



The Frequency of the Porcine Stress Gene in Texas Show Pigs

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The effects of the porcine stress gene have been documented for thirty years. Like any other gene, a copy of this gene can be inherited from each parent, the dam and the sire. Animals inheriting a copy of the stress gene from both parents (referred to as “nn”), exhibit extreme nervousness and excitability (including “tail twitching” when exposed to a stressful situation such as being snared for clipping or loaded on trailers for transport) as well as inferior meat quality. The muscles from stress positive animals are often PSE, or pale, soft and exudative. The meat is light pink to grayish white in color, does not hold its shape well and appears watery in the package. This condition causes the carcasses to be classified as unacceptable quality. Carcasses drip in the cooler and lose moisture, causing the meat to be very dry when cooked. An Iowa State University study revealed that *over 95% of nn animals had PSE*. Additionally, over 15% of stress positive animals *died* while being moved from one location to another. However, the use of this gene became popular because stress positive pigs were 2.7 – 4.0% higher in lean composition than their normal littermates. This increase is due to both an increase in muscling as well as a decrease in fat. Researchers report that a sow with two copies of this gene (referred to as “nn”) will have decreased litter sizes and will raise up to one less pig per litter less than normal sows (referred to as “NN”). Additionally, litter weaning weights from nn sows average about 10% less than litters from normal sows. Stress positive animals tend to be smaller at birth and do not grow any faster than NN animals. Pigs inheriting a single copy (one inherited from either that sire or the dam, but not both; referred to as “Nn”) exhibit characteristics that are intermediate between normal and stress positive animals. A relatively simple genetic test is available for identification of the pig’s genotype (either NN, Nn or nn).

A number of symptoms get “blamed” on the stress gene in the show pig industry, including death loss during transport and show, the excitable nature of some of these animals and poor pork quality. However, with the exception of the National Barrow Show progeny test, little information is available about the frequency of this gene in the show pig population. In an effort to estimate the frequency of this gene in the show pig population, blood samples were obtained from the barrow carcass contest entries from the 2000 and 2001 San Antonio Livestock Exposition (SALE) and the 2000 and 2001 Houston Livestock Show and Rodeo (HLSR). This included class winners, breed champions and reserve breed champions from SALE and the first and second placing hogs from each class (including breed champions and reserves) from HLSR. A total of 193 barrows were tested for the stress gene. These animals were truly the “best of the best” – the top 193 of 20,603 hogs entered in these shows (less than 1%). The question that we attempted to answer was: *Do you need the stress gene to win?*

At each of these shows, hogs are classified by breed by a committee and broken into classes by weight within each breed. No registration papers from breed associations are necessary to show, however representatives from the eight major breeds are involved in the classification process. All carcass contest animals were transported to the Texas A&M University meat lab for evaluation. Carcass data, including quality measurements, were recorded 24 hours post-harvest. The frequency of each genotype is reported in Table 1.

The genotypic frequencies did not significantly change from 2000 to 2001 as seen in Table 2. Although it may appear that the frequencies remain relatively stable, with data from only two years, this conclusion is premature. Funding has been obtained for the continuance of this study through the 2002 show season in order to expand the data set.

Table 1. Frequency of the normal (NN), heterozygous (Nn) and stress positive (nn) genotypes of the class winners from the 2000 and 2001 San Antonio Livestock Exposition and the 2000 and 2001 Houston Livestock Show and Rodeo*.

Total combined data:

NN = 107 barrows	55.44%
Nn = 78 barrows	40.41%
nn = 8 barrows	4.15%

Frequencies by breed:

Breed	number	NN	Nn	nn
Chester White/Landrace/White OPB	18	11	7	0
Yorkshire	24	20	4	0
Hampshire	34	21	13	0
Poland China/Spot	23	3	15	5
Berkshire	12	6	3	3
Duroc	33	17	16	0
Crossbred	49	29	20	0

* NN = normal, Nn = heterozygous, nn = homozygous positive for the stress gene.

Table 2. Frequency (by year) of the normal (NN), heterozygous (Nn) and stress positive (nn) genotypes of the class winners from the 2000 and 2001 San Antonio Livestock Exposition and the 2000 and 2001 Houston Livestock Show and Rodeo*.

<u>2000:</u>		
NN =	51 barrows	52.58%
Nn =	41 barrows	42.27%
nn =	5 barrows	5.15%
<u>2001:</u>		
NN =	57 barrows	59.37%
Nn =	36 barrows	37.50%
nn =	3 barrows	3.13%

* NN = normal, Nn = heterozygous, nn = homozygous positive for the stress gene.

In the carcass contests, SALE places the top six carcasses, and HLSR places the top ten. Therefore, 32 hogs have placed in these four shows in the past two years. Of these, 16 were normal (NN) and 16 were heterozygous (Nn). None of the placing carcasses were nn. Carcasses are disqualified from the contest for failing two of the four minimum quality standards for loin muscle color, muscle firmness, marbling or fat firmness. Of the 33 carcasses that were disqualified, 14 were NN (42.4%), 18 were heterozygous (54.5%) and one was positive (3.0%). In other words, *almost 60%* of the hogs disqualified from the carcass contest (based on the same criteria that is used in packing plants and consumer studies) inherited at least one copy of the stress gene.

Even more startling was an increase in the number of animals disqualified because of quality in 2001 as compared to 2000. In 2000, 10 carcasses were disqualified on carcass from both shows. In 2001, 23 carcasses were disqualified. This is an alarming trend that cannot be attributed to the stress gene (PSE is caused by numerous factors; genotypic frequencies were similar between years; Table 2) and has a potential impact on consumer satisfaction. Consumers have repeatedly shown a preference for darker (“redder”) meat in taste panels. Therefore, not only were a large number of these show pigs considered unacceptable for the consumer, but most of these inherited at least one copy of the stress gene. The quality issue needs to be addressed by the show pig industry.

The swine industry has decided (although not unanimously) to take steps to eliminate this gene. Most feel that the risks of losing customers (especially in the export market) due to poor pork quality (even when producing only heterozygous animals) are not worth the benefits of increased muscling and leanness. The National Swine Registry (NSR) has implemented the following policies on the porcine stress gene: No known stress positive or stress carrier animals will be allowed to be exhibited or sold at any NSR sponsored event. NSR also requires the DNA stress gene status of A.I. sires to be declared on all A.I. certificates issued for the registration of litters. Additionally, all four of the major breeds have adopted policies that will require any pig farrowed after a certain date (1/1/00 for Yorkshire and Landrace; 1/1/01 for Duroc and 1/1/02 for Hampshires) found to be a stress carrier to have its pedigree cancelled. The Chester White Association has a similar policy. Conversely, in order to increase genetic diversity within the breed, the Spot Association opened its breed registry to include Pietrains, a Belgium breed with an exceptionally high frequency of the stress gene.

Back to the question, is the stress gene necessary to win? At two of the largest barrow shows in the country, the answer is NO. Over 55% of the top one percent were free of the stress gene. While there may have been a time that the swine industry propagated the use of this gene, the genetics are available today to produce the heavily muscled, lean carcass that consumers desire, without the

negative effects associated with this gene. If the show pig industry wants to improve its image and the quality of the product it is producing for the dinner plate, total elimination of the stress gene is necessary.

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