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Research Article

AN OBSERVATIONAL QUESTIONNAIRE-BASED STUDY ON THE REPRODUCTIVE, BEHAVIORAL AND WELFARE CONSEQUENCES OF FELINE STERILIZATION

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Abstract

Spaying and neutering are safe and effective surgical procedures widely used to control the feline population and prevent reproductive disorders. But very few data are available on the consequences of feline sterilization. The objective of this study was to find out the reproductive, behavioral, and welfare consequences of feline sterilization. The data were collected from the cat owners during the period of feline sterilization procedures performed from June 2025 to April 2026 at Central Veterinary Hospital, Dr. Sazid's Pet Care and Panacea Pet & Vet Care through a structured questionnaire. A total of 30 cats were included, comprising 16 (53.3%) local breeds, 4 (13.3%) mixed breeds, 8 (26.7%) Persian cats, and 2 (6.7%) Turkish Angoras, of which 22 (73.3%) were males and 8 (26.7%) were females. All surgeries were performed using the conventional open technique under general anesthesia. Owners were advised to maintain proper hygiene, restrict movement and use an Elizabethan collar to prevent interference with the surgical site. The results showed that most of the owners came for population control and prevention of unwanted litters of cat aged from 7 to 12 months, weight of cat, appetite, affection toward cats' owner, and fur quality improved, urine spray, attraction toward opposite sex, aggressiveness and outdoor roaming decreased including no reproductive health problem. The findings demonstrate that spaying and neutering contribute significantly to improved reproductive health, effective population control and enhanced overall welfare of cats, with minimal complications when appropriate surgical and postoperative care protocols are followed.

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Introduction

An animal kept for amusement or companionship as opposed to employment, farming, or study is called a pet. Pets live in proximity to people, receive loving care, and have their basic needs met by their owners. Out of an estimated 600 million cats worldwide, including roughly 480 million stray or wild cats, there are about 220 million pet cats (McKenzie, 2010).

Cats are kept as pets for stress relief, emotional support, and companionship. Compared to dogs, they require less upkeep, are flexible, independent, and may be left alone for extended periods of time (McKenzie, 2010). But sometimes behavioral signs of cats related to sexual hormones make annoyance to owners. To avoid these problems, they want permanent solutions like neutering in males and spaying in females. Pet owners have mixed feelings about neutering and spaying. The satisfaction

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of owners depends on the correction of these behavioral changes. But sometimes after neutering and spaying, no or little improvement in behavioral changes occurs (Amin, 2024). That's why our study is to find out the attitudes after neutering and spaying of cats.

Though there are non-surgical methods of contraception to prevent reproduction without removing the source of gonadal hormones by using progestins, androgens, or gonadotropin-releasing hormone (GnRH) analogs, the methods are not permanent, safe, and have life risks. Whereas surgical sterilization (spaying and neutering) remains the standard and safest method for permanent population control. A male cat's testicles are surgically removed during neutering to stop reproduction and lower reproductive hormones, which in turn reduces aggressive behavior, wandering, and territorial marking tendencies (Howe, 2015).

The surgical removal of a female cat's ovaries and typically the uterus (ovariohysterectomy or ovariectomy) to prevent pregnancy is known as spaying. In addition to lowering the danger of some cancers and reproductive disorders and controlling overpopulation, it also lessens aggressive behavior (Amin, 2024).

To reduce the number of homeless animals and manage cat overpopulation, neutering and spaying are crucial. In addition to improving behavior by reducing aggression and roaming, these procedures reduce the risk of reproductive problems such as uterine infections and malignancies. Cats who have been spayed or neutered typically have longer and healthier lives (Kustritz, 2014; McCallin, 2021).

Although they can be safely carried out as early as 8 weeks in healthy kittens, spaying and neutering should normally be done between the ages of 6 and 9 months. Early sterilization lowers the incidence of reproductive organ malignancies and helps prevent unwanted behaviors (Amin, 2024).

Before being neutered or spayed, cats should be in good health, free of infections, and completely immunized. A minimum body weight of roughly 1 kg is advised for early-age treatments. Anesthesia risks can be decreased by fasting for eight to twelve hours before to surgery. Pain control, activity restriction, monitoring the site of the incision, and follow-up appointments to guarantee appropriate healing are all part of postoperative care. These treatments promote ethical pet ownership and offer substantial long-term health and behavioral benefits (Kustritz, 2014). Many studies on the procedure of feline sterilization have been conducted previously. But few studies are available on the outcome of feline sterilization, especially on the reproductive, behavioral, and welfare aspects of cats. Therefore, the objective of this study was to assess the consequences of feline sterilization for a certain period and to make the owner aware of the consequences of feline sterilization through the output of this study.

Materials and methods

Study area

The study was carried out in Dhaka, Sylhet, and Rajshahi cities. The data were collected from Central Veterinary Hospital (Dhaka), Dr. Sazid's Pet Care (Rajshahi), Panacea Pet & Vet Care (Sylhet), and a questionnaire from the cat owners.

Study population and period

A total of 30 records of cat neutering and spaying from the placement areas were gathered over the period (June 2025 to April 2026).

Data collection procedure

A straightforward random sample technique was used to gather the data. Before the study began, a closed-ended questionnaire was created and used during the sampling procedure (Supplementary material 1). Cats that came to the clinic were closely monitored, particularly those who were brought in for spaying or

neutering. Owners were interviewed to collect data and their responses were based on their experiences. The owner's phone number was gathered to speak with them about the long-term effects of sterilization. Observations were made before, during and following surgery on 30 cats, 22 of which were male and 8 of which were female. The limitations of this study are that the sample size is relatively small and many of the behavioral outcomes are based solely on owner observations, which may introduce subjective bias.

