Non-reproductive Effects of Spaying and Neutering on Behavior in Dogs

Deborah L. Duffy, Ph.D., and James A. Serpell, Ph.D., Center for the Interaction of Animals and Society, School of Veterinary Medicine, University of Pennsylvania

Although there are scattered reports in the literature of apparently adverse effects of spaying and neutering on canine behavior, there are very few quantitative studies and most of these have employed behavioral measures of unknown reliability and validity.

The present study used the Canine Behavioral Assessment and Research Questionnaire (C-BARQ)© to investigate the impact of spaying/neutering in various dog populations, including (1) a random sample of 1,552 dogs belonging to 11 common breeds and (2) a convenience sample of over 6,000 dogs of various breeds recruited via an online survey. The C-BARQ is a reliable, standardized method for evaluating and screening dogs for the presence and severity of behavioral problems. It was developed by behavioral researchers at the University of Pennsylvania (Hsu and Serpell, 2003) and consists of a 101-item questionnaire that is simple to use, takes about 15 minutes to fill out, and can be completed by anyone who is reasonably familiar with the dog’s typical responses to ordinary, day-to-day events and stimuli. The C-BARQ is currently the only existing behavioral assessment instrument of its kind to be thoroughly tested for reliability and validity on large samples of dogs of various breeds. This process has resulted in the identification of the following 13 distinct behavioral factors or traits that are common to the majority of dogs, regardless of breed, age, sex or neuter status:

1. **Stranger-directed aggression**: Dog shows threatening or aggressive responses to strangers approaching or invading the dog’s or the owner’s personal space, territory, or home range.

2. **Owner-directed aggression**: Dog shows threatening or aggressive responses to the owner or other members of the household when challenged, manhandled, stared at, stepped over, or when approached while in possession of food or objects.

3. **Dog-directed fear/aggression**: Dog shows fearful and/or aggressive responses when approached directly by unfamiliar dogs.

4. **Familiar dog aggression**: Threatening or aggressive responses during competition for resources with other (familiar) dog(s) in the household.

5. **Stranger-directed fear**: Fearful or wary responses when approached directly by strangers.
6. **Nonsocial fear:** Fearful or wary responses to sudden or loud noises, traffic, and unfamiliar objects and situations.

7. **Separation-related behavior:** Vocalizes and/or engages in destructive behavior when separated from the owner, often accompanied or preceded by behavioral and autonomic signs of anxiety, including restlessness, loss of appetite, trembling, and excessive salivation.

8. **Attachment and attention-seeking:** Maintains close proximity to the owner or other members of the household, solicits affection or attention, and becomes agitated when the owner gives attention to third parties.

9. **Trainability:** Shows willingness to attend to the owner, obeys simple commands, fetches objects, responds positively to correction, and ignores distracting stimuli.

10. **Chasing:** Pursues cats, birds, and other small animals, given the opportunity.

11. **Excitability:** Strong reaction to potentially exciting or arousing events, such as going for walks or car trips, doorbells, arrival of visitors, and the owner arriving home; difficulty settling down after such events.

12. **Touch sensitivity:** Fearful or wary responses to potentially painful procedures, including bathing, grooming, claw-clipping, and veterinary examinations.

13. **Energy level:** Highly energetic, boisterous, and/or playful behavior.

The results of the study suggest that spayed female dogs tend to be more aggressive toward their owners and to strangers than intact females, but that these effects of spaying on behavior appear to be highly breed-specific. Contrary to popular belief, the study found little evidence that castration was an effective treatment for aggressive behavior in male dogs, and may exacerbate other behavioral problems. Further research will be needed to clarify the relationship between age of spaying/neutering and these apparent effects on behavior.

**Reference**
Session I: Non-reproductive Effects of Spaying and Neutering
Effects on Behavior
By Dr. Deborah Duffy

BEHAVIORAL EFFECTS OF SPAYING/NEUTERING IN DOMESTIC DOGS

Deborah L. Duffy, Ph.D.
James A. Serpell, Ph.D.
Center for the Interaction of Animals & Society
School of Veterinary Medicine
University of Pennsylvania

“Spaying and neutering makes pets better, more affectionate companions.”

