

## Behavioral and Physical Effects of Spaying and Neutering Domestic Dogs (*Canis familiaris*)

Summary of findings detailed in a Masters thesis submitted to and accepted by Hunter College by Parvene Farhooody in May, 2010.

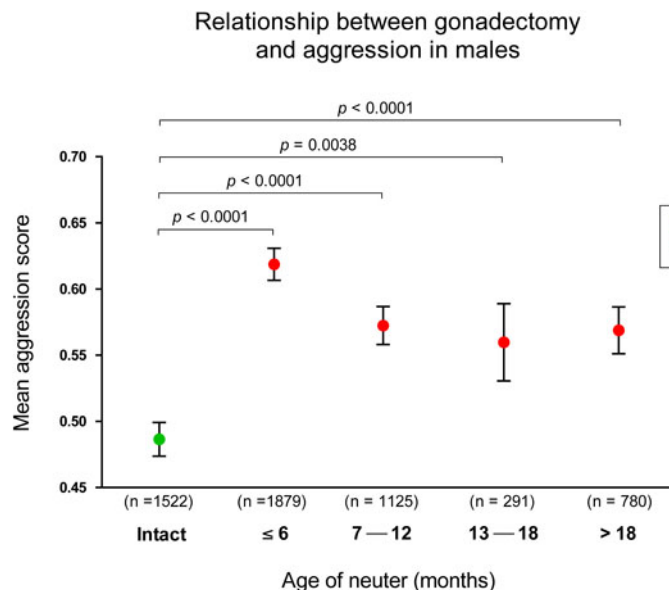
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Spaying and neutering domestic dogs is generally accepted as a relatively benign procedure conducted on millions of dogs each year. The view of spaying and neutering as benign and perhaps even beneficial to dogs has been based on extremely limited scientific study of how gonadectomy affects dog behavior and physiology. To investigate this, a 101-question survey called the Canine Behavior and Research Questionnaire was used to collect information on seven behavioral characteristics for 10,839 dogs. The C-BARQ is a qualitative behavioral assessment instrument created by James Serpell and his colleagues at the Center for the Interaction of Animals and Society at the University of Pennsylvania. At this time, it is the only behavioral assessment questionnaire that has been peer-reviewed and found to be reliable and valid (Hsu & Serpell, 2003).

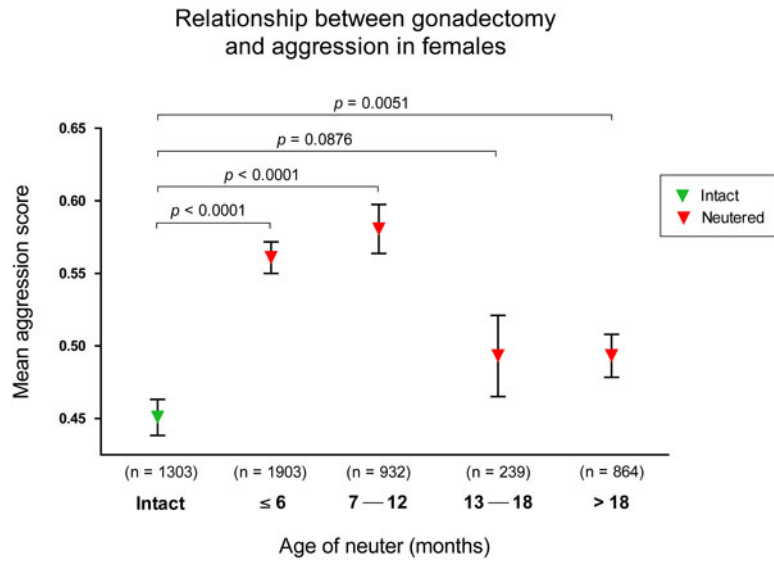
Behavioral characteristics of intact male and female dogs were compared with those of four groups of neutered dogs: those neutered at or before 6 months, between 7 and 12 months, between 13 and 18 months, and after 18 months. Our data showed that the behavior of neutered dogs was significantly different from that of intact dogs in ways that contradict the prevailing view. Among the findings, neutered dogs were more aggressive, fearful, excitable, and less trainable than intact dogs.

In addition, we measured eight individual bone lengths plus the height of 202 agility competition dogs to determine whether gonadectomy affected bone lengths. Preliminary analysis revealed significant differences in bone growth between the intact and neutered groups.