Restraining and pre-medication before neutering and spaying

Both pharmacological and physical restraints were used on cats. Atropine sulfate (0.04 mg/kg) and Xylazine (1 mg/kg) were administered intramuscularly as pre-medication. The testicles (male), ovary and uterus (female) were surgically removed using standard techniques under aseptic conditions and intramuscular anesthesia (Ketamine 10 mg/kg) (Fossum TW. 2018; Kuwitez, 2002). The surgery site was cleaned, sterilized, shaved, and trimmed. A diazepam–ketamine mixture with a 1:4 ratio was used to maintain general anesthesia, and normal saline was used for intravenous hydration treatment.

Pre-operative care before surgery

- Preparation of the patient
- Pre-operative care of the operative site
- Surgical hand preparation of the operating team
- Antimicrobial prophylaxis
- Proper ventilation and environment in the operating theatre
- Use of appropriate surgical attire and drapes
- Sterilization of surgical instruments

Surgical instruments

- Trimmer and blade
- Scalpel
- Scissors (curved and straight)
- Needle
- Needle holder
- Artery forceps (Curved and Straight).
- Rat-Tooth Forceps
- Spaying Hook
- Catgut 2-0
- Drapes
- Cotton, gauze, etc.

Surgical procedure of neutering for male cat

To lower the danger of infection, the surgical site was cleaned and shaved after the anesthetic medicines were administered. Sterile drapes were then used to keep the area clean. The testicle was exteriorized through a 1.5 cm incision made across the scrotum. Before the spermatic cord was released, the blood vessels were examined for bleeding and ligated at the base using Catgut 2-0. After that, both testicles were removed. The scrotal skin was crushed to seal the wound.

Surgical procedure of spaying for a female cat

Under general anesthesia, the procedure was carried out aseptically. The operational site was left open while the cat was placed on the operating table and covered with sterile drapes. At the caudal midline, about 2 cm from the umbilicus, a 1-2 cm incision was created. Artery forceps and gauze pressure were used to stop the bleeding. The peritoneum, muscle, and subcutaneous tissue were sliced one after the other. After identifying the uterine horn, the surgeon grasped each ovary, exteriorized it, and manually opened the broad ligament to reveal the ovarian attachments and blood vessels. The ovaries were removed after the ovarian pedicles were ligated using double catgut ligatures (1-0). Before the uterus was separated, it was extracted and the uterine vessels were closed on both sides. The uterine stump was examined for signs of bleeding. Simple continuous sutures were used to seal the fascia, muscle layers, and peritoneum using catgut (1-0). Catgut (2-0) was used to stitch the subcutaneous tissue, and non-absorbable nylon horizontal mattress sutures were used to seal the skin. Lastly, a benzoin seal and antiseptic povidone-iodine ointment were applied to the incision.

Post-operative care

Antibiotics (Ceftriaxone 20 mg/kg IM) and antihistamine (Pheniramine maleate 0.5 mg/kg IM) were administered for five days. Pain relief was provided with Meloxicam 0.2 mg/kg SC for three days. The owner was advised to keep the cat indoors in a quiet, confined area to limit movement. Povidone-iodine ointment was applied to the incision until fully healed. The cat fully recovered within 14 days after surgery.

Data analysis

All data were tabulated using Microsoft Excel 2019 (Microsoft, USA) and analyzed with STATA-14 between two groups. Average values of Results were expressed as frequencies, proportions, and percentages.

Results

In this study, data were collected from owners who were very interested in having their pets neutered or spayed to avoid unacceptable behavior. All the owners were very annoyed about the behavior during the heat period.

Breed and sex

This study included 30 cats of four breeds: 16 (53.3%) local, 4 (13.3%) mixed, 8 (26.7%) Persian cats, and 2 (6.7%) Turkish Angoras, comprising 22 (73.3%) males and 8 (26.7%) females (Figure 1).

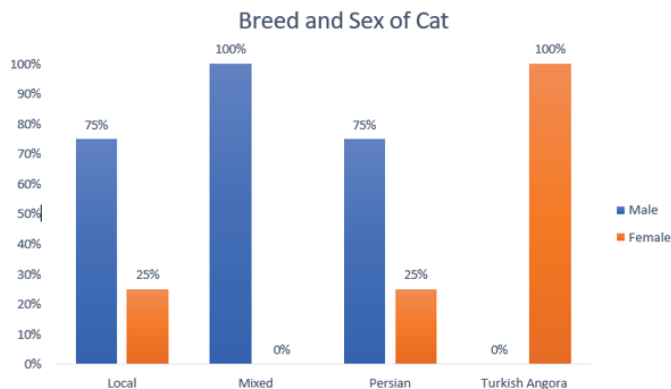


Figure 1. Percentage of breed and sex of cats undergoing surgery.

The native breeds and male cats made up the majority of the research population, suggesting a stronger inclination to include males in the study and a higher preference or availability of indigenous cats. There was reduced representation of exotic breeds like Persian and Turkish Angora, which may indicate restricted access or ownership. The results' generalizability may potentially be impacted by the unequal sex distribution.

Reason behind performing spaying or neutering

Among 30 cat owners, 12 (40%) owners performed spaying/neutering for population control, 8 (26.66%) for health improvement, 5 (16.67%) for reducing outdoor going tendency, 3 (10%) for reducing aggressiveness, and 2 (6.67%) for reducing urination here and there in the house (Figure 2).

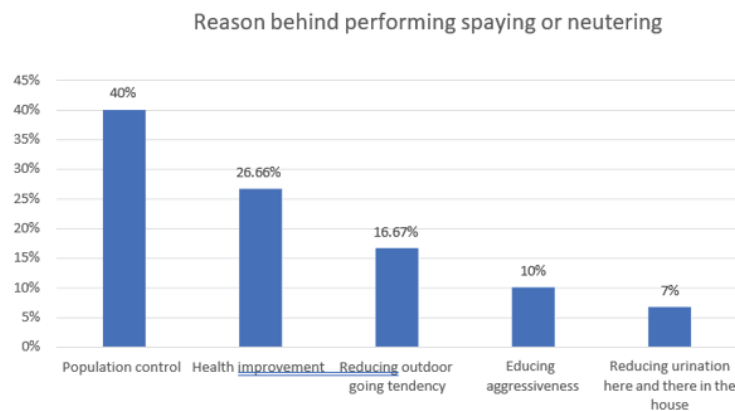


Figure 2. Percentage of reasons behind performing spaying or neutering.