“Female dogs, like males, have an increased risk of aggression if left intact.”

“Unsterilized animals often exhibit more behavior and temperament problems than do those who have been spayed or neutered.”

“It is true that unneutered dogs are often more aggressive and territorial (urine marking, fighting), but these traits should not be confused with loyalty and protection of their home and family.”

“The only behavior changes that are observed after neutering relate to behaviors influenced by male hormones.”

“.any (behavioral) change would be for the better. Altered pets are less aggressive toward other dogs and cats, are less likely to urine mark and wander, and generally have better personalities.”

OFTEN CITED BEHAVIORAL REASONS TO SPAY/NEUTER A PET:
(from websites of veterinary clinics, humane societies, trainers & animal shelters)
Session I: Non-reproductive Effects of Spaying and Neutering
Effects on Behavior
By Dr. Deborah Duffy

QUESTIONS:
- What effects does spaying/neutering have on non-reproductive behaviors?
- Sex differences?
- Breed differences?

Canine Behavioral Assessment & Research Questionnaire (C-BARQ)
http://www.vet.upenn.edu/cbarq/
101 Questions:
- 5-point scale
- mixture of severity scales and frequency scales

The C-BARQ Factors or Traits

- Stranger-directed aggression (10 items)
- Owner-directed aggression (8 items)
- Dog-directed fear/aggression (8 items)
- Dog rivalry (4 items)
- Stranger-directed fear (4 items)
- Nonsocial fear (6 items)
- Separation-related behavior (8 items)
- Attachment/attention-seeking (6 items)

- Trainability (8 items)
- Chasing (4 items)
- Excitability (6 items)
- Touch sensitivity (4 items)
- Energy (2 items)
Session I: Non-reproductive Effects of Spaying and Neutering
Effects on Behavior
By Dr. Deborah Duffy

Miscellaneous C-BARQ Items

Item 78: Escaping/roaming  Item 89: Separation urination
Item 79: Rolling in scent  Item 90: Separation defecation
Item 80: Coprophagia (eating feces)  Item 91: Hyperactivity
Item 81: Chewing objects  Item 94: Staring (obsessive)
Item 82: Mounting  Item 95: Snapping at flies (obsessive)
Item 83: Food begging  Item 96: Tail-chasing
Item 84: Food stealing  Item 97: Shadow/light-chasing
Item 85: Fear of stairs  Item 98: Barking
Item 86: Pulling on leash  Item 99: Autogrooming (self)
Item 87: Marking with urine  Item 100: Allogrooming (others)
Item 88: Submissive/emotional urination  Item 101: Other abnormal/stereotypic

Random Sample Survey

Respondents:
- 1,552 dog owners (breed club members)

Dogs
- Age: ≥ 1 year old (mean 6 years, Std.dev. 3.2 yrs)
- Sex: Male:Female ratio = 1:1
- 40% Spayed/Neutered
Session I: Non-reproductive Effects of Spaying and Neutering
Effects on Behavior
By Dr. Deborah Duffy

Reasons for Spaying/Neutering:

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth Control</td>
<td>41.8</td>
</tr>
<tr>
<td>Required by Shelter/Breeder</td>
<td>2.2</td>
</tr>
<tr>
<td>Control/Prevent Behavior Problems</td>
<td>18.1</td>
</tr>
<tr>
<td>Control/Prevent Health Problems</td>
<td>31.4</td>
</tr>
<tr>
<td>Recommended by Veterinarian</td>
<td>.5</td>
</tr>
<tr>
<td>Other</td>
<td>6.0</td>
</tr>
</tbody>
</table>
Session I: Non-reproductive Effects of Spaying and Neutering
Effects on Behavior
By Dr. Deborah Duffy