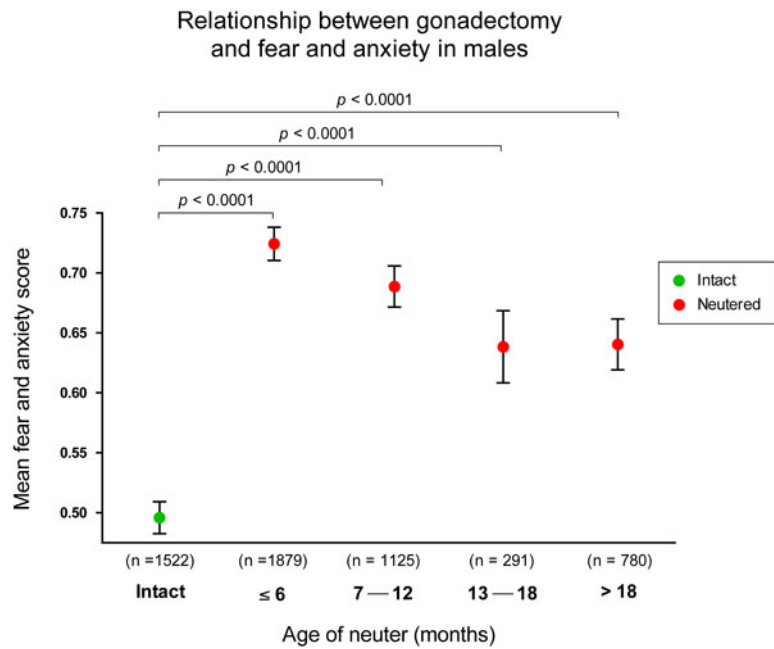
These findings strongly support the need for an immediate re-evaluation of the current recommendation to spay or neuter dogs to prevent or treat behavior problems, and an equally pressing need to more fully examine the wide range of physical effects of spaying and neutering pet dogs.



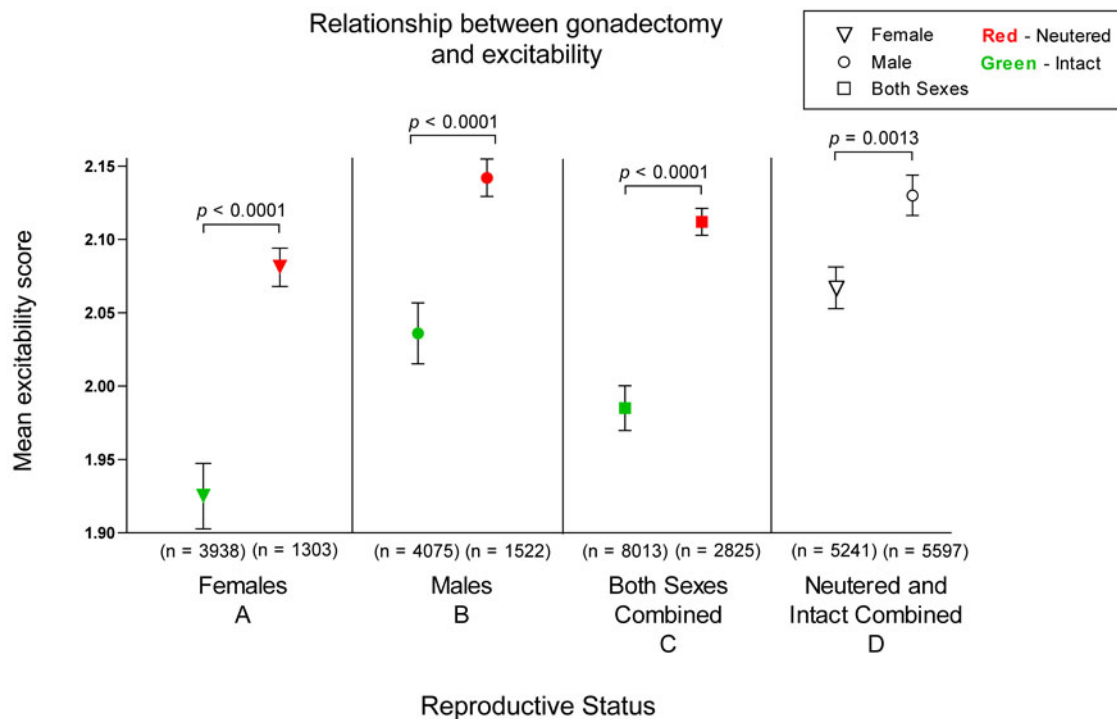
**Figure 1.** Aggression scores in male dogs neutered at different ages compared with intact male dogs. There was a significantly higher aggression score in neutered dogs as compared to intact dogs regardless of the age at which the dogs were neutered.