The primary motivation for spaying and neutering was population control, demonstrating a high level of awareness regarding ethical pet ownership. Although behavioral reasons were less frequently mentioned, health benefits were also acknowledged, indicating a lack of awareness of the procedure's complete benefits.

Age of performing neutering or spaying

The ideal age for performing neutering in male cats and spaying in female cats is generally between 6 and 12 months of age. Among 30 cat owners, 4 (13.33%) owners performed spaying/neutering before 6 months, 12 (40%) at between 7 months and 1 year, 10 (33.34%) after 1 year, and 4 (13.33%) after 2 years (Figure 3).

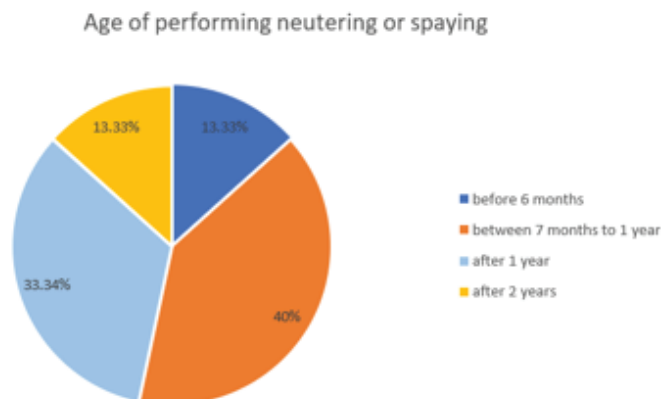


Figure 3. Percentage of age at which spaying or neutering.

The majority of owners spayed or neutered their pets between the ages of seven months and a year, suggesting that moderate timing is preferred over early intervention. Many postponed the treatment for more than a year, indicating a lack of knowledge about the advantages of early-age sterilization. Overall, among the respondents, early spaying or neutering (before six months) was comparatively rare.

Amount of weight gain after surgery

During the study, the cats were weighed after one month of surgery. It was found that 24 (80%) cats gained about 500 grams, 4 (13.3%) gained about 1 kg, and 2 (6.7%) gained more than 1 kg after 1 month of surgery. After 3 months, 10 (33.3%) gained about 1.5kg and 20 (66.7%) gained more than 2 kg (Figure 4).

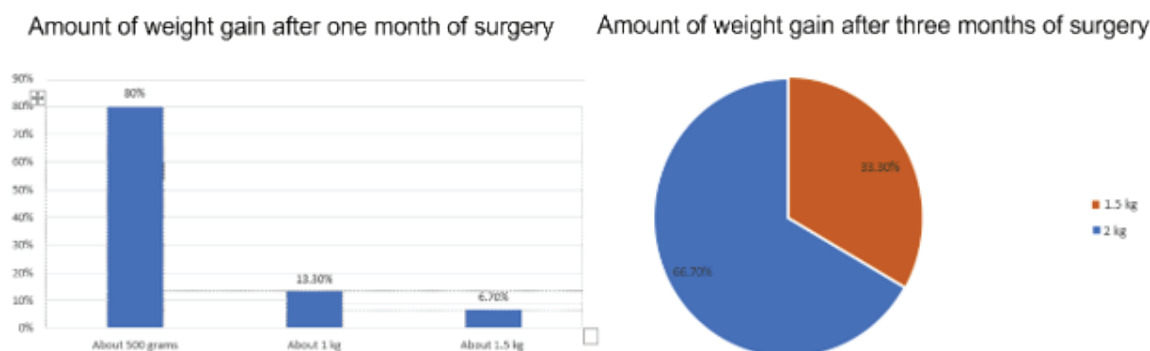


Figure 4. Percentage of weight gain after one and three months of surgery.

A steady, increasingly noticeable tendency of weight growth after spaying or neutering. The majority of cats gained a reasonable amount of weight during the first month, but after three months, there was a noticeable increase. This pattern highlights the necessity for appropriate food and weight management following surgery by implying that metabolic changes following sterilization, perhaps in conjunction with unaltered feeding behaviors and decreased activity, lead to progressive weight gain.

Demand for feed after surgery

After sterilization, most cats experience an increase in appetite due to hormonal changes and a reduced metabolic rate. In this study, changes in feeding behavior were observed in 30 cats. Among them, 24 cats showed an increase in appetite, including 20 males (90.9%) and 4 females (50%), while 6 cats exhibited a decrease in appetite, comprising 2 males (9.1%) and 4 females (50%) (Figure 5).

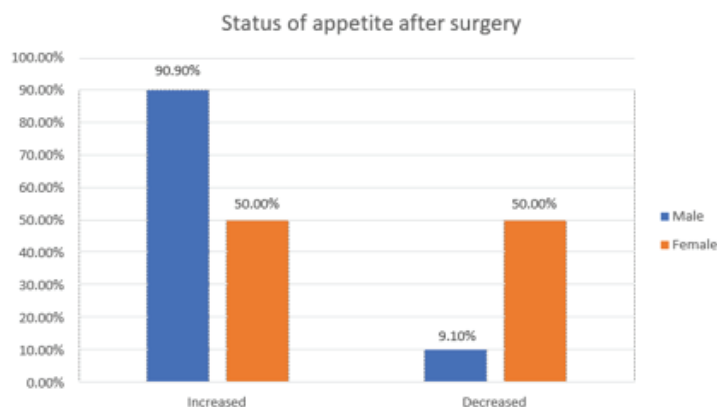


Figure 5. Percentage of appetite after surgery.