- **SPAYED FEMALES ARE MORE AGGRESSIVE TOWARD PEOPLE**
  
  - Stranger-directed aggression: 
    - INTACT: n=345
    - SPAYED: n=164
  
  - Owner-directed aggression: 
    - INTACT: n=377
    - SPAYED: n=174

  **p < 0.025

- **SPAYED FEMALES ARE MORE FEARFUL AND SENSITIVE TO TOUCH**
  
  - Non-social fear: 
    - INTACT: n=349
    - SPAYED: n=166
  
  - Touch sensitivity: 
    - INTACT: n=393
    - SPAYED: n=181

  * p < 0.05
  ** p < 0.025

  Mann-Whitney U test
Session I: Non-reproductive Effects of Spaying and Neutering
Effects on Behavior
By Dr. Deborah Duffy

**NEUTERED MALES MARK THEIR "TERRITORIES" LESS OFTEN**

- Urine marking
  - MALES

  - INTACT
    - n = 502
  - NEUTERED
    - n = 80

* p < 0.005

*Mann-Whitney U test*

**SPAYED/NEUTERED DOGS BEG FOR FOOD AND LICK PEOPLE/OBJECTS MORE OFTEN**

- Intact
  - Female
    - n = 398
  - Male
    - n = 502

- Neutered
  - Female
    - n = 406
  - Male
    - n = 520

** p < 0.001

* p < 0.004

*Mann-Whitney U test*
Session I: Non-reproductive Effects of Spaying and Neutering

Effects on Behavior

By Dr. Deborah Duffy

BREED-SPECIFIC EFFECTS OF SPAYING/NEUTERING

DOG-DIRECTED AGGRESSION/FEAR

<table>
<thead>
<tr>
<th>INTACT</th>
<th>SPAYED/NEUTERED</th>
</tr>
</thead>
</table>

*** p < 0.005 (dog-directed aggression/fear)
* p < 0.05 (dog-directed fear)
** p < 0.05 (dog-directed aggression)

Convenience Sample Survey

Respondents:
- 3,593 dog owners (open-access to C-BARQ website)
- Only 1 dog per owner

Dogs:
- Age: 6 months – 23 years (mean 4.8 years, Std.dev. 3.2 yrs)
- Sex: Male:Female ratio = 1:1
- 76% Spayed/Neutered
- 17 breeds (plus mixed breeds) with sample size of ≥ 50 dogs each

Reasons for spaying/neutering:
- Birth control (40%)
- Required by breeder/shelter (30%)
Session I: Non-reproductive Effects of Spaying and Neutering

Effects on Behavior

By Dr. Deborah Duffy

SPAYED/NEUTERED DOGS ARE MORE AGGRESSIVE TOWARD PEOPLE AND OTHER DOGS

<table>
<thead>
<tr>
<th></th>
<th>Dog-directed Aggression/Fear</th>
<th>Owner-directed Aggression</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTACT</td>
<td>Female: 4.5 ± 0.5</td>
<td>Female: 0.1 ± 0.5</td>
</tr>
<tr>
<td></td>
<td>Male: 6.0 ± 0.8</td>
<td>Male: 0.2 ± 0.6</td>
</tr>
<tr>
<td>SPAYED/NEUTERED</td>
<td>Female: 7.5 ± 1.0</td>
<td>Female: 0.5 ± 0.5</td>
</tr>
<tr>
<td></td>
<td>Male: 8.0 ± 1.2</td>
<td>Male: 0.5 ± 0.5</td>
</tr>
</tbody>
</table>

