PORCINE STRESS SYNDROME AND ITS EFFECT TO SWINE POPULATION

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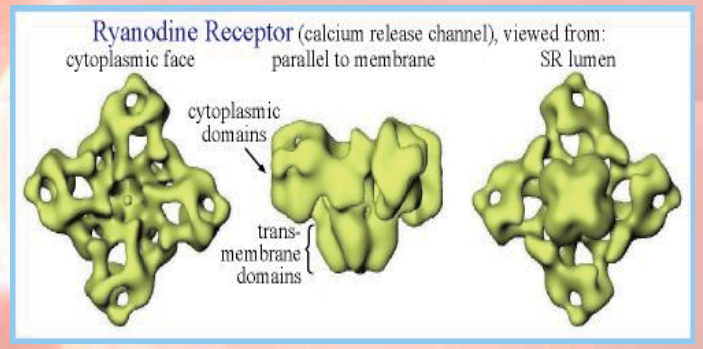
PORCINE STRESS SYNDROME (PSS)

- **A genetic disorder in pigs**
- **Halothane gene or ryanodine receptor 1 gene is responsible for porcine stress syndrome (PSS) that is elicited when the animals are experiencing stress or when they have been exposed to halothane (Rosenvold and Andersen, 2003)**

RYANODINE RECEPTOR 1 GENE



http://cosmos.ucdavis.edu/archives/2008/cluster8/chen_jennifer.pdf

Figure 1. Structure of the Ryanodine Receptor

PORCINE STRESS SYNDROME (PSS)

- **Pigs under PSS condition may suffer the following symptoms:**
  - **heat stress, labored breathing, muscle rigidity and in worst cases, death (Band et al. 2005)**

http://www.fao.org/docrep/003/t0756e/t0756e05.htm

Figure 2. Rapid death of positive pigs can occur when exposed to severe stress

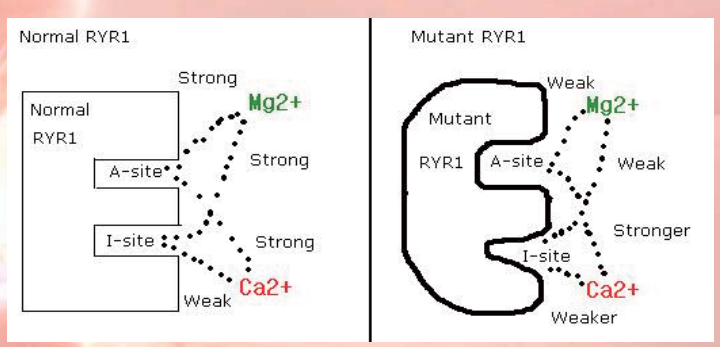
PORCINE STRESS SYNDROME (PSS)

- General anesthetics such as the halothane gas can also trigger the symptoms of PSS thus, the name "halothane gene"

http://virtuavet.wordpress.com/2012/08/26/mini-pig-neuter-day/

Figure 3. Anesthetic Induction

NORMAL AND MUTANT RYR1 GENE



http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1181092

Figure 4. Difference between the affinities of cytosolic Ca^{2+} and cytosolic Mg^{2+} in normal and mutant RYR1

PORCINE STRESS SYNDROME (PSS)

- PSS is caused by a defect in the ryanodine receptor 1 (RYR1) gene

  -The defect is caused by Cytosine/Thymine mutation at nucleotide 1843 in the RYR1 gene. As a result, the amino acid Cysteine is replaced by arginine (Jovanovic et al. 2005).