Following the treatment, the majority of cats—especially males—saw an increase in appetite, indicating a clear correlation between sterilization and improved feeding behavior. On the other hand, decreased appetite was more uniformly and less frequently seen in females. These results underline the significance of monitoring nutritional intake to prevent excessive weight gain, particularly in male cats, and show a sex-related variation in post-operative feeding behavior.

Post-Surgical changes in aggressiveness

During the study, aggressiveness was identified as one of the primary reasons owners chose to neuter or spay their cats. Following surgery, only 2 male cats (9.1%) exhibited aggressive behavior, which was mainly observed around the subsequent heat cycle. No female cats displayed any aggression after spaying (Figure 6).

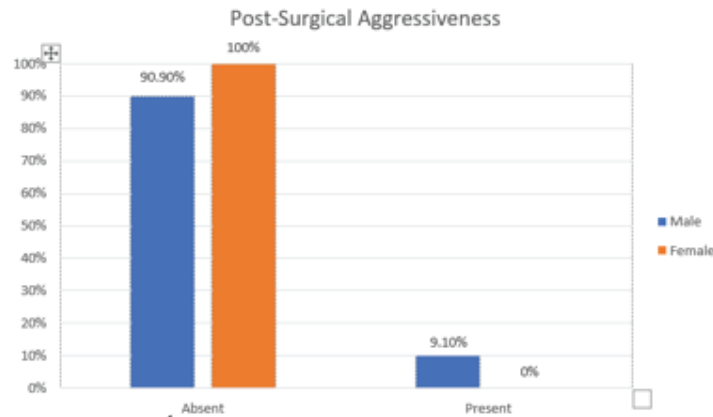


Figure 6. Percentage of post-surgical aggressiveness.

Aggressive behavior is effectively reduced by spaying or neutering, especially in females that did not exhibit post-operative hostility. It is clear that behavioral alterations stabilize soon after sterilization because the few instances of hostility seen in males were restricted and linked to lingering hormonal effects around the first post-surgery heat cycle.

Urine spray

Before surgery, cats commonly spray urine in various places during their heat cycle. This study observed the occurrence of urine spraying behavior after spaying or neutering. It was found that only 2 (9.1%) male cats continued to show urine spraying behavior during the immediate heat cycle following surgery. No female cats exhibited this behavior after spaying (Figure 7).

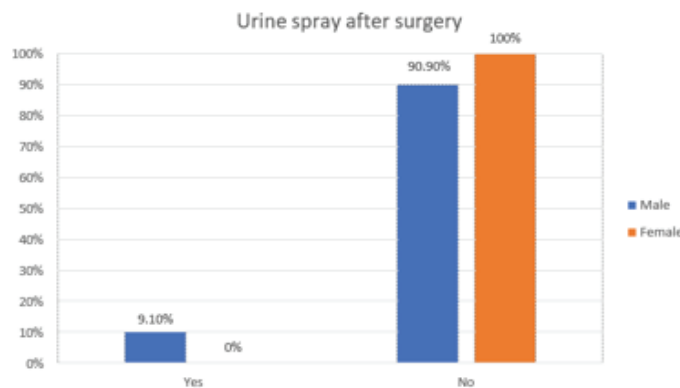


Figure 7. Percentage of urine spraying after surgery.

Urine spraying habit is effectively reduced by spaying and neutering; after surgery, no females display this activity. The few males (9.1%) who persisted in spraying only did so during the first heat cycle following surgery, indicating that this behavior is momentarily influenced by residual hormones but quickly goes away.

Defecation after surgery

Most of the cats had their first defecation primarily on the second day after surgery. On the second day, defecation was observed in 8 (36.3%) male cats and 4(50%) of female cats. By the third day after surgery, 14(63.7%) male cats and 4(50%) female cats had defecated (Figure 8).

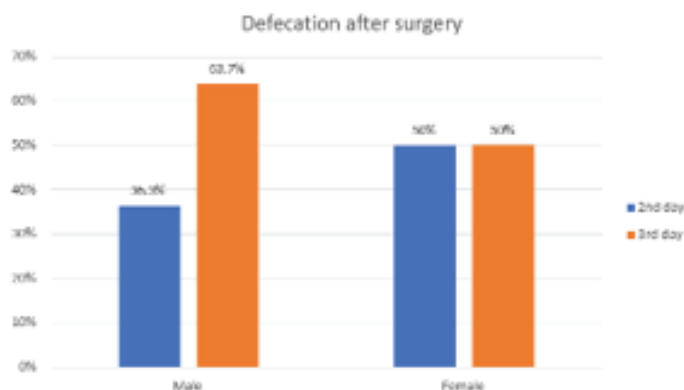


Figure 8. Percentage of defecation after surgery.

Within three days following surgery, the majority of cats started defecating normally again, with males recovering a little quicker than females. This implies that, although there is individual variance, post-operative bowel function usually returns to normal shortly.

Postoperative Heat Cycle Observation

All owners of the 30 cats were carefully questioned about the occurrence of the first heat cycle after surgery in both male and female cats, as the primary concern influencing their decision to opt for surgery was the cessation of the heat cycle. The study revealed that a total of 4 (18.2%) male cats exhibited a single episode of heat behavior after surgery. In contrast, none of the female cats showed any occurrence of a heat cycle following the surgical procedure (Figure 9).

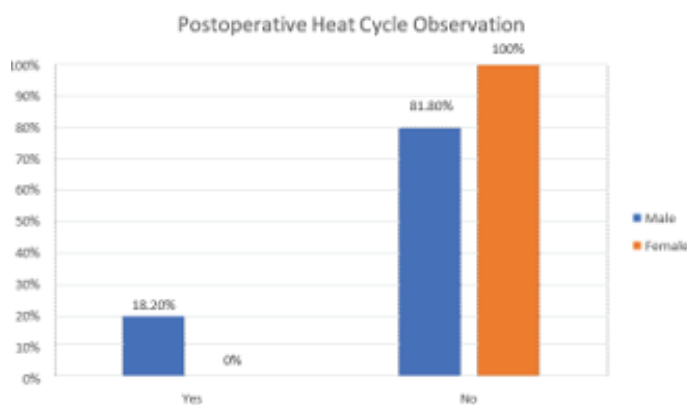


Figure 9. Percentage of post-operative heat cycle.