n=247, n=672, n=276, n=542, n=283, n=766, n=353, n=638

** p < 0.0001
* p < 0.0005
Bonferroni corrected p value: 0.0016
Mann-Whitney U test

SPAYED/NEUTERED DOGS ARE MORE FEARFUL AND SENSITIVE TO HANDLING

<table>
<thead>
<tr>
<th></th>
<th>Touch Sensitivity</th>
<th>Non-social Fear</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTACT</td>
<td>Female: 2.5 ± 0.5</td>
<td>Female: 1.0 ± 0.5</td>
</tr>
<tr>
<td></td>
<td>Male: 3.0 ± 0.8</td>
<td>Male: 1.5 ± 0.7</td>
</tr>
<tr>
<td>SPAYED/NEUTERED</td>
<td>Female: 5.0 ± 1.0</td>
<td>Female: 1.5 ± 0.5</td>
</tr>
<tr>
<td></td>
<td>Male: 6.0 ± 1.2</td>
<td>Male: 2.0 ± 0.8</td>
</tr>
</tbody>
</table>

n=277, n=716, n=351, n=597, n=267, n=709, n=328, n=603

* p < 0.0001
Mann-Whitney U test
Session I: Non-reproductive Effects of Spaying and Neutering
Effects on Behavior
By Dr. Deborah Duffy

**SPAYED DOGS ARE LESS ENERGETIC**

![Bar graph showing energy levels of intact and spayed/neutered dogs, with Mann-Whitney U test results.](image)

**SPAYED/NEUTERED DOGS ROLL IN & EAT FECES MORE OFTEN**

![Bar graph showing frequency of rolling in feces and coprophagia among intact and spayed/neutered dogs, with Mann-Whitney U test results.](image)
Session I: Non-reproductive Effects of Spaying and Neutering
Effects on Behavior
By Dr. Deborah Duffy

**NEUTERED DOGS BEG & STEAL FOOD MORE OFTEN**

![Graph showing differences in begging and stealing behavior between intact and spayed/neutered dogs](image)

* * * p < 0.0001

**SPAYED/NEUTERED DOGS SELF-GROOM & BARK EXCESSIVELY**

![Graph showing differences in self-grooming and barking behavior between intact and spayed/neutered dogs](image)

** p < 0.0001
* p < 0.001
**Session I: Non-reproductive Effects of Spaying and Neutering**

**Effects on Behavior**

By Dr. Deborah Duffy

---

**BREED-SPECIFIC EFFECTS OF SPAYING/NEUTERING**

**TOUCH SENSITIVITY**

<table>
<thead>
<tr>
<th>Breed</th>
<th>Female (n=23)</th>
<th>Male (n=51)</th>
<th>Female (n=39)</th>
<th>Male (n=40)</th>
<th>Female (n=21)</th>
<th>Male (n=85)</th>
<th>Male (n=26)</th>
<th>Male (n=55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTACT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPAYED/NEUTERED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Mann-Whitney U test  
  * p < 0.025
  ** p < 0.01

---

**SEX-SPECIFIC EFFECTS OF SPAYING/NEUTERING**

**Stranger-directed Aggression**

Dobiean Pinschers

<table>
<thead>
<tr>
<th>Breed</th>
<th>Female (n=22)</th>
<th>Male (n=28)</th>
<th>Female (n=28)</th>
<th>Male (n=13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTACT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPAYED/NEUTERED</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Mann-Whitney U test  
  * p < 0.025
  ** p < 0.01

---
SUMMARY

- For most behaviors, spaying/neutering was associated with worse behavior, contrary to conventional wisdom.
- A few behaviors (e.g., energy level, urine marking) were reduced in spayed/neutered dogs.
- The effects of spaying/neutering are often specific to certain breeds and are not always equivalent between sexes.

CONCLUSIONS

- Significant differences in scores do not necessarily indicate severe behavioral problems.
- Neutering male dogs does not render them useless for protection or guarding.
- We need to investigate mechanisms for behavioral effects of spaying and develop alternatives.
- Dog owners need to receive accurate information to help them form realistic expectations.
Session I: Non-reproductive Effects of Spaying and Neutering
Effects on Behavior
By Dr. Deborah Duffy

ACKNOWLEDGEMENTS

- Dr. Yuying Hsu (Nat. Taiwan Normal University).
- Kathy Kruger (Univ. of Pennsylvania).
- Various breed clubs.
- All participants.