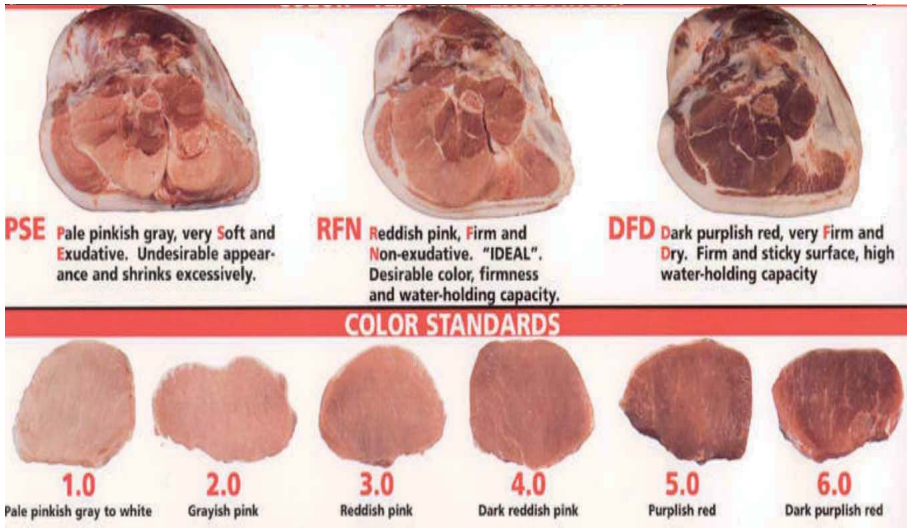
PORCINE STRESS SYNDROME (PSS)

- Favero (2000) added that the increased anaerobic respiration in muscles generates rapid decrease in pH after death

  -affects the meat quality characteristics such as color and water-holding capacity which are not suitable for meat preparation due to excessive water loss

PORCINE STRESS SYNDROME (PSS)

- The HAL gene or RYR1 gene brings a condition describing the quality of pork as pale, soft and exudative (PSE) which is a negative effect



http://www.globalswine.com/assets/images/qualitystandards.jpg

Figure 5. Pork Quality Standards. National Pork Producers Council

HTTP://WWW.FAO.ORG/DOCREP/003/T0756E/T0756E05.HTM

Figure 6. Dark, firm and dry pork (right); pale, soft and exudative pork (left); the normal pork is in the middle.

SCREENING FOR PORCINE STRESS SYNDROME

- The screening will enable breeders to effectively determine which pigs will be suitable for breeding
  - This will then allow only better quality of pork that will increase the economic value of the meat

SCREENING FOR PORCINE STRESS SYNDROME

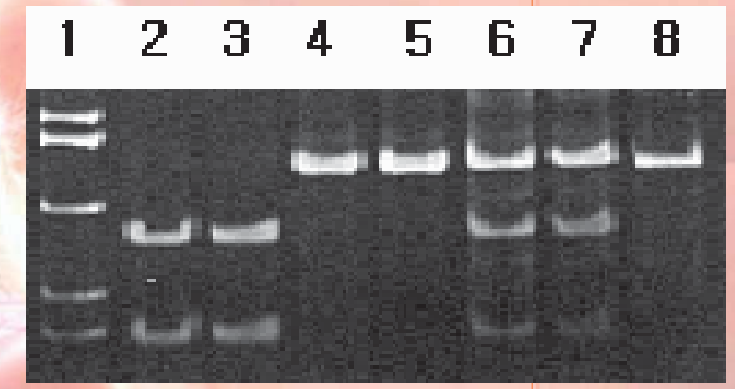


Figure 7 from Jin et. al. (2005). The PCR-RFLP analysis of RYR1 gene. Lane 1, standard markers pUC18/*Hae*III; Lanes 2 and 3, DNA from a normal pig; Lanes 4 and 5, DNA from a mutant pig; Lanes 6 and 7, DNA from a carrier pig; Lane 8, PCR products that amplified from 18,475 to 18,695.

SCREENING FOR PORCINE STRESS SYNDROME

- **Application of MS-PCR in Screening for Porcine Stress Syndrome**
  - **MS PCR is a PCR-based technique developed by Rust et al. in 1993, whereby both normal and mutant alleles can be amplified in the same reaction tube, using different length allele-specific primers**

PORCINE STRESS SYNDROME (PSS)

- **The gene can occur in three possible genotypes: normal (NN), carrier (Nn) and positive (nn)**
- **Using MS-PCR the DNA of the animals had the size of:**

  114 bp- Normal

  114 and 134 bp- Carrier

  134 bp- Mutant

PORCINE STRESS SYNDROME (PSS)