While a tiny percentage of males experienced a single post-operative heat episode, probably as a result of hormones still in circulation, spaying females successfully abolished heat behavior. This demonstrates that, with a few brief exceptions in males, sterilization consistently reduces reproductive activity.

Post-neutering/spaying attraction toward other cats

Neutering and spaying markedly reduce reproductive hormone levels, which generally results in a decrease or complete cessation of attraction toward other cats. In the present study, post-surgical attraction was observed to be partially reduced in 20 cats (66.67%), completely abolished in 8 cats (26.67%), and, notably, increased in 2 cats (6.66%) (Figure 10).

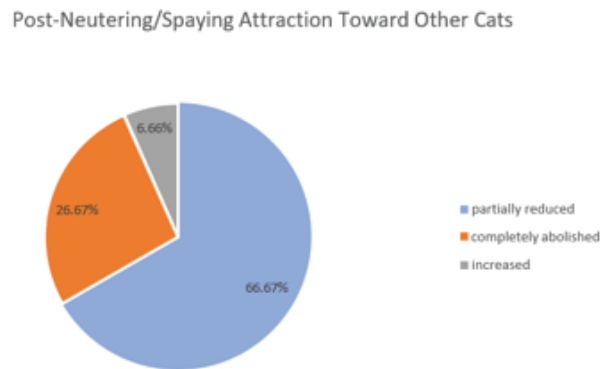


Figure 10. Post-Neutering/Spaying Attraction Toward Other Cats.

The figure suggests that spaying and neutering generally reduce post-surgical sexual attraction in cats, with the majority showing partial reduction and a smaller proportion experiencing complete abolition. The slight increase observed in a few cats may reflect individual variability or temporary hormonal effects, highlighting those responses to sterilization can differ among animals.

Post-surgical affection of cats toward their owners

Neutering and spaying significantly alter reproductive hormone levels, which can influence not only mating-related behaviors but also social and affiliative interactions. In the present study, post-surgical affection toward owners was observed to be moderately reduced in 8 cats (26.67%), whereas a notable increase in affectionate behavior was recorded in 22 cats (73.33%) (Figure 11).

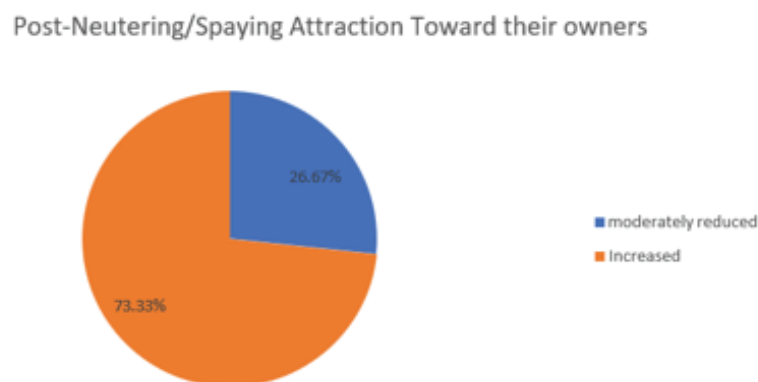


Figure 11. Post-surgical affection of cats toward their owners.

The figure indicates that spaying and neutering generally enhance cats' affectionate behavior toward their owners, with the majority showing increased attachment. Only a small proportion exhibited a moderate reduction in affection, suggesting that sterilization has a predominantly positive impact on owner–cat bonding.

Effect of Spaying or Neutering on the Fur Quality of Cats

Spaying and neutering significantly reduce reproductive hormones, which can influence the growth, texture, and overall quality of a cat's coat. In the present study, fur quality was moderately decreased in 8 cats (26.67%) and markedly improved in 22 cats (73.33%) (Figure 12).

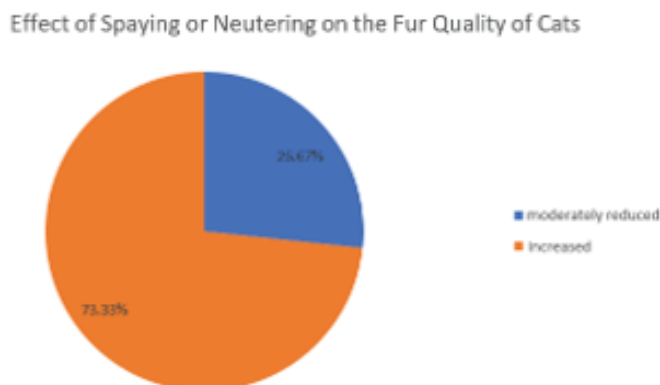


Figure 12. Percentage of fur quality after surgery.

For the majority of cats, spaying and neutering are linked to improved fur quality, with 73.33% exhibiting noticeable improvement. A lesser percentage saw a modest decline, indicating that although coat condition is generally improved by sterilization, individual reactions may differ.

Impact of Spaying and Neutering on Outdoor Roaming Behavior in Cats

Since spaying and neutering reduce reproductive hormone levels, they typically decrease mating-related behaviors, including wandering or outdoor roaming. In the present study, the tendency to roam outdoors was absent in 28 cats (93.3%) and observed in only 2 cats (6.7%) (Figure 13).