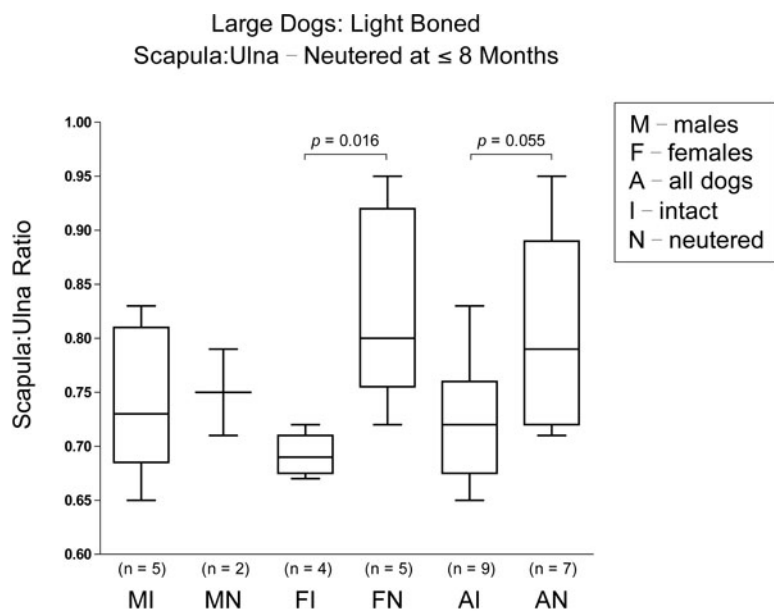
**Figure 2.** Aggression scores in female dogs spayed at different ages compared with intact female dogs. There was a highly significant increase in aggression score of dogs spayed at 12 months or earlier as compared to intact dogs.



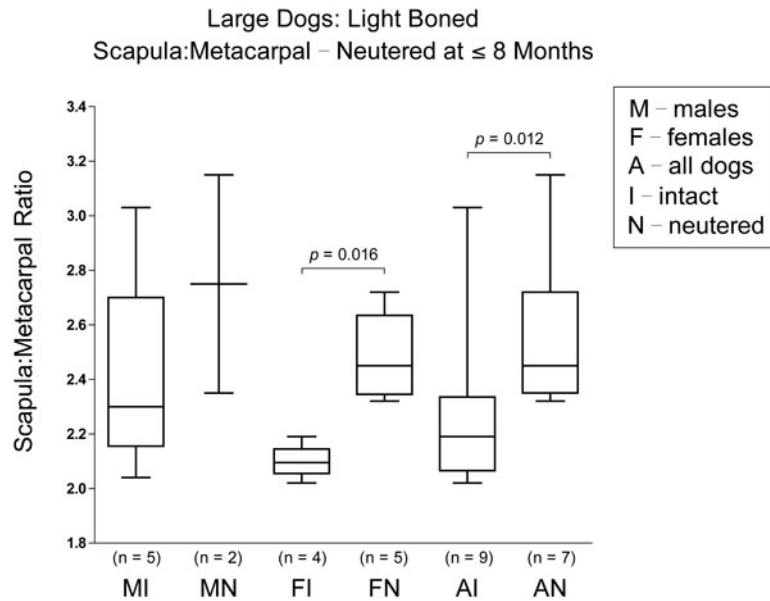
**Figure 3.** Fear and anxiety scores in male dogs neutered at different ages compared with intact male dogs. There was a significant increase in fear and anxiety scores in neutered dogs as compared to intact dogs regardless of the age at which the dogs were neutered.



**Figure 4.** Fear and anxiety scores in neutered dogs compared with intact dogs. A, all intact females (green) compared with all neutered females (red). B, all intact males (green) compared with all neutered males (red). C, all intact male and female dogs (green) compared with all neutered male and female dogs. D, all intact and neutered females (open triangle) compared with all intact and neutered males (open circle). In all cases, spayed or neutered dogs had higher excitability scores.



**Figure 5.** Comparison of bone length between the scapula and ulna of intact and neutered light-boned large dogs. From left: intact male dogs compared with neutered male dogs, intact female dogs compared with neutered female dogs, all intact dogs compared with all neutered dogs. Spayed females had significantly longer scapula:ulna ratios than intact females.



**Figure 6.** Comparison of bone length between the scapula and metacarpals of intact and neutered light-boned large dogs. From left: intact male dogs compared with neutered male dogs, intact female dogs compared with spayed female dogs, all intact dogs compared with all neutered dogs. Spayed females had significantly longer scapula:metacarpal ratios than intact females.

### Summary

The above data is just a small sample of the significant data that were determined in this study. By using large a sample of dogs than any used previously to examine behavior in dogs, we found significant correlations between neutering dogs and increases in aggression, fear and anxiety, and excitability, regardless of the age at which the dog was neutered. There were also significant correlations between neutering and decreases in trainability and responsiveness to cues. The other three behavioral categories examined (miscellaneous behavior problems, attachment and attention-seeking behavior, and separation-related behavior) showed some association with neutering, but these differed more substantially depending on the age at which the dog was neutered. The overall trend seen in all these behavioral data was that the earlier the dog was neutered, the more negative the effect on the behavior. A difference in bone length was found between neutered and intact dogs, suggesting that neutering has an effect on bone growth, which may be related to other orthopedic effects documented in the literature. Examination of changes in bone length of gonadectomized dogs is continuing.