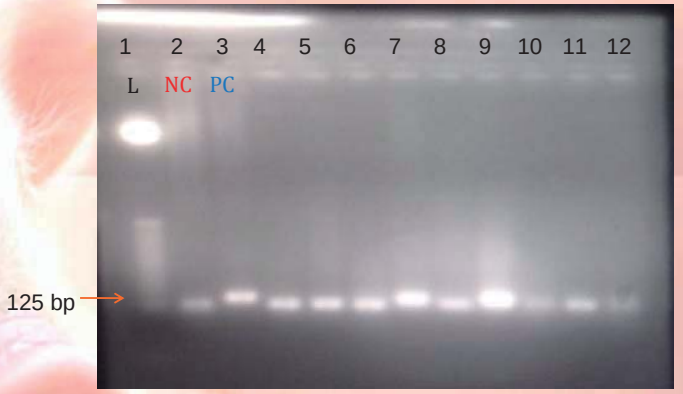


Figure 8. Agarose gel electrophoresis of the Hal gene amplified by MS-PCR. Lane 1- Molecular weight marker ladder 50 bp; lane 2 is NC; lane 3 is PC; lanes 4-12 are DNA samples

PORCINE STRESS SYNDROME (PSS)

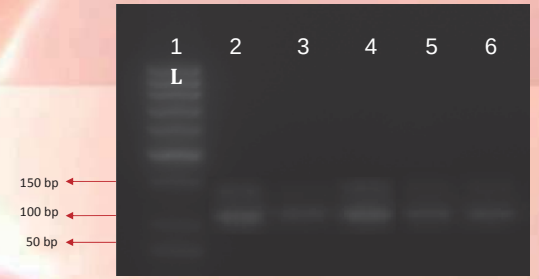


Figure 9. Agarose gel electrophoresis of the Hal gene amplified by MS-PCR. Lane 1- Molecular weight marker ladder 50 bp; lanes 2-12 were classified as heterozygotes, *Nn* (134 and 114 bp)

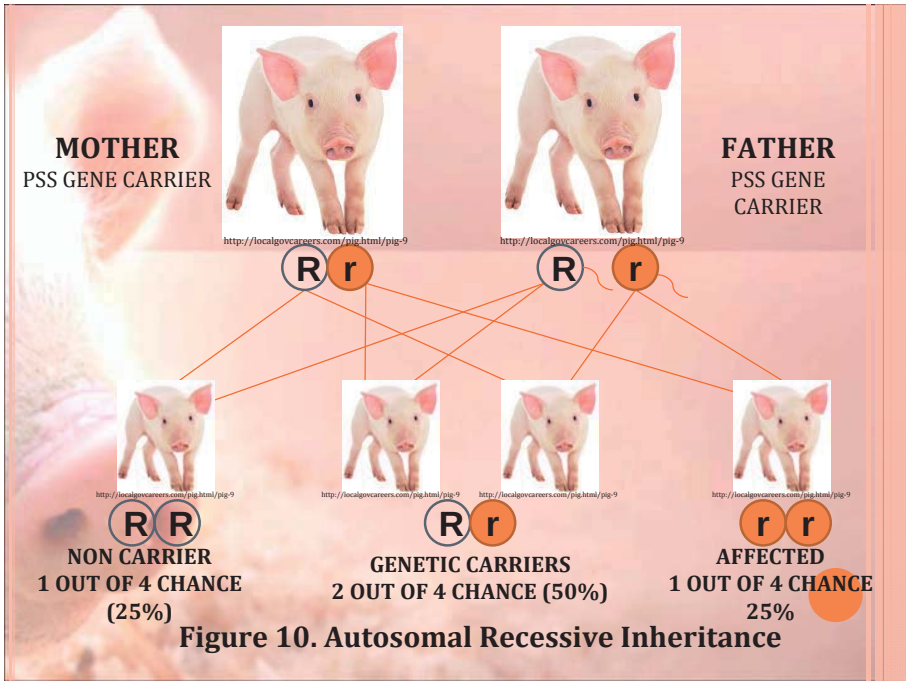


Figure 10. Autosomal Recessive Inheritance

SCREENING FOR PORCINE STRESS SYNDROME

- **Manipulation of the breeding system can be done via molecular analysis such as genetic screening using live pigs which is a fast and noninvasive type of testing (Bastos et al. 2000)**

SCREENING FOR PORCINE STRESS SYNDROME

- **Correlation within and among the breed should be done so that one may be able to determine the relationship between PSS and breed in the swine population.**

→ **This may help in the formation of a new breeding program that could possibly eliminate the PSS in the breeding stock.**

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THANK YOU!!