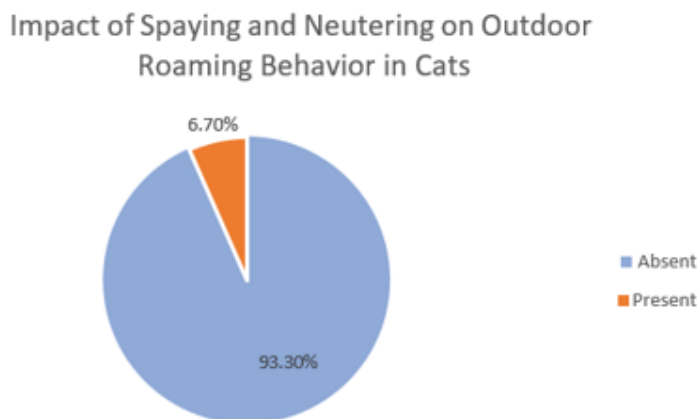


Figure 13. Percentage of roaming behavior after surgery.

The majority of cats (93.3%) remained indoors after being spayed and neutered, which successfully decreased their propensity to wander outside. The technique had a significant impact in reducing outdoor wandering, as evidenced by the small fraction that persisted in roaming behavior.

Post-Surgical Activity Levels in Cats

Activity levels in cats may change following surgery due to the reduction in reproductive hormones or the effects of the procedure itself. In the present study, 10 male cats (45.5%) and 4 female cats (50%) remained active after surgery, whereas 12 male cats (54.5%) and 4 female cats (50%) exhibited reduced activity and became less active (Figure 14).

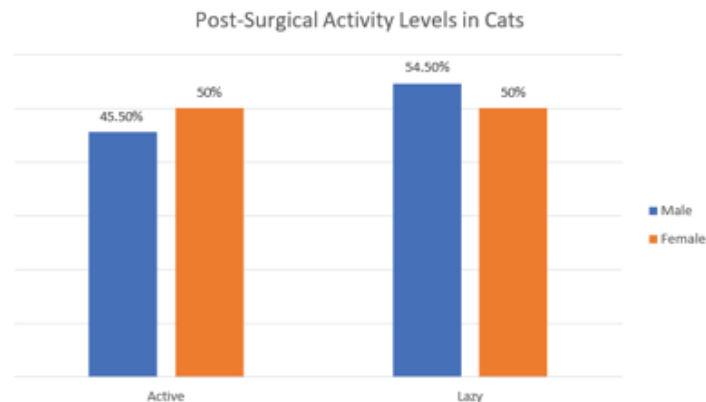


Figure 14. Percentage of activity after surgery.

Cats' degrees of post-surgical activity varied. Although over half of both sexes continued to be active, a somewhat greater percentage of men (54.5%) displayed decreased activity. This suggests that while some cats' energy levels may be momentarily affected by spaying and neutering, the overall effect on activity is moderate and inconsistent.

Occurrence of Serious Illnesses in Cats Following Spaying or Neutering

Spaying and neutering reduce the risk of serious illnesses in cats by preventing reproductive-related diseases. In females, spaying prevents uterine infections and lowers the risk of mammary tumors, while in males, neutering eliminates testicular cancer and reduces prostate problems. Sterilized cats also roam less, decreasing the likelihood of injuries and infections, thereby improving overall long-term health. In this study, none of the cats developed any serious illnesses following surgery (Figure 15).

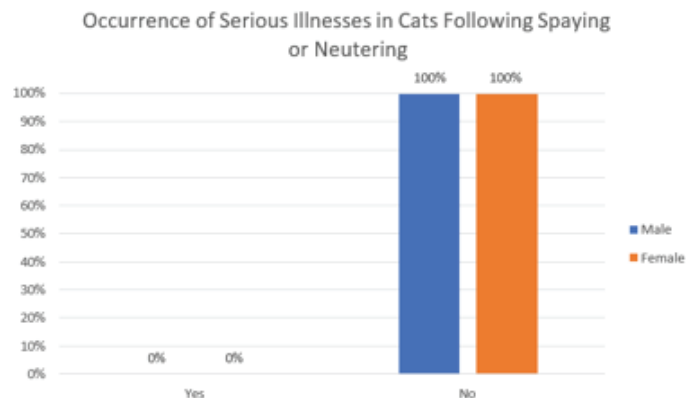


Figure 15. Occurrence of serious illnesses in cats following spaying or neutering.

The graph indicate that spaying and neutering were safe for the cats in this study, as no serious post-operative illnesses were observed. This suggests that, when performed properly, the procedures carry minimal health risks.

Discussion

Both elective and emergency veterinary surgery are possible. Both male and female cats undergo major behavioral and physiological changes as a result of sterilization, an elective surgical procedure. Cats typically show less aggressiveness, less urine marking, and an end to heat cycles following the operation. The main reasons pet owners choose surgery are fulfilled when the heat cycle is effectively regulated. It should be mentioned, nevertheless, that some of these habits might still exist in individual cats, and sterilization does not ensure that all behavioral problems will be resolved (Cafazzo, 2019).

This survey shows that four (13.33%) owners spayed or neutered their animals before six months, which is an anomaly. Because extremely young kittens may not be able to endure anesthesia and surgery because to their small size and insufficient physical development, spaying or neutering them before the age of six months is typically seen as less safe. Cats can acquire adequate skeletal and systemic maturity between the ages of 6 and 12 months, which lowers surgical risks while still avoiding the first heat and undesired reproduction. Standard veterinary advice suggests waiting until about six months for the best safety and results, even though early-age sterilization can be done successfully in specific conditions. Although recent research shows that early neutering (as young as 8–12 weeks) is generally safe when carried out by qualified veterinarians, many practitioners prefer to wait until about 6 months in order to balance physical maturity with avoiding the first heat. This preference reflects a precautionary, experience-based approach rather than evidence of serious harm (Howe, 2015).

Only two male cats (9.1%) and no female cats displayed violent behavior following surgery, indicating a gender difference in post-surgical hostility. Aggression and other unpleasant behaviors are known to be correlated with testosterone levels. While a cat's testosterone levels are lowered after neutering, the hormone is not completely removed. Because of this, during the first month following surgery, some cats may exhibit hormone-driven behaviors like hostility or heat-related symptoms (Wei *et al.*, 2014). Owners did, however, note that throughout the ensuing months, violent behavior generally decreased.

