The Effect of Selection for Lean Growth on Swine Behavior and Welfare

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Introduction

The selection of animals for human use has occurred since prehistoric times. A survey of Paleolithic and Mesolithic sites across Europe found that 91% had remains of red deer, 83% of pigs, and 61% of both cattle and roe deer (Appleby, 1999). The process of domestication occurred through the human selection for specific animal traits. The species had characteristics which made domestication possible. For example, dangerous animals, such as deer with antlers, were passed over in favor of less dangerous animals, such as cows with horns or swine with teeth. In addition, the animals selected had to be easy to tame and live in groups, and have promiscuous mating systems rather than pairing for life. Promiscuous mating allowed humans to choose the individuals that would mate together, with the aim of passing on desirable traits.

An understanding of genetics has resulted in producers being able to change animals to meet the needs and/or desires of the consumer. In today's swine industry, selection has focused on the rate of muscle growth with minimal fat deposition (i.e., lean gain), responding to the consumer's demand for high quality, lean pork. Intensive or continuous selection for a single trait can result in numerous reproductive, neurological and behavioral problems. Belyaev (1979) refers to this type of selection as destabilizing selection, in contrast with stable selection which occurs in nature. Selection for high production efficiency has resulted in numerous undesirable side effects (Rauw et al., 1998). In swine, selection for rapid gains and leanness has resulted in pigs with numerous problems from the perspective of both the pig and producer. High lean swine have been reported to experience more leg problems due to a decrease in leg strength (Sather, 1987; Webb et al., 1983). In addition, these animals suffer from cardiovascular inadequacy during periods of high metabolism. Behaviorally, selection for high lean gain has resulted in pigs with more excitable temperaments (Grandin, 1994). This increased level of fear and anxiety results in more handling problems for producers and processors. High lean swine are reported to balk more and be more difficult to drive through races at slaughter plants (Grandin and Deesing, 1998). In addition, high lean swine demonstrate an increased response to the stress of transportation, leading to more deaths on arrival as well as more PSE and lower meat quality. Therefore, the production of high lean growth swine results in production and animal welfare problems that the swine industry must address while still developing selection programs to provide consumers with a desirable product. In general, the development of lean growth lines of pigs has occurred with little emphasis on other traits, especially behavioral traits. In general, there has been little scientific investigation of the anecdotal reports that lean swine are more difficult to handle or more susceptible to the stress associated with transportation.

Behavioral Methods to Evaluate Fear and Anxiety

There are numerous behavioral methods to study the fear and anxiety in animals. The open field test has been used extensively in rodents (Archer, 1973). During an open field test, an animal is placed in an open area and the behavior of the animal is monitored to determine what

area of the arena the animal enters. Higher levels of activity usually suggest lower levels of anxiety. Because of its easy use, rapidity, and standardization, open field tests have been used on cattle (Boissy and Le Neindre, 1990), sheep (Moberg et al., 1980), and pigs (Shea-Moore, 1998). Responses to novel stimuli utilize other types of tests, such as introducing a novel object into a pen, and giving the animal the opportunity to leave the cage and explore unfamiliar surroundings. In addition, the response of animals to humans has been tested using the "standard human approach test" in numerous species including swine (Hemsworth and Coleman, 1998).

There are various concerns about these behavioral methods for assessing fear and anxiety. First, it is unclear to what extent artificial stimuli relate to the biological significance of the behavior produced. Second, since we know that different motivation systems exist between species, there are limits in extrapolating experimental models or patterns across species or even sexes (Gray, 1987). Finally, there has been little validation of the methodologies described, especially for domestic farm animals. For example, it has recently been determined that in order for the human-approach test to be a reliable indicator of a pig's behavioral and physiological response to humans, the test should be carried out within a familiar arena and only after an adequate post-handling acclimatization period (Marchant et al., 1999).

USDA/Purdue Efforts

The development of lean lines of swine is associated with several behavior, production and welfare issues. The Department of Animal Sciences in collaboration with the USDA has been involved with a number of experiments investigating the implications of selection of high lean growth swine on the behavior and welfare of these animals. Research results include the following:

- Low lean swine were found to be more active and less anxious than high lean swine in an open field test (Shea-Moore, 1998).
- High lean gain pigs were more aggressive than low lean gain pigs (Busse et al., 1999).
- Whole blood serotonin levels (which may be related to aggression) were significantly higher in high lean gain pigs than in control pigs.

Conclusion

Selection for specific traits, such as high lean growth, results in numerous behavioral, production and welfare problems. Additional research is needed to determine the extent to which high lean animals differ from low lean animals. Once these differences are understood, perhaps environmental solutions (alternative housing, new management techniques, etc.) can be developed to solve some of the problems. However, it is unlikely that welfare problems developed through breeding can be completely solved through environmental or nutritional means. Ultimately, the solution is for breeders to pay attention to the animal welfare implications of selection.

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