy of halothane screening

| Method of Classification | All pigs | Positive | Negative |
|---|---|---|---|
| Initial Screening | 17/191[a] .05 ± .01[b] | 4/99 .02 ± .01 | 13/92 .08 ± .01 |

[a] Number of disagreements/number of screenings.

[b] Probability of misclassification ± standard error.

**Conclusions:** Halothane screening is a reliable predictor of PSS susceptibility with a 95-97% accuracy in 7-10 week-old pigs. Feed restricton prior to screening induced a delay in response of PSS pigs or prevented expression.

## Selected References:

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[a] Fraser Sweatman Inc., Buffalo, New York