Only two male cats (9.1%) showed signs of pee spraying following surgery. After surgery, no female cats show signs of pee spraying. Although both sexes may exhibit this behavior soon after surgery due to heat-related hormonal changes, male cats are typically more likely than female cats to spray urine. Urine spraying can be seen as a physiological indicator of heat, and this behavior is linked to abrupt changes in hormone levels after sterilization (Dias Costa, 2017). The cat's body undergoes major hormonal and physiological changes following surgical sterilization, which may momentarily affect such behaviors. The body weight has been increased in our study. As the hormonal activity has been abolished, the activity of cat has been decreased that predispose to the use of energy in the growth of the cat (Fettman. 1997).

In this study, xylazine sedation and injectable ketamine anesthesia were used for all procedures. Defecation, which is usually thought to be normal for three to four days, may occasionally be temporarily delayed by this anesthetic treatment. However, cat owners may be concerned if their pets don't defecate for a lengthy time. Individual variances in anesthetic response and dosage caused variations in the timing of defecation. On the second day of the trial, 50% of the female cats and 40% of the male cats defecated. Fifty percent of female cats and sixty percent of male cats had defecated by the third day following surgery. Overall, the cats' gastrointestinal systems returned to normal with ease, and no purgative medications were needed after

surgery (Palmer and Clare, 2012). In order to reduce the number of unwanted cats and enhance community welfare, spaying and neutering are crucial tactics. These practices assist decrease issues brought on by stray cats, such as disease transmission, scavenging, and aggression, and lessen the strain on overcrowded animal shelters, where euthanasia may take place owing to capacity constraints. Additionally, sterilization greatly reduces urine spraying and the unpleasant odor that goes along with it, as well as male territorial behavior and fighting-related injuries. In general, these methods advance public health and animal welfare (Bradshaw and Carmel, 2017).

Following sterilization, no discernible breed-related behavioral or physiological alterations were seen. Four males (18.2%) experienced a single postoperative heat cycle, most likely as a result of leftover reproductive hormones; all females and eighteen males (81.8%) did not exhibit any heat symptoms. In line with the main objective of spaying or neutering, no cat underwent more than one cycle, indicating a successful termination of heat and great owner satisfaction (Faver, 2009; Murray, 2009).

Last but not least, sterilization is essential for decreasing reproductive practices that could result in unintended pregnancies and for minimizing the danger of a number of serious illnesses, including infectious diseases like feline panleukopenia, prostate problems, and mammary gland cancers. Effective behavioral control following surgery was demonstrated in this study by the absence of persistent urine spraying, recurring heat signals, or repeated aggression in cats that displayed a single post-operative heat cycle. As a result, a significant degree of owner satisfaction was noted. However, the overall effect of sterilization may differ according on the physiological state, medical history, and personality of the individual animal (Howe, 2015).

Conclusion

The findings of this case report elucidate the multifactorial effects of spaying and neutering on feline behavior and physiology across parameters such as aggression, urine spraying, defecation patterns, feed intake, attraction toward conspecifics, fur quality, roaming behavior, health status, activity levels, and post-operative heat cycles. A single post-operative heat cycle was observed in 4 (18.2%) male cats. Post-surgical aggression was exclusively identified in males, affecting 2 (9.1%) individuals, primarily during the immediate post-operative hormonal phase, while none of the 8 female cats exhibited aggression despite some showing a single heat cycle. Urine spraying was similarly confined to males, recorded in 2 (9.1%) cases and associated with residual hormonal influence. Defecation resumed by the second day in 8 (36.3%) males and 4 (50%) females, increasing to 14 (63.7%) males and 4 (50%) females by the third day. Attraction toward other cats was partially reduced in 20 (66.67%) cases, completely abolished in 8 (26.67%), and increased in 2 (6.66%), whereas affection

toward owners increased in 22 (73.33%) cats and decreased moderately in 8 (26.67%). Fur quality improved in 22 (73.33%) cats and declined in 8 (26.67%), while outdoor roaming behavior was absent in 28 (93.3%) cats and observed in only 2 (6.7%). No serious post-operative illnesses were reported. In terms of activity, 10 (45.5%) males and 4 (50%) females remained active, whereas 12 (54.5%) males and 4 (50%) females showed reduced activity. Overall, these findings demonstrate that spaying and neutering effectively mitigate undesirable reproductive and behavioral traits and support population control, although transient variations may persist due to residual hormonal influences, with outcomes influenced by breed, sex, and individual variability.

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Supplementary Material 1.

Questionnaire for a cat owner experience with neutering/spaying

1: Basic Information About the Cat

- Cat's Name: _____
- Age: _____
- Breed: _____
- Gender: ☐ Male ☐ Female

2: Decision to Neuter/Spay

- Did you neuter/spay your cat?
☐ Yes ☐ No
- If **Yes**, what influenced your decision? (*Select all that apply*)
 - ☐ Health reasons
 - ☐ Behavior control (e.g., aggression, spraying)
 - ☐ Population control
 - ☐ Reducing outdoor going tendency
 - ☐ Other: _____
- If **No**, what are your reasons?
 - ☐ Lack of awareness
 - ☐ Fear of surgery/complications
 - ☐ Cost concerns
 - ☐ Want to breed the cat
 - ☐ Cultural/religious beliefs
 - ☐ Other: _____

3: Age

- At what age was your cat neutered/spayed?
 - ☐ Under 6 months
 - ☐ 6 months – 1 year
 - ☐ 1 – 2 years
 - ☐ Over 2 years
- Did you have any concerns about the timing?
☐ Yes ☐ No

If yes, please specify: _____

4: Pre-Surgical Preparation of Cats

- Did the veterinarian give pre-surgery instructions?
☐ Yes ☐ No
- If yes, what instructions were given?
 - ☐ Fasting before surgery
 - ☐ Medication instructions
 - ☐ Restrict movement
 - ☐ Other: _____
- Did you face any difficulty preparing your cat?
☐ Yes ☐ No

If yes, explain: _____

5: Post-Surgical Experience

- How long did your cat take to recover?
 - ☐ 1–2 days
 - ☐ 3–5 days
 - ☐ 1 week
 - ☐ More than 1 week
- Did your cat experience any complications?
☐ Yes ☐ No

If yes, specify: _____ **6: Positive Effects After**

Neutering/Spaying (Select all that apply)

- ☐ Reduced aggression
- ☐ Less roaming behavior
- ☐ No heat cycle (female cats)
- ☐ No unwanted pregnancy
- ☐ Reduced spraying/marking
- ☐ Improved health (fewer reproductive diseases)
- ☐ Other: _____

7: Negative Side Effects Observed

(Select all that apply)

- ☐ Excessive weight gain
- ☐ Reduced activity level
- ☐ Behavioral changes (e.g., lethargy)
- ☐ Post-surgical complications (infection, swelling)
- ☐ Increased appetite
- ☐ No negative effects
- ☐ Other: _____

8: Owner Satisfaction & Opinion

- Overall, are you satisfied with your decision?
☐ Yes ☐ No ☐ Not sure
- Would you recommend neutering/spaying to other cat owners?
☐ Yes ☐ No
- Additional comments or experience:

Example of 2 questionnaires for a cat owner experience with neutering/spaying:

I.Owner's name: Sumaiya Jahan

Owner's contact no: 01733793327

1: Basic Information About the Cat

- Cat's Name: Oreo
- Age: 2 Years
- Breed: Persian
- Gender: ☒ Male

2: Decision to Neuter/Spay

- Did you neuter/spay your cat?
: ☒ Yes
- If **Yes**, what influenced your decision?
: ☒ Behavior control (e.g., aggression, spraying)
☒ Population control

3: Age

- At what age was your cat neutered/spayed?
: ☒ 1 – 2 years

4: Pre-Surgical Preparation of Cats

- Did the veterinarian give pre-surgery instructions?
: ☒ Yes
- If **yes**, what instructions were given?
: ☒ Fasting before surgery
- Did you face any difficulty preparing your cat?
: ☒ No

5: Post-Surgical Experience

- How long did your cat take to recover?
: ☒ 3–5 days
- Did your cat experience any complications?
: ☒ No

6: Positive Effects After Neutering/Spaying:

- ✓ Reduced aggression
- ✓ Reduced spraying/markings
- ✓ Improved health (fewer reproductive diseases)

7: Negative Side Effects Observed:

- ✓ Reduced activity level
- ✓ Behavioral changes (e.g., lethargy)

8: Owner Satisfaction & Opinion

- Overall, are you satisfied with your decision?
: ✓ Yes
- Would you recommend neutering/spaying to other cat owners?
: ✓ Yes

II. Owner's name: A.F.M. Abdullah

Owner's contact no: 01521707782

1: Basic Information About the Cat

- Cat's Name: Kitty
- Age: 2.5 Years
- Breed: Local
- Gender: ✓ Male

2: Decision to Neuter/Spay

- Did you neuter/spay your cat?
: ✓ Yes
- If Yes, what influenced your decision?
: ✓ Behavior control (e.g., aggression, spraying)
: ✓ Reducing outdoor going tendency

3: Age

- At what age was your cat neutered/spayed?
: ✓ 6 months – 1 year

4: Pre-Surgical Preparation of Cats

- Did the veterinarian give pre-surgery instructions?
: ✓ Yes
- If yes, what instructions were given?
: ✓ Fasting before surgery
- Did you face any difficulty preparing your cat?
: ✓ No

5: Post-Surgical Experience

- How long did your cat take to recover?
: ✓ 3–5 days
- Did your cat experience any complications?
: ✓ No

6: Positive Effects After Neutering/Spaying:

- ✓ Less roaming behavior
- ✓ Reduced spraying/markings
- ✓ Improved health (fewer reproductive diseases)

7: Negative Side Effects Observed:

- ✓ Reduced activity level
- ✓ Behavioral changes (e.g., lethargy)

8: Owner Satisfaction & Opinion

- Overall, are you satisfied with your decision?
: ✓ Yes
- Would you recommend neutering/spaying to other cat owners?
: ✓ Yes

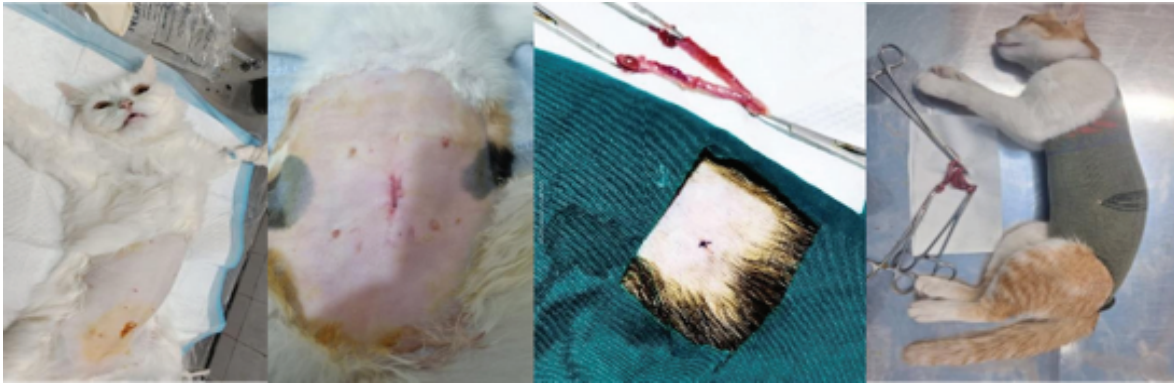
Supplementary Material 2.



Supplementary Figure1: Neutering of Tom



Supplementary Figure 2: spaying of queen due to pyometra



Supplementary Figure 3: Spaying of queen